# Industry-specific impact assessment Program: Banana

## Impact assessment report for project *Capacity building in bananas study tour* (BA12703)

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**Project code:**

MT19012

**Date:**

18 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

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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 project BA12703 titled "*Capacity building in bananas study tour".* The project was funded by Hort Innovation over the period June 2013 to November 2014.

### 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 BA12703 contributed to increased industry knowledge and capacity and is likely to have contributed to the implementation of practice changes that will improve productivity and profitability for some Australian banana growers.

### Investment Criteria

Total funding from all sources for the project was $0.24 million (present value terms). The investment produced estimated total expected benefits of $0.38 million (present value terms). This produced an estimated net present value of $0.13 million, a benefit-cost ratio of 1.55 to 1, an internal rate of return (IRR) of 8.85% and a MIRR of 6.90% over 30-years at a discount rate of 5% and reinvestment rate of 5%.

### Conclusions

Four economic and social impacts were also identified but not valued as part of the current assessment. Thus, given the impacts not valued, combined with conservative assumptions made for the principal economic impacts valued, it is reasonable to conclude that the investment criteria reported may be an underestimate of the actual performance of the BA12703 investment.



## Keywords

Impact assessment, cost-benefit analysis, BA12703, banana, capacity, capacity building, study tour

# 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 almond (AL), banana (BA), citrus (CT) and onion (VN) research, development and extension (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 24 projects worth approximately $16.72 million,
- Eight CT projects worth $5.40 million (nominal Hort Innovation investment) from a total population of 35 projects worth $15.78 million, and
- Four VN projects worth $2.40 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. Four projects had been randomly selected as part of a related Hort Innovation project (MT18011) and were included in the samples for the AL industry (AL14006 and AL16004) and the CT industry (CT15006 and CT15013). This left 25 unique projects randomly selected for evaluation under MT19012.

Project BA12703*: Capacity building in bananas study tour* was randomly selected as one of the 25 unique MT19012 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 (RDCs), Cooperative Research Centres (CRCs), State Departments of Agriculture, and some universities. The approach includes both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2018).

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

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

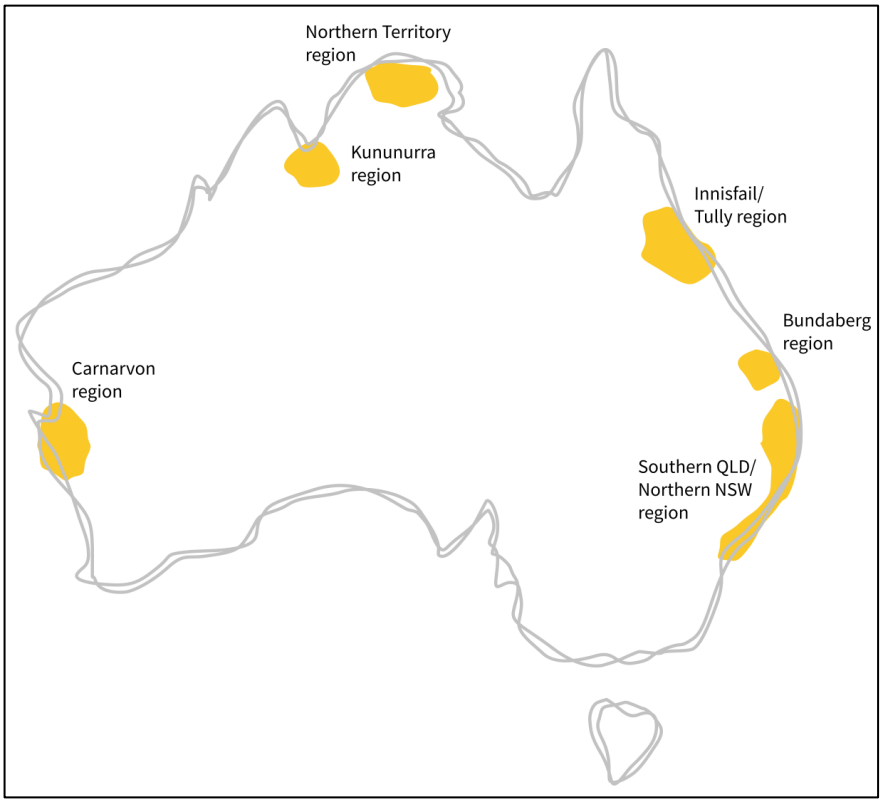
# Background & Rationale

## Background

*The Australian Banana Industry*

Bananas have been grown in Australia since the 1880s. Today, bananas are grown in subtropical and tropical regions including in Queensland (Qld), northern New South Wales (NSW), the Northern Territory (NT) and Western Australia (WA) (Hort Innovation, 2020). On average, Qld accounts for approximately 90% of the total area of bananas grown and over 95% of total Australian production (10-year average[1]). Figure 1 shows Australia's banana growing regions and Table 1 provides a summary of the data for production of bananas for both Australia and Qld.

Figure 1: Australia's Banana Growing Regions




Source: https://australianbananas.com.au/Pages/all-about-bananas/the-banana-story

[1] Based on area data from the Australian Bureau of Statistics (ABS), series 7121.0 *Agricultural Commodities, Australia* 2009/10 to 2018/19, and production data from the Australian Banana Growers' Council (ABGC)

Table 1: Production Statistics for the Australian and Qld Banana Industry (year ended 30 June 2010 to 2019)

| **Australia** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year ended 30 June** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **10yr Avg.** |
| Total area (ha) | 12,497 | 13,296 | 15,484 | 15,348 | 12,879 | 11,788 | 16,612 | 14,021 | 12,477 | 11,902 | 13,630 |
| Area (bearing age) (ha) | 11,543 | 11,196 | 13,496 | 14,218 | 12,085 | 10,936 | 15,610 | 13,274 | 11,551 | 10,962 | 12,487 |
| Production[(a)] (t) | 309,505 | 330,980 | 202,423 | 339,922 | 370,176 | 370,989 | 395,878 | 413,660 | 388,265 | 371,915 | 349,371 |
| Yield (t/ha) | 26.8 | 29.6 | 15.0 | 23.9 | 30.6 | 33.9 | 25.4 | 31.2 | 33.6 | 33.9 | 28.0 |
| Gross value ($m) | 488.1 | 316.0 | 466.8 | 490.7 | 341.3 | 455.0 | 409.0 | 538.5 | 487.6 | 490.9 | 448.4 |
| **QLD** | | | | | | | | | | | |
| **Year ended 30 June** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **10yr Avg.** |
| Total area (ha) | 10,869 | 11,480 | 13,576 | 13,886 | 11,356 | 10,101 | 15,794 | 13,182 | 11,502 | 10,829 | 12,258 |
| Area (bearing age) (ha) | 10,083 | 9,727 | 11,810 | 12,986 | 10,726 | 9,446 | 14,933 | 12,597 | 10,693 | 10,030 | 11,303 |
| Production[(b)] (t) | 270,358 | 287,553 | 177,135 | 310,468 | 328,548 | 320,442 | 378,709 | 392,562 | 359,425 | 340,294 | 316,549 |
| Yield (t/ha) | 26.8 | 29.6 | 15.0 | 23.9 | 30.6 | 33.9 | 25.4 | 31.2 | 33.6 | 33.9 | 28.0 |
| Gross value ($m) | 448.3 | 283.1 | 415.4 | 456.5 | 322.8 | 440.8 | 401.2 | 525.8 | 472.0 | 468.3 | 423.4 |

Source: ABS Series 7121.0 *Agricultural Commodities, Australia* (2009/10 to 2018/19) and ABS Series 7503.0 *Value of Agricultural Commodities Produced, Australia* (2009/10 to 2018/19)

(a) Production data from the ABGC based on compulsory levies.

Derived from ABS area (bearing age plants) and the Australian average yield for each year.

*Capacity building in for the Australian banana industry*

The banana industry is a vital part of the Qld and Australian economy. Its ongoing viability depends on having a well-qualified workforce of growers, researchers, and other industry stakeholders at all levels. Capacity building and continued innovation is essential to ensure the banana industry continues to meet challenges associated with all stages of the banana supply chain.

For example, *Fusarium wilt* Tropical Race 4 (TR4, also known as Panama disease) was first detected in Australia in the NT in Cavendish bananas in 1997 and lead to the decimation of the NT banana industry. In 2013 the disease was restricted to only the NT in Australia. China and the Philippines are two of the world's largest banana producing countries currently dealing with TR4. It is important that the Australian industry consider what these countries have learned and what strategies overseas banana producers are using to deal with the disease. Also, Costa Rica and Ecuador (Central America) are known for high quality banana fruit for export as well as innovations that have led to minimal waste. Facilitating international industry and scientific networks may create opportunities for Australian banana producers to increase their international competitiveness.

### Rationale

The Hort Innovation Banana Strategic Investment Plan 2017-2021 (2017) identified that RD&E investment was needed to:

- Collaborate with the international community to accelerate the identification and development of disease resistant varieties,
- Continue to research and refine agronomic practices to improve productivity, quality and environmental outcomes,
- Identify and develop innovative leaders to promote adoption of best management practices (BMPs) and drive the development and adoption of innovative practices,
- Provide pathways for growers to become aware of, and adopt, continuous improvement methodologies, and
- Research other use options that minimise waste during periods of peak supply.

Project BA12703 (*Capacity building in bananas study tour*) was co-funded with participants to enable a group of 18 different growers and two Australian Banana Growers' Council tour leaders to go on two separate banana tours to China and the Philippines in 2013 and Costa Rica and Ecuador in 2014 to build capacity and bring back new ideas to continue innovation in the Australian banana industry (Jim Pekin, pers. comm., 2020).

# Project Details

## Summary

Project Code: BA12703

Title: *Capacity building in bananas study tour*

Research Organisation: Australian Banana Growers Council Inc.

Principal Investigator: Jay Anderson

Period of Funding: June 2013 to November 2014

## Objectives

Project BA12007 was funded to support two Innovative Banana Growers Study Tours. The specific aims of the two planned study tours were as follows:

1. The aim of the 2013 study tour is to provide innovative and youngish growers with the opportunity to see first-hand the various practices used across the supply chain in China and the Philippines, and to help them gain a greater understanding of how these impact on production in Australia. Participants on these tours will observe a diverse range of practices in use including the management of Panama Tropical Race 4, and will consequently be able to identify both on-farm and off-farm practices that may be beneficial or detrimental to production here and grow their understanding of how foreign/ competitor markets operate.
2. The aim of the 2014 study is to provide innovative and youngish growers with the opportunity to see first-hand the various practices used across the supply chain in Costa Rice and Ecuador, and to give them the opportunity to see production systems with a focus on quality which they may want to modify and implement on their own farms.

## Logical Framework

Table 2 briefly describes the activities, outputs, outcomes, and actual and potential impacts of project BA12703 in a logical framework.

Table 2: Logical Framework for Project BA12703

| | |
|---|---|
| Activities | <u>Study Tour 2013: China and the Philippines</u><br>• Nine growers and one ABCG tour leader (who organised the logistics) first travelled to Hong Kong and attended the Asia Fruit Logistica Exhibition on 5 September, a trade show for international fruit and vegetable businesses.<br>• The tour group then headed to China (6 September 2013) to observe banana plantations and local banana supply chain practices.<br>• Over the course of their visit to China, the study tour visited:<br>  ○ The Jin Sui Company banana plantations (Guangxi Province),<br>  ○ Gutan Market Place (Guangxi Province),<br>  ○ An organic fertiliser plant (Jin Sui Company) (Guangxi Province),<br>  ○ A series of smaller farms and new plantations, the market centre and banana trading area (Guangxi Province),<br>  ○ Gao Ming Company plantation (Hainan Province),<br>  ○ Wan Zhong Company (Hainan Province), and<br>  ○ A tissue culture laboratory (Hainan Province).<br>• On 10 September 2013, the tour group travelled on to the Philippines and, hosted by Unifrutti, visited the following companies/sites in Davao, Mindanao:<br>  ○ Daficor Box Plant,<br>  ○ Macondray Plastics,<br>  ○ Ansaldo Nursery,<br>  ○ RBFI Farms, |

| | |
|---|---|
| | ○ DARBCO IFS Farm,<br>○ Macondray Plastics Recycling, and<br>○ CHISI Wharf.<br>• The study team returned to Australia on 13 September 2013 to report their findings from the first study tour.<br>• Information was disseminated through presentations at the following meetings:<br>○ Mareeba Banana Growers' Association (9 October 2013)<br>○ Cassowary Coast Banana Growers' Association (10 October 2013)<br>○ Banana Agribusiness Managers (BAGMAN) meeting (10 October 2013)<br>○ Ecosciences Precinct (Brisbane) (1 November 2013)<br><br><u>Study Tour 2014: Central America</u><br>• A different group of nine growers and one ABCG tour leader convened for the second, 2014 banana study tour to Central America (Jim Pekin, pers. comm., 2020).<br>• On 14 July 2014, the group travelled first to Ecuador and visited the following sites:<br>○ Guayaquil,<br>○ Several farms in Oro Province,<br>○ A port at Puerto Bolivar, Machala to observe banana ship loading, and<br>○ Additional farms at Oro, including plant crop near Puerto Inca.<br>• The study team then met with Eduardo Garcia, the Executive Director of the Ecuadorian Banana Exporters Association.<br>• The team then travelled to Costa Rica on 17 July. Initially the group met with Alasdair Macleod, the Managing Director of Fyffes Bananas International, who gave a presentation.<br>• The presentation then was followed by a tour of Earth University's commercial banana farm and discussion with its Development Officer.<br>• The study team then visited the following sites:<br>○ Two campuses of Corbana Research Institute to talk with various researchers,<br>○ Guaria Farm, Frobana Farm and Banana Siquirres Farm, and<br>○ The Maersk container terminal in Limon.<br>• On 19 July 2014, the study group travelled on to Martinique (an island in the Lesser Antilles in the Caribbean) and visited:<br>○ Anne Marie's ripening rooms (Muma Fruits),<br>○ Bertrand Aubrey's Chalvet farm and Frederick De Reynal's Farm at Basse Point,<br>○ Bananamart (the banana industry association) where the team was given a presentation,<br>○ Two smaller farms with Laurent Gervais from IT2,<br>○ Antilles Vitro Plants nursery (including a presentation by Milagro on crop data analyses), and<br>○ Ban Hackaert farm where the study group observed a demonstration of borer control on-farm by SCIC Environmental.<br>• The study group completed their Central America tour on 23 July 2014 and returned to Australia to report their findings.<br>• Study group members presented the findings of the second study tour to the Mareeba Banana Growers' Association meeting on 8 October 2014 and the Tweed Brunswick Banana Growers' Association meeting on 12 November 2014. |
| Outputs | <u>Study Tour 2013: China and the Philippines</u><br>• From the Hong Kong trade show, study participants learned that one of Australia's biggest problems in exporting produce to the rest of the world is the cost of production.<br>• Further, the sophistication of transport, handling and marketing of fruit and vegetables was noted, especially the innovations being made in the packing sector to preserve the quality of fresh produce and also to suit long distance shipping and increase life on shelves.<br>• TR4 was discussed often on the China study tour. Some of the group' s key observations included: |

| | |
|---|---|
| | ○ There was no wheel or boot washes before entering any of the farms visited in China.<br>○ According to the local guide, there was not a lot of awareness of TR4 with local farmers.<br>○ Perhaps the cold winters in Guangxi keep the disease under control more than in areas that experience tropical climate all year round.<br>○ Apparently, the Central Government's view on TR4 is that bananas are not a staple part of the Chinese diet. Thus, if there is a shortage the population will not starve. Wheat, rice, meat, and vegetables are what keep the population fed. When there is no land left without TR4 they will simply import bananas from overseas.<br>• Observations on TR4 from the Philippines included:<br>○ Growers take the disease very seriously. Wheel washes and boot washes were required everywhere the team went. However, there are not many areas in the Davao region without TR4.<br>○ One farm was observed to be fenced off containing a possible Moko[2] infection.<br>○ Biosecurity seems to be purely up to the grower/merchant.<br>• Recommendations and implications from the first study tour included:<br>○ *Panama disease*<br>▪ Education of banana growers about what the disease looks like.<br>▪ Education of the general public to inform them about the current threat and to spread the quarantine message.<br>▪ Co-operation with other industries and NT, New South Wales, and Qld governments to spread the message on interstate quarantine concerns.<br>○ *On-farm practices*<br>▪ Foot baths and controlled entry is important.<br>▪ The fact that the most part, if not all, of their fertiliser program was organic composting is something that Australia can learn from.<br>○ *Packaging*<br>▪ Can Australia use carton bags that can wrap bananas in cartons better than carton liners?<br>▪ Fruity gift boxes may be a useful value add produce following on from observations at the Asia Fruit Logistica Exhibition.<br><br><u>Study Tour 2014: Central America</u><br>• A number of key implications and recommendations for the Australian banana industry were reported by the study group. These included:<br>• **More emphasis on bunch protection.** It was widely evident at all farms in the three countries visited that great care is taken to ensure the bunches reach the packing facilities in pristine condition.<br>• In Ecuador and Costa Rica, the system used in-field was a cableway to transport bunches to the shed. In Martinique, farmers use sophisticated tractor drawn trailers that allow bunches to hang freely without touching each other on the way to the shed.<br>• The use of pads and jigs to avoid pressure injuries to bunches while they are being humped is something that could have benefits to the harvest process used in Australia.<br>• The evidence was clear that packing facility operation is much improved when fruit arrives at the shed free of damage. |

[2] Moko is a bacterial disease caused by *Ralstonia solancearum* race 2. Moko has caused severe losses in banana crops in Central and South America, the Caribbean, and the Philippines. Yield reductions of 70% due to Moko have been reported in Guyana. For more information see: https://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Moko-FS.pdf#:~:text=The%20symptoms%20produced%20by%20Moko%20may%20vary%20depending,or%20whitish%20panels%2C%20before%20dying.%20Suckers%20may%20wilt.

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| | • **More consideration of chemicals.** All farms that export to Europe had stringent conditions placed on them with regard to what chemicals they can use.<br>• No farm visited used any insecticide on their soil and nematicide use was either low or non-existent.<br>• Australia has not been as advanced in non-chemical management of Banana Weevil Borer. The use of pheromone lures would help to reduce insecticide use. The issue is labour cost.<br>• The only chemical treatments were for Black and Yellow Sigatoka, post-harvest crown fungus control and impregnated bunch covers or strips.<br>• All farmers and agronomists indicated that root and soil health were the key to being able to farm successfully without traditional chemicals.<br>• The Australian industry should consider this matter now, before similar requirements (e.g. banning of certain insecticides and/or aerial spraying) are imposed.<br>• **Sap management.** Sap (latex) build up on packing shed equipment seemed well controlled at all packing facilities visited. Some facilities used additives to sorting tanks and one facility used intravenous drop technology to give controlled release of additives to water.<br>• At least one facility in Costa Rice was using citric acid in their water tanks. Another facility in Ecuador was using Biolatex to break down sap.<br>• A comprehensive review of what is available around the world would be useful so that products can be trialled in Australian facilities.<br>• **Varieties.** Only a small percentage of the varieties grown in the countries visited were Williams or Grande Naine.<br>• Of the varieties used, Israeli variety 'GALL' showed the most promise of being suited to Australian conditions. Consideration should be given to studying this variety for Australia as soon as possible.<br>• **Are our cartons too complex?** The cartons used to export bananas from all three countries were of simpler construction and cheaper than those used in Australia.<br>• Farm to port roads were equivalent to, or in worse condition than, those in Australia, putting fruit through ample shock and vibration testing.<br>• While there are many variables that affect consumer end banana quality, it would appear that Australian cartons may be unnecessarily complex and expensive.<br>• **Collaboration with Earth University.** There is a potential benefit to the Australian industry (and other industries) if Australia was to either fund a position for an Australian Agriculture Science student to attend Earth University, or for an Australian company or research organisation to provide 15 weeks employment for a fourth year Earth University student.<br>• Either or both of these opportunities may facilitate scientific information flowing from Costa Rica to Australia and vice versa. |
| Outcomes | • Key learnings and recommendations from the two study tours, disseminated to industry through the participants at key industry association meetings, have been taken up and/or acted on by industry stakeholders to improve the Australian industry's economic and environmental sustainability.<br>• Following the two study tours, the key learnings that have since been adopted by industry include (Jim Pekin, pers. comm., 2020):<br>  ○ The importance of early detection of Panama disease TR4, through surveillance and then the rapid deployment of measures to contain the fungal spores. This coincided with the discovery of TR4 in QLD for the first time in March 2015;<br>  ○ Biosecurity measures to prevent emergency plant pests from entering farms, e.g. including the learnings of what did not work in those countries;<br>  ○ There is far more interest by growers, researchers, and extension providers on the value of good soil health (however, the study tours were not the only cause of this);<br>  ○ GALL, a range of Taiwanese and other varieties have now been imported and most are in QLD farm trials, as well as on research stations; |

| | |
|---|---|
| | ○ Pheromone lures were trialled, with continued use commercially in NSW in particular;<br>○ Bunch protection for improved pack out and quality has been implemented by innovative growers; and<br>○ 90% of the industry now uses the more efficient "international standard" banana carton, which is 15kg. Prior to the study tour, they did not exist in Australia and13 kg cartons were predominant: However, there were other drivers of this practice change as well. |
| Impacts | • Potentially, some contribution to reduced risk of incursion, establishment and/or spread of Fusarium wilt TR4 in Qld.<br>• Potentially, some contribution to improved productivity and/or profitability for the Australian banana industry driven by:<br>i) reduced costs (e.g. improved packaging, reduced chemical use),<br>ii) improved practices along the supply chain (e.g. sap management, better bunch protection), and/or<br>iii) increased average yields from future adoption of improved varieties and on-farm practices (e.g. biosecurity, pest management).<br>• Potentially, some contribution to future reductions in the use of agriculture chemicals (e.g. pesticides) and associated chemical export off-farm.<br>• Increased research capacity through improved international networks and collaborations.<br>• Increased industry knowledge and capacity through enhanced international grower networks.<br>• Potentially, increased regional community wellbeing through spill-overs from a more productive and profitable Australian banana industry. |

# Project Investment

### Nominal Investment

Table 3 shows the annual investment (cash and in-kind) in project BA12703 by Hort Innovation and ABGC.

Table 3: Annual Investment in the Project BA12703 (nominal $)

| Year ended 30 June | Hort Innovation ($) | ABGC ($) | Total ($) |
|---|---|---|---|
| 2013 | 0 | 41,220 | 41,220 |
| 2014 | 18,760 | 0 | 18,760 |
| 2015 | 5,693 | 97,707 | 103,400 |
| **Totals** | 24,453 | 138,927 | 163,380 |

Source: BA12703 Project Agreement and Variation documents supplied by Hort Innovation 2020

### Program Management Costs

For the Hort Innovation investment the cost of managing and administrating the Hort Innovation funding was added to the Hort Innovation contribution for the project via a management cost multiplier (1.162). This multiplier was estimated based on the share of 'payments to suppliers and employees' in total Hort Innovation expenditure (3-year average) reported in the Hort Innovation's Statement of Cash Flows (Hort Innovation Annual Report, various years). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 3.

For the ABGC funding, it was assumed that project management, research of the itineraries and delivery of the trip logistics plus administration costs were already built into the cost data show in Table 3 (Jim Pekin, pers. comm., 2020).

### Real Investment and Extension Costs

For the purposes of the investment analysis, investment costs of all parties were expressed in 2019/20 dollar terms using the Gross Domestic Product deflator index (ABS, 2020). No additional costs associated with project extension were incorporated as the project included a number of extension and communication activities directed at disseminated project findings to key industry associations and government stakeholders.

## Impacts

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

Table 4: Triple Bottom Line Categories of Principal Impacts from Project BA12703

| | |
|---|---|
| Economic | • Potentially, some contribution to reduced risk of incursion, establishment and/or spread of *Fusarium wilt* TR4 in Qld.<br>• Potentially, some contribution to improved productivity and/or profitability for the Australian banana industry driven by:<br>i) reduced costs (e.g. improved packaging, reduced chemical use),<br>ii) improved practices along the supply chain (e.g. sap management, better bunch protection), and/or<br>iii) increased average yields from future adoption of improved varieties and on-farm practices (e.g. biosecurity, pest management). |
| Environmental | • Potentially, some contribution to future reductions in the use of agriculture chemicals (e.g. pesticides) and associated chemical export off-farm. |
| Social | • Increased research capacity through improved international networks and collaborations.<br>• Increased industry knowledge and capacity through enhanced international grower networks.<br>• Potentially, increased regional community wellbeing through spill-overs from a more productive and profitable Australian banana industry. |

### Public versus Private Impacts

The impacts identified in this evaluation are both private and public in nature. Private benefits are likely to be realised by Australian banana growers through improved on-farm practices and other supply chain improvements learnt from the international banana study tours.

Public benefits also may occur and include increased scientific capacity and increased regional community wellbeing as a result of a more productive and profitable banana industry.

### Distribution of Private Impacts

The impacts on the Australian banana industry from investment in project BA12703 will be shared along the banana supply chains with input suppliers, growers, processors, transporters, wholesalers, retailers and consumers all sharing impacts produced by the project according to relevant short- and long-term supply and demand elasticities.

### Impacts on Other Australian Industries

No direct impacts on industries other than the Australian banana industry were identified.

### Impacts Overseas

No significant impacts for countries outside of Australia were identified. However, the knowledge created by the project and international grower and researcher collaborations may result in some positive impacts for banana industries overseas through knowledge sharing.

### Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 5. The project findings and related impacts will contribute to Rural RD&E Priority 4, with some contribution to Priorities 2 and 3, and to Science and Research Priority 1.

Table 5: Australian Government Research Priorities

| Australian Government | |
|---|---|
| **Rural RD&E Priorities (est. 2015)** | **Science and Research Priorities (est. 2015)** |
| 1. Advanced technology<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<br>6. Resources<br>7. Advanced Manufacturing<br>8. Environmental Change<br>9. Health |

Sources: (Commonwealth of Australia, 2015) and (Australian Government, 2015)

### Alignment with the Banana Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the banana industry are outlined the Banana Strategic Investment Plan 2017-2021[3] (2017). Project BA12703 addressed Outcome 4 (Strategy 4.1 and, to some extent, Strategy 4.3) with some contribution to Outcome 1 (all Strategies, 1.1 to 1.5) and Outcome 2 (Strategies 2.1).

## 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.

Investment in BA12703 has contributed to the adoption of a range of practices that are likely to contribute to long-term productivity and profitability for the Australian banana industry, particularly for innovative growers and those who participated directly in the study tours. One primary economic impact was valued as part of the assessment, the project's contribution to improved increased productivity and/or productivity for some Australian banana growers. This impact is likely to be driven by:

i) Reduced production costs,
ii) Supply chain efficiencies, and/or
iii) Increased average yields.

### Impacts Not Valued

Not all of the impacts identified in Table 4 could be valued in the assessment. In particular, social impacts were hard to value due to a lack of evidence/data on which to base credible assumptions, difficulty in quantifying the causal relationship and the pathway between BA12703 and the impact and/or the complexity of assigning

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

magnitudes and monetary values to the impact.

The economic impact identified but not valued was:

- Potentially, some contribution to reduced risk of incursion, establishment and/or spread of Fusarium wilt TR4 in Qld. However, this impact may be partially captured through the valuation of improved productivity/profitability for some banana growers through improved on-farm biosecurity.

The environmental impact identified but not valued was:

- Potentially, some contribution to future reductions in the use of agriculture chemicals (e.g. pesticides) and associated chemical export off-farm.

The social impacts identified but not valued were:

- Increased research capacity through improved international networks and collaborations.
- Increased industry knowledge and capacity through enhanced international grower networks.
- Potentially, increased regional community wellbeing through spill-overs from a more productive and profitable Australian banana industry.

### Valuation of Impact 1: Increased productivity/profitability for some Australian banana growers

The investment in BA12703 is likely to have contributed to the current and future adoption of a range of practices that will contribute to increasing the future productivity and profitability of the Australia banana industry including better on-farm biosecurity, new and improved varieties, improved pest and disease control, improved supply chain management (e.g. packaging, sap management, and bunch protection), and reduced chemical use.

The valuation of the impact was built on the assumption that, on average, investment in project BA12703 is likely to lead to increased net returns for a proportion of Australian banana growers. Specific assumptions for the valuation of Impact 1 are described in Table 6.

**Attribution**

As noted in the outcomes section of Table 2 (logical framework), some of the productivity/profitability enhancing practice changes may have been driven by other factors beyond the study tours funded by BA12703. To accommodate other factors that may have contributed to the benefits estimated an attribution factor of 10% was applied to the total benefits.

**Counterfactual**

It was assumed that the benefits estimated (at an attribution of 10%) would not have occurred without investment in BA12703.

### Summary of Assumptions

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

Table 6: Summary of Assumptions

| Variable | Assumption | Source/Comment |
|---|---|---|
| **Key Baseline Data** | | |
| Total average Australian banana production area (bearing age) | 12,487 ha | 10-year average derived from ABS Series 7121.0 *Agricultural Commodities, Australia* (2009/10 to 2018/19) (see Table 1) |
| Total average Australian banana production | 349,371 t | 10-year average, derived from ABGC production statistics based on the compulsory industry levy (see Table 1) |
| Estimated average net return to growers | $22.00 / 15kg carton | Analyst estimate, based on the average net return to grower after marketing and ripening costs reported in the Banana Enterprise Comparison Report 2016/17 |

| | | |
|---|---|---|
| | | (Appendix 1) (Pinnacle Agribusiness, 2018) |
| **Impact 1: Increase productivity/profitability for some Australian banana growers** | | |
| **Valuation Assumptions** | | |
| Proportion of the Australian industry (by area) implementing changes driven, at least in part, by BA12703 | 2.0% | Analyst assumption, conservative estimates based on the number of participants in the study tours, the extension activities undertaken within the project, and support of the ABGC |
| Increase in net returns to growers that implement change | 2.5% | |
| First year of impact | 2014/15 | Year after first study tour |
| Year of maximum impact | 2018/19 | Five years after first study tour |
| **Risk Factors and Other Variables** | | |
| Probability of output | 100% | Analyst assumption, based on successful completion of BA12703 |
| Probability of outcome | 100% | Analyst assumption, based on evidence of industry adoption of findings from BA12703 |
| Probability of impact | 80% | Analyst assumption, allows for exogenous factors that may affect realisation of impact |
| Attribution of benefits to investment in BA12703 | 10% | See 'valuation of impact 1' above. |

# 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 7 shows the investment criteria estimated for different periods of benefit for the total investment. Table 8 shows the investment criteria estimated for different periods for the investment by 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 BA12703 (16.9%).

Table 7: Investment Criteria for Total Investment in Project BA12703

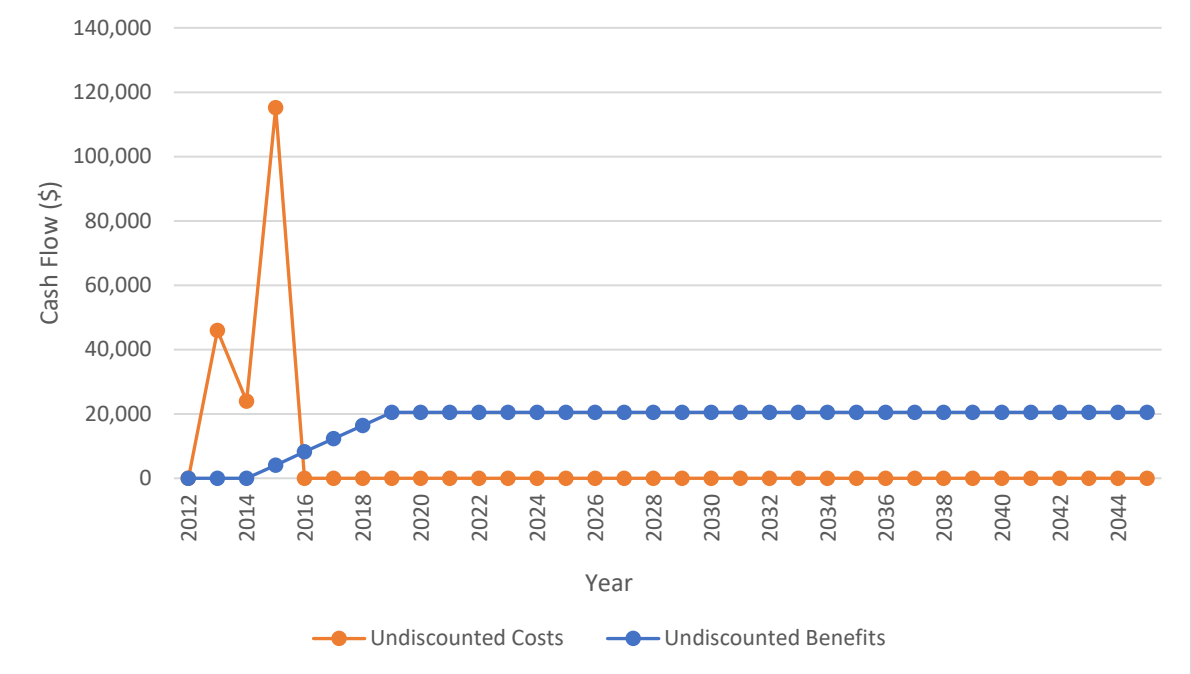
| **Investment Criteria** | **Years after Last Year of Investment** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **0** | **5** | **10** | **15** | **20** | **25** | **30** |
| Present Value of Benefits ($m) | 0.01 | 0.09 | 0.18 | 0.25 | 0.30 | 0.34 | 0.38 |
| Present Value of Costs ($m) | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| Net Present Value ($m) | -0.24 | -0.15 | -0.07 | 0.00 | 0.06 | 0.10 | 0.13 |
| Benefit-Cost Ratio | 0.02 | 0.37 | 0.73 | 1.02 | 1.24 | 1.42 | 1.55 |
| Internal Rate of Return (%) | negative | negative | 0.03 | 5.21 | 7.32 | 8.34 | 8.85 |
| MIRR (%) | negative | negative | negative | 5.18 | 6.55 | 6.87 | 6.90 |

Table 8: Investment Criteria for Hort Innovation Investment in Project BA12703

| Investment Criteria | Years after Last Year of Investment | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| Present Value of Benefits ($m) | 0.00 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.06 |
| Present Value of Costs ($m) | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Net Present Value ($m) | -0.04 | -0.03 | -0.01 | 0.00 | 0.01 | 0.02 | 0.02 |
| Benefit-Cost Ratio | 0.02 | 0.37 | 0.73 | 1.01 | 1.23 | 1.41 | 1.54 |
| Internal Rate of Return (%) | negative | negative | 0.03 | 5.00 | 7.23 | 8.14 | 8.76 |
| MIRR (%) | negative | negative | negative | 5.11 | 6.50 | 6.84 | 6.87 |

The annual undiscounted benefit and cost cash flows for the total investment for the duration of BA12703 investment plus 30 years from the last year of investment are shown in Figure 2.

Figure 2: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs




## Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 9 present the results. The investment criteria showed a moderate sensitivity to the discount rate. This was largely because the benefits occur into the long-term future and future cash flows are subjected to more significant relative discounting.

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

| Investment Criteria | Discount rate | | |
|---|---|---|---|
| | 0% | 5% (base) | 10% |
| Present Value of Benefits ($m) | 0.59 | 0.38 | 0.28 |
| Present Value of Costs ($m) | 0.19 | 0.24 | 0.32 |
| Net Present Value ($m) | 0.41 | 0.13 | -0.03 |
| Benefit-cost ratio | 3.21 | 1.55 | 0.89 |

A sensitivity analysis was then undertaken for the proportion of the Australian banana production area implementing practice changes driven, at least in part, by BA12703. The results, presented in Table 10, show a moderate sensitivity to the area of banana affected. A break-even analysis indicated that, with all other assumptions held at base values, the proportion of the banana production area implementing practice change partially attributable to BA12703 would need to be approximately 1.3% (161 ha of banana plants of bearing age) for the investment criteria to be positive (benefit-cost ratio of 1:1).

Table 10: Sensitivity to Assumed Proportion of Australian Banana Area Implementing Practice Change (Total investment, 30 years)

| **Investment Criteria** | **Proportion of banana area** | | |
|---|---|---|---|
| | **0.5%** | **2.0% (base)** | **5.0%** |
| Present Value of Benefits ($m) | 0.09 | 0.38 | 0.95 |
| Present Value of Costs ($m) | 0.24 | 0.24 | 0.24 |
| Net Present Value ($m) | -0.15 | 0.13 | 0.70 |
| Benefit-cost ratio | 0.39 | 1.55 | 3.88 |

Finally, a sensitivity analysis was undertaken on the attribution of benefits to the investment in BA12703. The results are presented in Table 11 and show a moderate sensitivity to the attribution level assumed.

Table 11: Sensitivity to Assumed Attribution of Benefits to BA12703 (Total investment, 30 years)

| **Investment Criteria** | **Benefits Attributable to BA12703** | | |
|---|---|---|---|
| | **2%** | **10% (base)** | **25%** |
| Present Value of Benefits ($m) | 0.08 | 0.38 | 0.95 |
| Present Value of Costs ($m) | 0.24 | 0.24 | 0.24 |
| Net Present Value ($m) | -0.17 | 0.13 | 0.70 |
| Benefit-cost ratio | 0.31 | 1.55 | 3.88 |

### 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 – one primary economic impact was valued; however, six other potential economic, environmental, and social impacts were not able to be valued within the scope of the current assessment. The non-valued social impacts were considered largely secondary benefits and were likely small relative to the primary impact valued.

Confidence in assumptions was rated as Medium-Low. Data used in the analysis were mostly drawn from published and/or credible sources such as Hort Innovation, published scientific journal articles and the ABS. However, the specific impact of each practice change driven by the BA12703 investment, as well as the counterfactual were analyst assumptions and are therefore somewhat uncertain.

## Conclusion

The investment in BA12703 contributed to increased industry knowledge and capacity and is likely to have contributed to the implementation of practice changes that will improve productivity and profitability for some Australian banana growers.

Total funding from all sources for the project was $0.24 million (present value terms). The investment produced estimated total expected benefits of $0.38 million (present value terms). This produced an estimated net present value of $0.13 million, a benefit-cost ratio of 1.55 to 1, an internal rate of return (IRR) of 8.85% and a modified IRR of 6.90% over 30-years at a discount rate of 5% and reinvestment rate of 5%.

Four economic and social impacts were also identified but not valued as part of the current assessment. Thus, given the impacts not valued, combined with conservative assumptions made for the principal economic impacts valued, it is reasonable to conclude that the investment criteria reported may be an underestimate of the actual performance of the BA12703 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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## 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 acknowledgments:
Jim Pekin, Chief Executive Officer, Australian Banana Growers' Council
Brendan O'Keeffe, Analyst, Horticulture Innovation Australia Ltd

## Abbreviations

| | |
|---|---|
| ABGC | Australian Banana Growers' Council |
| ABS | Australian Bureau of Statistics |
| AL | Almond |
| BA | Banana |
| BAGMAN | Banana AgriBusiness MANagers' Association |
| BMP | Best Management Practice |
| CRC | Cooperative Research Centre |
| CRRDC | Council of Rural Research and Development Corporations |
| CT | Citrus |
| Hort Innovation | Horticulture Innovation Australia Ltd |
| MIRR | Modified Internal Rate of Return |
| NSW | New South Wales |
| NT | Northern Territory |
| PVB | Present Value of Benefits |
| Qld | Queensland |
| R&D | Research and Development |
| RD&E | Research, Development and Extension |
| RDC | Research and Development Corporation |
| SIP | Strategic Investment Plan |
| TR4 | Fusarium Wilt Tropical Race 4 |
| VN | Onion |
| WA | Western Australia |