Hort Innovation

Final Report

Industry-specific impact assessment program: Nursery

Impact assessment report for project *Evaluation of nursery tree stock balance parameters* (NY15001)

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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 (Hort Innovation) investment in *NY15001: Evaluation of Nursery Tree Stock Balance Parameters.* The project was completed over the period from July 2017 to June 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 2020/21 dollar terms and were discounted to the year 2020/21 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 this nursery project addressed improvements in specification of potted landscape tree stock characteristics sold by Australian nurseries. It was concluded that modifications to the existing Standard were necessary to more accurately reflect tree quality for nursery owners and their customers.

The project led to changes in the national standard that have benefited both nursery potted plant producers as well as the customers for nursery grown landscape trees. In recognition of the value of the research, the tree stock project received the 2019 Award of Merit from the Australian Institute of Horticulture.

Investment criteria

Total funding from all sources for the project was $0.20 million (present value terms). The investment produced estimated total expected benefits of $1.33 million (present value terms). This gave a net present value of $1.13 million, an estimated benefit-cost ratio of 6.7 to 1, an internal rate of return of 28.4% and a modified rate of return of 12.7%.

Conclusions

The investment in NY15001 provided increased confidence to sellers and purchasers of landscape trees regarding tree quality across the full range of container sizes and tree types; the new standard has resulted in usage of the improved information on tree quality assessment by the landscape tree nursery industry and its associated customers. Application of the new standard by nursery owners is expected to be associated with improved tree quality, better selection for specific purposes, and subsequent performance of container-grown landscape trees planted in the community.

Keywords

Impact assessment, cost-benefit analysis, nursery industry, greenlife, tree stock for landscape use, container grown trees

Introduction

All research, development, and extension (RD&E) and marketing levy investments undertaken by Horticulture Innovation Australia Limited (Hort Innovation) are guided and aligned to specific investment outcomes, defined through a Strategic Investment Plan (SIP). The SIP guides investment of the levy to achieve each industry's vision. The relevant 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 berry (RB + BS), mango (MG), turf (TU) and nursery (NY) RD&E investment funds.

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

- Four RB + BS projects were chosen worth $1.44 million (nominal Hort Innovation investment) from an overall population of 16 projects worth an estimated $8.59 million,
- Three MG projects worth $1.77 million (nominal Hort Innovation investment) from an overall population of 16 projects worth approximately $7.9 million,
- Four TU projects worth $0.66 million (nominal Hort Innovation investment) from a total population of 15 projects worth $4.81 million, and
- Three NY projects worth $0.96 million (nominal Hort Innovation investment) from an overall population of 19 projects worth $7.32 million.

The project population for each industry included projects where a final deliverable had been submitted in the five-year period from 1 July 2015 to 30 June 2020.

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 where possible given the small sample sizes. Also, for the NY sample only, there were three projects that had been evaluated previously in 2019 (two projects) and 2020 (one project). Hort Innovation requested that the three additional NY projects be assessed against the current sample criteria. All three projects that had previously been evaluated met the current sample criteria. As a result, and to increase the sample size for the NY industry evaluations, the benefit and cost cash flows from the 2019 and 2020 evaluations were updated and the three projects were incorporated into the current NY sample.

General Method

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

The evaluation process involved identifying and briefly describing project objectives, activities and outputs, outcomes, and 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

Background & Rationale

The Australian nursery industry includes plant producers and retail nurseries (garden centres) as well as the businesses that manufacture, import and supply the products and services sold through these and other retail outlets such as hardware stores and supermarkets. These businesses include seed producers, plant propagators, and producers of mulch and fertilisers and garden equipment. The nursery and garden industry is supported also by a substantial number of businesses which are engaged in the care and maintenance of gardens, for example lawn mowing contractors.

One sector of the nursery industry is focused on producing nursery-grown trees for landscape use by the community. Demand for landscape trees has been increased by the Greener Spaces, Better Places initiative (formerly known as the 202020 Vision). This is a national collaborative campaign to increase urban green space in Australia by 20% by the year 2020. The campaign commenced in 2013. The simple rationale for the campaign is that plants and trees cool down cities, reduce pollution, get people out and about and make us healthier, happier and more productive.

Previous to the current investment, increasing attention to quality assessment of nursery-grown trees for landscape use had resulted in a national standard (AS 2303:2015), including specification criteria. The standard was being used to assess the quality of trees via above and below ground information, as well as the root to shoot balance. However, questions remained on the criteria for assessing root to shoot balance in nursery-grown trees under the 2015 national standard AS 2303:2015 Tree Stock for Landscape Use. The new standard did not fully recognise factors such as the different climates around Australia, potential differences between species such as exotic vs native, speed of growth, and drought tolerance differences in nursery production practices that together could result in natural variation in root to shoot balance in otherwise sound, high-quality nursery tree stock (Mark Tjoelker, pers. comm., 2020).

Industry thus required further investigation of the specification criteria required for nursery producers and their customers in relation to the root to shoot balance of the then existing national standard. This requirement led to the funding of Hort Innovation Project NY15001.

The nursery industry has a national levy struck at 5% of the sale price or landed cost price of a container (pot). Hort Innovation manages the proportion of nursery levy funds that is directed to investment in nursery RD&E and marketing programs. Separately, Plant Health Australia manages biosecurity funds. Greenlife Industry Australia (GIA) (formerly knowns as Nursery & Garden Industry Australia) is the peak industry body for the nursery and garden industry. The vision of the GIA is to create a climate in which the industry can grow and prosper.

The research and development activities of the Australian nursery industry are guided by the industry's Strategic Investment Plan (SIP). The activities are funded by levies payable on nursery stock produced in Australia. The process of preparing this SIP was managed by Hort Innovation in consultation with the Industry Representative Body and the Strategic Investment Advisory Panel. The current SIP has been driven by levy payers and addresses the Australian nursery industry's RD&E needs from 2017 to 2021. The current SIP addresses four desired outcomes and each outcome is pursued by a set of strategies that guide RD&E investment. The specific outcomes and strategies addressed by Project NY15001 are addressed specifically later in this evaluation.

Project Details

Summary

Project Code: NY15001

Title: *Evaluation of Nursery Tree Stock Balance Parameters*

Research Organisation: Western Sydney University

Project Leader: Mark Tjoelker, Western Sydney University

Period of Funding: July 2017 to June 2018

Objectives

This project aimed to deliver an industry engagement program to communicate research findings back to growers and industry stakeholders and facilitate uptake and adoption of the new nation-wide quality assessment standard for nursery grown trees for landscape use. Within this broad aim the specific objectives were:

1) Extend and translate NY15001 research results and findings to industry, key stakeholders and customers nationally via a roadshow, workshops, and relevant trade conferences.
2) Develop a general guideline around the current tree standard (AS 2303) as well as new information on tree stock balance. It is envisioned that that is would be communicated in the form of a "How to Guide" for customers and associated online tool.
3) Contribute expertise to the update of any new standard, pending acceptance, including preparation of materials and presentation to the standards committee.

The project objectives above build on an earlier NY15001 agreement spanning August 2015 through April 2017. The work reported in this document was the result of a contact variation and new contract to deliver the research findings and develop the new standard (Mark Tjoelker, pers. comm., 2020).

Logical framework

Table 1 following provides a detailed description of the project in a logical framework format.

Table 1: Logical Framework for Project NY15001

Activities	<u>Pre-engagement activities</u> • Visits to 23 wholesale nurseries were made to all Australian mainland states and biometric data were collected on about 14,000 containerised trees. • The tree data assembled were analysed with regard to the current specifications in AS 2303 for root to shoot balance. <u>Engagement and communication activities</u> • A nation-wide roadshow to engage industry stakeholders was undertaken including Melbourne, Adelaide, Perth, Brisbane, Darwin and Sydney; total attendance at these events totalled 518 persons. • The roadshow included presentations and discussions, as well as nursery demonstrations. • A 'How to Guide' for tree nursery growers was produced, as well as an on-line tool (smart-phone ready) for nursery tree stock quality assessment along with project videos.

	• Apart from nursery owners, targeted nursery customers such as council tree managers, landscapers, arborists, urban foresters, landscape architects and tree buyers were engaged. • Workshops, national trade conferences, trade journals, a project website, and articles in industry publications and social media were used to disseminate findings to the nursery industry and landscape tree purchasers. <u>Changes to AS 2303 activities</u> • The project team contributed expertise to the process of updating the AS 2303 by the Australian Standards Committee.
Outputs	<u>Pre-engagement outputs</u> • The analysis of the tree data revealed that the specification of root to shoot balance in AS 2303:2015 did not adequately capture the existing natural variation across all sizes of otherwise conforming trees. The largest disparity was detected between evergreen and deciduous tree species in smaller container volumes (Mark Tjoelker, pers. comm., 2020). • It was concluded that modifications to the existing Standard were necessary to more accurately reflect tree quality for nursery owners and their customers. <u>Industry engagement outputs</u> • Dissemination of findings to nursery owners and customers was successfully undertaken via a range of mechanisms as described earlier in activities. <u>Changes to AS 2303 outputs</u> • Assistance was provided to the Australian Standards Committee for updating AS 2303:2015 "Tree Stock for Landscape Use". • The project Leader (Mark Tjoelker was nominated to the EV-018, Arboriculture as an independent expert on the tree stock balance provisions. <u>Awards</u> • Receipt of the 2019 Award of Merit from the Australian Institute of Horticulture for the tree stock outreach project, awarded during the annual meeting in Perth.
Outcomes	• A revised Australian Standard (AS 2303:2018) has been developed due to the Hort Innovation investment; the new national standard was published on 21 December 2018; the new standard provides research-based, technical information to evaluate quality of trees, applicable to all species and regions in Australia. • Increased confidence was delivered to sellers and purchasers of landscape trees regarding tree quality across the full range of container sizes and tree types; the new standard encourages purchasers to be more knowledgeable. • This resulted in usage of the improved information on tree quality assessment by the landscape tree nursery industry and its associated customers, that is, nursery tree consumers. • Application of the new standard by nursery owners is expected to be associated with improved tree quality, better selection for specific purposes, and subsequent performance of container-grown landscape trees planted in the community.
Impacts	• Potential for increased sales and profitability by nurseries supplying container-grown landscape trees and by increased demand from national urban greening interests. • Helps drive and reward innovation in nursery growers who produce trees that conform to the new standard (Mark Tjoelker, pers. comm., 2020). • Improved satisfaction of purchasers of potted landscape trees from nurseries.

Project Investment

Nominal investment

Table 2 shows the investment made in Project NY15001 funded by Hort Innovation and partly funded and carried out by Western Sydney University. As mentioned earlier, the investment made in Table 3 built on an earlier investment by Hort Innovation and Western Sydney University that spanned the August 2015 through April 2017 period.

Table 2: Annual Investment in Project NY15001 (nominal $)

Year ended 30 June	Horticulture Innovation Australia	Western Sydney University	TOTAL
2018	101,500	42,200	143,700
Totals	**101,500**	**42,200**	**143,700**

Source: Project Research Agreement

Program management costs

For the Hort Innovation investment the cost of managing its funding was added to the Hort Innovation contribution in Table 2 via a management cost multiplier (1.162). This multiplier was estimated based on the share of 'payments to suppliers and employees' in total Hort Innovation expenditure (3-year average) reported in the Hort Innovation's Statement of Cash Flows (Hort Innovation Annual Report, various years). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 2.

For the Western Sydney University, a management cost multiplier of 1.0 for the in-kind contribution and administration costs for the project was applied to the nominal $ amounts appearing in Table 2.

Real investment and extension costs

For purposes of the investment analysis, the investment costs of all parties were expressed in 2020/21 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2021). No additional costs of extension were included as the project itself involved industry (including nursery tree growers and landscape tree buyers) and was heavily extension and communication oriented.

Impacts

Table 3 provides a summary of the principal types of impacts delivered by the project, based on the logical framework. Impacts have been categorised into economic, environmental and social impacts.

Table 3: Triple Bottom Line Categories of Principal Impacts from Project NY15001

Economic	• Increased quantity and value of landscape container-grown trees supplied to nursery customers.
Environmental	• Potential for improved environmental amenities by both private interests and all tiers of public government agencies. • Potential increase in the value of biodiversity in some local government areas.
Social	• Potential health and well-being improvements in some urban local government areas from increased tree cover.

Public versus private impacts

The impacts identified from the investment are predominantly private impacts accruing to nurseries producing landscape trees, as well as their customers. However, some of these impacts will be gained by the public sector's increased efficiency of choice and subsequent utilisation of landscape trees, for example, by local government agencies, and the State and Commonwealth Governments.

Distribution of private impacts

The private impacts will have been distributed between nursery owners and their customers. The share of impacts realised by nurseries and their customers will depend on both short- and long-term supply and demand elasticities experienced within the value chain of the landscape tree sector of the industry.

Impacts on other Australian industries

It is likely that most impacts will be mostly confined to the Australian nursery industry and purchasers of container-grown landscape trees.

Impacts overseas

It is unlikely that there will be any significant spillover impacts from the project to overseas interests. However, the research-based innovation in the new national standard in AS2303:2018 has the potential to garner international interest as other national, state or local industry bodies or governments seek to adopt or update their existing quality assessment standards for nursery tree stock production for landscape use (Mark Tjoelker, pers. comm., 2020).

Match with national priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project outcomes and related impacts will contribute primarily to Rural RD&E Priority 4, and to Science and Research Priority 7.

Table 4: Australian Government Research Priorities

Australian Government	
Rural RD&E Priorities (est. 2015)	**Science and Research Priorities (est. 2015)**
1. Advanced technology 2. Biosecurity 3. Soil, water and managing natural resources 4. Adoption of R&D	1. Food 2. Soil and Water 3. Transport 4. Cybersecurity 5. Energy and Resources 6. Manufacturing 7. Environmental Change 8. Health

Sources: DAWR (2015) and OCS (2016)

Alignment with the Nursery Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the Australian nursery industry are outlined in the Nursery Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2017). Project NY15001 addressed Nursery Strategic Investment Plan (SIP) Outcome 2, Strategy 2.3 and Outcome 4, Strategy 4.1 and 4.7.

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

Valuation of Impacts

Impact valued

The impact that was valued was the increased quantity and value of landscape potted trees supplied to nursery customers. 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 not valued

Not all of the impacts identified in Table 3 could be valued in the assessment. The following potential impacts were not valued due to the difficulty of making credible assumptions:

- improved environmental amenities,
- the increase in the value of biodiversity in some local government areas, and
- the health and wellbeing improvements in some urban local government areas.

Summary of assumptions

The impact that was valued was: The increased quantity and value of landscape potted trees supplied to nursery customers as a result of the investment.

The assumptions that have been used to value the increases due to the improved specifications are provided in Table 5. The assumption table shows a small proportion of growers are estimated to have improved their management resulting in a small increase in average yield and quality from year to year.

Table 5: Summary of Assumptions for Impact Valued

Variable	Assumption	Source/Comment
Impact 1: Increased value of landscape potted trees supplied to nursery customers.		
Greenlife business population (number of nurseries)	1,777	Nursery Industry Statistics & Research Final Report (Hort Innovation Project NY16004 (Vaughan 2017).
Average turnover per business.	$1 million per annum	Hort Innovation Project NY16004 data shows that most greenlife businesses (59%) have a turnover of less than $500,000 per year but that businesses with a turnover of more than $2 million per year account for 74% of the industry's gross value of production. A typical greenlife business of $1 million per year has been assumed for the current evaluation.
Gross turnover increase due to increased demand and value to nursery/consumers	0.50%	Analyst estimate. Turnover is assumed to increase marginally due to increased confidence gained by sellers and purchasers of landscape trees across the full range of container sizes and tree types. There are few statistics available on average turnover change from year to year and the various factors that

		might drive such changes. Also, note Table 10 where a sensitivity analysis has been undertaken on this assumption and a break even percentage is now included in track just above Table 10.
Profit as a percentage of turnover	9.8% (average of 15% and 4.6%)	Previous benchmarking studies have estimated profit as a percentage of turnover of nurseries at between 4.6% and 15% (e.g. IBISWORLD)
Year of first impact.	2019/20	Analyst estimate of year in which new measures commence
Year in which impact reaches a peak.	2022/23	Analyst estimate of year in which standards are fully implemented
Risk and attribution factors		
Probability of outcome	80%	Analyst estimate made after considering NY15001 milestone and final reports.
Probability of impact given usage	75%	Analyst estimate
Attribution	22.4%	Based on total investment in NY15001 as defined in the project population as a proportion of total investment in NY15001 that included the earlier data collection and analysis.

Results

All costs and benefits were discounted to 2020/21 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 (2017/18) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment criteria

Tables 6 and 7 show the investment criteria estimated for different periods of benefits for the total investment and the Hort Innovation investment alone.

Table 6: Investment Criteria for Total Investment in Project NY15001

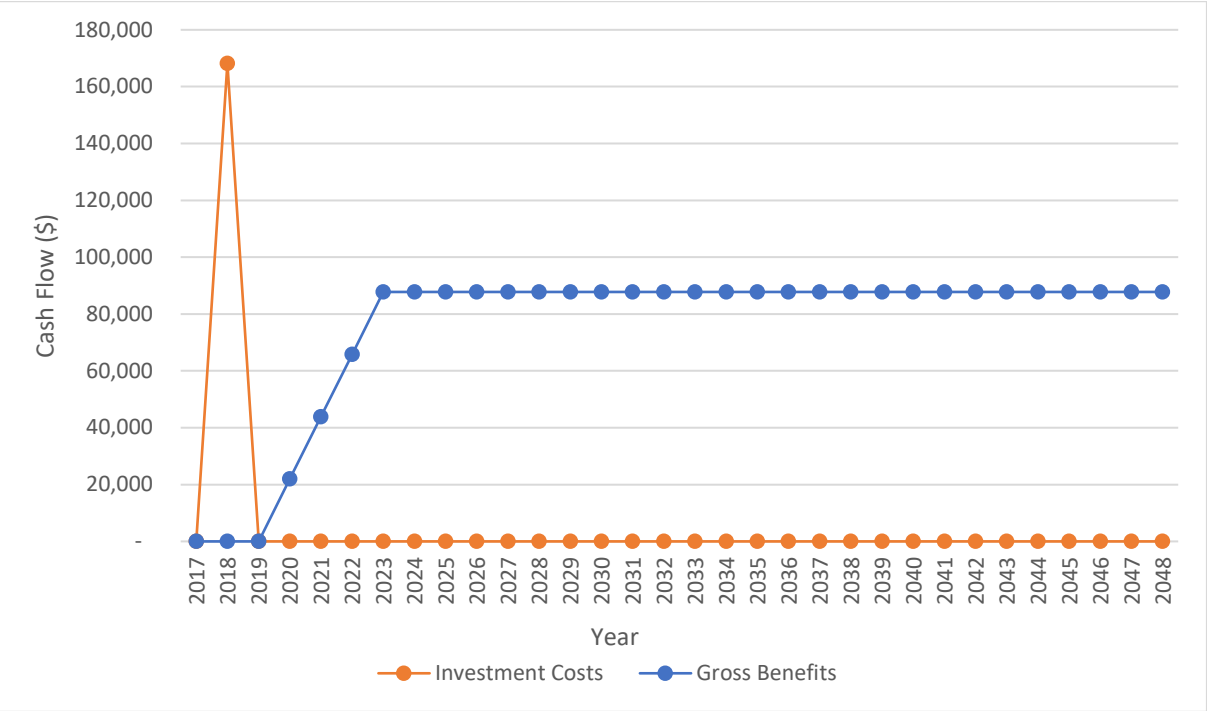
Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0.00	0.21	0.55	0.82	1.04	1.20	1.33
Present Value of Costs ($m)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Net Present Value ($m)	-0.20	0.01	0.36	0.63	0.84	1.00	1.13
Benefit-Cost Ratio	0.00	1.06	2.79	4.16	5.22	6.06	6.72
Internal Rate of Return (%)	negative	6.5	24.8	27.6	28.2	28.4	28.4
MIRR (%)	negative	8.0	21.6	18.2	15.7	14.0	12.7

Table 7: Investment Criteria for Hort Innovation Investment in Project NY15001

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0.00	0.15	0.41	0.61	0.76	0.88	0.98
Present Value of Costs ($m)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Net Present Value ($m)	-0.15	0.01	0.26	0.46	0.62	0.74	0.83
Benefit-Cost Ratio	0.00	1.06	2.79	4.16	5.22	6.06	6.72
Internal Rate of Return (%)	negative	6.5	24.8	27.6	28.2	28.4	28.4
MIRR (%)	negative	15.7	24.2	19.7	16.7	14.7	13.3

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the NY15001 investment plus 30 years from the last year of investment are shown in Figure 1.

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



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 8 presents the results that show a moderately high sensitivity to the discount rate.

Table 8: Sensitivity to Discount Rate (Total investment, 30 years)

Investment Criteria	**Discount rate**		
	0%	**5%**	**10%**
Present Value of Benefits ($m)	2.41	1.33	0.86
Present Value of Costs ($m)	0.17	0.20	0.23
Net Present Value ($m)	2.24	1.13	0.63
Benefit-cost ratio	14.10	6.72	3.77

A sensitivity analysis was then undertaken for the gross turnover increase assumed for those nursery suppliers that utilise the new standard. Results are provided in Table 9 and show a moderate sensitivity to the range of value increase assumed. The increase in turnover for the project investment just to break even was estimated as 0.074%.

Table 9: Sensitivity to Increase in Nursery Gross Turnover Assumption (Total investment, 30 years)

Investment Criteria	**Value Increase**		
	0.25%	**0.5% (Base)**	**0.75%**
Present Value of Benefits ($m)	0.67	1.33	2.00
Present Value of Costs ($m)	0.20	0.20	0.20
Net Present Value ($m)	0.47	1.13	1.80
Benefit-cost ratio	3.36	6.72	10.07

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 10). 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 10: Confidence in Analysis of Project

Coverage of Benefits	Confidence in Assumptions
Medium-High	Medium-Low

Coverage of benefits was assessed as Medium-High. The most important impact was valued: increased profitability for greenlife nursery owners that will be shared with their customers). As several other impacts were identified but not valued, the investment criteria as provided by the valued benefit are likely to be an underestimate of the total value of the project investment.

Confidence in assumptions for valuation was rated as Medium-Low as a number of the necessary assumptions made were not supported by surveys or other forms of evidence and had to be made according to the limited evidence produced by the project and the analyst's experience (e.g. the risk parameters).

Conclusion

The investment in NY15001 has contributed to the development of a revised Australian Standard (AS 2303:2018). The revised standard provides research-based, technical information to evaluate quality of trees, applicable to all species and regions in Australia; a new national standard was published on 21 December 2018 and is likely to increase the quantity and value of landscape container-grown trees supplied to nursery customers.

Total funding from all sources for the project was $0.20 million (present value terms). The investment produced estimated total expected benefits of $1.33 million (present value terms). This gave a net present value of $1.13 million, an estimated benefit-cost ratio of 6.7 to 1, an internal rate of return of 28.4% and a modified internal rate of return of 12.7%.

It should be noted that the project analysis focused only on the delivery part of an overall investment that included other Hort Innovation and Western Sydney University resources. However, while the delivery component depended on earlier data collection and analysis, this was addressed in the current analysis via the application of an attribution factor applied to the total impact.

The following impacts were identified but not valued:

- improved environmental amenities,
- the increase in the value of biodiversity in some local government areas, and
- the health and wellbeing improvements in some urban local government areas.

Hence, the investment criteria estimated by the evaluation may have somewhat underestimated the actual performance of the investment.

Glossary of Economic Terms

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

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Brendan O'Keeffe, Analyst, Horticulture Innovation Australia

Abbreviations

CRRDC	Council of Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Australian Government)
GIA	Greenlife Industry Australia
GDP	Gross Domestic Product
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
OCS	Office of Chief Scientist Queensland
RD&E	Research, Development and Extension
SIP	Strategic Investment Plan