

Final Report

Economic impact assessment for Hort Frontiers: An evaluation of *Market development program – almonds (AM15007)*

Project leader:

Michael Clarke

Delivery partner:

AgEconPlus

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Project:

Economic impact assessment for Hort Frontiers (HA20000)

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Level 7
141 Walker Street
North Sydney NSW 2060

Telephone: (02) 8295 2300

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Public summary

Hort Frontiers invests funds from a wide range of co-investors including businesses, research agencies, government departments, education institutions, the Australian Government and horticulture levies. Economic impact assessment of these investments is required to meet Hort Innovation obligations under its Organisational Evaluation Framework, its Statutory Funding Agreement, and to demonstrate a return to a diverse set of co-investors and other stakeholders.

This economic impact assessment of the Hort Frontiers program addresses these requirements through the completion of a series of project-specific, ex-post, independent impact assessments of the program. The economic impact assessment was completed using guidelines prepared by the Council of Rural Research and Development Corporations (CRRDC 2018).

The project assessed in this impact assessment was *AM15007: Market Development Program-Almonds*. The Hort Frontiers project has contributed to the potential expansion of the export markets for Australian almonds in several Asian countries (including the Middle East). Project costs were large and upfront while benefits are likely to be considerable and concentrated in the near-term. Consequently, the estimated return on investment was relatively high.

Technical summary

This report presents the results of an impact assessment of a Hort Frontiers project AM15007: *Market Development Program - Almonds*. The project was funded by Hort Innovation over the period December 2016 to June 2019.

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 2021/22-dollar terms and were discounted to the year 2022/23 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).

The Hort Frontiers project has contributed to a larger export of Australian almonds to several Asian markets (including the Middle East). Project costs were large and upfront while benefits are likely to be concentrated in the near-term future, rather than the longer term. Consequently, return on investment was estimated as high.

Total funding from all sources for the project was \$1.41 million (present value terms). The investment produced estimated total expected benefits of \$13.56 million (present value terms). This gave a net present value of \$12.15 million, an estimated benefit-cost ratio of 9.61 to 1, and a modified internal rate of return of 18.8%. As several other identified impacts were not valued, the investment criteria estimated by the evaluation may be underestimates of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, almonds, exports, market development, Asia.

Introduction

The Hort Frontiers program facilitates collaborative cross-industry investments that are focused on high-risk, transformative research, development, and extension (RD&E) with the potential for significant impact. Investments are longer-term, complex, and focus on traditionally underinvested themes.

Hort Frontiers invests funds from a wide range of co-investors including businesses, research agencies, government departments, education institutions, the Australian Government and horticulture levies. Economic impact assessment of these investments is required to meet Hort Innovation obligations under its Organisational Evaluation Framework, its Statutory Funding Agreement, and to demonstrate a return to a diverse set of co-investors and other stakeholders.

This economic impact assessment of the Hort Frontiers program addresses these requirements through the completion of a series of project-specific, ex-post, independent impact assessments of the program. A total of eight (8) RD&E investments (projects) were selected through a stratified, random sampling process. The projects, and the total life-of-project (LOP) value of their Hort Innovation managed investment in nominal terms are described in Table 1.

Table 1: Hort Frontiers Project Sample for Impact Assessment

Hort Frontiers Fund	Project Code	Project Title	Total LOP Investment ^(a) (nominal \$)
Advanced Production Systems	AS19005	Australian Protected Cropping RD&E Strategy 2030	140,322
Fruit Fly	HG14033	SITplus: Raising Qfly Sterile Insect Technique to World Standard	20,502,806
Green Cities	GC15002	Which plant where when and why database	10,573,638
Health, Nutrition & Food Safety	HN15000	Innovative Cold Plasma for Horticultural Industries	5,080,321
International Markets	AM15007	Market Development Program - Almonds	925,499
International Markets	AM17001	Developing a national systems approach for meeting bio-security requirements to access key Asian markets	4,830,614
Leadership	LP15001	Global Masterclass Horticulture	3,235,805
Pollination	PH16004	Securing pollination for productive agriculture: guidelines for effective pollinator management and stakeholder adoption	2,182,967

(a) Hort Innovation managed investment

The project population for each fund from which the random sample was selected included completed projects where a final deliverable had been submitted and accepted in the three-year period from 1 July 2019 to 30 June 2022.

The projects in the random sample were selected such that:

- (1) The total LOP sample value (in nominal dollar terms) represented at least 10% of the total Hort Innovation managed investment in the overall Hort Frontiers project population, and
- (2) The total Hort Innovation managed investment in each project was greater than, or equal to, \$100,000 (to exclude 'trivial' projects).

Further, the random sample was stratified first by Hort Frontiers Fund, to ensure all relevant Funds were represented, and then by LOP value range.

The final stratified random sample shown in Table 1 included the required eight (8) projects. At least one project from each Hort Frontiers Fund was selected and at least one project from each LOP range (as defined by Hort Innovation). The final random sample had a total nominal LOP value of \$47.47 million (Hort Managed investment) equivalent to approximately 51.6% of the overall total nominal LOP value in the population. Also, the final random sample included one project completed in 2019/20, two completed in 2020/21, and five completed in 2021/22 (all relevant years represented).

Project AM15007: *Market Development Program - Almonds* was one of the investments randomly selected and is analysed in this report.

Methodology

The impact assessments followed 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 assessment components that are in accord with the impact assessment guidelines of the Council of Rural Research and Development Corporations (CRRDC) (CRRDC, 2018).

The evaluation process followed an input to impact continuum and involved identifying and briefly describing project objectives, activities, outputs, actual and expected outcomes, and any actual and/or potential impacts associated with project outcomes. The principal economic, environmental, and social impacts then were summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then valued in monetary terms. The decision to value an impact identified was based on:

- Data availability and information necessary to form credible valuation assumptions,
- The complexity of the relevant valuation methods applicable given project resources,
- The likely magnitude of the impact and/or the expected relative value of the impact compared to other impacts identified, and
- The strength of the linkages between the RD&E investment and the impact identified.

Where impact valuation was exercised, the impact assessment used cost-benefit analysis (CBA) as a principal tool. 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 the individual investment evaluated are likely to represent an underestimate of the true performance of the investment.

Background and Rationale

The Hort Frontiers International Markets Fund Project “AM15007: Market Development -Almonds” was funded in the context of the Australian almond industry being a relatively small producer but a significant exporter in the overall world production of almonds. At that time, the United States Californian almond industry produced greater than 80% of the world’s almond production.

In 2016 Australian almond production was based largely in the Sunraysia region of Victoria (61% by area), the Riverland region in South Australia (20% by area) and the Riverina region in New South Wales (15% by area). The total planted area of trees was 39,610 ha in 2016. Total Australian production in 2016 was 82,333 tonnes of which 23,275 tonnes were consumed domestically and 58,944 tonnes (72%) exported. Countries in Europe and in Asia Pacific Oceania were the major Australian almond export destinations (Australian Almonds, 2016-17).

Previous to the commencement of AM15007 Asian countries represented important markets for Australian almonds, accounting for greater than 56% of total Australian exports in 2015; in addition, the East Asian markets of the Middle East represented 11% and the North-East and South-East Asian markets represented 10%.

Australian almond production area (ha) and production and export volumes from 2014 to 2021 are shown in Table 2. The table shows that the area planted to almonds in Australia was still increasing in 2016-2017, at the time the project was funded. It was therefore considered imperative to continue to grow Australian almond exports to accommodate the expected future production increase. In pursuit of this imperative, both established and new markets in Asia were identified as principal future prospects for export market expansion for Australian almonds.

Table 2: Australian Almond Area and Production 2011 to 2021

Year ended 30 June	Australian Almond Area (ha)	Australian Almond Production (kernel tonnes)	Australian Almond Exports (kernel tonnes)
2014	27,771 (b)	65,060 (b)	49,751 (b)
2015	34,023 (b)	82,509 (b)	59,307 (b)
2016	39,733 (b)	82,333 (b)	58,944 (b)
2017	47,239 (b)	79,477 (b)	54,343 (b)
2018	52,093 (b)	79,901 (b)	60,894 (b)
2019	53,014 (a)	104,441 (a)	71,633 (a)
2020	58,523 (a)	114,427 (a)	65,060 (a)
2021	n.a.	124,439 (a)	84,014 (a)

n.a. not available

Sources: (a) 2020/21 Australian Horticulture Statistics Handbook, and (b) Almond 2020-21 Insights, Almond Board of Australia

Project Details

Summary

<p>Project Code: AM15007</p> <p>Title: <i>Market Development Program – Almonds</i></p> <p>Research Organisation: Almond Board of Australia</p> <p>Project Team: Ross Skinner (Project Leader), Chief Executive Officer, Almond Board of Australia; Joseph Ebbage, Market Development Manager, Almond Board of Australia.</p> <p>Period of Funding: Years ending June 2017 to June 2019.</p>

Objectives

The four strategic objectives of Project AM15007 were:

- To continue to grow the established markets of Central and West Asia.
- To build market share in the emerging markets of North-East and South-East Asia.
- To leverage the health and nutritional benefits of almonds by growing market share in the Fresh Produce categories of supermarkets in key North-East and South-East Asian markets.
- To leverage the opportunities presented to Australian almonds by the Free Trade Agreements between Australia and Japan, Korea, and China.

Logical Framework

Table 3 provides a detailed description of project AM15007 in a logical framework.

Table 3: Logical Framework for Project AM15007

<p>Activities</p>	<ul style="list-style-type: none"> • The three principal activities undertaken in the project included trade exhibitions, outbound market education visits and on-ground trade communication. • Nine trade exhibitions were supported by the project from September 2016 to May 2019; venues for these exhibitions were to include Hong Kong (two), Dubai (three), Shanghai (three), Guangzhou (one); however, the Australian industry did not attend the Asia fruit Logistica held in Hong Kong in 2018 and 2019; instead, they exhibited at the China Tree Nut Conference in Guangzhou China in 2017, 2018 and 2019. • In addition, exhibits were held at Foodex in Tokyo and Food & Hotel Indonesia in Jakarta. • In each year of the project there was one Outbound Education Market Visit to each of the Japanese (Tokyo) and Korean (Seoul) markets. These activities were organized in order to develop greater understanding of market requirements and to educate nut traders of the advantages of Australian almonds as well as featuring the recent Japan-Australia and Korea-Australia Free Trade Agreements. • Trade communication activities included quarterly e-newsletters that communicated seasonal growing updates that featured video footage of Australian almond orchards.
<p>Outputs</p>	<p>Key outputs driven by the activities within the market development project targeted at Asian countries included:</p> <ul style="list-style-type: none"> • Increased and improved information delivery processes to export markets compared to what would have been the case without the project. • Increased awareness and knowledge delivered to existing and prospective Asian almond purchasers of the availability, quality and other information associated with Australian almonds. • Improved information delivered to almond purchasers regarding the advantages of Australian almonds as driven by the recent Japan-Australia and Korea-Australia Free Trade Agreements.

<p>Outcomes</p>	<ul style="list-style-type: none"> • Improved relationships between the Australian almond industry and existing and potential Asian almond importers. • Increased knowledge by Central and West Asian importers of almonds regarding the advantages of Australian almonds. • An increase in demand for Australian almonds in the target markets. • An increase in experience of Australian almond marketers in strategies to increase market demand.
<p>Potential Impacts</p>	<ul style="list-style-type: none"> • Increased demand for Australian almonds in Asian (including the Middle East) markets. • Improved stability of producer incomes through development of export markets that contributes to: <ul style="list-style-type: none"> ○ increased export prices, or ○ an avoidance of a price fall for Australian almonds in Asian (including the Middle East) markets, and/or ○ avoidance of a price fall in non-Asian markets due to greater sales to Asian markets. • An increase in the strategic capacity of Australian almond marketers to develop improved export strategies in the future. • Maintenance of profitability of Australian almond producers with positive impacts on Australian regional communities.

Project Investment

Nominal Investment

Table 4 shows the annual investment (cash and in-kind) in project AM 15007 by Hort Innovation and the Almond Board of Australia.

Table 4: Annual Investment in the Project AM15007 (nominal \$)

Year ended 30 June	Hort Innovation (\$)	Almond Board of Australia (\$)	Total (\$)
2017	116,031	184,169	300,200
2018	119,202	189,202	308,404
2019	122,483	194,412	316,895
Totals	357,716	567,783	925,499

Source: Contract Variation between Hort Innovation and the Almond Board of Australia

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 (1.143). The multiplier was 1.143 (3-year average, 2018/19-2020/21) – calculated based on payments to suppliers and employees and payments to R&D providers reported in the Statement of Cash Flows in the Hort Innovation Annual Reports (2019-2021). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 4.

Real Investment and Extension Costs

For the purposes of the investment analysis, the investment costs of all parties were expressed in 2021/22-dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2022). There were no additional costs assumed associated with project extension as the project itself was embedded in the Asian markets supply chains.

Impacts

Table 5 provides a summary of the principal types of impacts delivered by the project, based on the logical framework (Table 3). Impacts have been categorised into economic, environmental, and social impacts.

Table 5: Triple Bottom Line Categories of Principal Impacts from Project AM15007

Economic	<ul style="list-style-type: none"> • Increased demand for Australian almonds in Asian (including the Middle East) markets. • Improved stability of producer incomes through development of export markets that contributes to: <ul style="list-style-type: none"> ○ increased export prices, or ○ an avoidance of a price fall for Australian almonds in Asian (including the Middle East) markets, and/or ○ avoidance of a price fall in non-Asian markets due to greater sales to Asian markets.
Environmental	<ul style="list-style-type: none"> • Nil
Social	<ul style="list-style-type: none"> • Contribution to improved regional community wellbeing from spill-over income and employment benefits as a result of project contribution to maintenance of current levels of Australian almond production and profitability. • An increase in the strategic capacity of Australian almond marketers to develop improved strategies in the future.

Public versus Private Impacts

The impacts identified from the investment are both private and public in nature. Private impacts mostly accrue to almond growers and exporters. Public impacts include gains for regional communities and the additional future capacity gained by almond marketers.

Distribution of Private Impacts

Private impacts will be captured by the producers and marketers of Australian almonds. These impacts will be shared by entities along the supply chain according to the relevant short- and long-term elasticities of supply and demand along the chain.

Impacts on Other Australian Industries

It is unlikely that there will be impacts on any other Australian primary industries.

Impacts Overseas

Project AM15007 may have some impacts on the supply of almonds from other exporting countries but any such impacts have not been addressed and were beyond the scope of the current analysis.

Match with National Priorities

The Australian Government’s National Science and Research Priorities and National Agricultural Innovation Priorities are reproduced in Table 6. The project outcomes and related impacts will contribute to National Science and Research Priority 1 and National Agricultural Innovation Priority 1.

Table 6: Australian Government Research Priorities

Australian Government Strategies and Priorities	
National Science and Research Priorities ¹	National Agricultural Innovation Priorities ²
<ol style="list-style-type: none"> 1. Food – optimising food and fibre production and processing; agricultural productivity and supply chains within Australia and global markets. 2. Soil and Water – improving the use of soils and water resources, both terrestrial and marine. 3. Transport – boosting Australian transportation: securing capability and capacity to move essential commodities; alternative fuels; lowering emissions. 4. Cybersecurity – improving cybersecurity for individuals, businesses, government, and national infrastructure. 5. Energy and Resources – supporting the development of reliable, low cost, sustainable energy supplies and enhancing the long-term viability of Australia’s resources industries. 6. Manufacturing – supporting the development of high value and innovative manufacturing industries in Australia. 7. Environmental Change – mitigating, managing, or adapting to changes in the environment. 8. Health – improving the health outcomes for all Australians. 	<p>On 11 October 2021, the National Agricultural Innovation Policy Statement was released. It highlights four long-term priorities for Australia’s agricultural innovation system to address by 2030. These priorities replace the Australian Government’s Rural Research, Development and Extension Priorities which were published in the 2015 Agricultural Competitiveness White Paper.</p> <ol style="list-style-type: none"> 1. Australia is a trusted exporter of premium food and agricultural products by 2030. 2. Australia will champion climate resilience to increase the productivity, profitability, and sustainability of the agricultural sector by 2030. 3. Australia is a world leader in preventing and rapidly responding to significant incursions of pests and diseases through futureproofing our biosecurity system by 2030. 4. Australia is a mature adopter, developer, and exporter of digital agriculture by 2030.

Alignment with the Hort Frontiers Almond Fund Strategic Priorities

The Hort Frontiers Almond Fund has four investment themes (Hort Innovation, 2022):

- 1) Industry supply, productivity, and sustainability
- 2) Demand creation
- 3) Extension and capability
- 4) Business insights

Project AM15007 directly delivered against Theme 2: Demand creation.

¹ See: 2015 Australian Government Science and Research Priorities. <https://www.industry.gov.au/data-and-publications/science-and-research-priorities>

² See: 2021 National Agriculture Innovation Policy Statement. https://www.awe.gov.au/agriculture-land/farm-food-drought/innovation/research_and_development_corporations_and_companies#government-priorities-for-investment

Case Study

The following section provides real world feedback on how the outputs of the investment have benefited almond export businesses in Australia.

R&D CASE STUDY: MASTERING AUSTRALIAN HORTICULTURE

THE CHALLENGE

Over the past decade, Australian almond exports have increased by 213%. Around 70% of production currently is exported (Australian Trade and Investment Commission, 2022) and new almond plantings have continued to increase.

Industry and government considered it critical to the economic sustainability of the almond industry to continue to grow Australian almond exports to accommodate expected future production increases. New and improved market access and trade opportunities in north-east and south-east Asia were highlighted as a priority and strategic focus for almond export market development.

MEET THE SELECT HARVESTS TEAM



Members of the Select Harvest Team at the Australian Export Awards 2019 (photo credit: Select Harvest, 2019)

Select Harvests is one of Australia’s largest almond growers and processors. The company has been increasing production, so it has extra capacity to supply more markets. The company’s two biggest markets are China and India, the company also exports to the Middle East and Europe.

‘Select Harvests has always been good at diversifying our markets,’ says Ekrem Omer, International & Retail Sales Manager, Select Harvests. ‘We’re interested in markets with a demand for healthy snacks and which are easy to access from Australia.’ (Austrade, 2022).

THE APPROACH

Select Harvests has attended a range of almond industry and brand promotional events and trade exhibitions supported by the ABA trade development project. The company also took part in an Austrade–ABA virtual meeting as part of the Australia-India Business Exchange program as well.

Select Harvests’ participation in industry-wide promotional programs, together with direct marketing activities has driven significant sales growth. Working together with the ABA, Select Harvests now intends to further develop and establish these events and themes into an annual promotions calendar (Select Harvests, n.d.).



Australian almonds (photo credit: Austrade, 2022)

THE IMPACT

For Select Harvest, production has increased from 14,200 tonnes in 2015/16 to 29,000 tonnes in 2021/22. Exports continue to be a strategic focus for the company. Select Harvests is one of Australia's largest almond exporters and continues to build strong relationships in the fast-growing markets of India and China, as well as maintaining established routes to markets in Asia, Europe, and the Middle East (Select Harvests, 2022). Participation in the Hort Innovation almond market development program, including representation at international trade exhibitions, outbound market education visits, and on-ground trade communication, has contributed to the company's continued export growth and diversification as well as overall profitability.

Nationally, Australian almond export volumes were up 12.5% year-on-year as of 31 December 2018, on the back of a significant increase in shipments to north-east Asian markets. Shipments to North-east Asia (China, Japan, Hong Kong, Korea, and Taiwan) totalled 12,464 tonnes as of 31 December 2018, up 749 % on the 1,467 tonnes sent up until 31 December 2017. The Chinese market absorbed almost all of this volume (11,414 tonnes), with small volumes sent to Hong Kong (249 tonnes) and Japan (799 tonnes). Sales to South-East Asia also were up, increasing by 84% over the 2018/19 season, with Vietnam (8,343 tonnes) the leading market in this region (Jones, 2019).



Select Harvest almond orchard (photo credit: Select Harvests, 2022)

Valuation of Impacts

Impacts Not Valued

Not all the impacts identified in Table 5 could be valued in the assessment. Of the six identified impacts, three of the five potential impacts were not valued and included:

- Avoidance of a price fall in non-Asian markets due to greater sales to Asian markets than would otherwise have been the case (driver of producer income stability).
- An increase in the strategic capacity of Australian almond marketers to develop improved strategies in the future.
- Avoidance of a reduced impact on Australian regional communities affected by a potential fall in profitability of Australian almond producers.

These impacts were not valued due to lack of data to support credible assumptions.

Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly as 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.

Three of the six identified impacts were considered for valuation under a single valuation framework:

- An increased volume of sales of Australian almonds to Asian markets at the existing prices (increased demand for Australian almonds).
- Maintained average export price (increased income stability – incorporates both avoided price fall and increased export price impacts).

Impact 1: Increased Net Revenue to the Australian Almond Industry (Increased Export Demand)

Due to a lack of timely data associated with any changed quantities and prices for exports to Asian markets and the number of Asian markets that may have been affected by Project AM15007, valuation was exercised using a simple assumption of an increased quantity of almonds being sold to Asian markets; that is, the Asian markets expanded due to the project. Hence, it was assumed there was an increase in net revenue to the Australian almond industry due to the project.

Summary of Assumptions

The potential impact of AM15007 on increased net revenue was assessed using the assumptions provided in Table 7.

Table 7: Assumptions for Increased Net Revenue to the Australian Almond Industry

Variable	Assumption/Value	Source/Comment
Assumptions Prior to Project Impact		
Australian average total exports of Australian almonds in the 3 years ending June 2016 to 2018	58,060 kernel tonnes	Derived from Table 2: Almond 2020-21 Insights, Almond Board of Australia
Estimate of Australian almond exports destined for Asian countries in the years ending June 2016 to June 2018 (base estimate)	40,642 kernel tonnes	Based on Asian countries representing 70% of total Australian kernel average export tonnage; Asian countries represented greater than 56% of total Australian exports in 2015. In addition, the East Asian markets of the Middle East represented 11% and the North-East and South-East Asian markets represented 10% of total Australian almond exports (Sources: 2020/21 Australian Horticulture Statistics Handbook; Almond 2020-21 Insights, Almond Board of Australia).

Assumptions for Post Project Period		
Australian almond exports to Asia in 2020-21	46,906 tonnes kernel	Almond Insights 2020-21 Note: the export volumes for this period were likely impacted by Covid-19 trade disruptions.
Value of Australian almond exports to Asia in 2020-21	\$342.01 m	
Value of almond exports to Asia (\$/tonne) in 2020-21	\$7,291 per tonne	\$342.01 m/46,906 tonnes
Increase in Australian almond tonnage exported to Asia over 3 years, from year ending June 2019 to June 2021	6,264 tonnes kernel	46,906 tonnes – 40,642 tonnes
Value of increased exports to Asia over the three years (2019-2021)	\$45.67m.	6,264 tonnes x \$7,291 per tonne
Proportion of increase in value directly attributable to the project	20%	Agtrans Research
Value of increased exports to Asia due to project during 2019-2021	\$9.13 m	20% of \$45.67 m
Allocation of increased value of increased exports to Asia by year due to project		
Year of impact	Proportion of increase in value directly attributable to project AM15007	Explanatory comments
2018-2019	20%	First year of impact
2019-2020	30%	Second year of impact
2020-2021	40%	Third year of impact
2021-2022	50%	Period of maximum impact of project
2022-2023	50%	
2023-2024	50%	
2024-2025	40%	
2025-2026	30%	Residual impacts only – assumes no additional investment after AM15007. Residual impact of 10% attributable to AM15007 continues to last year of benefits assumed at 30 years after the last year of investment in the project.
2026-2027	20%	
2027-2028	10%	
Risk factors and counterfactual		
Probability of Project outputs being delivered	100%	Agtrans Research
Probability of Project outcomes being delivered	75%	
Probability of project impacts being delivered	50%	
Counterfactual	The outcomes and impacts assumed driven by the project investment (the 20% increased exports to Asian markets) would not have been delivered without the project investment	

Results

All costs and benefits were discounted to 2022/23 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (2018/19) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

Table 8 and Table 9 show the investment criteria estimated for different periods of benefits for the total investment and Hort Frontiers investment, respectively. Hort Frontiers present value of benefits (Table 9) was estimated by multiplying the total present value of benefits by the Hort Frontiers proportion of total undiscounted costs expressed in 2021/22-dollar terms (41.9%).

Table 8: Investment Criteria for Total Investment in Project AM15007

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits (\$m)	1.01	9.21	11.97	12.69	13.13	13.40	13.56
Present Value of Costs (\$m)	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Net Present Value (\$m)	-0.40	7.80	10.56	11.27	11.72	11.99	12.15
Benefit-Cost Ratio	0.72	6.52	8.48	8.99	9.30	9.49	9.61
Internal Rate of Return (%)	17.6	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
MIRR (%)	n.s.	129.0	71.7	38.5	27.6	22.1	18.8

n.s. no solution

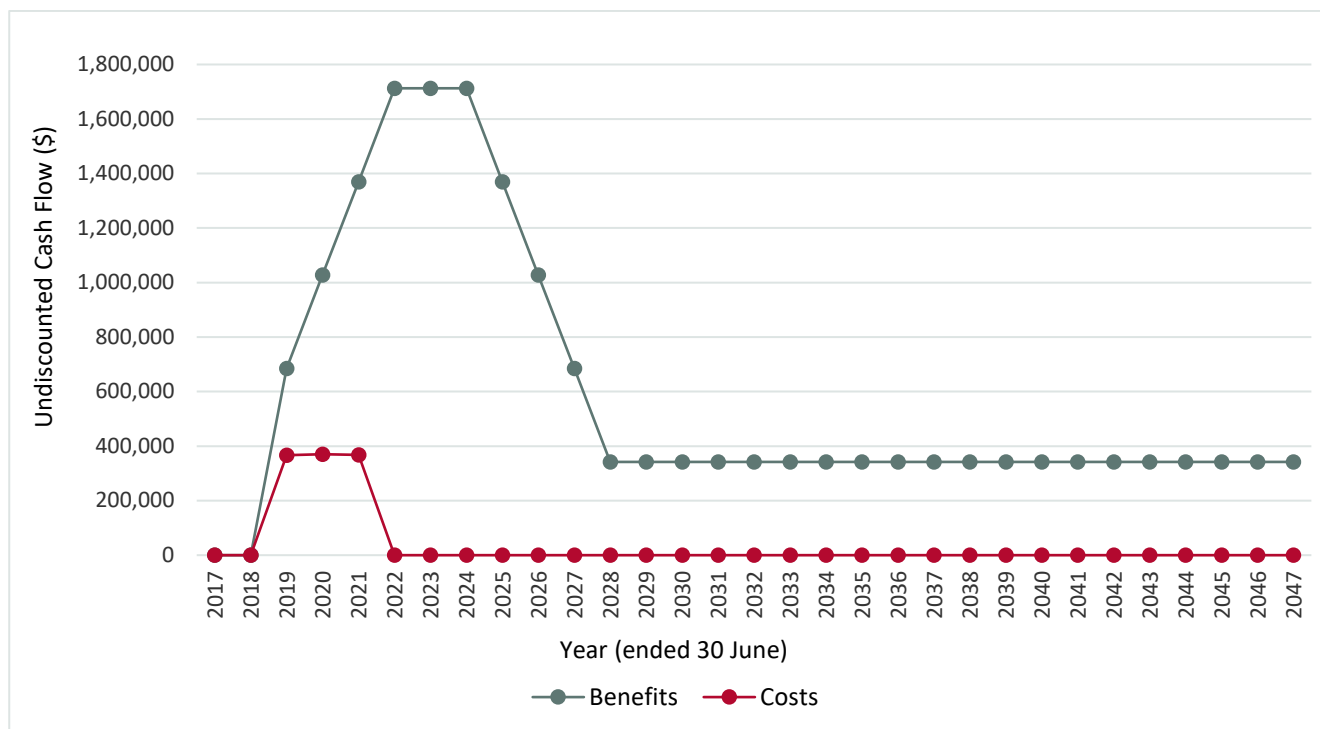
Table 9: Investment Criteria for Hort Innovation Investment in Project AM15007

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits (\$m)	0.42	3.86	5.01	5.31	5.50	5.61	5.68
Present Value of Costs (\$m)	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Net Present Value (\$m)	-0.17	3.26	4.42	4.72	4.90	5.02	5.09
Benefit-Cost Ratio	0.72	6.52	8.48	8.99	9.30	9.49	9.61
Internal Rate of Return (%)	17.6	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
MIRR (%)	1.2	286.4	60.0	35.3	26.1	21.2	18.2

n.s. no solution

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the AM15007 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 conducted 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 10 presents the results. The results are not particularly sensitive to the discount rate. This is due to the short period of time between the investment being made and the resulting impacts.

Table 10: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	Discount Rate		
	0%	5% (base)	10%
Present Value of Benefits (\$m)	18.84	13.56	13.08
Present Value of Costs (\$m)	1.10	1.41	1.79
Net Present Value (\$m)	17.73	12.15	11.30
Benefit-cost ratio	17.04	9.61	7.33

A sensitivity analysis was then undertaken on the increase in the exports to Asia that may have been due to the project investment. Results are provided in Table 11.

**Table 11: Sensitivity to Increase in Almond Exports to Asia due to Project AM 15007
(Total investment, 30 years)**

Investment Criteria	Increase in Australian Almond Exports to Asia due to Project AM 15007		
	10%	20% (base)	30%
Present Value of Benefits (\$m)	6.78	13.56	20.35
Present Value of Costs (\$m)	1.41	1.41	1.41
Net Present Value (\$m)	5.37	12.15	18.94
Benefit-cost ratio	4.80	9.61	14.41

In terms of the global almond market, the supply of almonds from California (U.S.A.) may have a significant impact on prices and the competitiveness of Australian almond exports. A break-even analysis was conducted on the increase in Australian exports and showed that, all other assumptions at their base values, the investment criteria remain positive (benefit-cost ratio of 1:1) where the increase in Australian almond exports attributable to the investment in AM15007 is just 2.08%.

Confidence Rating

The results produced are highly dependent on the assumptions made, some of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 12). The rating categories used are High, Medium, and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some uncertainties in assumptions made

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

Table 12: Confidence in Analysis of Project

Coverage of Benefits	Confidence in Assumptions
Medium	Medium-Low

Coverage of benefits valued was assessed as Medium. The principal impact, the Australian almond market expansion in Asia was valued. However, several other identified impacts were not valued. Confidence in assumptions was rated as Medium-Low as highly informed estimates of the market expansion due to the project were not available.

Conclusions

The Hort Innovation project (AM15007) has successfully contributed to a market expansion for Australian almonds in Asian markets. At the time of project funding, export market expansion was considered essential for the Australian almond industry as future almond production was expected to increase due to increased tree plantings. Potential impacts of the project included:

- Increased sales of Australian almonds in Asian markets.
- Increased price or an avoidance of a price fall for Australian almonds in Asian markets.
- Avoidance of a price fall in non-Asian markets due to greater sales to Asian markets.
- An increase in the strategic capacity of Australian almond marketers to develop improved strategies in the future.
- Avoidance of a reduced impact on Australian regional communities affected by a potential fall in profitability of Australian almond producers.

Total funding from all sources for the project was \$1.41 million (present value terms). The investment produced estimated total expected benefits of \$13.56 million (present value terms). This gave a net present value of \$12.15 million, an estimated benefit-cost ratio of 9.61 to 1, and a modified internal rate of return of 18.8%. As several other identified impacts were not valued, the investment criteria estimated by the evaluation may be underestimates of the actual performance of the investment.

Recommendations

Impact assessment is now a mature process within Hort Innovation. No recommendations are made for further refinement.

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Abbreviations and Acronyms

CBA	Cost Benefit Analysis
CRRDC	Council of Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Australian Government)
GDP	Gross Domestic Product
IRR	Internal Rate of Return
LOP	Life of Project
MIRR	Modified Internal Rate of Return
n.a.	not available
n.s.	no solution
R&D	Research and Development
RD&E	Research, Development and Extension

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.