Hort Innovation

Final Report

Fund Impact Assessment 2020/21 for cherry, vegetables and small tropicals: Evaluation of VG13072

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Delivery partner:

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Project code:

MT21013

Project:

Fund Impact Assessment 2020/21 for cherry, vegetables and small tropicals (MT21013)

Disclaimer:

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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 *VG13072 Export Opportunities for Carrots, Sweet corn, Beans, Broccoli and Baby leaf - symposia*. The project was funded by Hort Innovation over the period February 2014 to August 2018.

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 2021-22 dollar terms and were discounted to the year 2021-22 using a real (inflation-adjusted), risk free, pre-tax 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

A clear path to impact was identified for VG13072 within the analysis. The project started with a symposium targeted to two specific markets (UAE and Malaysia) and focused on a select group of vegetables carrot, sweet corn, bean, broccoli and baby leaf vegetable. The subsequent symposia / seminars broadened the information to vegetable export markets in general. There was consensus in discussions with stakeholders that the series of symposia/seminars provided valuable information that growers were able to directly apply to their businesses to establish or increase vegetable exports.

The impact valued was:

- [Economic] Increased industry production and exports, specifically for carrots, sweet corn, beans, broccoli and baby leaf vegetables into the Malaysian and UAE markets, and for vegetable more generally.

The results reflect the benefit of increased knowledge and skills around the export of Australian vegetables supporting increased industry confidence to sustainably increase production to meet the increased market opportunities. The analysis quantified the benefits by valuing the increased export value for the UAE and Malaysia (select vegetables) and vegetable exports more generally and applying a gross margin to reflect the farm-gate benefit.

The benefits were assessed to be maximized across the period of 2014-15 to 2018-19 in line with the delivery of the symposia; however, attribution of the increased exports over this period was reduced due to the many other factors contributing to export value (stakeholder pers comm) as well as the overlap of preceding export facilitation projects (VG13097, VG15075, VG13048) subsequent export facilitation projects (VG16085, VG16061). The benefits were also adjusted down for the potential for the project/outcomes to have been funded in the absence of Hort Innovation levy funding (R&D counterfactual).

Not all the identified impacts could be valued in the assessment. These additional social impacts have the potential to provide additional industry impact above what has been quantified.

Investment criteria

Total funding from all sources for the project was $0.62 million (2022 equivalent value). The investment produced estimated total expected benefits of $2.76 million (2022 equivalent value). This gave a net present value of $2.14 million, an estimated benefit-cost ratio of 4.45 to 1, an internal rate of return of 80% and a modified internal rate of return of 10%.

Keywords

Impact assessment, cost-benefit analysis, vegetable, export, trade, biosecurity, market access

Introduction

Evaluating the impacts of levy investments is important to demonstrate to levy payers, Government and other industry stakeholders the economic, social and environmental outcomes of investment for industry, as well as being an important step to inform the ongoing investment agenda.

The importance of ex-post evaluation was recognised through the Horticulture Innovation Australia Limited (Hort Innovation) independent review of performance completed in 2017, and was incorporated into the Organisational Evaluation Framework.

Reflecting its commitment to continuous improvement in the delivery of levy funded research, development and extension (RD&E), Hort Innovation required a series of impact assessments to be carried out on a representative sample of investments across a cohort of Funds in its RD&E portfolio. The assessments were required to meet the following Hort Innovation evaluation reporting requirements:

- Reporting against the Hort Innovation's Strategic Plan and the Evaluation Framework associated with Hort Innovation's Statutory Funding Agreement with the Commonwealth Government.
- Reporting against strategic priorities set out in the Strategic Investment Plan for each Hort Innovation industry fund.
- Annual Reporting to Hort Innovation stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

As part of its commitment to meeting these reporting requirements, Ag Econ was commissioned to deliver the *Fund Impact assessment 2020/21: Cherry, Sweetpotato, Vegetables, Small Tropicals (MT21013)*. This program consisted of a once-off impact assessment series of randomly selected Hort Innovation RD&E investments (projects) within each of the nominated Funds.

Project *VG13072 Export Opportunities for Carrots, Sweet corn, Beans, Broccoli and Baby leaf - Symposia* was randomly selected as one of the nine investments in the 2020-21 sample for the Vegetable Fund. This report presents the analysis and findings of the project impact assessment.

General method

The 2020-21 population for the Vegetable Fund was defined as an RD&E investment where a final deliverable had been submitted in the five year period from 1 July 2016 to 30 June 2021. This generated an initial population of 315 Hort Innovation investments, worth an estimated $88.7 million (nominal Hort Innovation investment). Projects in the Frontiers Fund, those of less than $80,000 Hort Innovation investment, multi industry projects where the Vegetable Fund was less than 50% of total Hort Innovation investment, enabler projects that don't directly support a 2017-2021 Vegetable Strategic Investment Plan (SIP) Outcome, and projects that have had a previous impact assessment completed were removed from the sample. A total of 90 projects with a combined value of $54.8 million satisfied these criteria and formed the eligible population. The eligible population was then stratified according to the 2017-2021 Vegetable SIP outcomes, and four project value clusters based on the distribution of project value within the population ($80,000-$265,000; $265,000-$440,000; $440,000-$695,000; $695,000-$8,680,000). A random sample of 9 projects was selected worth a total of $5.86 million (nominal Hort Innovation investment), equal to 10.7% of the eligible RD&E population (in nominal terms).

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

The evaluation process involved reviewing project contracts, milestones, and other documents; interviewing stakeholders including Hort Innovation staff, project delivery partners, growers and other industry stakeholders where appropriate (see Acknowledgements); and collating additional industry and economic data where necessary. Through this process, the project activities, outputs, outcomes, and impacts were identified and briefly described; and the principal economic, environmental, and social impacts were summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were valued in monetary terms. Where impacts were valued, 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. As not all impacts were valued, the investment

criteria reported potentially represents an underestimate of the performance of that investment.

Background and rationale

Industry background

The national vegetable levy is payable on all vegetable crops excluding potatoes, onions, mushrooms, sweetpotatoes, asparagus, garlic, ginger, herbs (except fresh shallots and parsley) and tomatoes. The levy is payable on vegetables that are produced in Australia and either sold by the producer or used by the producer in the production of other goods. Producers pay levies to the Department of Agriculture, Fisheries and Forestry (DAFF), which is responsible for the collection, administration and disbursement of levies and charges on behalf of Australian agricultural industries. Hort Innovation manages the vegetable levy funds which are directed to R&D investments.

The Australian levy paying vegetable industry has approximately 1,700 growers across Australia (Hort Innovation 2022a), with a 5-year average (to 2020-21) production value of $2.5 billion, growing at a trend 6.19% and a volume trend of 1.77% per annum (Hort Innovation 2022b). The majority of leviable vegetables are supplied to the domestic market, with approximately 10% exported at a total value of $170 million in 2020-21 growing at an average 1.19% per annum from 2016-17. Leviable vegetables are grown across Australia, however Queensland accounts for the highest share (32%), followed by Victoria (24%), Western Australia (16%), New South Wales (8%), South Australia (9%) and Tasmania (8%) in 2020-21.

Rationale

Alignment with the Vegetable SIP 2017-21

Historically the Australian levy vegetable industry has had a low level of exports averaging around 7% of production from 2013-2015. This, and the relatively concentrated Australian retail market, leaves vegetable producers with little choice in sales options. Further, the relatively flat consumer demand in Australia has meant that any significant increases in vegetable production puts downward pressure on prices limiting the sustainable growth

The vegetable levy investments are guided by a Strategic Investment Plan (SIP). The Vegetable SIP 2017-21 identified “Growth in the export markets” as a priority outcome (Outcome 2) for Australia’s vegetable industry. This outcome was supported by the strategies including “Improve the export capability of Australian vegetable growers” and “Better understand the export opportunities available to the vegetable industry”.

VG13072 was commissioned to deliver a series of seminars aimed at strengthening Australia’s vegetable export capacity by providing targeted information and resources for growers.

Alignment with national priorities

The Australian Government’s National RD&E priorities (2015a) and Science and Research Priorities (2015b) are reproduced in Table 1. The VG13072 project outcomes and related impacts will contribute to RD&E Priority 4, and to Science and Research Priority 1.

Table 1. National Agricultural Innovation Priorities and Science and Research Priorities

Australian Government	
National RD&E Priorities (2015a)	**Science and Research Priorities (2015b)**
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.

Project details

Summary

Table 2. Project details

Project code	VG13072
Title	Export Opportunities for Carrots, Sweet corn, Beans, Broccoli and Baby leaf - Symposia
Research organization	AUSVEG Ltd
Project leader	Richard Mulcahy
Funding period	February 2014 to August 2018

Logical framework

Table 3. Project logical framework

Activities	• Preparation, development and coordination of:
	  ○ An export symposium focused on Malaysia and UAE to explore the opportunities for Australian grown vegetables (specific focus carrots, sweet corn, beans, broccoli and baby leaf vegetables) **2015**. Held in Adelaide SA and attended by 66 participants (invited as they were already exporting to the destination or had an active interest in commencing exports). The aim was to *provide growers with a range of information on the exporting requirements of these unique markets while also identifying current commodity trends and demands for both countries.*
	  ○ A 'Practicalities of exporting symposium' **2016** (non-market and non-vegetable specific). Held in Gold Coast QLD with the *aim of delivering a forum specifically designed to provide vegetable growers with a practical overview to begin or expand on their export operations.*
	  ○ An 'Australian vegetables export seminar' **2017** (non-market and non-vegetable specific). Held in Adelaide SA and attended by 75 vegetable growers from across Australia. The *aim of the event was to provide the industry with an overview of the recently developed Vegetable Industry Export Strategy 2020 and how it will help the industry to drive export growth.*
	  ○ An 'Australian vegetables export seminar' **2018** (non-market and non-vegetable specific). Held in Brisbane QLD and attended by 100 vegetable growers from across Australia. The *key aims were to provide an 'export 101' detailing the basics of the export process for growers who are looking to commence their export journey. And to provide a session on 'export opportunities' to provide exporting growers with insights from other horticultural sectors who have been successful.*
	• Subsidisation of grower attendance.
	• Communication materials post-symposia.

Outputs	• A four-year series of vegetable export symposia / seminars (attended by a combined total of 310 Australian vegetable growers).
	• Communication and extension materials:
	  ○ Fact sheets
	  ○ Symposium/seminar speaker presentations (Video and transcripts).

Outcomes	• Increased knowledge of Malaysian and UAE export markets, supporting growers and packers to take advantage of opportunities in these markets. • Increased industry confidence to sustainably increase production to meet increased export market opportunities. • Improved export readiness of the Australian vegetable industry (via improved knowledge around practical aspects of exporting, brand development and understanding consumer markets). • Improved decision-making capability and strategic market understanding • Expanded export opportunities for growers who hadn't previously exported (due to increased information / tools and formation of new commercial relationships), increasing potential export participation.

Impacts	• [Economic] Increased industry production and exports, specifically for carrots, sweet corn, beans, broccoli and baby leaf vegetables into the Malaysian and UAE markets, and for vegetable more generally. • [Social] Increased contribution to regional community wellbeing from more profitable vegetable growers. • [Social] Increased capacity and understanding of export markets and trade negotiations underpinning industry development • [Economic] Decreased market risk through the diversification of markets / sales channels.

Project costs

Nominal investment

Table 4. Project nominal investment

Year end 30 June	Hort Innovation ($)	AUSVEG ($)	Total ($)
2014	225,904	0	225,904
2015	0	0	0
2016	0	0	0
2017	233,288	0	233,288
2018	284,821	0	284,821
2019	-165,916*	0	-165,916
Total	578,097	0	578,097

* At the end of project $246,549 was returned to Hort Innovation, which was subtracted from FY2019 disbursed funds.

Program management costs

R&D costs should also include the administrative and overhead costs associated with managing and supporting the project. The Hort Innovation overhead and administrative costs were calculated for each project funding year based on the data presented in the *Statement of Comprehensive Income* in the *Hort Innovation Annual Report* for the relevant year. Where the overhead and administrative costs were equal to the total expenses, less the research and development and marketing expenses. The overhead and administrative costs were then calculated as a proportion of combined project expenses (RD&E and marketing), averaging 15.4% for the VG13072 funding period (2014-2019). This figure was then applied to the nominal Hort Innovation investment shown in Table 3.

Real Investment costs

The investment costs of all parties were expressed in 2021-22 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2022).

Extension costs

Communication and extension were activities conducted within the project, so the project expenditure is assumed to be inclusive of extension costs.

Project impacts

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.

Impacts valued

The impact valued was:

- [Economic] Increased industry production and exports, specifically for carrots, sweet corn, beans, broccoli and baby leaf vegetables into the Malaysian and UAE markets, and for vegetable more generally.

The impact was valued by applying a gross margin on the increased exports (over the project period above the pre-project baseline). This was calculated separately for carrot, sweet corn, bean, broccoli and baby leaf vegetable exports to Malaysia and the UAE starting in 2014-15 following the Malaysia and UAE symposium, and for all vegetables starting in 2016-17 following the first general export symposium in June 2016. The benefits were assumed to be maximized across the period of 2014-15 to 2018-19 in line with the delivery of the symposia; however, attribution of the increased exports over this period was reduced due to the many other factors contributing to export value (stakeholder pers comm) as well as the overlap of preceding export facilitation projects (VG13097, VG15075, VG13048) subsequent export facilitation projects (VG16085, VG16061). The benefits were also adjusted down for the potential for the project/outcomes to have been funded in the absence of Hort Innovation levy funding (R&D counterfactual).

Impacts not valued

The impacts from VG13072 contributed to the general development in knowledge of Australian vegetable exports. Not all of the impacts identified in Table 3 could be valued in the assessment, particularly where there was a lack of data making it difficult to quantify the causal relationship and impact pathway. Other impacts identified but not valued were:

- [Social] Increased contribution to regional community wellbeing from more profitable vegetable growers.
- [Social] Increased capacity and understanding of export markets and trade negotiations underpinning industry development
- [Economic] Decreased market risk through the diversification of markets / sales channels.

Public versus private impacts

The impacts identified from the investment are predominantly private impacts accruing to vegetable growers and supply chain participants.

Distribution of private impacts

The potential private impacts of VG13072 would include direct and flow-on (spillover) impacts. Spillover impacts would include:

- Production-induced effects, which reflect the flow-on changes to the supply chain (upstream and downstream) that result from farm level changes in inputs (chemicals, labour, packaging, transport, marketing) associated with practice change.
- Consumption induced effects, which reflect the flow-on changes generated through the payments of wages and salaries to households and the subsequent expenditure of those incomes of purchasing household goods and services.

Furthermore, the true impact would also be influenced by the equilibrium (price) effect, which reflects changes in prices (of inputs and outputs) as a result in changes in supply and demand of those inputs and outputs. The price effect, essentially shifts benefits along the supply chain and between producers to consumers. The extent to which this would occur would depend on the slope of the short and long term supply and demand curves.

Impacts on other Australian industries

The project activities and findings were explicit to the Australian vegetable industry.

Impacts overseas

Increased exports have implications for the destination country in regards to vegetable supply and price effects; however, given the likely small share of Australian produce these impacts are likely minimal.

Data and assumptions

A summary of the key assumptions made in the assessment is provided in Table 5.

Table 5. Summary of assumptions for impact valuation

Variable	Assumption	Source / comment
Discount rate	5% (± 50%)	CRRDC Guidelines (2018)
R&D counterfactual	75% (± 33%)	Market growth and exports are a priority for both public and private investors alike; however, the key activities of VG13072 involved the engagement of growers nationally, which was considered more likely to be achieved with levy funding through Hort Innovation. As such, it was assumed that 75% of the benefits would not have occurred without Hort Innovation funding of this project.
Adoption costs	Nil	Costs of exports are considered within farm gross margin
Gross margin on vegetable production (% of revenue)	10% (± 50%)	Three year average gross margin for Australian vegetable farms 2016-17 to 2018-19 (ABARES 2019)

Carrot, sweet corn, bean, broccoli and baby leaf vegetable exports to Malaysia and the UAE		
Export benefit to UAE and Malaysia start	2014-15	Following the Malaysia and UAE symposium in January 2015. Given the small window remaining in the financial year, an attribution of only 25% was applied (see attribution below).
Vegetable export annual values	See appendix A. TradeMap (2022) and Hort Innovation (2022b)	
Attribution of outcome (increased export value)	2014-15= 6% 2015-16= 25% 2016-17= 19% 2017-18= 13% 2018-19= 6% All (±50%)	Stakeholders agreed that VG13072 built on the capacity for the industry to increase participation in vegetable exports. However, they also agreed that there are many other factors contributing to export value. Attribution of benefits to VG13072 was also influenced by the overlap of preceding export facilitation projects (VG13097, VG15075, VG13048) and subsequent export facilitation projects (VG16085, VG16061). Attribution was lower in 2014-15 due to the UAE and Malaysia symposium being delivered in January 2015 with limited time to take advantage in 2014-15. Attribution declined rapidly from 2017-18 due to the commencement of the related VG16061 and VG16085 which delivered multiple export readiness and training workshops from 2017. The attribution factors were also tested at ±50% due to the high level of uncertainty.
General vegetable exports to all markets		
Export benefit start	2016-17	Following the general vegetable export symposia in June 2016.
Vegetable export annual values	See appendix A. TradeMap (2022) and Hort Innovation (2022b)	
Attribution of outcome (increased export value)	2016-17= 25% 2017-18= 5% 2018-19= 3% All (±50%)	Stakeholders agreed that VG13072 built on the capacity for the industry to increase participation in vegetable exports. However, they also agreed that there are many other factors contributing to export value. Attribution of benefits to VG13072 was also influenced by the overlap of preceding export facilitation projects (VG13097, VG15075, VG13048) and subsequent export facilitation projects (VG16085, VG16061). Attribution declined rapidly from 2017-18 due to the commencement of the related VG16061 and VG16085 which delivered multiple export readiness and training workshops from 2017. The attribution factors were tested at ±50% due to the high level of uncertainty,

Results

All costs and benefits were discounted to 2021-22 using a real discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (2018-19) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment criteria

Table 6 shows the impact metrics estimated for different periods of benefit for the total investment (100% funded by Hort Innovation).

Table 6. Impact metrics for the total investment in project VG13072

Impact metric	Years after last year of investment						
	0	5	10	15	20	25	30
PVC ($m)	0.62	0.62	0.62	0.62	0.62	0.62	0.62
PVB ($m)	2.76	2.76	2.76	2.76	2.76	2.76	2.76
NPV ($m)	2.14	2.14	2.14	2.14	2.14	2.14	2.14
BCR	4.45	4.45	4.45	4.45	4.45	4.45	4.45
IRR	80%	80%	80%	80%	80%	80%	80%
MIRR	43%	23%	16%	13%	12%	11%	10%

Figure 1 shows the annual undiscounted benefit and cost cash flows for the total investment of VG13072. Cash flows are shown for the duration of the investment plus 30 years from the last year of investment. The variance in early benefits are reflective of actual fluctuations in total export values.

Figure 1. Annual cash flow of undiscounted total benefits and total investment costs

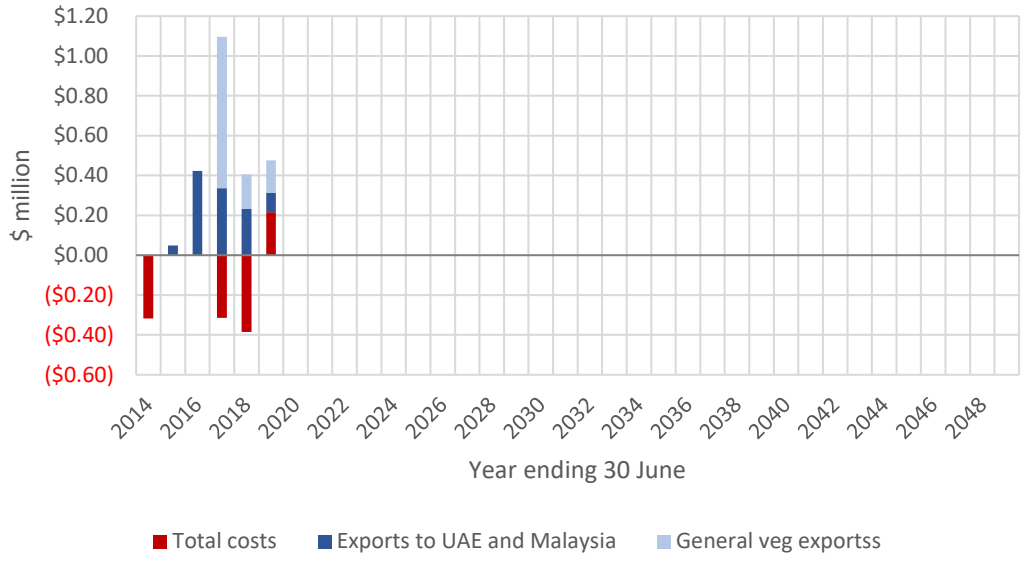
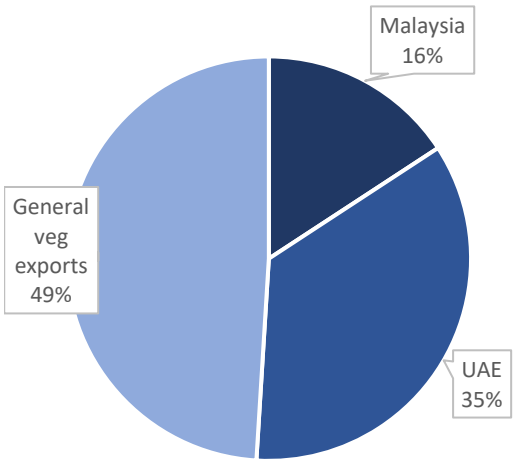


Figure 2 shows the annual undiscounted benefit for the different impact markets (specific or general). For exports to the UAE and Malaysian markets, figure 3 shows the benefit by vegetable type.



Sensitivity analysis

This analysis contained assumptions with a high level of uncertainty. Table 7 presents the results of sensitivity testing around these metrics. Data ranges and sources are described in Table 5.

Table 7. Sensitivity of impact (total investment BCR) to changes in key underlying variables

Variable		Low	Baseline	High
Discount rate	Variable range	2.5%	5.0%	7.5%
	BCR range	4.48	4.45	4.43
Gross margin for vegetables (%)	Variable range	5%	10%	15%
	BCR range	2.23	4.45	6.68
Attribution of outcome (increased export value) to VG13072	Variable range	12.5%	25%	37.5%
	BCR range	2.23	4.45	6.68
R&D counterfactual	Variable range	50%	75%	100%
	BCR range	2.97	4.45	5.94

Conclusions

A clear path to impact was identified for VG13072 within the analysis. The project started with a symposium targeted to two specific markets (UAE and Malaysia) and focused on a select group of vegetables carrot, sweet corn, bean, broccoli and baby leaf vegetable. The subsequent symposia / seminars broadened the information to vegetable export markets in general. There was consensus in discussions with stakeholders that the series of symposia/seminars provided valuable information that growers were able to directly apply to their businesses to establish or increase vegetable exports.

The analysis showed that the quantified benefits were greater than the investment costs for VG13072, with a BCR 4.45:1. The results reflect the benefit of increased knowledge and skills around the export of Australian vegetables supporting increased industry confidence to sustainably increase production to meet the increased market opportunities. The analysis quantified the benefits by valuing the increased export value for the UAE and Malaysia (select vegetables) and vegetable exports more generally and applying a gross margin to reflect the farm-gate benefit.

To account for the uncertainty in the underlying data, sensitivity testing was conducted that showed a BCR ranging from 2.23 to 6.68. The results were most sensitive to the tested ranges of three inputs:

- Attribution of outcome. Stakeholders agreed that the symposia provided important information that enabled growers to take advantage of export market opportunities; however, there remained several other factors influencing the quantity and value of Australian vegetable exports. For example, seasonal production, world vegetable supply, and comparative cost (influenced by exchange rates, cost of freight, price (supply and demand) volumes). In addition, there were a number of related and at times overlapping levy funded export development projects aimed at

increasing Australian vegetable exports which further decreased the benefit that could be attributed specifically to VG13072. Maximum attribution of 25% was estimated, declining over time and tested at ± 50%.

- Gross margin. There is a large variance in gross margin for one commodity from year to year and farm to farm. Across all vegetables, the variance widens greatly. A gross margin of 10% was applied using the three-year average gross margin for Australian vegetable farms, from the 2016-17 to 2018-19 (ABARES 2019), sensitivity testing (± 50%).
- R&D counterfactual. Market growth and exports are a priority for both public and private investors alike, however, the key activities of VG13072 involved the engagement of growers nationally, which was considered more likely to be achieved with levy funding through Hort Innovation. As such, it was estimated that 75% (± 33%) of the benefits would not have occurred without Hort Innovation funding of this project.

This analysis quantified direct private benefits accruing to vegetable growers. Additional flow-on (spillover) private impacts would be generated in the wider economy. Changes in farm inputs from increased production and exports would result in corresponding spillover changes in income for businesses providing those goods and services. The total private impacts would be further redistributed between growers, supply chain partners and consumers depending on both short- and long-term supply and demand elasticities.

A lack of underlying data meant that there were also social outcomes identified but not quantified which had the potential to provide additional impact above that quantified in this analysis.

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References

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2019). *Australian vegetable-growing farms, An economic survey, 2018–19*. Retrieved from: https://www.agriculture.gov.au/abares/research-topics/surveys/vegetables. Accessed December 2022.

Australian Bureau of Statistics (ABS) (2022). 5206.0 – *Australian National Accounts: National Income, Expenditure and Product, June 2022*. Table 5. Expenditure on Gross Domestic Product (GDP), Implicit price deflators. Retrieved from: https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-national-income-expenditure-and-product/latest-release#data-download

AUSVEG (2015) *Export opportunities for carrots, sweet corn, beans, broccoli and baby leaf – symposia (VG13072)*. Final report, funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Retrieved from https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/vg13072/. Accessed December 2022.

Commonwealth of Australia (2015a). *Agricultural Competitiveness White Paper*. Retrieved from https://www.awe.gov.au/agriculture-land/farm-food-drought/agriculture-white-paper. Accessed July 2022.

Commonwealth of Australia (2015b). *Strategic Science and Research Priorities*. Canberra: Commonwealth of Australia. Retrieved from https://www.industry.gov.au/data-and-publications/science-and-research-priorities#:~:text=Australia%20depends%20on%20science%20and,and%20improve%20national%20well%2Dbeing. Accessed July 2022.

Council of Rural Research and Development Corporations (CRRDC) (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

Hort Innovation (2017). *Vegetable Strategic Investment Plan 2017-2021*. Retrieved from https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-pdfs-new/hortinnovation-sip-vegetable-2017-2021.pdf. Accessed June 2022.

Hort Innovation (2022a). *Vegetable Strategic Investment Plan 2022-2026*. Retrieved from https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-2022-2026-pdfs/hort-innovation-sip-2022-26-vegetable-r.pdf. Accessed June 2022.

Hort Innovation (2022b). *Horticulture Statistics Handbook 2012-13 to 2020-21*. Received from Hort Innovation pers comm. Data available https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/grower-resources/ha18002-assets/australian-horticulture-statistics-handbook/

Trade Map (2022). International Trade Centre. Retrieved from https://www.trademap.org/. Accessed December 2022

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.
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.

Abbreviations

CRRDC Council of Rural Research and Development Corporations

DAFF Department of Agriculture, Fisheries and Forestry (Australian Government)

GDP Gross Domestic Product

GVP Gross Value of Production

IRR Internal Rate of Return

MIRR Modified Internal Rate of Return

PVB Present Value of Benefits

PVC Present Value of Costs

RD&E Research, Development and Extension

SIP Strategic Investment Plan

PIPS Productivity Irrigation, Pests and Soils

OBA Orchard Business Analyst

Appendix A. Value of Australian exports

Table 8 shows trade value data used in the impact assessments of project VG13072, with green shading denoting the project period. The harmonised system (HS) code for categorising exports is shown for individual vegetables. The two year period 2013-14 was used as the baseline to calculated the benefits of additional export value during the project. Data for Malaysia and the UAE was drawn from TradeMap (2022). Data for total vegetable exports (all markets all vegetabels) was drawn from the Hort Stats Handbook (Hort Innovation 2022b). Data for total vegetables was used (rather than just leviable vegetables) given the non-commodity specific content and typical crossover of production within vegetable growing and exporting businesses.

Table 8. Value (AU $ million) of Australian exports to Malaysia (select vegetables), the UAE (select vegetables), and all markets (all vegetables)

	Malaysia						UAE						All markets
By year	**Carrots** HS 070610	**Sweet corn** HS 071040	**Beans** HS 0708	**Broccoli** HS 07041	**Other (inc Leafy veg)** HS 070999		**Carrots** HS 070610	**Sweet corn** HS 071040	**Beans** HS 0708	**Broccoli** HS 07041	**Other (inc Leafy veg)** HS 070999		**Total veg**
2013	6.6	0.0	0.1	0.3	0.2		14.7	0.0	0.0	0.3	0.1		154.7
2014	6.8	0.0	0.0	0.4	0.2		17.7	0.0	0.0	0.3	0.5		161.3
2015	7.2	0.0	0.0	0.5	1.0		21.8	0.0	0.0	1.0	1.0		177.6
2016	11.6	0.0	0.0	0.8	0.4		26.8	0.0	0.0	1.7	1.3		231.6
2017	12.3	0.0	0.0	0.8	0.7		28.1	0.0	0.1	0.9	1.6		250.3
2018	12.8	0.0	0.0	0.9	0.4		29.6	0.0	0.0	0.6	1.1		254.5
2019	12.1	0.0	0.0	1.5	0.9		26.9	0.0	0.0	0.6	0.8		292.3
2020	12.8	0.0	0.0	2.0	0.6		24.4	0.0	0.0	1.1	1.2		275.6
2021	14.1	0.0	0.0	1.9	0.7		27.5	0.0	0.0	0.1	0.8		263.9

Data sources. Malaysia and UAE from TradeMap (2022) and All markets-all veg from Hort Innovation (2022b). Project period shown in green

Ends.