Horticulture Impact Assessment Program:

Appendix 13: Development of the Australian melon industry through communication and market focused activity (VM12003 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 *VM12003: Development of the Australian Melon Industry through communication and market focused activity.* The project was funded by Hort Innovation over the period June 2013 to September 2017.

Methodology

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

Results/key findings

The investment in VM12003 will likely contribute to increasing the productivity and profitability of the Australian melon industry by increasing the rate of adoption of new technologies and practices for growers. A result of coordinated communications and extension activities that are responsive to growers needs. Further, outputs of the project have also contributed to increased capacity of growers and the industry to manage and mitigate biosecurity threats and food safety issues. This results in a reduction or avoidance of losses to the industry from fewer or less severe biosecurity or food safety incidents.

Additional benefits from the project's outputs include communications to support domestic marketing activities and export development. As well, potential environmental benefits may be realised by supporting communication and extension of best management practices in relation to chemical use for pest management and food safety.

The social impacts arising from the project may include a greater recognition of the melon industry and engendering positive engagement amongst growers, researchers and government agencies; improved food safety for consumers; and spill-over benefits to local communities from more sustainable and profitable melon growers.

Investment Criteria

Total funding for the project was $0.85 million (present value terms) with Hort Innovation investment and voluntary contributions. The investment produced estimated total expected benefits of $3.47million (present value terms). This gave a net present value of $2.62 million, an estimated benefit-cost ratio of 4.1 to 1, an internal rate of return of 57.3% and a MIRR of 10.6%.

Conclusions

While several economic and social impacts identified were not valued, the impacts were considered indirect, uncertain and/or minor compared with the impacts valued. Nevertheless, combined with conservative assumptions for the impacts valued, investment criteria as identified by the valuation were positive and may be an underestimate of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, VM12003, melons, communication, market focussed activity

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.
- Reporting against strategic priorities set out in the Strategic Investment Plan (SIP) for each Hort Innovation industry fund.
- Annual Reporting to Hort Innovation stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

The first series of impact assessments included 15 randomly selected Hort Innovation RD&E investments (projects) worth a total of approximately $9.31 million (nominal Hort Innovation investment). The investments were selected from an overall population of 85 Hort Innovation investments worth an estimated $50.38 million (nominal Hort Innovation investment) where a final deliverable had been submitted in the 2017/18 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 *VM12003*: *Development of the Australian Melon Industry through communication and market focused activity* was selected as one of the 15 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 melon industry consists of approximately 300 growers producing on average 200,000 tonnes of melons annually across an area of some 8,500 hectares. Major production areas of melons are located in Queensland, which in 2016-17 had 3,252 ha planted with an average yield of 25.8t/ha, NSW 2,309 ha (average yield of 39.8t/ha), Northern Territory 1,283 ha (37.5t/ha average yield) and Western Australia 919 ha (average yield of 27.6t/ha), Victoria and South Australia also produce smaller quantities of melons (ABS 2018). The industry's average annual value of production over the four years to June 2017 was $186.3m (expressed in 2017/18 dollar terms).

Fresh watermelons, rockmelons and honeydew are produced all year round throughout Australia. Some specialty melons are available seasonally and marketed as differentiated products. The variation in production from year to year is the result of opportunistic production with some produces moving in and out of melon growing in response to melon prices.

Melons are marketed through the capital city wholesale markets or by direct sales to grocery retail chains, with only minor volumes sold to processors. In addition, exports of Australian melons totalled 20,271 tonnes with a value of $31.6m in 2017-18. Major export markets included New Zealand, United Arab Emirates, Singapore, Hong Kong and Qatar (Hort Innovation, 2019). Japan received its first imports of Australian melons in 2016, an activity supported by this project.

Rationale

The Australian melon industry supplies all domestic demand and a growing export sector. The industry is geographically diverse with growers in key production locations in all mainland states and the Northern Territory. The industry faces substantial threats and opportunities that are most effectively addressed collectively. This project was designed to continue the industry development and communication activities begun in VM09003 *Effective Management & Coordination of Melon Industry Development*. The project rationale was to build industry unity and grower involvement in industry affairs. This has been achieved through providing a collective focus which the industry has used to increase its profile; engage with researchers; create unification between melon growers and lead engagement with service providers. The project was designed to improve communications between growers and industry stakeholders to support strategic planning for the industry including the identification of high priority research and undertake awareness and extension of research findings to support grower adoption of best management practices. Further the project would support the efforts of the Australian Melon Association (AMA) to develop greater linkages between growers and government agencies for biosecurity and food safety programs and in responding to emerging issues, and support marketing activities through the provision of materials and building of awareness of melons amongst consumers.

Project Details

Summary

Project Code: VM12003

Title: *Development of the Australian Melon Industry through communication and market focused activity*: Australian Melon Association Inc.

Principal Investigator: Dianne Fullelove

Period of Funding: June 2013 to September 2017

Objectives

The project's key objectives were to:

1. Strengthen the AMA as the point of contact for all melon industry activities and communications for growers, researchers, and government.
2. Facilitate and coordinate industry activities to contribute to industry development.
3. Improve the communication capacity of the industry to respond to emerging issues.
4. Increase consumer awareness of melons and their attributes and the Australian melon industry.

Logical Framework

The focus of VM12003 was to provide a collective point for the melon industry to increase its profile within the rural domain; engage with researchers; create unification between melon growers; lead engagement with service providers. Project activities and outputs would contribute to industry management and development, communications, technology transfer and education. Table 1 provides a detailed description of the project in a logical framework.

Table 1: Logical Framework for Project VM12003

Activities and Outputs	• Industry development
	  ○ Coordinated with industry to establish R&D, Plant Health Australia and Emergency Plant Pest Response levies critical for continued Hort Innovation matched funding resulting in prioritised R&D projects.
	  ○ Strategic planning for industry – facilitated and coordinated development of the 2015-2020 Melon Industry Plan to enhance sustainable production, profitability, product innovation and marketing, including industry consultation meetings.
	  ○ Export development support to produce an Export Strategy and Plan, coordination with export authorities to assist industry meet new Japanese import protocols, facilitate research projects on irradiation protocols for New Zealand and interstate markets and use of dimethoate for exports to NZ; and coordinated workplace safety training for growers managing employees ("Melon Card").
	• Industry Management
	  ○ Biosecurity - managed biosecurity incursions for the melon industry: Cucumber green mottle mosaic virus (CGMMV) – 2014; 2015; 2016, Melon necrotic spot virus – 2014; 2016, Asian honey bee – 2016, Vegetable leafminer – 2015, Jack Beardsley mealybug – 2016.
	  ○ Liaison and coordination with state departments for pest surveillance and delivery of farm biosecurity information to all growers and produce regular electronic updates and factsheets to industry stakeholders including growers and seed companies.
	  ○ Organised and hosted grower information meetings, international science expert visits and scientific meetings.
	  ○ Contributed to development of a CGMMV National Management Plan in

	conjunction with AUSVEG. ○ Facilitated industry meetings and consultation identifying priority pest threats for the Melon Industry Biosecurity Plan (2014). ○ Food safety: represented the melon industry in food safety forums; led research project development for food safety in the industry; extended food safety guidelines for the melon industry compilation of materials, grower workshops and communication activities; and led management response to salmonella outbreak in 2016. • Communications ○ Developed communications plan for all stakeholders, growers, service providers and government. ○ Crisis communications plan developed in 2015. ○ Newsletters to industry stakeholders- print (quarterly) and electronic (monthly). ○ Redevelopment of industry website. ○ Electronic database of grower contacts for rapid email and SMS communications for crisis management. ○ Crisis Management plan developed and applied during Salmonella incident in 2016. ○ Disaster management – contributed and coordinated response to industry disasters to government media, government and growers in cases of Queensland flooding, biosecurity outbreaks and food safety (Salmonella). • Technology transfer strategies and activities ○ Organised 2 industry conferences and field days and 23 Industry update meetings for growers. ○ Research project management and contributing to communication activities, networking with growers and creating linkages with researchers. • Educational activities ○ Activities undertaken to educate consumers about melons and the Australian melon industry through social media campaigns and contributed resource material for various groups including Dieticians Association of Australia, BUPA Health Insurance sporting promotion, Sydney Fruit Festival and the Stay At Home Mums (SAHM) social media project.
Outcomes	• Increased credibility and salience of the AMA as the communication and coordination hub for the Australian melon industry to engage with government agencies, supply chain participants, researchers, Hort Innovation, Plant Health Australia and consumers. • Supported ongoing industry development by facilitating industry establishment of sustainable funding with implementation of the R&D and PHA levies. • Coordination of the development of industry planning (Research & Development Strategic Investment Plan, Melon Industry Biosecurity Plan (2014), Australian Melon Industry Marketing Plan and Australian Melon Industry Export Plan (2017). • Increased potential for management practice changes that increase efficiency and productivity reducing the unit cost of output within the melon industry. • Improvement in communication amongst industry stakeholders (growers, wholesalers, government, researchers) of biosecurity and food safety threats or incidents resulting in greater timeliness and effectiveness of coordinated responses at farm, regional and industry level. A 2017 survey of industry participants found that 80% of respondents supported continuation of the industry development program while 34% of respondents identified the Development project as the favoured source of industry information. A 2015 grower survey identified 98% of industry participants read the Melon eNews. Growers found the AMA communications to be important sources of information for technical information on biosecurity and food safety (2017 Survey).

	• Improved identification and support of high priority research needs for the melon industry and transparency of levy expenditure. • Increased quality and consistency of industry training programs in biosecurity and food safety due to improved coordination across regions and states. • Strategic support for developing and expanding melon export markets including the extension of complementary quality and phytosanitary requirements to meet export market conditions. • Source of support materials for domestic melon marketing programs.
Impacts	• Economic – production cost savings due to increased adoption rate of improved production practices and technologies. • Economic – avoided yield loss and sale losses with maintenance of pest and disease control practices and improved coordination of responses at farm, regional and industry levels to biosecurity incidents. • Economic – increased exports of melons and support of domestic consumption. • Capacity – industry communication, extension and research skills developed. • Social – increased industry unity and engagement and recognition of the melon industry and growers amongst agriculture sector and Australian consumers. • Social - increased income in regional Australia associated with a more profitable and sustainable melon industry (spill-over benefit).

Project Investment

Nominal Investment

Table 2 shows the annual investment (cash) in project VM12003 by Hort Innovation and includes both voluntary contributions from industry and industry levy. There were no 'other' investors in the project.

Table 2: Annual Investment in the Project VM12003 (nominal $)

Year ended 30 June	Hort Innovation managed & voluntary contributions ($)	Other ($)	Total ($)
2013	158,334	0	158,334
2014	112,152	0	112,152
2015	97,152	0	97,152
2016	114,445	0	114,445
2017	34,724	0	34,724
2018	49,987	0	49,987
Totals	566,794	0	566,794

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.

Real Investment and Extension Costs

For the purposes of the investment analysis, investment costs of were expressed in 2017/18 dollar terms using the GDP deflator index. Since 'Awareness' and 'Extension' activities are core to the project these are already part of the project costs.

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 VM12003

Economic	• Increased adoption of beneficial management practices from training and other extension and awareness activities resulting in reduced costs of production. • Reduced impact of biosecurity and food safety incidents from improved coordination of industry mitigation practices and eradication or management responses. • Increased sales of melons through support of domestic marketing and export development.
Environmental	• Increased use by growers of best management practices in relation to chemical use for pest management and food safety.
Social	• Recognition of contribution of growers to the melon industry and positive engagement of growers with researchers and government agencies • Increased individual capacity and wellbeing of melon farm managers and staff. • Improved food safety for consumers. • Spill-over benefits to other susceptible crop species from improved plant and disease management in melons. • Spill-over benefits to local communities from sustainable and profitable melon growers.

Public versus Private Impacts

The majority of impacts identified in this evaluation are melon industry related and therefore are considered private benefits. Public benefits have also been delivered including two types of social benefit. Social benefits delivered by the research included improved food safety for consumers through increased awareness and understanding of appropriate treatment of melons prior to sale by growers; as well as additional regional incomes resulting from the increased profitability of melon production.

Distribution of Private Impacts

The impacts on the melon industry from investment in this project will be shared along the supply chain with growers, packers, transporters, wholesalers, retailers and consumers all sharing impacts produced by the project. 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 both domestic and export melon markets.

Impacts on Other Australian Industries

Impacts on industries other than the melon industry and its associated sectors may include potential gains in other industries via spill-overs from improved biosecurity outcomes. The avoidance, management or eradication of plant pests or diseases that may impact on other crop species such as other cucurbits, fruits or vegetables.

Impacts Overseas

Apart from increased volumes and quality of melon imports supported by the project's planning and coordination there are not likely to be other overseas impacts from the project.

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 primarily to Rural RD&E Priorities 1, 2 and 4, and to Science and Research Priority 1.

Table 4: Australian Government Research Priorities

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

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

Match with Melon Strategic Investment Plan 2018-2022 Priorities

The strategic outcomes and strategies of the melon industry are outlined in the Melon Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2017). Project VM12003 addressed all four SIP outcomes, particularly Outcome 2, Strategy 2.2.

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 of the project were valued including the economic benefits derived from the increased rate of adoption of new technologies and farm best management practices that increase productivity and leads to reduced costs of production. The second stream of benefits valued include the reduction in costs to industry of biosecurity and food safety incidents. These reduced costs are a consequence of the project's communication, extension and training outputs that improve producers' capacity to avoid or minimise the severity of biosecurity and food safety incidents. Similarly, at the industry level, the project's communication and coordination plans enable timelier implementation of mitigation or eradication responses by growers and industry collectively.

Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment. At this time there is uncertainty regarding the level of attribution of increased exports to the specific contribution of the project with recent and current investments directly contributing to export development. These include the development of export manuals and production guidelines, collaborations with other horticultural industries (Hort Innovation, undated), increased levels of investment by exporters (Anthony Joseph, *pers com*) and recent trade changes such as the Free Trade Agreement with Japan in 2016 (Hort Innovation, undated). Further the Export Strategic Plan developed in 2017 means there is limited subsequent data available to determine impact of the plan to date. However it is clear that the project was important in facilitating the development of the Export Strategic Plan and communicating with growers about melon export markets while the AMA has continued to develop export opportunities such as Japan after completion of VM12003.

Likewise, environmental and social impacts were difficult to value due to a lack of evidence/data to quantify these impacts and determine the level of attribution to this development and communications project.

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

The economic impacts identified but not valued were:

- Increased sales of melons through support of domestic marketing and export development.

The environmental impact identified but not valued was:

- Increased use by growers of best management practices in relation to chemical use for pest management and food safety with benefits to the farm and local environments.

The social impacts identified but not valued were:

- Recognition of contribution of growers to the melon industry and positive engagement of growers with researchers and government agencies
- Increased individual capacity and wellbeing of melon farm managers and staff.
- Improved food safety for consumers.
- Spill-over benefits to other susceptible crop species from improved plant and disease management in melons and strategies for crises management of food safety and biosecurity issues.
- Spill-over benefits to local communities from sustainable and profitable melon growers.

Valuation of Impact 1: Increased rate of uptake of new technologies and best management practices

The VM12003 investment extended new technologies and improved management practices to melon producers that increased productivity and effectively reduced production costs. The project would have an additive impact by increasing the rate of adoption of improved practices by melon growers. VM12003 specifically improved communication amongst industry partners and undertook extension activities via regular newsletters and initiated and managed industry and grower meetings and field days, where various new technologies and best management practices were extended and demonstrated to growers. It is noted that an AMA survey identified that 98% of melon growers read the Melon eNews in addition to the project coordinating industry conferences and 23 regional industry update meetings. The types of technologies and practices communicated and extended through the project included agronomy and irrigation, variety selection, pest control, for example the use of barrier crops, food safety practices and melon quality guidelines.

It is conservatively estimated that adoption of improved practices results in a reduction in costs of production of 3% measured at the gross margin level. This level of improvement is consistent with the order of magnitude realised by productivity gains in Australian agriculture of approximately 2% and up to 5% in cropping systems (Mallawaarachchi et al 2009).It is noted that the Draft Melon Industry Strategic Investment Plan 2018-2021 estimates up to a 6% reduction in production costs from new technologies and the adoption of best management practices in addition to a 6% increase in production yields over 2018-2021 being adopted by some 5% of the grower base (provided by Hort Innovation).

On farm adoption commences in the third year of the project and maximum adoption is attained 5 years after this. Adoption is assumed to reach a maximum level of 50% of the major growing regions (Queensland, NSW, Northern Territory and Western Australia) and 25% of the remaining growing areas (Victoria and South Australia).

Attribution

For the analysis it is estimated that the increased adoption rate (beyond the counterfactual adoption rate described below) of the 3% reduction in gross margin costs, is fully attributable to Project VM12003 activities and outputs.

Counterfactual

In the absence of VM12003, there are still other government agencies, private sector service providers and input suppliers that are involved in extending new technologies to growers however in a less coordinated manner. Therefore, the adoption of the cost reducing technologies and best management practices by 3% will occur but at a slower rate. The maximum level of adoption will be the same as the with-project VM12003 scenario (50% of the major growing regions in Queensland, NSW, Northern Territory and Western Australia and 25% of the remaining growing areas in Victoria and South Australia). However, the rate of adoption of technologies and practices would be slower with maximum adoption being delayed by 3 years beyond the 'with-project' investment scenario. That is, adoption will commence in the same year (as the 'with-project' scenario) however maximum adoption is achieved after 8 years.

Valuation of Impact 2: Reduced impact of biosecurity and food safety incidents from improved coordination of industry mitigation practices and management or eradication strategic responses

The VM12003 project has undertaken various activities that improve communication amongst industry stakeholders (growers, wholesalers, government, researchers) relating to biosecurity and food safety issues. It is likely that this has resulted in greater timeliness and effectiveness of coordinated industry response at farm, regional and industry level to possible food safety and on-farm biosecurity issues. These outputs include initiation and coordination of awareness and training activities for farmers and staff to improve food handling techniques and also for on-farm biosecurity preparedness to manage pest and disease threats. The Draft Melon Industry Strategic Investment Plan estimates that the Outcome 4: The Australian melon industry has implemented actions in prioritised areas to mitigate and minimise risks including biosecurity and food safety and will result in:

- a reduction in the impacts associated with industry crises by up to 10%[2] from development and implementation of a national industry crisis and risk management plan and availability of information on biosecurity issues and industry obligations.
- Up to a 30%[1] reduction in economic impact associated with biosecurity and food safety issues through implementation of best practices on farm, food safety training and skills development for employees.

Combined these benefits were estimated in the Draft Melon Industry Strategic Investment Plan at an average $410,000 per annum ($2018 value) over 14 years of the Plan's impact. It is feasible that the VM12003 project which directly addressed communication and coordination activities relating to various pest and disease incursions and food safety issues had a similar magnitude of benefits.

Attribution

The estimated average annual benefit is an outcome from Project VM12003 outputs and activities and is in addition to the benefits derived from the various government (federal, state and local) agencies activities that are involved in managing food safety and on-farm biosecurity issues. Therefore this estimated additional benefit is fully attributable to Project VM12003.

Counterfactual

As stated, a number of State and Federal Government agencies have and continue to undertake research and monitor plant health and disease issues such as Plant Heath Australia, Department of Agriculture and Water Resources, and various state agriculture Departments. Similarly, Government agencies involved in food safety and health such as Food Standards Australia New Zealand (FSANZ) and state regulators and state Departments of agriculture are variously involved in providing technical advice and research, and awareness amongst producers of best management practices to mitigate or avoid biosecurity or food safety issues. These operate independently of the activities coordinated by VM12003 but realistically in a less coordinated and timely manner for the melon industry.

[2] The actual economic impact is dependent upon the likelihood of occurrence of a biosecurity or food safety issue and its potential impact of production. The economic impact being reduced by having industry plans to minimise the risk of pest and diseases.

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: Increased rate of uptake of new technologies and best management practices		
WITH Investment in Project VM12003		
Attribution of cost saving practices.	Cost savings of $192/ha, a 3% cost reduction in on-farm variable costs to point of harvest attributable to the project.	Consultant estimate based upon other industry estimates and is consistent with the Draft Melon Industry Strategic Investment Plan 2018-2021 with estimated technology improvements and best management practices resulting in 6% cost reduction. Assumes weighted watermelon: rock melon gross margin 70:30 reflecting national production mix of watermelon:rockmelon (Hort Innovation 2019) Cost saving estimated from NSW DPI Melon budgets (NSWDPI 2013) adjusted to 2017/18 $ value.
Maximum adoption.	50% of Qld, NSW, NT and WA (total 7763 ha) 25% of Vic, SA (total 700 ha)	Consultant estimate and drawn from ABS (2018) and Hort Innovation (2019).
Maintenance of benefits and dis-adoption.	Benefits maintained for 10 years from initial adoption and then decline over the following 5 years to zero.	Consultant estimate.
Year of first impact.	2014-15	Second full year after commencement of project, consultant estimate based on timing of project field days and communications.
Annual adoption rate.	20% annual increase for 5 years (to maximum adoption).	Consultant estimate of adoption profile based upon other annual cropping industry adoption rates given the 50% maximum adoption area would likely cover a substantial proportion of large specialised producers.
WITHOUT Investment in Project VM12003		
Year of first impact	2014-15	Second full year after commencement of project, consultant estimate based on timing of project field days and communications.
Annual adoption rate	12.5% annual increase for 8 years (to maximum adoption).	Consultant estimate of adoption profile based upon other annual cropping industry adoption rates given the 50% maximum adoption area would likely cover a substantial proportion of larger specialised producers.
Level of impact and maximum adoption.	See ‘with investment’ assumptions above	
Impact 2: Reduced impact of biosecurity and food safety incidents from improved coordination of		

industry mitigation practices and management		
Project's contribution to annual industry value of biosecurity and food safety preparedness provided by project.	$410,000.	Sourced from Draft Melon Industry Strategic Investment Plan 2018-2021 (Hort Innovation submitted).
Year of first impact and Attribution	Full attribution for 4 years from 2015-16 decreasing by 25% each of the following 3 years to zero by year 4 post project.	Consultant estimate considering the continued focus of continuing projects and activities after completion of VM12003 identified in the Melon Industry Strategic Plan
WITHOUT Investment in Project VM12003		
Biosecurity and food safety threats avoided or minimised	No additional benefits	Consistent with the Draft Melon Industry Strategic Investment Plan

The two quantified benefit streams were assumed to be superseded by future melon industry investments under the Melon Industry Strategic Plan. For Impact 1: Increased rate of uptake of new technologies and best management practices - benefits are maintained for 10 years after which benefits attributable to VM12003 decline to zero after a further 5 years. In the case of Impact benefit stream 2: Reduced impact of biosecurity and food safety incidents from improved coordination of industry mitigation practices and management project benefits would occur from the second full year of the project and be superseded after 7 years by continued investments by the industry highlighted in the Melon Industry Strategic Plan.

Results

All costs and benefits were discounted to 2018/19 values 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

Investment Criteria

Table 6 shows the investment criteria estimated for different periods of benefit for the total investment. Hort Innovation was the only contributor to this project so there is no second set of analyses showing results for Hort Innovation.

Table 6: Investment Criteria for Hort Innovation being the Total Investment in Project VM12003

Investment Criteria	Years after Last Year of Investment						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	1.88	3.47	3.47	3.47	3.47	3.47	3.47
Present Value of Costs ($m)	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Net Present Value ($m)	1.03	2.62	2.62	2.62	2.62	2.62	2.62
Benefit-Cost Ratio	2.21	4.09	4.09	4.09	4.09	4.09	4.09
Internal Rate of Return (%)	44.2	57.0	57.3	57.3	57.3	57.3	57.3
MIRR (%)	31.03	25.9	25.9	15.0	12.9	11.6	10.6

The annual undiscounted benefit and cost cash flows for the total investment for the duration of VM12003 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

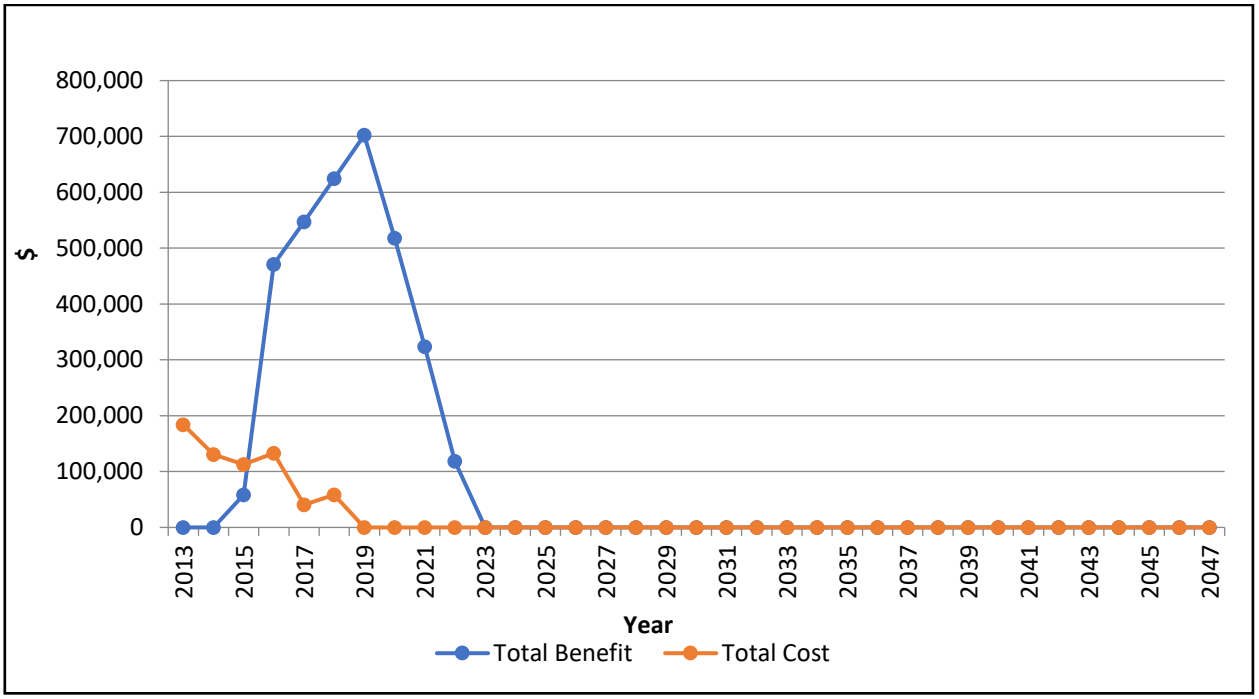

Table 7 shows the contribution of each impact to the total PVB.

Table 7: Contribution of Benefits

Impact	PVB ($M)	% of Total PBV
Impact 1: Increased rate of uptake of new technologies and best management practices	1.21	34.9%
Impact 2: Reduced impact of biosecurity and food safety incidents from improved coordination of industry mitigation practices and management	2.26	65.1%
Total	3.47	100%

Sensitivity Analyses

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

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

Investment Criteria	Discount rate		
	0%	5%	10%
Present Value of Benefits ($m)	3.42	3.47	3.52
Present Value of Costs ($m)	0.69	0.85	1.04
Net Present Value ($m)	2.74	2.62	2.48
Benefit-cost ratio	4.97	4.09	3.39

A sensitivity analysis was then undertaken to estimate benefits from costs saved by adoption of the best management practices and technologies extended through the project's communications and grower events. With a more modest assumed cost saving adoption rate of 30%, the project continues to produce a positive return on investment – Table 9.

Table 9: Sensitivity to the increased rate of adoption of cost saving technologies (expressed as percentage increase in adoption rate above the without scenario over the first five years of the project)
(Total investment, 30 years)

Investment Criteria	**Increased rate of adoption of cost saving technologies over without project scenario**		
	30%	**60% (Base case)**	**90%**
Present Value of Benefits ($m)	3.31	3.47	3.63
Present Value of Costs ($m)	0.85	0.85	0.85
Net Present Value ($m)	2.46	2.62	2.78
Benefit-cost ratio	3.90	4.09	4.28

A final sensitivity test examined the level of estimated benefits from investment in VM12003 in terms of costs saved from improved industry preparedness and coordination for biosecurity and food safety threats or incidents – Table 10.

Table 10: Sensitivity to estimated benefit attributable to VM12003 from improving the industry's capacity to manage biosecurity and food safety issues
(Total investment, 30 years)

Investment Criteria	**Estimated annual benefit attributable to VM12003**		
	-50% ($205,000)	**Base case ($410,000)**	**+50% ($615,000)**
Present Value of Benefits ($m)	2.34	3.47	4.59
Present Value of Costs ($m)	0.85	0.85	0.85
Net Present Value ($m)	1.49	2.62	3.75
Benefit-cost ratio	2.76	4.09	5.42

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**
Medium	Medium-low

Coverage of benefits was assessed as medium-high. Two key benefits (increased rate of adoption of technologies from the project's communications and extension activities and avoided losses from improved industry preparedness and coordination of biosecurity and food safety issues) were quantified, other economic benefits –from communications to support marketing programs and exports) were not valued. Consequently, the investment criteria as provided by the valued benefits are likely to be underestimated to some degree.

Confidence in assumptions was rated as medium-low. The approach used was similar to other independent impact assessments of extension activities in Australian agriculture where particular extension activities are most likely to increase the rate of adoption by farmers rather than total level of adoption. The estimated impacts from improved capacity of the industry to manage biosecurity and food safety issues is consistent with the Draft Melon Industry Strategic Investment Plan 2018-2021.

Conclusion

The investment in VM12003 will likely contribute to maintaining and increasing the profitability of the Australian melon industry through increasing the rate of adoption of new technologies and practices for growers through coordinated communications and extension activities that are responsive to growers needs. Further outputs of the project have also contributed to increased capacity of growers and the industry to manage and mitigate biosecurity threats and food safety issues. This results in a reduction or avoidance of losses to the industry from fewer or less severe biosecurity or food safety incidents.

Additional benefits from the project's outputs include communications to support of domestic marketing and export development. As well, potential environmental benefits by supporting the communication and extension of best management practices in relation to chemical use for pest management and food safety to growers are likely.

The social impacts arising from the project include a greater recognition of the melon industry and engendering positive engagement amongst growers, researchers and government agencies; improved food safety for consumers; and spill-over benefits to local communities from more sustainable and profitable melon growers.

Total funding for the project was $0.85 million (present value terms) with Hort Innovation investment being the sole investor. The investment produced estimated total expected benefits of $3.47million (present value terms). This gave a net present value of $2.60 million, an estimated benefit-cost ratio of 4.1 to 1, an internal rate of return of 57.3% and a modified internal rate of return of 10.6%.

While several economic, environmental and social impacts identified were not valued, the impacts were considered indirect, uncertain and/or minor compared with the impacts valued. Nevertheless, combined with conservative assumptions for the impacts valued, investment criteria as provided by the valuation may be underestimates of the actual performance of the investment.

Glossary of Economic Terms

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

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Abbreviations

AMA	Australian Melon Association
CRRDC	Council of Research and Development Corporations
CGMMV	Cucumber green mottle mosaic virus
GDP	Gross Domestic Product
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
NSW	New South Wales
NZ	New Zealand
PVB	Present Value of Benefits
RD&E	Research, Development and Extension
SIP	Strategic Investment Plan