Hort Innovation

Final Report

Fund Impact Assessment 2020/21 for cherry, vegetables and small tropicals: Evaluation of VG13078

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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 *VG13078 Extension of integrated crop protection information.* The project was funded by Hort Innovation over the period May 2014 to November 2017.

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

Project VG13078 worked in conjunction with the Soil Condition Management Extension and Capacity Building project (VG13076 Soil Wealth) over a three-year period with the aim of improving soil management and integrated crop protection (ICP) practices within vegetable growing production systems for better economic outcomes. VG13078 increased vegetable grower and advisor awareness, knowledge, skills and resources relating to improving soil management and integrated crop protection (ICP) practices within vegetable growing production systems. As a result, the project supported an increased level of adoption of ICP practices than would otherwise have occurred.

The impacts valued were:

- [Economic] Increased adoption of soil management and ICP practices supporting farm productivity and profitability through a combination of:
  - Increased gross yields.
  - Reduced losses from mitigation of disease, pest or weed outbreaks.
  - Reduced input costs.

Not all of the identified impacts could be valued in the assessment, particularly where there was a lack of credible data. These additional economic, social and environmental impacts have the potential to provide additional industry impact above what has been identified.

Investment criteria

Total funding from all sources for the project was $2.27 million (2022 equivalent value). The investment produced estimated total expected benefits of $11.92 million (2022 equivalent value). This gave a net present value of $9.65 million, an estimated benefit-cost ratio of 5.25 to 1, an internal rate of return of 34% and a modified internal rate of return of 8%.

Conclusions

The Integrated Crop Protection (ICP) extension project aimed to promote good management practices for plant health in the Australian vegetable industry. Project VG13078 was successful in its objective of progressing vegetable growers and other relevant stakeholders along a path towards increasingly advanced levels of ICP implementation and adoption on farm.

Keywords

Cost-benefit analysis, crop protection, impact assessment, integrated crop protection (ICP), vegetables

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 *VG13078 Extension of integrated crop protection information,* 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

Integrated Crop Protection (ICP), or Integrated Pest Management (IPM), is an approach that integrates all available methods of controlling pests, rather than just relying on pesticides and is seen as an important focus area for the industry due to a number of converging factors. Uptake of ICP strategies across horticulture had been low despite the considerable investment that had been made in this area. Project VG13078 was implemented to benefit vegetable growers through higher ICP awareness and increased ICP uptake which would in turn lead to improved economic outcomes for vegetable growers. Due to the alignment in outcomes relating to pests, weeds, diseases, chemicals and overall crop health, VG13078 was designed to work in conjunction with *Soil Wealth Phase 1* (VG13076) and the later project *Soilborne Disease* (VG15010).

Alignment with the Vegetable Strategic Investment Plan 2017-2021

Vegatable levy investments are guided by a Strategic Investment Plan (SIP). VG17013 was closely aligned with the Vegetable SIP 2017-2021 Outcome 3: *Improved farm productivity*, Strategy 3.4 *Pests and diseases*.

Alignment with national priorities

The Australian Government's National RD&E priorities (2015a) and Science and Research Priorities (2015b) are reproduced in Table 1. VG13078 project outcomes and related impacts contribute to RD&E Priority 2, 3 & 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	VG13078
Title	Extension of Integrated Crop Protection Information
Research organization	RMCG
Project leader	Dr Anne-Maree Boland
Funding period	May 2014 to Nov 2017

Logical framework

A logical framework is shown in Table 3 to highlight the connection between the project activities, outputs, outcomes, and impact.

Table 3. Project logical framework

Activities	In collaboration with VG13076 (SoilWealth) and VG15010 (Soilborne Disease), VG13078 completed the following activities: • Operating demonstration sites – 15 on-farm demonstration sites with results communicated to growers and advisers via over 60 field days, farm walks and workshops. • Linking with grower groups • Running master classes and networking opportunities • Conducting training and events • Initiating benchmarking activities • Producing publications and videos • Continuing online communications and knowledge management.
Outputs	In collaboration with VG13076 and VG15010 (Soilborne Disease), VG13078 produced: • Soil Wealth – an Integrated Crop Protection website (www.soilwealth.com.au) • 59 fact sheets • 12 case studies • 36 videos, webinars and apps • 26 Soil Wealth and ICP E-newsletters • 15 Facebook pages (for each of the demonstration sites) • 2 Twitter accounts with more than 1,700 followers
Outcomes	• Improved awareness, knowledge, capacity and decision-making about pest, weeds and diseases for producers and their advisors. • Improved management of chemicals and a reduced reliance on chemicals in vegetable production. • Growers Increasingly accepting and adopting ICP as a key component in vegetable growing. • Farm Level application of ICP resulting in improved management of pests, weeds and diseases.

Impacts	• [Economic] Increased adoption of ICP practices supporting farm productivity and profitability through a combination of:
	  ○ Increased gross yields.
	  ○ Reduced losses from mitigation of disease, pest or weed outbreaks.
	  ○ Reduced input costs.
	• [Economic, Environmental] Mitigation of adverse weather events (e.g. topsoil runoff) for vegetable growers, reducing management costs and environmental damage.
	• [Social] Increased capacity and understanding of soil management and ICP principles by vegetable growers supporting greater levels of industry cohesion, engagement and sentiment.

	• [Social] Engagement with complimentary research programs supporting increased research capacity and goodwill. • [Social] Increased contribution to regional community wellbeing from more profitable vegetable growers. • [Environmental] Reduced reliance on chemical and nutrition inputs decreasing the associated risk of environmental damage • [Environmental] Increased biodiversity through enhanced soil microbial activity.

Project costs

Nominal investment

Table 4. Project nominal investment

Year end 30 June	Hort Innovation ($)	Total ($)
2014	350,789	350,789
2015	325,733	325,733
2016	220,433	220,433
2017	65,000	65,000
2018	255,300	255,300
Total	**1,217,255**	**1,217,255**

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 15.9% for the VG13078 funding period (2014-2018). This figure was then applied to the nominal Hort Innovation investment shown in Table 4. Note that annual reports for 2014 and 2015 financial years were not available online at the time of reporting, so an average of the 2016-2021 financial years of 15.9% was assumed to apply for these years.

Real Investment costs

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

Extension costs

Communication and extension activities were 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 following impacts were quantified:

- [Economic] Increased adoption of ICP practices supporting farm productivity and profitability through a combination of:
  - Increased gross yields.
  - Reduced losses from mitigation of disease, pest or weed outbreaks.
  - Reduced input costs.

Valuation method

The impacts were valued by applying an estimated increase in gross economic benefit from improved yields and reduced input costs informed through various reported crop trials and case studies within this and other Hort Innovation projects. An adoption factor was then applied to account for the estimated project reach and adopting growers as reported from the end of project survey results.

Impacts not valued

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:

- [Economic, Environmental] Mitigation of adverse weather events (e.g. topsoil runoff) for vegetable growers, reducing management costs and environmental damage.
- [Social] Increased capacity and understanding of soil management and ICP principles by vegetable growers supporting greater levels of industry cohesion, engagement and sentiment.
- [Social] Engagement with complimentary research programs supporting increased research capacity and goodwill.
- [Social] Increased contribution to regional community wellbeing from more profitable vegetable growers.
- [Environmental] Reduced reliance on chemical and nutrition inputs decreasing the associated risk of environmental damage
- [Environmental] Increased biodiversity through enhanced soil microbial activity.

Public versus private impacts

The potential impacts identified from the investment are predominantly private impacts accruing to vegetable growers and supply chain participants. However, some public benefits have also been produced in the form of capacity built and spill-overs to regional communities from potential enhancements to grower income (or reduced loss of income) and industry capability.

Distribution of private impacts

The analysis quantified direct benefits accruing to vegetable growers. Additional flow-on (spillover) impacts would be generated in the wider economy. These 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 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. RD&E that focusses on increased productivity would support increased industry supply (in the short or long term subject to capacity constraints), and thereby put downward pressure on prices, effectively shifting some of the benefit from 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

While the research was funded by the vegetable levy, the implications of the project will likely also support improvements in other “non vegetable levy” crops grown in field conditions such as potatoes, onions, sweetpotatoes, asparagus, garlic, and ginger.

Impacts overseas

While the projects drew on established soil and ICP research, likely with some international relevance, the focus on extension and adoption in Australian conditions makes an overseas impact unlikely.

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)
Impact start	2016	Analyst assumption. Field trials and Master Classes were conducted from the onset of the project which would have led to initial uptake of practices by some growers within the next cropping season.
Annual production ($m) levied vegetables	2,611.1 (±7%)	Australian Horticulture Statistics Handbook, 5 year average 2017-2021 (Hort Innovation 2022b). Sensitised at ± 1 Standard Deviation.
Relevant producers reached from extension (production %)	30% (±25%)	VG13078 final report, the project had exposure reaching 25% of production. The project included a range of extension activities that will have ongoing exposure to the industry including more than 70 fact sheets produced, 55 case studies, 30 videos most of which were intended to be accessible to growers. A conservative total reach of 30% was used tested at plus and minus 25%.
Likely to adopt from project participation (% of growers)	10%	VG13078 final report survey results showed 10% of participants said they were likely to change practices because of the project.
Likely to adopt partly from project participation (% of growers)	17%	VG13078 final report survey results showed 34% of participants said they intended to make changes partly as a result of the Soil Wealth and ICP work. Due to being partly attributable an adjustment factor of 0.50 has been applied to this figure = 17%.
Total Industry adoption	8.1% (±50%)	Total industry adoption has been calculated as a function of industry reach and adoption attributed to the work and learnings from VG13078 and VG13076: 30% x (10% + 17%) = 8.1% of the industry.
Time to max adoption	6 years	The project Impact Survey results found that: "It was very likely (69%) or likely (20%) these changes would be implemented in the next two to three years" From this it is estimated that adoption is at 89% by 3 years after the project conclusion and full adoption is by year 6.
ICP and Soil Wealth Economic Gain (gross margin)	5% (±25%)	Soil Wealth project VG13076 worked in conjunction with VG13078 with one of the objectives being a 10% individual crop economic improvement from a combination of yield improvement and cost reduction. A conservative 5% gross margin improvement was applied.
Outcome attribution to VG13078 (industry adoption)	25% (±20%)	25% of the adoption outcome was attributed specifically to the extension activities with the remaining 75% attributed to the underlining ICP R&D that was being extended.
Attribution decline	5 years of full attribution, then declining 12.5% (±20%)	After 5 years (2023), attribution is set at a compounded decline of 12.5% per year for the remaining 25 year analysis period. This reflects the likelihood that further research will provide updated knowledge and resources concerning targeted cover cropping practices, reducing the relevance of VG13078's findings over time.
VG13078's portion of Extension	50.1%	As project VG13078 worked in conjunction with VG13076 attribution has been split as a % of funding share.
R&D counterfactual	90%	For R&D counterfactual there is a low likleyhood that the extension of this range of R&D would have been undertaken other then by Hort Innovation.

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 (2020-21) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment criteria

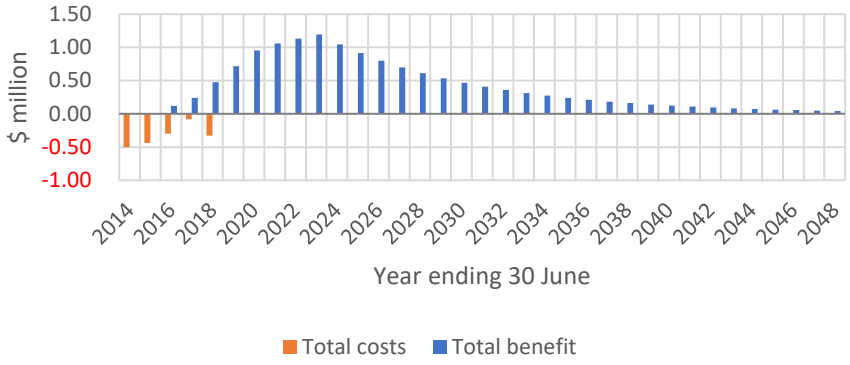
Table 6 shows the impact metrics estimated for different periods of benefit for the total investment. Hort Innovation was the only investor in the project.

Table 6. Impact metrics for the total investment in project VG13078

Impact metric	Years after last year of investment						
	0	5	10	15	20	25	30
PVC ($m)	2.27	2.27	2.27	2.27	2.27	2.27	2.27
PVB ($m)	1.04	6.31	9.70	11.07	11.61	11.84	11.92
NPV ($m)	-1.23	4.04	7.43	8.80	9.34	9.56	9.65
BCR	0.46	2.78	4.27	4.87	5.12	5.21	5.25
IRR	Negative	30%	34%	34%	34%	34%	34%
MIRR	Negative	19%	16%	13%	11%	9%	8%

Figure 1 shows the annual undiscounted cash flows for the total investment of VG13078. Cash flows are shown for the duration of the investment plus 30 years from the last year of investment.

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



Sensitivity analysis

A sensitivity analysis was carried out on key variables identified in the analysis where a data range was identified, or there was a level of uncertainty around the data. Table 8 presents the results for those variables that experienced the highest sensitivity on the final impact. Data ranges and sources are described in Table 5.

Table 8. 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	6.56	5.25	4.29
Industry production ($m)	Variable range	2425	2611	2798
	BCR range	4.88	5.25	5.63
Relevant producers reached (%)	Variable range	23%	30%	38%
	BCR range	3.94	5.25	6.56
Total industry adoption (%)	Variable range	4.1%	8.1%	12.2%
	BCR range	2.63	5.25	7.88

ICP and Soil Wealth economic gain (%)	Variable range	2.5%	5.0%	7.5%
	BCR range	2.63	5.25	7.88
Attribution to VG13078 (industry adoption) (%)	Variable range	20.0%	25.0%	30.0%
	BCR range	4.20	5.25	6.30
Attribution decline compound rate (%)	Variable range	10.0%	12.5%	15.0%
	BCR range	5.71	5.25	4.89
R & D counterfactual (%)	Variable range	81.0%	90.0%	99.0%
	BCR range	4.73	5.25	5.78

Discussion and conclusions

Project VG13078 was implemented to benefit vegetable growers through higher ICP awareness and increased ICP uptake which would in turn lead to improved economic outcomes for vegetable growers. The project was designed to be delivered in conjunction with *Soil Wealth Phase 1* (VG13076) and the later project *Soilborne Disease* (VG15010) due to the alignment in outcomes relating to pests, weeds, diseases, chemicals and overall crop health.

The analysis showed that the quantified benefits were greater than the investment costs for VG13078, with a BCR 5.25:1. The project was successful in increasing the uptake of soil management and ICP practices by Australian vegetable growers and the results reflect the outcome of improved industry knowledge and engagement, driving the adoption of ICP practices supporting increases to crop yield and reducing input costs.

Extension is a key step in the impact pathway of R&D as it effects both the speed and overall adoption. VG13078 included a comprehensive range extension and communication initiatives which was the driving factor in realising the industry benefits from this and prior R&D investments. The ICP initiatives were also supported by the complimentary Soil Wealth project VG15010 with the impacts estimated through the impact assessment scaled to each projects portion of investment. The success of the combined soil wealth and ICP program is also evident in industry support for its continuation as *Soil wealth and integrated crop protection – phase 2 (VG16078)* to continue to continue to provide vegetable producers with the latest information in soil and pest related areas.

To account for the variability in the underlying data, sensitivity testing was conducted across a range of variables, that showed a BCR ranging from 2.63 to 7.88. The results were most sensitive to the tested ranges of four inputs:

- ICP and Soil Wealth Economic Gain. Assessing the overall economic benefit from ICP practices is difficult due to the extensive range of ICP practices being looked at over a large variety crop types and growing situations. The soil wealth sister project VG13076 had a profitability goal targeting a 10% individual crop economic improvement when implementing a range of soil health initiatives and found that a 10% improvement was more than possible under trial conditions. In a similar result project VG16068 had a capsicum project trial which reported a 9% yield increases from cover cropping alone. While there is limited data on commercial scale implementation of ICP, trials and grower case studies from VG13078 and subsequent projects (Soilwealth 2023 and VG16068) indicate that across varied crop types, growing practices and growing regions, a 5% potential economic gain (from a combination of increased yield and reduced costs) is achievable, which was applied as a gross margin improvement and tested at plus and minus 50%, which resulted in a BCR range of 2.63 to 7.88.
- Total Industry Adoption. Total industry adoption from the extension work of this project was estimated using VG13078 final report participant survey results. The survey showed that the ICP extension work was effective in reaching the industry and initiating a change in practices with an estimated total industry adoption estimated at 8.1% and tested at 4.1% and 12.2% (±50%). This resulted in a BCR range of 2.63 to 7.88.
- Relevant producers reached. The project documents stated the project had exposure to growers and advisers covering 25% of the Australia vegetable industry and also included a range of extension activities that will have ongoing further exposure to the industry. A further reach of 5% was assumed to occur in the years following the project completion, giving a total 30% tested at 23% and 38% (±25%). This resulted in a BCR range of 3.94 to 6.56.
- Attribution to VG13078. The extent to which the adoption generated by VG13078 is attributable to the extension versus the underlying R&D work that was extended has been estimated at 25% (extension) and 75% to the underlying R&D investments. This was sensitivity tested at 20% and 30% (±20%) which resulted in a BCR range of 4.20 to 6.30.

A lack of underlying data meant that there were economic and social outcomes identified but not quantified which had the potential to provide additional impact to the vegetable industry. As such, the quantified impacts represent a conservative estimate of the total potential impact that would be realized through cover cropping across the levy-paying vegetable industry.

The analysis quantified private benefits accruing to levy paying vegetable growers. The findings of the project would also likely support benefits in other “non vegetable levy” crops grown in field conditions such as potatoes, onions, sweetpotatoes, asparagus, garlic, and ginger. As these industries did not fund the project, they are considered to have benefited from spillover effects. Additional spillover impacts would be generated in the wider economy. Adoption of ICP practices have associated changes in production management costs such as reduced chemical use, and increased planting costs for cover crops. At the same time, improved yield results in increased post-harvest costs such as packaging, transport, and marketing. Changes in these costs would result in corresponding spillover changes in income to businesses providing those goods and services, which would generate additional impact (both positive and negative) above that quantified in this analysis. The equilibrium industry production and price would also be impacted as a result in the changed farm productivity, effectively distributing some of the benefits between growers and the supply chain and to consumers depending on the underlying short to long run supply and demand elasticities.

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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

ENDS.