# Industry-specific impact assessment program: apple and pear

## Impact assessment report for project *Apple and pear industry Asian export market development* (AP11023)

**Impact analyst:**

Joseph Abell

**Delivery partner:**

AgEconPlus and Agtrans Research

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MT18009

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Level 7
141 Walker Street
North Sydney NSW 2060

Telephone: (02) 8295 2300

www.horticulture.com.au

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# 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 *AP11023 Apple and pear industry Asian export market development.* The project was funded by Hort Innovation over the period April 2012 to March 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 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

investment has enabled stronger links between exporters in Australia and importers in Asia. Consequently, AP11023 is likely to contribute to increased exports to South East Asian markets. There may also be positive social impacts through increased incomes to Australian apple and pear growing regions and increased capacity for future Australian export growth in other markets.

### Investment Criteria

Total funding from all sources for the project was $1.00 million (present value terms). Of this total, Hort Innovation provided an investment of $0.54 million (present value terms). The investment produced an estimated total expected benefits of $6.10 million (present value terms). This gave a net present value of $5.10 million, an estimated benefit-cost ratio of 6.09 to 1, an internal rate of return of 100.3% and a MIRR of 12.5%.

### Conclusions

Four impacts were identified of which one was valued. When the inability to value all impacts is combined with conservative assumptions for the principal economic impact valued, it is reasonable to conclude that the valuation may be an underestimate of the actual performance of the investment



# Keywords

Impact assessment, cost-benefit analysis, AP11023, Apples and Pears, export, market development, Asia market development.

# Introduction

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

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

This impact assessment program addresses this requirement through conducting a series of industry-specific ex-post independent impact assessments of the apple & pear (AP), avocado (AV), mushroom (MU) and table grape (TG) RD&E investment funds.

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

- Nine AP projects were chosen worth $15.46 million (nominal Hort Innovation investment) from an overall population of 19 projects worth an estimated $33.31 million,
- Seven AV projects worth $1.91 million (nominal Hort Innovation investment) from an overall population of 27 projects worth approximately $9.97 million,
- Five MU projects worth $1.75 million (nominal Hort Innovation investment) from a total population of 20 projects worth $7.94 million, and
- Six TG projects worth $2.84 million (nominal Hort Innovation investment) from an overall population of 11 projects worth $5.0 million.

The project population for each industry included projects where a final deliverable had been submitted in the five-year period from 1 July 2013 to 30 June 2018.

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

*Project AP11023 Apple and pear industry Asian export market development* was randomly selected as one of the 22 unique MT18009 investments and was analysed in this report.

# General Method

The impact assessment follows general evaluation guidelines that are now well entrenched within the Australian primary industry research sector including Research and Development Corporations, Cooperative Research Centres, State Departments of Agriculture, and some universities. The approach includes both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2018).

The evaluation process involved identifying and briefly describing project objectives, activities and outputs, outcomes, and impacts. The principal economic, environmental and social impacts were then summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then valued in monetary terms. Where impact valuation was exercised, the impact assessment uses cost-benefit analysis as its principal tool. The decision not to value certain impacts was due either to a shortage of necessary evidence/data, a high degree of uncertainty surrounding the potential impact, or the likely low relative significance of the impact compared to those that were valued. The impacts valued are therefore deemed to represent the principal benefits delivered by the project. However, as not all impacts were valued, the investment criteria reported for individual investments potentially represent an underestimate of the performance of that investment.

# Background & Rationale

## Background

Apples and pears are two of the main horticulture crops produced in Australia. Combined, the apple and pear industries produce more fresh fruit than any other fruit industry in Australia (APAL, 2019). The main production of apples and pears occurs in Victoria (at 45% and 88% of national production respectively), with major apple producers also located in all other states. Most Australian apples and pears are for fresh supply, but both also have significant production sent for processing (for juices and other value-added products).

In 2017/18, Australian apples had a farm gate value (FGV) of $418.3 million and production of 269,355 tonnes, while pears (including Nashi) had an FGV of $80.2 million and production of 103,748 tonnes (ABS, 2019a). Domestic apple consumption has remained relatively stable over time, but per capita consumption has been. Fresh pear (excluding Nashi) per capita consumption has remained stable since 2002/03 (Hort Innovation, 2017).

Exports, while relatively small compared to domestic consumption, represent an important growth area for apples and pears. A total of 2,134 tonnes (or 1% of fresh production) of apples was exported in 2014/15 (Hort Innovation, 2017) with major markets being Papua New Guinea, United Kingdom, Sri Lanka, and Hong Kong.

For pears, a total of 7,647 tonnes (7% of fresh production) was exported the same year (Hort Innovation, 2017), with major export markets being New Zealand, Indonesia, Canada, Singapore, and more recently India. Australia does allow imports of both apples and pears, but quantities are relatively small compared to domestic production.

There are both opportunities and challenges for the Australian apple and pear industry to improve in areas such as biosecurity, inconsistency of eating quality, export competition and market access, and an oversupply leading to lower prices (Hort Innovation, 2017).

The collective goal of the two industries is to increase the growth in domestic consumption of apples and pears, and to see growth in exports. The apple and pear industries have funded a number of projects, through Hort Innovation and industry RD&E investments, around improving access to the Asian export market, improved marketing of apples and pears, and improving industry productivity and quality (APAL, 2013).

Statutory levies are in place for both industries for Emergency Plant Pest Response, National Residue Testing, Plant Health Australia, Marketing and Research and Development (R&D). Marketing and R&D levies are managed by Hort Innovation. Apple and Pear Australia Ltd (APAL) is the apple and pear industries' representative body and non-profit membership organisation.

## Rationale

The apple and pear industry had an aim of increasing exports to 10% of marketable product by 2015 according to the Apple and Pear industry strategic plan 2017-21 (Hort Innovation, 2016). The Australian market is open to international competition with imports from China and New Zealand entering the Australian market in 2011. Therefore, while such imports are insignificant to date, they could increase over time and Australian growers needed to increase competitiveness and exports to make up for any future potential loss in the domestic market.

Also, at the same time, increased competition from Chile and South Africa has reduced the world price for apples and therefore Australian export prices.

With competition from large apple and pear producing nations such as Chile and New Zealand in the Asian market, the Australian apple and pear industry have identified that high-quality Australian product can maintain existing market premiums. Australia is recognised globally for the Crisps Pink (otherwise known as Pink Lady), well-known for being a high-quality eating apple. There was considered to be an opportunity for further market development of premium Australian apples and pears in the Asian Export Market., particularly in Thailand, Malaysia, Singapore, Indonesia, and Hong Kong.

# Project Details

## Summary

Project Code: AP11023

Title: *Apple and pear industry Asian export market development*

Research Organisation: Department of Primary Industries, Victoria (DPIV)

Principal Investigator: Aimee McCutcheon

Period of Funding: April 2012 to March 2015

## Objectives

The objectives of the project were to:

1. Developing an export paradigm in the Australian industry;
2. Developing market access by:
   (i) providing technical support to overcome phytosanitary barriers to trade; and,
   (ii) gaining a detailed commercial understanding of the quality specifications, price positioning and other trade aspects of specific markets.
3. Developing a critical mass of exports with exporters working together as a team (termed "Team Australia");
4. Implementing trade promotions and coordinating marketing programs in identified markets.

## Logical Framework

Table 1 provides a description of AP11023, a market data collection and analysis project, in a logical framework.

Table 1: Logical Framework for Project AP11023

| | |
|---|---|
| Activities and Outputs | • From 2010 to 2015 the project developed and addressed key areas of the Apple and Pear Export Development Plan. These four areas were<br>  ○ Developing an export paradigm in the Australian Industry<br>  ○ Developing market access<br>  ○ Developing a critical mass of exporters with a number of exporters<br>  ○ Implementing a coordinated trade promotion and marketing program.<br>• For the development of the export program, the project undertook<br>  ○ Workshops<br>  ○ Study Tours<br>  ○ Importer Tours<br>  ○ Publications<br>• The export program ran from 2012 to 2015, and involved 13 workshops, three study tours, six publications, three importer tours, and three Pink Lady in-market promotional activities.<br>• Workshops explained the importance of exports and explained principal details on exporting.<br>• Study tours involved taking growers to export markets to meet importers and to better understand local infrastructure and import market conditions.<br>• Importer tours involved bringing importers to Pink Lady growing regions, in order to build increased confidence and build stronger business-to-business relationships.<br>• Up to date publications were produced throughout the project and distributed to APAL members, highlighting key issues for exporting and market access.<br>• In 2014, a pear export tour was organised to Indonesia, Thailand, and Singapore. The tour composition represented 40% of the Australian pear industry.<br>• The project developed a market access strategy for mainland Australia apples to |

| | |
|---|---|
| | enter into the Mainland China and Taiwan markets; the strategy included a range of activities including phytosanitary issues, Australian interests working together via the sharing of information, developing an export brand, and a range of promotional activities.<br>• There was also assistance provided by the project to maintain market access to Malaysia, Indonesia, Singapore, Thailand, and Vietnam.<br>• The project provided support to Apple and Pear Australia Limited (APAL) and the Commonwealth government on both technical and non-technical market access issues for apples and pears.<br>• Responses to phytosanitary concerns were provided to APAL, importing country officials and the Australian Government.<br>• The project gathered different Australian exporters to form a "Team Australia", providing a united front for developing an export brand, and identifying appropriate importers; this was considered more effective compared to individual exports acting alone.<br>• Team Australia shared marketing and supply chain information, market intelligence, and Pink Lady export supply standards.<br>• In later stages in the project, a pear 'Team Australia' was formed.<br>• Trade promotions focused only on Australian Pink Lady apples, so other Pink Lady apples from other countries did not get extra promotion off the back of the Australia effort.<br>• A market development manager from APAL helped lead Team Australia on disseminating market intelligence, project information, and learning points to growers and exporters.<br>• DEDJTR and APAL delivered a three-year national project on trade promotion and marketing activities for export markets.<br>• DEDJTR and APAL developed promotional material such as in-store material and advertising.<br>• The promotional activities were heavily linked to other projects. For example, the travel costs of the marketing development manager were included in Project AP11016, while Project AP11025 assisted in gathering marketing access material (for Project AP11023).<br>• Throughout the project, there was a reviewed export target of apples and pears down from 10% of total yearly production in 2015 to 5% of total yearly production in 2019.<br>• Throughout the project, a Mandarin-speaking marketing manager was appointed as a direct result of the knowledge gained through one of the study tours.<br>• Improved handling and processing in the retail chain was identified and recognised by the project as an important improvement area to address. |
| Outcomes | • The project focused on a whole of industry approach rather than individuals acting alone, allowing the continued development of the export plan into the future.<br>• As a result of undertaking the project, it was realised that the best prospects for future growth for apples and pears could come from Thailand and Malaysia.<br>• The attitudes of participating growers towards exports has changed because of the extension activities undertaken by the project. Those growers now have a better appreciation to realise the opportunities and sophistication of the different Asian markets.<br>• Through the study tours and appointing a Mandarin-speaking marketing manager, there is a greater understanding for growers and exporters of the requirements for successfully entering the Chinese speaking markets.<br>• The Team Australia approach was deemed a success and the concept has been continued.<br>• There has been an increase in export sales of Australian Pink Lady apples. Due to a promotional campaign in Thailand, there was an increase in customers of Australian apples from 10,000 in 2012 to 18,000 in 2013.<br>• The project assisted in achieving a ten-year high volume of apple exports in 2017 |

| | |
|---|---|
| | (Prowse, 2017).<br>• Exports are now more focused on premium apples and pears, compared to the situation before the project.<br>• As reported earlier, the new horizons initial export goal was 10% by 2015 but was revised down to 5% in 2019 during the project. Also, there is a new goal of 10% of apple and pear fresh production exported by 2027.<br>• Overall, before the project exports were considered opportunistic, with no Australian exports filling gaps (Barber, 2017). The project has provided a systematic plan for exports, improving the possibility and probability of increased, and more stable, Australian apple and pear exports. |
| Impacts | • Increased profitability for Australian apple and pear growers and exporters due to increased market access and from the relationships built in the project.<br>• Increased positive spillovers and wellbeing to apple producing regional areas through increased profits along supply chains.<br>• Increased industry and grower capacity to develop skills, attitudinal change, and export market strategies. |

# Project Investment

### Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project AP11023 by Hort Innovation and Department of Primary Industries, Victoria (DPIV). There were no 'other' investors in this project.

Table 2: Annual Investment in the Project AP11023 (nominal $)

| Year ended 30 June | Hort Innovation ($) | DPIV ($) | Total ($) |
|---|---|---|---|
| 2012 | 5,000 | 5,000 | 10,000 |
| 2013 | 110,000 | 110,000 | 220,000 |
| 2014 | 115,000 | 115,000 | 230,000 |
| 2015 | 115,000 | 115,000 | 230,000 |
| **Totals** | 345,000 | 345,000 | 690,000 |

### 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 all parties were expressed in 2017/18 dollar terms using the GDP deflator index (ABS, 2018). There were no additional costs associated with the project extension. Results were communicated to Australian apple and pear exporters, overseas importers, and growers as part of the project.

# 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 AP11023

| | |
|---|---|
| Economic | • Increased profitability for Australia apple and pear exporters due to increased market access to Asian markets and from importer customer relationships built in the project.<br>• Progress in developing potential future market access for mainland Australian apples to China. |
| Environmental | • Nil. |
| Social | • Increased positive spillovers and community wellbeing in regional areas through increased income.<br>• Increased industry and grower capacity to develop export market strategies.<br>• Increased grower capacity to change via knowledge, attitudes, skills and aspirations. |

### Public versus Private Impacts

Impacts identified in this assessment are mostly private in nature. Private benefits will be realised by apple and pear growers and exporters via additional profitable exports and an increased industry capacity to develop export market strategies. Public benefits will include increased spillovers to communities in apple and pear growing areas associated with a more profitable growing industry.

### Distribution of Private Impacts

The impacts on the apple and pear industry from investment in this project will be shared along the supply chain with input suppliers, growers, processors, transporters, wholesalers, and exporters all sharing impacts produced by the project.

### Impacts on Other Australian Industries

There may be small spillovers to other industries who are exporting to Asian markets due to the outputs produced. The project findings could make future export plans easier than otherwise would be the case without the project.

### Impacts Overseas

There may be increased revenue for importers of Australian apples and Pears in Asian markets. Consumers will also benefit, with supermarket chains more likely to stock Australian apples and pears, improving consumer product choice and utility. There may also be possibly decreased revenue for other apple and pear exporting nations due to competition with Australian apples and pears.

### Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project findings and related impacts will contribute to Rural RD&E priority 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<br>2. Biosecurity<br>3. Soil, water and managing natural resources<br>4. Adoption of R&D | 1. Food<br>2. Soil and Water<br>3. Transport<br>4. Cybersecurity<br>5. Energy and Resources<br>6. Manufacturing<br>7. Environmental Change<br>8. Health |

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

### Alignment with the Apple and Pear Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the pear industry are outlined in the Apple & Pear Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2017). Project AP11023 addressed Outcome 2 (through Strategy 2.6 and Strategy 2.5 with some contribution from Strategy 2.3).

## 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.

One impact was valued, the increased exports and associated profit increases due to the project.

### Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment.

Potential market access for mainland Australian apples and pears into the Chinese market also was not valued. While the project has significantly contributed to advancing market access for mainland Australian apples, the impact of mainland market access to China was too tentative and uncertain, as negotiations are still ongoing. It should be noted that Tasmania, as an island state, has special status in apple exporting because of its fruit fly-free status. In 2016/17, Australian apple exports to China, Japan and Taiwan were solely met by Tasmanian apples.

Social impacts were hard to value due to lack of evidence/data, and the difficulty in quantifying the causal relationship and pathway between AP11023 and the impact and the complexity of assigning monetary values to the impacts.

The social impacts identified but not valued were:

- Increased future capacity in gaining access and capitalising on export markets, as well as building a range of grower skills.
- Increased spillovers such as regional employment and community incomes, in apple and pear growing regions associated with a more profitable industry with additional exports.

### Valuation of Impact: Increased exports and improved premiums

Without the project, exports would not have been as effective in gaining market access to Asian markets. The impact analysis takes into account additional Australian apple and pear exports to South-East Asian countries, specifically Thailand, Malaysia, Singapore, Indonesia, and Hong Kong. Due to market access issues, mainland

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

Australian apples exports to China are not valued as it is unknown when these will occur. The evaluation uses historical export data, and assumes that from 2014 to 2018, the project affected exports to the markets identified above.

It is assumed that from 2019, exports to relevant markets will increase 5% a year for 5 years as a result of the project. There is a 15% probability assumed that the impact from 2019 to 2023 will be realised.

After 2023, it is assumed that further investment will have to take place to ensure that the benefits continue. Future extension is not assumed in the analysis, therefore the last year of benefits is assumed as 2023.

Some production and price data relevant to the valuation was not available so several assumptions had to be made. Data for 2013/14 is assumed to be the same as the previous year (2012/13). For 2014/15 for pear exports to Malaysia, Hong Kong, and Singapore, data was not available so data for exports in 2012 has been used.

**Counterfactual**

The analysis assumes that the level of exports to the markets specified above would have been 30% lower than assumed with the project.

### Summary of Assumptions

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

Table 5: Summary of Assumptions

| Variable | Assumption | Source/Comment |
|---|---|---|
| **Impact 1: Additional Exports for Apple Growers** | | |
| Average annual export of apple varieties (2016-2018) | 4,202 tonnes per annum | Hort Innovation (2018) |
| Average annual value of apple exports (2016-2018) | $10.58 million per annum | Hort Innovation (2018) |
| Average export price of Australian apples | $2,517 per tonne (a) | $10.58 m/4,202 tonnes |
| Average non-export gross value of Australian apples (2016-2018) | $1,738 per tonne | ABS (2019a, 2019b) |
| Australian Apple export premium | $779 per tonne (b) | $2,517 - $1,738 |
| Australian Apple exports to relevant markets in 2019 (e.g. Thailand, Malaysia, Singapore, Indonesia, and Hong Kong) | 1,261 tonnes | Agtrans Research based on historical data from Prowse (2014a) and Fresh Intelligence Consulting (2017, 2018) |
| Export premium due to exporting to relevant markets post-2018 | $981,714 per annum | $779 * 1,261 |
| Annual increase in exports to relevant markets from 2019 – 2023 | 5% increase in volume per annum for five years | Agtrans Research |
| First year of benefits | 2015 | Agtrans Research |
| Final year of benefits | 2023 | Agtrans Research |
| Additional cost due to exporting as opposed to the local market (as a percentage of export revenue based on fob) | 5% (c) | Agtrans Research |

| | | |
|---|---|---|
| Probability of impact post-2018 | 15% | Agtrans Research |
| **Impact 2: Additional Exports for Pear Growers** | | |
| Average annual export of pear varieties (2016-2018) | 10,619 tonnes per annum | Hort Innovation (2018) |
| Average annual value of pear exports (2016-2018) | $17.83 m per annum | Hort Innovation (2018) |
| Average export price of Australian pears | $1,679 per tonne (a) | $17.83 m/10,619 tonnes |
| Average non-export gross value of Australian pears (2016-2018) | $998 per tonne | ABS (2019a, 2019b) |
| Australian pear export premium | $681 per tonne (b) | $1,679 - $998 |
| Australian pear exports to relevant markets in 2019 (e.g. New Zealand, Indonesia, Canada, Singapore and India) | 3,504 tonnes | Agtrans Research based on historical data from Prowse (2014b) and Fresh Intelligence Consulting (2017, 2018) and Hort Innovation (2018) |
| Export premium due to exporting to relevant markets post-2018 | $2.39 m | $681 * 3,504 |
| Annual increase in exports to relevant markets from 2019 – 2023 | 5% increase in volume per annum for five years | Agtrans Research |
| First year of benefits | 2015 | Agtrans Research |
| Final year of benefits | 2023 | Agtrans Research |
| Additional cost due to exporting as opposed to the local market (as a percentage of export revenue based on fob value) | 5% (c) | Agtrans Research |
| Probability of impact post-2018 | 15% | Agtrans Research |
| **Counterfactual** | | |
| Level of current exports of both apples and pears to relevant markets without the project | 70% | Agtrans Research |

(a) Free-on-board (fob) price

(b) Note that the grower will not retain all of the benefits expressed via such a premium; this is an indicative industry benefit that will be shared with other supply chain participants.

(c) Depending on the export contract, there may be additional costs over supplying the local market such as building export consignment quantities, meeting phytosanitary and customs requirements, insurance, exchange rate costs, other transaction costs, and risk management costs.

# Results

All costs and benefits were discounted to 2018/19 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the modified internal rate of return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (2014/15) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

### Investment Criteria

Table 6 shows the investment criteria estimated for different periods of benefit for the total investment. Table 7 shows the investment criteria estimated for different periods for the Hort Innovation only. The present value of benefits (PVB) for Hort Innovation was estimated by multiplying the total PVB by the proportion of Hort Innovation investment in project AP11023 (53.7%).

Table 6: Investment Criteria for Total Investment in Project AP11023

| **Investment Criteria** | **Years after Last Year of Investment** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **0** | **5** | **10** | **15** | **20** | **25** | **30** |
| Present Value of Benefits ($m) | 0.75 | 5.49 | 6.10 | 6.10 | 6.10 | 6.10 | 6.10 |
| Present Value of Costs ($m) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Net Present Value ($m) | -0.25 | 4.49 | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 |
| Benefit-Cost Ratio | 0.75 | 5.48 | 6.09 | 6.09 | 6.09 | 6.09 | 6.09 |
| Internal Rate of Return (%) | negative | 100.0 | 100.3 | 100.3 | 100.3 | 100.3 | 100.3 |
| MIRR (%) | 91.3 | 67.8 | 31.0 | 21.0 | 16.6 | 14.1 | 12.5 |

Table 7: Investment Criteria for Hort Innovation Investment in Project AP11023

| **Investment Criteria** | **Years after Last Year of Investment** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **0** | **5** | **10** | **15** | **20** | **25** | **30** |
| Present Value of Benefits ($m) | 0.36 | 2.64 | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 |
| Present Value of Costs ($m) | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| Net Present Value ($m) | -0.18 | 2.11 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 |
| Benefit-Cost Ratio | 0.66 | 4.91 | 5.46 | 5.46 | 5.46 | 5.46 | 5.46 |
| Internal Rate of Return (%) | negative | 91.2 | 91.5 | 91.5 | 91.5 | 91.5 | 91.5 |
| MIRR (%) | 24.4 | 606.1 | 47.0 | 26.2 | 19.1 | 15.6 | 13.5 |

The annual undiscounted benefit and cost cash flows for the total investment for the duration of AP11023 investment plus 30 years from the last year of investment are shown in Figure 1.

Figure 1: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs

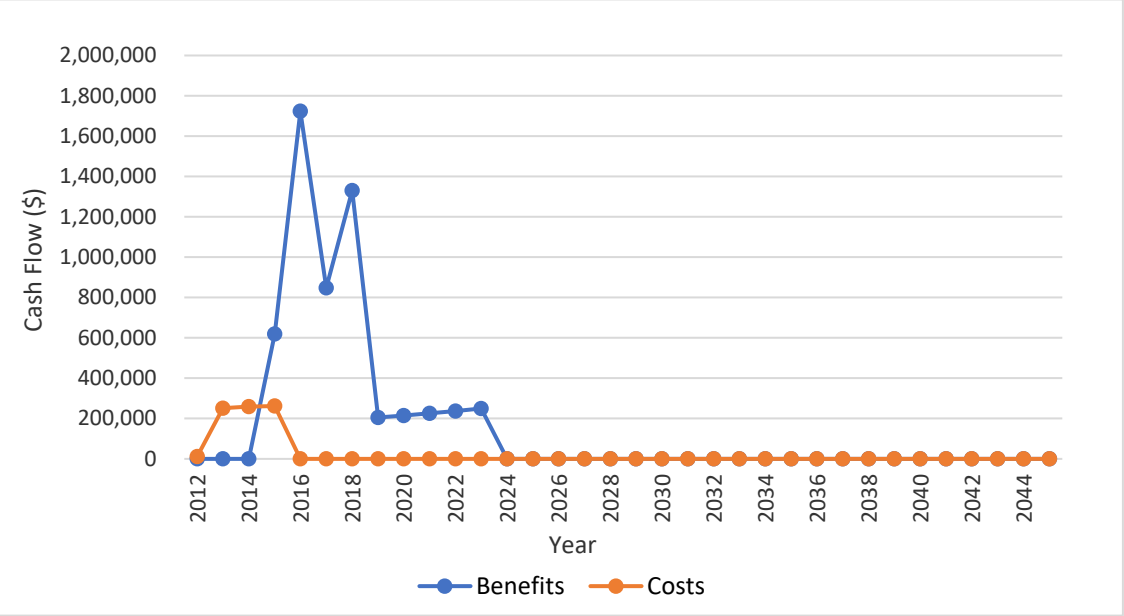


Table 8 shows the contribution of each impact to the total Present Value of Benefits (PVB).

Table 8: Source of Benefits

| Impact | PVB ($M) | % of Total PVB |
|---|---|---|
| Impact 1: Benefits from increased apple exports | 1.59 | 26% |
| Impact 2: Benefits from increased pear exports | 4.52 | 74% |
| Total | 6.10 | 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 9 present the results. Due to some benefits occurring before 2019, the 10% discount rate produces a higher net present value.

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

| Investment Criteria | Discount rate | | |
|---|---|---|---|
| | 0% | 5% | 10% |
| Present Value of Benefits ($m) | 5.65 | 6.10 | 6.63 |
| Present Value of Costs ($m) | 0.78 | 1.00 | 1.27 |
| Net Present Value ($m) | 4.87 | 5.10 | 5.36 |
| Benefit-cost ratio | 7.21 | 6.09 | 5.22 |

A sensitivity analysis was then undertaken for the assumed probability of impact of the project post-2018 to AP11023. Results are presented in Table 10. Only a moderate sensitivity was observed.

Table 10: Sensitivity to Probability of Impact Post-2018
(Total investment, 30 years)

| **Investment Criteria** | **Sensitivity to Probability of Impact** | | |
|---|---|---|---|
| | **7.5%** | **15%** | **30%** |
| Present Value of Benefits ($m) | 5.59 | 6.10 | 7.13 |
| Present Value of Costs ($m) | 1.00 | 1.00 | 1.00 |
| Net Present Value ($m) | 4.59 | 5.10 | 6.13 |
| Benefit-cost ratio | 5.58 | 6.09 | 7.11 |

A final sensitivity test examined the assumed counterfactual scenario (level of exports achieved without the project AP11023). Results are presented in Table 11. The results show a strong sensitivity to the counterfactual with the Benefit-cost ratio halving when the assumption for the percentage of actual exports increases from 70% to 85%.

Table 11: Sensitivity to Counterfactual
(Total investment, 30 years)

| **Investment Criteria** | **Exports Without Project AP10035 (percentage of actual exports)** | | |
|---|---|---|---|
| | **85%** | **70%** | **55%** |
| Present Value of Benefits ($m) | 3.05 | 6.10 | 9.16 |
| Present Value of Costs ($m) | 1.00 | 1.00 | 1.00 |
| Net Present Value ($m) | 2.05 | 5.10 | 8.15 |
| Benefit-cost ratio | 3.04 | 6.09 | 9.13 |

### 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 was assessed as Medium as one impact was valued, with the potential benefit from exporting to China from mainland Australia not valued.

Confidence in assumptions was rated as Medium-Low. The assumptions are based on generic export data and predictions based on past data. In addition, the counterfactual and causal links of the outcomes and impacts assumed are not strongly supported by data.

## Conclusion

The investment has strengthened links between Australian exporters and importers in Asian markets. Consequently, AP11023 is likely to have contributed to increased exports to South East Asian markets. There may also have been delivered some positive social impacts through increased incomes to apple and pear growing regions and increased capacity for future export growth in other Asian markets.

Total funding from all sources for the project was $1.00 million (present value terms) including $0.54 million (present value terms) from Hort Innovation. The investment produced an estimated total expected benefit of $6.10 million (present value terms). This gave a net present value of $5.10 million, an estimated benefit-cost ratio of 6.09 to 1, an internal rate of return of 100.3% and a modified internal rate of return of 12.5%.

Several impacts identified were not valued. This, when combined with conservative assumptions for the principal economic impact valued, it is reasonable to conclude that the valuation may be an underestimate of the actual performance of the investment.

## Glossary of Economic Terms

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

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## Abbreviations

| | |
|---|---|
| ABS | Australian Bureau of Statistics |
| APAL | Apple and Pear Australia Limited |
| CRRDC | Council of Research and Development Corporations |
| DAWR | Department of Agriculture and Water Resources (Australian Government) |
| DPIV | Department of Primary Industries, Victoria |
| GDP | Gross Domestic Product |
| GVP | Gross Value of Production |
| IRR | Internal Rate of Return |
| MIRR | Modified Internal Rate of Return |
| OCS | Office of Chief Scientist Queensland |
| PVB | Present Value of Benefits |
| R&D | Research and Development |
| RD&E | Research, Development and Extension |
| SIP | Strategic Investment Plan |