Industry-specific impact assessment program: Almond

Impact assessment report for project *Almond International Networking* (AL12701)

Impact analyst:

Michael Clarke

Delivery partner:

AgEconPlus and Agtrans Research

Project code:

MT19012

Date:

December 2020

Funding statement:

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

Publishing details:

Published and distributed by: Hort Innovation

Level 7
141 Walker Street
North Sydney NSW 2060

Telephone: (02) 8295 2300

www.horticulture.com.au

Contents

Tables

Figures

Executive Summary

What the report is about

This report presents the results of an impact assessment of a Horticulture Innovation Australia Limited (Hort Innovation) investment in *AL12701: Almond International Networking.* The project was funded by Hort Innovation over the period April 2013 to May 2015.

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 AL12701 has allowed the Australian almond industry to access research completed by the large Californian and Spanish almond industries, collaborate in future relevant research projects, lobby jointly with the Californian almond industry for improved market access and share worldwide market intelligence across nut and dried fruit industries. The investment has added to the capacity of the industry, will improve its long term profitability and the efficiency of its research program.

Investment Criteria

Total funding from all sources for the project was $0.16 million (present value terms). The investment produced estimated total expected benefits of $0.63 million (present value terms). This gave a net present value of $0.48 million, an estimated benefit-cost ratio of 4.06 to 1, an internal rate of return of 67.4% and a modified internal rate of return of 10.8%.

Conclusions

Investment in Project AL12701 has allowed the Australian almond industry to access international research and market intelligence generated by almond growing ‘powerhouses’ the United States and Spain and in so doing improve Australian almond grower profit and the efficiency of research investment. Two identified impacts were not valued as they were considered uncertain and difficult to value with credible assumptions. Hence, investment criteria provided by the valuation may be underestimates of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, almond, networking, collaboration, Almond Board of California, Spain, US Almond Conference.

Introduction

All research, development, and extension (RD&E) and marketing levy investments undertaken by Horticulture Innovation Australia Limited (Hort Innovation) are guided and aligned to specific investment outcomes, defined through a Strategic Investment Plan (SIP). The SIP guides investment of the levy to achieve each industry's vision. The current industry SIPs apply for the financial years 2016/17 – 2020/21.

In accordance with the Organisational Evaluation Framework, Hort innovation has the obligation to evaluate the performance of its investment undertaken on behalf of industry.

This impact assessment program addresses this requirement through conducting a series of industry-specific ex-post independent impact assessments of the almond (AL), banana (BA), citrus (CT) and onion (VN) RD&E investment funds.

Twenty-nine RD&E investments (projects) were selected through a stratified, random sampling process. The industry samples were as follows:

- Nine AL projects were chosen worth $5.84 million (nominal Hort Innovation investment) from an overall population of 21 projects worth an estimated $10.78 million,
- Eight BA projects worth $3.02 million (nominal Hort Innovation investment) from an overall population of 22 projects worth approximately $16.72 million,
- Eight CT projects worth $5.4 million (nominal Hort Innovation investment) from a total population of 35 projects worth $15.78 million, and
- Four VN projects worth $2.4 million (nominal Hort Innovation investment) from an overall population of 8 projects worth $3.89 million.

The project population for each industry included projects where a final deliverable had been submitted in the five-year period from 1 July 2014 to 30 June 2019.

The projects for each industry sample were chosen such that the investments represented (1) at least 10% of the total Hort Innovation RD&E investment expenditure for each industry, and (2) the SIP outcomes (proportionally) for each industry.

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 almond industry is a significant horticultural sector with a five-year average production area of 36,206 ha, a production volume of 85,909 tonnes (kernel weight equivalent), and a Farmgate Value of $665.6 million – Table 1.

Table 1: Almond Industry Performance 2015-2019

Year Ended 30 June	Area of Production (ha)	Production (t)	Gross Value of Production ($m)	Farmgate Value ($m)
2015	29,437	82,509	707.5	672.1
2016	30,981	82,333	854.1	811.4
2017	35,866	80,800	553.6	525.9
2018	39,662	79,901	553.1	525.4
2019	45,089	104,000	835.1	793.3
Average	36,206	85,909	700.7	665.6

Source: Australian Horticulture Statistics Handbook and Almond Insights, various years. Tonnes is kernel weight equivalent.

The industry is comprised of a value chain that spans investors, almond growers through to end retail consumers and export markets. A number of the larger Australian growers have become vertically integrated and encompass processing, packing, domestic and export marketing (Hort Innovation, 2017).

Almond research and development (R&D) activity is guided by the Almond industry's Strategic Investment Plan (SIP). The activities are funded by levies payable on almonds produced in Australia; and the R&D levy funds are managed by Hort Innovation.

The current SIP has been developed with levy payers and addresses the Australian Almond industry's needs from 2017 to 2021. Strategies and priorities in the Plan have been driven by a set of five desired outcomes (Hort Innovation, 2017):

1. Pest and disease damage to almonds has been reduced through enhanced integrated pest management and integrated disease management.
2. A major productivity gain in almond pollination by 2022 through a 25% reduction in honey bee stocking rate with no loss in pollination efficiency (nut set).
3. Improvements in the crop production system have lifted average industry kernel yield from 3 to 4 t/ha, 4ML of irrigation water generates a tonne of almond kernel yield and proven 'shake and catch' harvesting / processing technology is in place.
4. Australian almonds are an informed industry that adopts R&D outcomes and has the capacity to support current and future industry needs.
5. Increased domestic almond consumption up from 16,000 t in 2016 to 27,500 t in 2022. Increased export sales up from 61,000 t in 2016 to 110,000 t in 2022.

Australia has progressed rapidly to be the second largest almond producer in the world. California is the world's largest almond industry. There is much to learn from California's research and marketing programs. Insights are also anticipated from closer contact with plant breeders in the Spanish almond industry.

Rationale

The Almond Board of Australia (ABA) has commenced the development of a beneficial relationship with the Almond Board of California (ABC). Prior to this project the ABA received access to the nutritional research undertaken by American researchers during the past decade at a cost of $15 million. Access to ABC staff and their agronomic researchers was also made available. It was the intention of this project to send ABA directors and staff to the US Almond Conference each year to continue to build this profitable relationship.

The broader international almond, other nut and dried fruit industries were also to be engaged via this project through the annual International Nut Conference and Frucom. Frucom is the representative body of European traders in dried fruits and nuts.

The Spanish industry, which has rootstock and hard shell variety breeding ~~projects~~projects, and a significant agronomic research program was visited in 2013 and 2015. Researchers involved in high density orchard development for apples, pears and summerfruit were also a focus for development of research networks as the Australian almond industry moves to develop advanced production systems based on dwarfing rootstocks. The project was to facilitate meetings to discuss technology extension with industry organisations that have had success with orchard intensification using dwarfing rootstocks.

Project Details

Summary

Project Code: AL12701

Title: Almond International Networking

Research Organisation: Almond Board of Australia (ABA)

Project Leader: Ross Skinner

Period of Funding: April 2013 to May 2015

Objectives

The key objective of this project was to build a network of contacts and develop relationships with organisations and individuals that provide a 'value-add' to the Australian almond industry. Value was to be sought through insights on international issues, access to research results, data, knowledge, and processes in areas of production, processing, market access and development, nutrition, technology transfer, intellectual property commercialisation and organisational management.

Logical Framework

Table 2 provides a detailed description of the project in a logical framework.

Table 2: Logical Framework for Project AL12701

Activities	• Preparation of an international network development program with the ABA Board of Directors. Program was compliant with Hort Innovation and ABA policies on overseas travel and included visit itineraries, nominated participants, and travel cost detail. • Attendance at the US Almond Conferences 2012 to 2014, Sacramento California and meeting with US research and marketing teams. • Meetings and discussions with US researchers to share R&D findings, industry statistical data and market development information. • Topics covered with the US industry included opportunities for collaboration on R&D, dwarfing rootstock development, drying techniques, almond food safety, sustainability, extension techniques, market outlook, market access and trade development, market intelligence, marketing strategies focussed on nutrition and enhanced consumer health. • Attendance at the International Nut Council Conferences (INC) 2013 to 2015 in Barcelona, Melbourne, and Turkey. INC meetings addressed contemporary research and marketing issues in almonds and other nut crops (peanut, walnut, pecan, hazelnut, etc.). • Meetings and a study tour of Spain addressed Spanish industry research in relation to dwarfing rootstocks/intensive planting systems, vigour management, tree training systems, low chill requirements, drought tolerance, resistance to Armillaria, propagation of cuttings, tree nutrition, alternative harvesting systems, almond drying techniques, market research, and research on the nutritional benefits of almond consumption. • As a result of the study tour, the Institut de Recerca i Tecnologia Agroalimentàries (IRTA) Spain expressed interest in forming R&D partnerships and completing sabbaticals with Australian almond breeders. • Meetings in New Zealand with research providers Crop and Food NZ, AgFirst, PollenPlus. There were no costs allocated to AL12701 for this trip. Trip focussed on orchard intensification in the apple industry, industry production and financial benchmarking, honey bee health and pollination technologies that do not rely on honey bees. • Meetings in Bangalore India to explore joint research opportunities of benefit to the almond industry and pursue improved market access for Australian almonds. • Liaison with the Indian and Middle East trade, ABC and Australian High Commission staff to improve market access for almond exports. • Facilitation of overseas researcher visits to Australia including microbial food safety specialist Dr Linda Harris University of California – Davis, plant breeder John Slaughter

	Burchell Nursery California, and research program manager Dr Karen Lapsley to initiative discussions between ABA and ABC on joint industry priorities for collaborative research. • Preparation and submission to ABA Board and Hort Innovation of written reports on each overseas visit. Reports were made available to the ABA Board at the first meeting of the Board following the participants return from overseas. • Reports detailed contacts established, knowledge gained, benefits accessed and recommended future actions to be undertaken. • Reports were circulated to relevant ABA subcommittees (e.g. Plant Improvement, Production, Processing, Market Development), the Hort Innovation Strategic Investment Advisory Panel and other industry stakeholders. • ABA staff who participated in international network development were required to follow-up actions identified as part of their employment Key Performance Indicators. • ABA Directors control 85% of the industry's production, 95% of processing and 99% of marketing. Consequently, reports provided to the ABA Board were assured of widespread dissemination and knowledge application. • International network development reports were presented at field days, conferences and as articles in industry publications providing further opportunity for industry to access project outputs.
Outputs	• Closer working relationship with the ABC delivering benefits in relation to market access and trade negotiations, food safety research, aflatoxin pre-shipment sampling and testing program, MRL negotiations with the European Union, monitoring almond variety improvement in California, researcher visits/workshops (addressing production systems, nutrition, pollination, food safety, pests/diseases, and collaborative research projects). • Increased involvement in the International Nut Council – sector outlook data. • Access to Spanish varieties, and monitoring of their high density production systems. • Relationships that facilitated the establishment of Spanish tissue culturing company Agromillora in Australia to rapidly multiply rootstocks for the benefit of the almond and other horticultural industries. • Development of key contacts in dried fruit and nut organisations such as Frucom. • Travel for almond representatives to India to participate in Hort Innovation conducted study tour and research collaboration forum.
Outcomes	• More efficient Australian almond industry through the flow of new information to the industry and maintenance of a strong international network for continuing cooperation and collaboration on R&D and market insights. For example, the project provided access to $US15M in nutritional research completed by the US industry, rootstocks from Spain suitable for incorporation into Australian research programs, and resolution of trade restrictions with both the EU (food safety) and Industry (in-country processing). • Findings from international research to inform Australia almond production (e.g. food safety, orchard intensification, pollination efficiency). • Market initiatives and insights aimed at improving export market access and delivering additional profitable sales for Australian almond growers. • Joint research initiatives to deliver research projects at a lower cost.
Impacts	• Economic – lower costs of production from adopting overseas research. • Economic – additional sales from improved market access and market insight. • Economic – improved resource allocation in research. • Capacity – ABA and other industry stakeholders with additional networks and knowledge. • Social - contribution to improved regional community wellbeing in almond growing areas from spill-over benefits as a result of a sustainable, profitable almond industry.

Project Investment

Nominal Investment

Table 3 shows the annual investment made in Project AL12701 by Hort Innovation. There were no other investors in the project.

Table 3: Annual Investment in Project AL12701 (nominal $)

Year ended 30 June	Hort Innovation ($)	Other ($)	TOTAL ($)
2013	30,000	0	30,000
2014	30,000	0	30,000
2015	30,000	0	30,000
Total	**90,000**	**0**	**90,000**

Source: AL12701 Revised Schedule

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 3.

Real Investment and Extension Costs

For purposes of the investment analysis, the investment costs of all parties were expressed in 2019/20 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2020). No additional extension costs are envisaged.

Impacts

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

Table 4: Triple Bottom Line Categories of Principal Impacts from Project AL12701

Economic	• Additional almond grower profit - cost savings arising from adoption of overseas research and additional sales due to improved market access and market insight. • Efficiency gains in Australian almond research resource allocation.
Environmental	• Nil.
Social	• ABA and other industry stakeholders with additional capacity developed through international networks and knowledge. • Contribution to improved regional community wellbeing in almond growing areas from spill-over benefits as a result of a sustainable, profitable almond industry.

Public versus Private Impacts

The impacts identified from the investment are predominantly private impacts accruing to almond growers i.e. additional profit from adopting overseas generated research, improved market access and market insight. However, some public benefits have also been produced including additional industry capacity, and spill-over benefits to regional communities.

Distribution of Private Impacts

The private impacts (additional profit) will be distributed between growers, processors, and the balance of the supply chain. 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 almond market.

Impacts on Other Australian Industries

Some of the insights generated and linkages made will have relevance to other Australian industries e.g. market outlook information generated by the International Nut Council and Frucom will be relevant to smaller Australian nut and dried fruit industries with limited capacity to generate their own data. These data are shared by the almond industry through Australian publications and conferences.

Impacts Overseas

The international collaboration facilitated by AL12701 is a 'two-way street' and the Australian almond industry has an open policy on sharing research outputs with overseas almond industries. The Californian almond industry has already benefited from Australian research focussed on drought management, irrigation, nutrition, varietal breeding and orchard and processing equipment innovation.

Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 5. The project outcomes and related impacts will contribute to Rural RD&E Priorities 2 and 4 and Science and Research Priority 1 and 8.

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 and Resources 6. Manufacturing 7. Environmental Change 8. Health

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

Alignment with the Almond Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the almond industry are outlined in the Almond Industry's Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2017). Project AL12701 has made contributions to Outcome 2, (pollination efficiency), Outcome 3 (improvements in the crop production system), Outcome 4 (adoption of R&D) and Outcome 5 (increased domestic and export almond consumption).

Valuation of Impacts

Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when some uncertainty was involved. Sensitivity analyses were undertaken for those variables where there was greatest uncertainty or for those that were identified as key drivers of the investment criteria.

Two impacts were valued:

- Increase in almond grower profit associated with adoption of overseas research and additional sales due to improved market access and market insight.
- Efficiency gains in Australian almond research resource allocation.

Impacts Not Valued

Not all of the impacts identified in Table 4 could be valued in the assessment. Those not valued were:

- ABA and other industry stakeholders with additional capacity developed through international networks and knowledge.
- Contribution to improved regional community wellbeing in almond growing areas from spill-over benefits as a result of a sustainable, profitable almond industry.

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

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

Valuation of Impact 1: Increase in almond grower profit

AL12701 has provided access to overseas generated research that will lower the cost of future almond production. Relevant research includes insights into more efficient production systems, nutrition, pollination, and pest/disease management. Some of these research findings are ready for implementation. Others speed outcomes from Australian research projects. Research resulting from the international collaboration is expected to contribute to improved almond grower productivity. While some production costs may increase to achieve this improved productivity, the increase in productivity is assumed to more than compensate for this, and therefore there will be an overall cost reduction for production costs per unit of almond production.

Other research insights garnered from international networking will increase the profitable sales of Australian almonds. These will include market access and trade negotiations in India, food safety research, aflatoxin pre-shipment sampling/testing protocols, and MRL negotiations with the ABC for improved access to the European Union.

Valuation of Impact 2: Efficiency gains in Australian almond research allocation

In 2018/19, $4.18 million was spent on almond research managed by Hort Innovation (https://www.horticulture.com.au/growers/almond-fund/). AL12701 will contribute additional overseas generated information and increased cooperation and collaboration between researchers. It will also contribute to improved understanding of industry issues, current and past research, and therefore improvements in the setting of goals and priorities for research funding. Therefore, it can be assumed that the research investment is made in a more efficient manner than it would have been without the project being funded.

Attribution

AL12701 was not the only source of information on overseas research findings and market conditions. The almond industry is characterised by large-scale, well-resourced firms who are able to travel and source their own information. For this reason, a 50% attribution estimate for AL12701 has been assumed.

Counterfactual

If project AL12701 had not been funded by Hort Innovation, it is assumed that the project would have proceeded in some form with ABA funding which constituted half of the AL12701 budget. Consequently a 50% counterfactual has been applied.

Summary of Assumptions

A summary of the key assumptions is provided in Table 6.

Table 6: Summary of Assumptions for Impact Valuation

Variable	Assumption	Source/Comment
Impact 1: Increase in almond grower profit		
Area of Australian almond production.	45,089 ha	2019 area of production sourced from Hort Innovation 2020.
Increase in profit due to saved costs and improved market knowledge garnered from overseas research.	0.25%	Analyst assumption to be tested using sensitivity analysis. Cost savings realised include savings from replicating US nutritional research, a Spanish rootstock that has entered the Australian breeding/evaluation program, and resolution of trade restrictions with both the EU (food safety) and Industry (in-country processing).
Profit on almond production – without AL12701.	$11,360/ha	Gross receipts of $25,000/ha (Australian Nut Industry Council, undated) less production costs of $13,640 (adapted from Waycott, 2011).

Year of first impact.	2016/17	Two years after AL12701 completion and allowing for on-farm adoption of research findings and incorporation of market intelligence into sales plans.
Year of maximum impact.	2019/20	Three years after initial adoption – rapid adoption as industry is well-networked with effective communication and extension systems.
Level of first adoption.	15%	Analyst assumption – one large industry player adopts in the first year.
Level of maximum adoption.	50%	Analyst assumption – the project has delivered useful profit generating initiatives.
Year of final impact.	2025/26	Cost savings and market insights become redundant 10 years after AL12701 was completed.
Impact 2: Efficiency gains in Australian almond research allocation		
Annual expenditure on almond research by Hort Innovation.	$4.18 million	https://www.horticulture.com.au/growers/almond-fund/
Efficiency of spending due to AL12701.	5%	Analyst assumption.
Year of first impact.	2016/17	Two years after AL12701 completion and allowing time for information garnered from overseas to impact on research investment decisions.
Year of last impact.	2021/22	Five years after first year of impact.
Assumptions common to quantification of both impacts		
Probability of outputs.	80%	Analyst assumption – outputs are mostly available some outputs such as dwarf rootstock and new varieties remain 'in the pipeline'.
Probability of outcomes.	75%	Analyst assumption – there is some risk that outputs will not translate into commercial outcomes.
Probability of impact.	75%	Analyst assumption – there is some risk that growers will not adopt.
Attribution	50%	See above.
Counterfactual.	50%	See above.

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 (2014/15) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

Tables 7 shows the investment criteria estimated for different periods of benefit for the total investment. Hort Innovation was the only investor in the project.

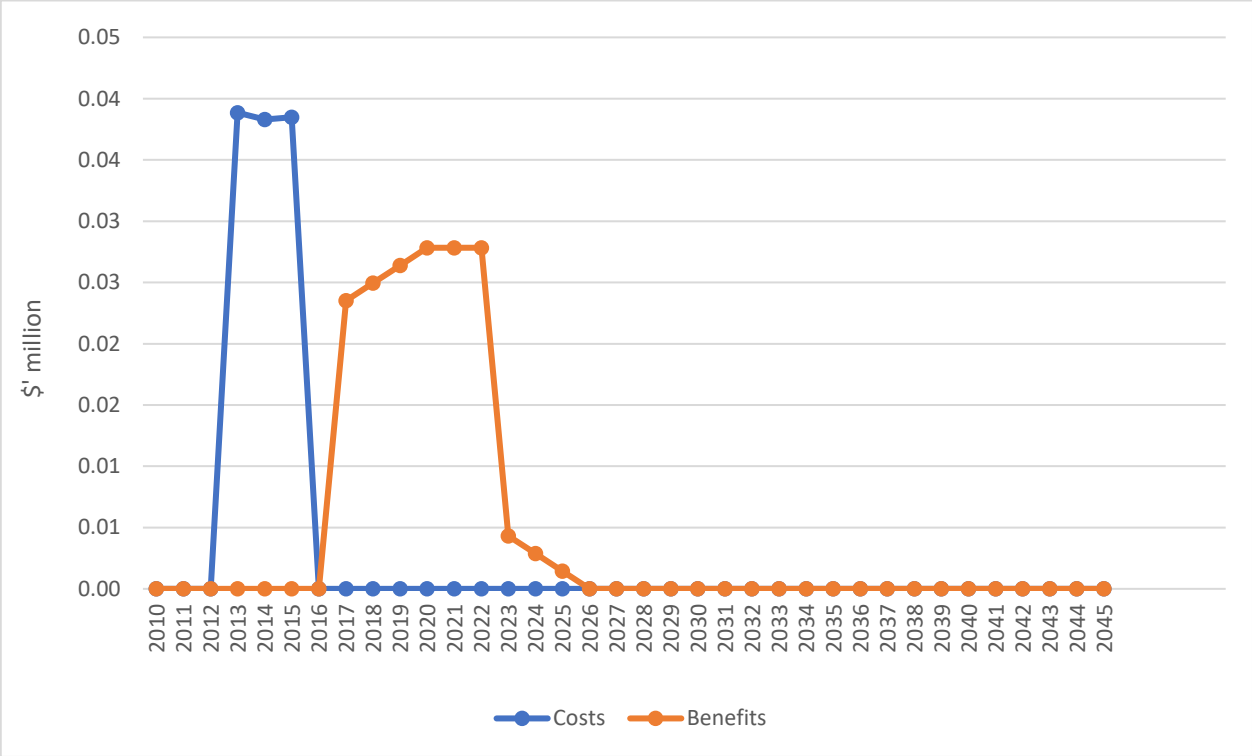
Table 7: Investment Criteria for Total Investment in Project AL12701

Investment Criteria	Years after Last Year of Investment						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	0.00	0.30	0.61	0.63	0.63	0.63	0.63
Present Value of Costs ($m)	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Net Present Value ($m)	-0.16	0.14	0.46	0.48	0.48	0.48	0.48

Benefit-Cost Ratio	0.00	1.93	3.96	4.06	4.06	4.06	4.06
Internal Rate of Return (%)	negative	45.7	67.2	67.4	67.4	67.4	67.4
MIRR (%)	negative	30.8	26.4	10.8	14.2	12.1	10.8

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the AL12701 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



Source of Benefits

Estimates of the relative contribution of each benefit valued, given the assumptions made, are shown in Table 8.

Table 8: Contribution to Total Benefits from Each Source

	Contribution to PVB ($m)	**Share of benefits (%)**
Increase in almond grower profit associated with adoption of overseas research and additional sales due to improved market access and market insight.	0.49	77.0
Efficiency gains in Australian almond research resource allocation.	0.15	23.0
Total	0.63	100.0

Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 9 presents the results. The results are moderately sensitive to the discount rate.

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

Investment Criteria	**Discount rate**		
	0%	**5% (base)**	**10%**
Present Value of Benefits ($m)	0.66	0.63	0.61

Present Value of Costs ($m)	0.12	0.16	0.21
Net Present Value ($m)	0.54	0.48	0.41
Benefit-cost ratio	5.71	4.06	2.97

A sensitivity analysis was then undertaken on the assumed contribution of project AL12701 to increased grower profit. Results are provided in Table 10. Even when the assumed increase in grower profit is reduced from 0.25% to 0.125%, the project continues to show a favourable return on investment.

Table 10: Sensitivity to Contribution of AL12701 to Increase in Almond Grower Profit
(Total investment, 30 years)

Investment Criteria	**Increase in Profit due to AL12701**		
	0.125%	**0.25% (base)**	**0.5%**
Present Value of Benefits ($m)	0.39	0.63	1.12
Present Value of Costs ($m)	0.16	0.16	0.16
Net Present Value ($m)	0.23	0.48	0.96
Benefit-cost ratio	2.50	4.06	7.19

A final sensitivity test examined the attribution of benefits to AL12701 (Table 11). The assumed attribution factor would need to fall from 50% to 12% before the project would be reduced to 'breakeven'.

Table 11: Sensitivity to Assumed Attribution Factor
(Total investment, 30 years)

Investment Criteria	**Assumed AL12701 Attribution Factor**		
	12% (breakeven)	**25%**	**50% (base)**
Present Value of Benefits ($m)	0.15	0.39	0.63
Present Value of Costs ($m)	0.16	0.16	0.16
Net Present Value ($m)	0.00	0.23	0.48
Benefit-cost ratio	0.98	2.50	4.06

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**
High	Low

Coverage of benefits valued was assessed as High – the two major benefits were valued. Confidence in assumptions was rated as Low, a number of key assumptions were made by the analyst.

Conclusion

The investment in AL12701 has allowed the Australian almond industry to access research completed by the large

Californian and Spanish almond industries, collaborate in future relevant research projects, lobby jointly with the Californian industry for improved market access and share worldwide market intelligence across nut and dried fruit industries. The investment has added to the capacity of the industry, will improve its long term profitability and the efficiency of its research program.

Total funding from all sources for the project was $0.16 million (present value terms). The investment produced estimated total expected benefits of $0.63 million (present value terms). This gave a net present value of $0.48 million, an estimated benefit-cost ratio of 4.06 to 1, an internal rate of return of 67.4% and a modified internal rate of return of 10.8%.

As two of the identified impacts were not valued, the investment criteria estimated by the evaluation 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.

Reference List

Almond Board of Australia (ABA) (2019) Almond Insights various editions https://industry.australianalmonds.com.au/almond-board/almond-insights/

Australian Bureau of Statistics. (2020, March 4). *5206.0 – Australian National Accounts: National Income, Expenditure and Product, Dec 2019*. Table 5. Expenditure on Gross Domestic Product (GDP), Implicit price deflators. Retrieved from Australian Bureau of Statistics: https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5206.0Dec%202019?OpenDocument

Australian Nut Industry Council (undated) Growing Tree Nuts in Australia. Retrieved at https://nutindustry.org.au/growing-tree-nuts-in-australia/

Council of Rural Research and Development Corporations. (2018). Cross-RDC Impact Assessment Program: Guidelines. Canberra: Council of Rural Research and Development Corporations. Retrieved from http://www.ruralrdc.com.au/wp-content/uploads/2018/08/201804_RDC-IA-Guidelines-V.2.pdf

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

Hort Innovation (2019) Horticulture Statistics Handbook 2017/18.

Hort Innovation (2020) Horticulture Statistics Handbook 2018/19. Retrieved from https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/

Office of the Chief Scientist (OCS). (2015). 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

Waycott, R (2011) The Economics of Growing Almonds. Retrieved at ttps://www.almonds.com/sites/default/files/content/attachments/economics_of_growing_almonds_revised.pdf

Acknowledgements

AgEconPlus and Agtrans Research would like to thank all the project and program personnel associated with Horticulture Innovation Australia Limited that were involved in the evaluation process. Their cooperation and feedback throughout the evaluation process contributed significantly to this report.

Specific acknowledgements:
Brendan O'Keeffe, Analyst, Hort Innovation
Ross Skinner, Chief Executive Officer, Almond Board of Australia

Abbreviations

ABA	Almond Board of Australia
ABC	Almond Board of California
AL	Almond
BA	Banana
CRRDC	Council of Research and Development Corporations
CT	Citrus
DAWR	Department of Agriculture and Water Resources (Australian Government)
EOI	Expression of Interest
GDP	Gross Domestic Product
GVP	Gross Value of Production
INC	International Nut Council
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
MRL	Maximum Residue Limit
OCS	Office of Chief Scientist Queensland
PVB	Present Value of Benefits
RD&E	Research, Development and Extension
RIRDC	Rural Industries Research and Development Corporation (now AgriFutures Australia)
VN	Onion