

## **Final Report**

**Project title:**

# **Horticulture Impact Assessment Program: Appendix 10: Women's and Vegetable Young Grower Development Missions 2016-2018 (VG15703 Impact Assessment)**

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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 *VG15703: Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018*. The project was funded by Hort Innovation over the period December 2015 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 2017/18 dollar terms and were discounted to the year 2018/19 using a discount rate of 5% to estimate the investment criteria and a 5% reinvestment rate to estimate the modified internal rate of return (MIRR).

### Results/key findings

The investment in VG15703 is likely to contribute to the earlier adoption of new technologies and management practices identified by some project participants of the “Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018” to the selected overseas countries. Adoption and adaptation of the cost reducing technologies or management practices by Australian vegetable growers would occur earlier than in the absence of the project. Additionally, economic benefits of the project arise from the value of the voluntary contribution made by project participants in vegetable industry leadership roles including more women in leadership roles. Increased leadership capacity obtained by participation by young growers and women in the industry will contribute to better industry decisions – more integrated, efficient and profitable supply chains, better allocation of public R&D and private marketing resources, along with capacity to shape favourable public policy outcomes.

### Investment Criteria

Total funding from all sources for the project was \$1.46 million (present value terms) with Hort Innovation investment in the project totalling \$0.95 million. The investment produced estimated total expected benefits of \$3.13 million (present value terms). This gave a net present value of \$1.67 million, an estimated benefit-cost ratio of 2.15 to 1, an internal rate of return of 24.1% and a MIRR of 7.9%.

### Conclusions

While several economic and social impacts identified were not valued, the impacts were considered indirect, uncertain and/or minor compared with the impacts valued. Nevertheless, combined with conservative assumptions for the impacts valued, investment criteria as provided by the valuation may be underestimates of the actual performance of the investment. Analysis results remain positive under all sensitivity tests applied.

## Keywords

Impact assessment, cost-benefit analysis, VG15703, vegetables, young growers, women, capacity building, leadership development, study tour

## Introduction

Horticulture Innovation Australia Limited (Hort Innovation) required a series of impact assessments to be carried out annually on a number of investments in the Hort Innovation research, development and extension (RD&E) portfolio. The assessments were required to meet the following Hort Innovation evaluation reporting requirements:

- Reporting against the Hort Innovation's current 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 (SIP) for each Hort Innovation industry fund.
- Annual Reporting to Hort Innovation stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

The first series of impact assessments included 15 randomly selected Hort Innovation RD&E investments (projects) worth a total of approximately \$9.31 million (nominal Hort Innovation investment). The investments were selected from an overall population of 85 Hort Innovation investments worth an estimated \$50.38 million (nominal Hort Innovation investment) where a final deliverable had been submitted in the 2017/18 financial year.

The 15 investments were selected through a stratified, random sampling process such that investments chosen represented at least 10% of the total Hort Innovation RD&E investment in the overall population (in nominal terms) and was representative of the Hort Innovation investment across six, pre-defined project size classes.

Project *VG15703: Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018* was selected as one of the 15 investments and was analysed in this report.

## General Method

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

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

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

## Background & Rationale

### Background

The Australian vegetable industry is large and diverse. There are approximately 1,675 vegetable-growing businesses paying the national vegetable levy accounting for 68% of all vegetable-growing farms. These farms are located in all regions of the country and represent more than 130 different vegetable crops. The gross value of vegetable production was approximately \$4.35 billion in 2017/18.

Australian vegetable farms range from a large number of businesses operating on smaller areas, including greenhouse production, through to larger operations. Some 13% of Australian vegetable farms planted more than 70ha of vegetables and these were responsible for over 60% of national output

(Frilay, Weragoda and Ashton 2018). The majority of industry production is consumed domestically. In 2017/18, Australian fresh vegetable exports were valued at \$255 million and processed vegetable exports were valued at \$73 million.

The Vegetable Strategic Investment Plan 2017-2022 (Hort Innovation 2017 summarises key industry opportunities including increasing exports to Asia and the advantage of southern hemisphere production to meet northern hemisphere demand, the industry's strong reputation for quality processes and standards, reliable production capacity across diverse regions, increasing supply chain and industry integration and increasing consumer aspirations for healthy diets.

However, the industry has identified substantial challenges. These include environmental, pest and disease factors, climate variability and biosecurity risks, competition from imports and increased global competition, high production costs, slowing productivity growth, labour constraints and costs and decreasing farmgate margins. Challenges also remain in terms of the limited uptake of industry knowledge, and transfer of innovation and adoption of best-practice management models by growers (Hort Innovation, 2017).

As part of a coordinated industry response to strategically address these opportunities and challenges, the industry is represented at the national level by AUSVEG. In turn the peak industry body has member groups from Australian state and territory horticulture industries. Importantly, leading growers and supply chain actors contribute to these industry organisations and committees, supporting grower engagement and input to agricultural and regional, organisations and policy development.

### Rationale

The vegetable industry has identified the need to address leadership on an ongoing basis. Previous vegetable industry strategic plans including Vegvision Strategic Plan 2020 (AVID, 2006) and the Australian Vegetable Industry Strategic Investment Plan 2012-2017 (Horticulture Innovation Australia Limited, 2012) outlined the need to grow cohesively and included ongoing investments in present and future industry leaders. Notably, the current Vegetable Strategic Investment Plan 2017-2022 (Hort Innovation, 2017) retains a focus on leadership and professional development.

Similarly, the Federal Government has identified five priorities for the agriculture sector where rural industry leadership is required, including the capacity to consider 1) global markets and drivers; 2) labour market long-term shortfalls and working visas opportunities; 3) the ability to engage with research and policy and understand future directions regarding production, resource use and management; 4) understanding the industry value chain; and 5) alignment of the whole industry with end consumers (Hort Innovation 2018, VG15030 Final Report).

To this end Hort Innovation has invested in the continued development of current and future vegetable industry leaders. This has included investments such as Growing Leaders 2013-2015 and Growing Leaders 2016-2018, and Women's Grower Study Tour 2014-2016. Complementing these investments, VG15703 *Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018* provides the opportunity for emerging industry leaders to attend international grower tours to key vegetable production regions around the world. It allows participants to be exposed to the global horticulture industry and meet their peers in different countries to discuss similar challenges and practices, as well as those specific to the regions visited.

The primary aims of the VG15703 missions are to:

- Expand the leadership capabilities of the next generation of leaders in the Australian vegetable industry through exposure to the international industry and forming vital networks with local and international growers and industry members.
- Help foster innovation in the Australian vegetable industry, as participants return with new knowledge and practices to improve the efficiency and profitability of their operations. Upon their return, participants would share their findings with their networks and through industry communications, allowing the wider Australian vegetable industry to benefit from the tour.

## Project Details

### Summary

Project Code: VG15703

Title: *VG15703: Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018*

Research Organisation: AUSVEG Pty Ltd

Principal Investigator: Shaun Lindhe

Period of Funding: December 2015 to June 2018

### Objectives

The project's key objectives were:

1. Identify and develop the leadership skills of any young growers who appear to be suited for future positions as industry leaders and potential representatives on the global level.
2. Strengthen relationships among the younger generation of Australian grower and with their international counterparts, an expand their networks within the vegetable industry (both domestic and international).
3. Expose young Australian vegetable growers to a range of vegetable growing, production and trade practices being utilized in North America, South America, East Asia, continental Europe and New Zealand.
4. Increase young grower' knowledge of the different techniques used in different international regions and industries to increase their understanding of their competitors.
5. Introduce the industry's leading female growers to production, technical, marketing and supply chain systems operating overseas that are recognised as setting a benchmark in vegetable growing and supply chain operations.
6. Strengthen relationships between Australia's female growers and their international colleagues and expand growers' networks, including researchers, marketers and other growers.
7. Identify any new tools or machinery options that can be brought to Australia. Following feedback from growers during the mission, opportunities will be sought to promote these new innovations to the Australian vegetable industry so growers can choose to incorporate these in their growing operations.
8. Add value and knowledge to the Australian vegetable industry through communication and dissemination of knowledge following the mission and by gaining a greater understanding of the global food supply chain and growing practices.
9. Identify and develop future female leaders of the Australian vegetable industry through grower participation in the mission and provide them with the skills, knowledge and confidence to critically review all aspects of their business operations.
10. Recognise and facilitate the important role that women play in the Australian vegetable industry by giving them an opportunity to meet and network with their peers around Australia and overseas.

### Logical Framework

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

Table 1: Logical Framework for Project VG15703

|                        |  |
|------------------------|--|
| Activities and Outputs | <p><u>2016 Young Grower Industry Leadership and Development Mission to South America</u></p> <p>7 participants representing growers and some levy-paying groups involved in the vegetable supply chain.</p> <p>12-24 September 2016, Chile, Brazil and Argentina.</p> <p>Examined on-farm challenges facing South American vegetable growers, the technology</p> |
|------------------------|--|

|  |  |
|--|--|
|  | <p>used in crop production and the complexities of the supply chain.</p> <p>Met with Austrade representatives and key members of South American horticulture to discuss the main issues affecting their respective industries and share their knowledge about different industry practices.</p> <p>Published output: Vegetables Australia article.</p> <p><u>2016 Women’s Industry Leadership and Development Mission</u></p> <p>9 female participants representing growers and some levy-paying groups involved in the vegetable supply chain.</p> <p>10-24 October 2016, United States of America and Canada.</p> <p>Visits to farms, machinery and precision agriculture firms as well as prominent horticulture groups.</p> <p>Observed the need for greater output from vegetable growing operations, the novel innovations used on-farm and off-farm, as well as the intricacies of the supply chain.</p> <p>Published output: Vegetables Australia article.</p> <p><u>2017 Young Grower Industry Leadership and Development</u></p> <p>10 participants representing growers and some levy-paying groups involved in the vegetable supply chain.</p> <p>1-13 October 2017, Germany, Belgium and the Netherlands.</p> <p>Visited leading horticultural companies, encompassing seed production, growing, packaging, markets and innovative technology sectors. The growers built networks with representatives from the companies visited, as well as form close relationships with other growers in the group.</p> <p>The mission allowed participants to view and discuss a range of innovative products which can assist in improving their farms.</p> <p>The group examined a range of techniques and products which differ from Australian practices, and were able to discuss with the hosts and each other how the product/technique could be adapted to Australian horticulture.</p> <p>Participants observed high levels of automation and innovative machinery being used. Use of natural resources, including geothermal, to control the climate and water the crops within the greenhouses, use of GPS units on produce bins, greenhouse automation laser technology for bird deterrence and packaging of fresh produce (PerfoTec) to extend product shelf life.</p> <p>Visited innovative companies that undertake R&amp;D in Europe.</p> <p>Report on the mission’s activities submitted.</p> <p><u>2017 Women’s Industry Leadership and Development Mission</u></p> <p>9 participants representing growers and some levy-paying groups involved in the vegetable supply chain.</p> <p>4 to 16 September 2017 Hong Kong, South Korea and Japan.</p> <p>Visited vegetable growing operations, packaging facilities, distribution centres and markets, and meetings with both government and non-government agencies.</p> <p>Develop networks among the various international hosts, as well as having the opportunity to network with each other.</p> <p>Discussed areas of mutual concern with the local growers and compare the similarities and differences in the issues facing each in their respective regions.</p> <p>Report on the mission’s activities submitted.</p> |
|--|--|



|          |   |
|----------|---|
|          | <p><u>2018 Young Grower Industry Leadership and Development Mission</u></p> <p>11 participants representing growers and some levy-paying groups involved in the vegetable supply chain.</p> <p>9-21 April 2018, New Zealand and USA.</p> <p>Examined vegetable growing operations, packaging facilities, distribution centres and markets in major vegetable growing regions in their respective countries.</p> <p>Viewed and discussed on-farm production practices and innovations (conventional and organic), packing house and processing developments, key areas for vegetable research, labour sourcing programs, agritech innovation, biological crop protection and vegetable seed protection and production.</p> <p>Visited fresh produce retail outlets to examine consumer presentation and value-adding options that growers have created to minimise waste and increase profitability.</p> <p>Report on the mission’s activities has been prepared for industry and submitted.</p> <p><u>2018 Women’s Industry Leadership and Development Mission</u></p> <p>7 participants representing growers and some levy-paying groups involved in the vegetable supply chain.</p> <p>22 April-4 May 2018, France, Belgium and the Netherlands.</p> <p>Current and potential female industry leaders examined European vegetable trade and growing operations processes, procedures and issues.</p> <p>Visited vegetable growing operations, packaging facilities, distribution centres and markets.</p> <p>Observed and discussed with peers, industry leading production and harvesting methods, export development, food safety practices, marketing, issues sourcing labour and using labour hire, and planning practices and industry research and development.</p> <p>Report on the mission’s activities has been prepared for industry and submitted.</p> |
| Outcomes | <p>Increase knowledge of new technologies and management practices that increase productivity including increased mechanisation that reduce reliance on labour (and reduce labour costs).</p> <p>Increased industry knowledge about benchmarking international production, technical, marketing and supply chain systems, leading to improvements in these aspects of Australian growing operations.</p> <p>Developed strong relationships and expanded networks between Australian growers and international industry members, including growers, researchers and marketers, which will improve knowledge transfer into the Australian vegetable industry.</p> <p>Greater awareness of Australian vegetable industry’s international competitiveness, with growers able to make informed decisions based on a better understanding of Australian industry’s position in an international context.</p> <p>Enhanced leadership capacity for growers who participate in the missions based on their increased knowledge, stronger relationships, expanded networks and ability to critically review their own operations and the operation of the Australian industry using the information they have gained.</p> <p>Women’s Industry Leadership and Development Mission built strong networks amongst the diverse group of female participants. Australian women industry leaders with peers, innovative agribusinesses, growing operations and government bodies across Asia, expanding their leadership capacities while developing a greater understanding of horticulture outside of Australia.</p> <p>Empowered women in the industry by increasing their connections with the international vegetable industry, as well as with each other, which not only strengthens their own</p>   |

|         |   |
|---------|---|
|         | <p>respective network within horticulture but the wider industry.</p> <p>Sharing of findings with industry through participants networks with Australian growers.</p> <p>Participants greater willingness and interest in contributing to various industry committees and representative organisations</p> <p><b><u>Sample of quotes from returning participants</u></b></p> <p><u>Women’s Industry Leadership and Development Missions</u></p> <p>“A great way to bond with like-minded people.”</p> <p>“This tour gives you insights and connects you with key players in the Asian market. If you are investigating exporting to Asia this tour would be a great place to start.”</p> <p>“Visiting other farms helps you see your own farm from a new perspective.”</p> <p>“It has been a great opportunity to make both national and international contacts.”</p> <p>“A great way to meet other women in the industry.”</p> <p><u>Young Grower Missions</u></p> <p>“Overall the tour encourages growers to think out of the box and to learn about growing techniques different from those used in Australia... Some original and passionate companies have demonstrated success on the way they do things and that it’s an inspiration for the people that are working in the industry.”</p> <p>“Many businesses in Europe lead the world in sustainable, user friendly, responsible and efficient use of resources, energy, water and production in farms. We are looking for integrated solution to achieve optimal crop production without compromising future generations.”</p> <p>“It was very interesting seeing the R&amp;D being done and how the industry really works together.”</p> <p>“You get to network with other young growers and broaden your perspective on farming by visiting some of the most advanced hort businesses in the world.”</p> <p>“You can always take in things from marketing, machinery, automation, building design, business structure etc. not to mention the valuable time spent with fellow growers.”</p> <p>“Is a good opportunity to open the mind and see what other farmers are doing around the world. The learnings can then be applied on Australian farms.”</p> |
| Impacts | <ul style="list-style-type: none"> <li>• Earlier adoption of new technologies and best management practices resulting in cost savings, identified and discussed during tour visits.</li> <li>• Increased capacity of young growers and women leaders in the Australian vegetable industry resulting in better decision making - more integrated, efficient and profitable supply chains, better allocation of public R&amp;D and private marketing resources, along with capacity to shape favourable public policy outcomes.</li> <li>• Adoption of environmentally sustainable practices and technologies.</li> <li>• Increased networks domestically and internationally amongst vegetable industry participants improving adoption of practices and identification of marketing opportunities.</li> <li>• More women in leadership roles in vegetable and horticulture industry organisations.</li> <li>• Increased satisfaction of growers from their involvement in the vegetable industry.</li> </ul>  |

## Project Investment

### Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project VG15703 by Hort Innovation and others. 'Other' investors were the participants providing their own cash contributions.

Table 2: Annual Investment in the Project VG15703 (nominal \$)

| Year ended 30 June | Hort Innovation (\$) | Other (\$)     | Total (\$)     |
|--------------------|----------------------|----------------|----------------|
| 2016               | 112,764              | 0              | 112,764        |
| 2017               | 136,464              | 40,126         | 176,590        |
| 2018               | 528,748              | 92,790         | 621,538        |
| <b>Totals</b>      | <b>777,976</b>       | <b>132,916</b> | <b>910,892</b> |

### Program Management Costs

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

### Real Investment and Extension Costs

For the purposes of the investment analysis, investment costs of all parties were expressed in 2017/18 dollar terms using the GDP deflator index.

No extension costs incurred. Minor costs associated with publicising both the opportunity and the returning participants are included in R&D investment costs.

### Participant Costs

The direct contributions made by each participant toward the trip costs totalled some \$133,000. Individuals also incur costs by forgoing work and or leisure. Each student is required to commit on average 13 days to undertake the travel and a further 1 day is assumed for the application process and preparation. Average daily salary cost is estimated at \$500 per person. The time and salary cost estimate is assumed to cover any out of pocket expenses incurred by the student.

## Impacts

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

Table 3: Triple Bottom Line Categories of Principal Impacts from Project VG15703

|               |  |
|---------------|--|
| Economic      | <ul style="list-style-type: none"> <li>• Production cost savings as a result of adoption of new technologies and best management practices observed and discussed during tour visits.</li> <li>• Better industry decisions – more integrated, efficient and profitable supply chains, better allocation of public R&amp;D and private marketing resources, along with capacity to shape favourable public policy outcomes.</li> </ul>  |
| Environmental | <ul style="list-style-type: none"> <li>• Adoption of environmentally sustainable practices and technologies.</li> </ul>  |
| Social        | <ul style="list-style-type: none"> <li>• Increased networks domestically and internationally amongst vegetable industry participants.</li> <li>• More women in leadership roles in vegetable and horticulture industry organisations.</li> <li>• Increased satisfaction of young growers from their involvement in the vegetable industry.</li> <li>• More women and young leaders able and willing to contribute to regional and rural Australia through industry committees and representative organisations.</li> </ul> |

### Public versus Private Impacts

The majority of impacts identified in this evaluation are vegetable industry related and therefore are considered private benefits. The private benefits will be captured by project participants. These private benefits will include improved profitability of the vegetable businesses represented by the participants from adoption of the new technologies and by other growers who subsequently adopt the new technologies. While the broader industry will benefit from having better equipped industry leaders resulting in better decision making in the Australian vegetable industry. Public benefits will include gains from improved understanding and commitment to environmental sustainability and leaders more able and willing to contribute to regional and rural Australia.

### Distribution of Private Impacts

The impacts on the vegetable industry from investment in this project will be shared along the supply chain with consumers, growers, packers, transporters, wholesalers and retailers all sharing impacts produced by the project. The share of benefits among consumers, producers and other supply chain participants will vary in the short- and long-term and will depend upon the relative supply and demand elasticities for the different vegetable markets including substitutes, and the nature of the supply shift produced by the project outcomes (Alston 2010; Alston, Norton and Pardey, 1995).

### Impacts on Other Australian Industries

Benefits to other industries include the addition of the small number of participants from the Young Grower and Women's Industry Leadership and Development Missions from the vegetable industry who contribute to broader rural industry policy development or leave the vegetable industry and take up positions in other sectors.

### Impacts Overseas

Improved networks of Australian vegetable industry participants with overseas peers would benefit the Australian industry and overseas peers. Skilled Australian vegetable industry leaders may choose to work in overseas vegetable industries or in the overseas parts of Australian supply chains – benefiting both foreign industries and the Australian vegetable industry.

### Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project findings and related impacts will contribute primarily to Rural RD&E Priorities 1 and 4, and to Science

and Research Priority 1.

Table 4: Australian Government Research Priorities

| Australian Government   |   |
|---|---|
| Rural RD&E Priorities (est. 2015)   | Science and Research Priorities (est. 2015)   |
| <ol style="list-style-type: none"> <li>1. Advanced technology</li> <li>2. Biosecurity</li> <li>3. Soil, water and managing natural resources</li> <li>4. Adoption of R&amp;D</li> </ol> | <ol style="list-style-type: none"> <li>1. Food</li> <li>2. Soil and Water</li> <li>3. Transport</li> <li>4. Cybersecurity</li> <li>5. Energy and Resources</li> <li>6. Manufacturing</li> <li>7. Environmental Change</li> <li>8. Health</li> </ol> |

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

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

The strategic outcomes and strategies of the vegetable industry are outlined in the Vegetable Strategic Investment Plan 2017-2021 (Hort Innovation, 2017). Project VG15703 addressed Vegetable Strategic Investment plan (SIP) Outcome 5, Strategies 5.3 and 5.5, as well as Outcome 2, Strategy 2.2 and Outcome 3, Strategy 3.8.

## Valuation of Impacts

### Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when some uncertainty was involved. Sensitivity analyses were undertaken for those variables where there was greatest uncertainty or for those that were identified as key drivers of the investment criteria.

Two key impacts of the project were valued. One was the increased productivity of vegetable production resulting in lower costs of production from the adoption of technologies or new management practices observed and discussed during the tours. The other is the additional voluntary days worked per participant on industry committees and representative organisations after returning from the Young Grower and Women's Industry Leadership and Development Missions 2016-2018. These two impacts were deemed to be the principal impacts of the project.

### Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment. The environmental and some of the social impacts were hard to value due to lack of evidence/data, difficulty in quantifying the causal relationship and pathway between VG15703 and the impact, and the complexity of assigning monetary values to these impacts.

The environmental impact identified but not valued was:

- Adoption of environmentally sustainable practices and technologies.

The social impacts identified but not valued were:

- Increased networks domestically and internationally amongst vegetable industry participants.
- More women in leadership roles in vegetable and horticulture industry organisations.
- Increased participation of young producers in vegetable and horticulture industry organisations.
- Increased satisfaction of growers from their involvement in the vegetable industry.

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

### Valuation of Impact 1: Increased rate of uptake of new technologies and best management practices

The VG15703 investment introduced new knowledge and management practices to participants which they observed *in situ* and discussed with leading overseas growers, supply chain personnel and researchers. Examples of technologies and practices highlighted by participating growers have included in-field packing technologies at harvest of some crops, new types of packaging to maintain freshness at harvest, environmentally sustainable bird control technologies (Shaun Lindge, *per com*). As a result, some 30% of participating growers would directly adopt and adapt a new technology or practice that in effect reduces costs of production<sup>2</sup>. It is estimated that these technologies would result in a 3% reduction in production costs estimated at the variable cost level, this estimate allows for implementation costs of the technology or practice. This level of improvement is consistent with the order of magnitude realised by productivity gains in Australian agriculture of up approximately 2% (Mallawaarachchi et al 2009). Further, a number of the growers participating in the Missions represent larger and well networked vegetable production businesses this will lead to some limited adoption through grower to grower extension. Some of these businesses represented in the tour are identified as industry leading farm businesses or in some instances have contract growing arrangements that facilitate diffusion of technologies to associated growers. It is estimated that for each of the 53 Mission participants adopting and adapted new practice or technology (30% of participants), an additional 5 growers will adopt the technology over a further 3 years as a result of contact and communication with these primary adopters. Benefits from the selected new technologies or practices will be maintained for some 20 years<sup>3</sup> after which benefits are assumed to decline or be disadopted over the subsequent 5 years.

#### Attribution

The attribution of this benefit is in terms of time to adoption with the cost saving of the additional new technology or practice adopted being realised earlier (Marsh *et al* 2004) and is fully attributable to Project VG15703 activities and outputs. VG15703 enables participating growers and industry personnel to observe and discuss with leading overseas producers, new technologies and improved management practices *in situ*. This provides a unique pathway for developing awareness and understanding of potential new approaches by these Australian participating growers that would otherwise become aware of at a much later date.

#### Counterfactual

In the absence of VG15703, such technologies and practices would have been slower to be adopted in Australia. The adoption of the selected new technologies or management practices in Australia by these growers would be delayed by five years beyond when adoption occurs as a result of participation in the Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018.

### Valuation of Impact 2: Increased capacity of the vegetable industry's leaders

VG15703 is designed to expand the leadership capabilities of the next generation of leaders including women in the Australian vegetable industry through exposure to the international industry and forming vital networks with local and international growers and industry members. Gaining a deeper insight into industry approaches to various challenges and opportunities in different contexts.

Previous economic analyses of capacity building of rural industry leaders have used the value of voluntary contributions to industry organisations and committees made by participants after their involvement in such projects. The literature on evaluating capacity building investments suggests that quantification of returns from leadership training might be achieved by measuring both the improved earnings of those participating in the training and improvement in industry outcomes through the value of voluntary work undertaken. Stiefelmeyer et al (2013) used this approach to evaluate investment in the Canadian Advanced Agricultural Leadership Program and calculated the value of voluntary work by determining the number of additional hours undertaken by

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<sup>2</sup> This proportion is based on a review of the feedback sheets from grower participants who identified a technology or practice to be considered for adoption and collaborated by Shaun Lindge (*AusVeg, pers com*). Further evidence could be collected if implementation of tracer frequently applied as part of measurement and evaluation in capacity building and extension projects was conducted (eg., Gordon and Chadwick 2007).

<sup>3</sup> New technologies (including new products) or practices have variable times to obsolescence while many technologies include new learning that contributes. Examples of technologies include new varieties which are used on average 17 years in Australian cropping systems, minimum tillage technologies continue to be practiced since adopted broadly in Australia during the 1990's (Mallawaarachchi *et al* 2009), herbicide technologies frequently have decades long use (Moss 2017).

graduates and applying wage equivalents. This method was subsequently applied to an analysis of Leadership training in the Australian Wine industry (AgEconPlus and Gillespie Economics 2017)).

This approach is partly adopted in valuing returns to the vegetable industry from the Young Growers and Women’s Leadership project (VG15703). In this analysis the value of additional days volunteered by some project participants to industry organisations and activities is captured however personal increased value of salaries and career progression is excluded. Taking a conservative approach, the extra value of participants is captured in large part, from the adoption of new technologies and practices by affiliated businesses (Impact 1, see Table 6). It is also recognised that the VG15703 project complements other leadership project investments for the Australian vegetable industry (see ‘Attribution’ below) with a number of participants also involved in these other leadership projects (Shaun Lindhe, AUSVEG, *per com*), therefore this source of benefits is excluded to avoid double counting. There is a diverse range of project participants from farm owners, managers and middle managers from associated vegetable industry businesses that are levy payers. A study of the value of voluntary contributions to industry organisations and committees applied a value of \$500/ day (AgEconPlus and Gillespie Economics 2017) and is applied here.

### Attribution

Other projects by Hort Innovation and AUSVEG are also designed to increase the capacity of vegetable industry leadership in Australia including Growing Leaders 2013-2015 and Growing Leaders 2016-2018, and Women’s Grower Study Tour 2014-2016. However this analysis assumes that the value of the increased leadership capacity derived from VG15703 is reflected in this additional time and is fully attributable to VG15703 as a result of their involvement in the tours.

### Counterfactual

If this project had not been funded the gap in vegetable industry specific leadership training would have been greater and there would be some shortage of leaders willing to take up voluntary positions within the industry.

### Summary of Assumptions

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

Table 5: Summary of Assumptions

| Variable  | Assumption   | Source/Comment  |
|---|--|---|
| <b>Impact 1: Increased productivity and cost reduction from early adoption and adaptation of technologies</b> |  |   |
| <b>WITH Investment in Project VG15703</b>   |  |   |
| Attribution of cost saving practices.   | Cost savings of \$284/ha, a 3% cost reduction in on-farm variable costs. | Consultant estimate based upon discussion with AUSVEG staff accounting for technologies identified by participants for adaptation and adoption on farm.<br><br>Cost saving estimated from vegetable farm survey data (ABARES, 2018) adjusted to 2017/18 \$ value. |
| Maximum adoption.   | 30% of participants  | Consultant estimate in discussion with AUSVEG staff accounting for technologies identified by participants for adaptation and adoption on farm.   |
| Area of vegetables grown per adopting farm  | 45 ha  | Consultant estimate following discussion with AUSVEG participants typically represent larger scale of businesses. (Frilay, Weragoda and Ashton 2018) midpoint of larger farms 20-70ha category).  |
| Additional farmer uptake  | 5 farms per adopting participant.  | Consultant estimate following discussion with AUSVEG, a number of participating farmers have contract   |

|   |   |  |
|---|---|--|
|   |   | arrangements with other farms to grow vegetables and encourage producers to adopt.   |
| Maintenance of benefits and dis-adoption.   | Benefits maintained for 20 years from initial adoption and then decline over the following 5 years to zero. | Consultant estimate.   |
| Year of first impact.   | 2019-20.  | Second year after completion of project, consultant estimate.  |
| Annual adoption rate.   | 20% annual increase for 5 years (to maximum adoption).  | Consultant estimate consistent with adoption rates in agricultural models.   |
| <b>WITHOUT Investment in Project VG15703</b>  |   |  |
| Year of first adoption.   | 2024/25   | Five years after completion of project, consultant estimate based on typically time lags for adoption.   |
| Level of impact.  | See 'with investment' assumptions above.  |  |
| <b>Impact 2: Better equipped industry leaders and industry decisions</b>  |   |  |
| <b>WITH Investment in Project VG15703</b>   |   |  |
| Number of Overseas mission participants.  | 53.   | VG 15703 Final report.   |
| Number of Overseas Mission participants linking to industry committees and representative organisations.                                      | 25%.  | Consultant estimate based on discussions with AUSVEG staff.  |
| Additional voluntary days worked per participant on industry committees and representative organisations.                                     | 9 days per year.  | Consultant estimate based on discussions with AUSVEG staff regarding participant profiles.   |
| Time to full representation post completion.  | 3 years post Mission participation.   | Consultant estimate recognising that while some participants already contribute to industry organisations substantially other Young Growers and Women Leaders will scale up their input. |
| Salary equivalent of each day volunteered to the Australian wine industry   | \$500/day.  | Assuming a salary of \$100,000, 1,800 hours worked per annum and a 7.5 hour work day (AgEconPlus and Gillespie Economics 2017).  |
| Number of years until number of days volunteered for industry committees and representative organisations attributable to project dissipates. | 10 years.   | Consultant assumption based on literature that concludes benefit of training is greatest immediately after training and diminishes over time.  |
| <b>WITHOUT Investment in Project VG15703</b>  |   |  |
| These additional days volunteered would not have been made to industry.   |   |  |



## Results

All costs and benefits were discounted to 2018/19 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (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 benefit for the total investment and the Hort Innovation investment respectively. The present value of benefits (PVB) attributable to Hort Innovation investment only, shown in Table 7, has been estimated by multiplying the total PVB by the Hort Innovation proportion of real investment (60.8%).

Table 6: Investment Criteria for Total Investment in Project VG15703

| Investment Criteria             | Years after Last Year of Investment |      |      |      |      |      |      |
|---------------------------------|-------------------------------------|------|------|------|------|------|------|
|                                 | 0                                   | 5    | 10   | 15   | 20   | 25   | 30   |
| Present Value of Benefits (\$m) | 0                                   | 1.90 | 3.09 | 3.13 | 3.13 | 3.13 | 3.13 |
| Present Value of Costs (\$m)    | 1.46                                | 1.46 | 1.46 | 1.46 | 1.46 | 1.46 | 1.46 |
| Net Present Value (\$m)         | -1.46                               | 0.44 | 1.64 | 1.67 | 1.67 | 1.67 | 1.67 |
| Benefit-Cost Ratio              | 0                                   | 1.30 | 2.12 | 2.15 | 2.15 | 2.15 | 2.15 |
| Internal Rate of Return (%)     | negative                            | 14.3 | 24.0 | 24.1 | 24.1 | 24.1 | 24.1 |
| MIRR (%)                        | negative                            | 11.2 | 13.3 | 10.7 | 9.3  | 8.5  | 7.9  |

Table 7: Investment Criteria for Hort Innovation Investment in Project VG15703

| Investment Criteria             | Years after Last Year of Investment |      |      |      |      |      |      |
|---------------------------------|-------------------------------------|------|------|------|------|------|------|
|                                 | 0                                   | 5    | 10   | 15   | 20   | 25   | 30   |
| Present Value of Benefits (\$m) | 0                                   | 1.15 | 1.88 | 1.90 | 1.90 | 1.90 | 1.90 |
| Present Value of Costs (\$m)    | 0.95                                | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Net Present Value (\$m)         | -0.95                               | 0.20 | 0.93 | 0.96 | 0.96 | 0.96 | 0.96 |
| Benefit-Cost Ratio              | 0                                   | 1.22 | 1.98 | 2.01 | 2.01 | 2.01 | 2.01 |
| Internal Rate of Return (%)     | negative                            | 9.5  | 19.5 | 19.6 | 19.6 | 19.6 | 19.6 |
| MIRR (%)                        | negative                            | 8.0  | 11.5 | 9.5  | 8.4  | 7.8  | 7.3  |

The annual undiscounted benefit and cost cash flows for the total investment for the duration of VG15703 investment plus 30 years from the last year of investment are shown in Figure 1.

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

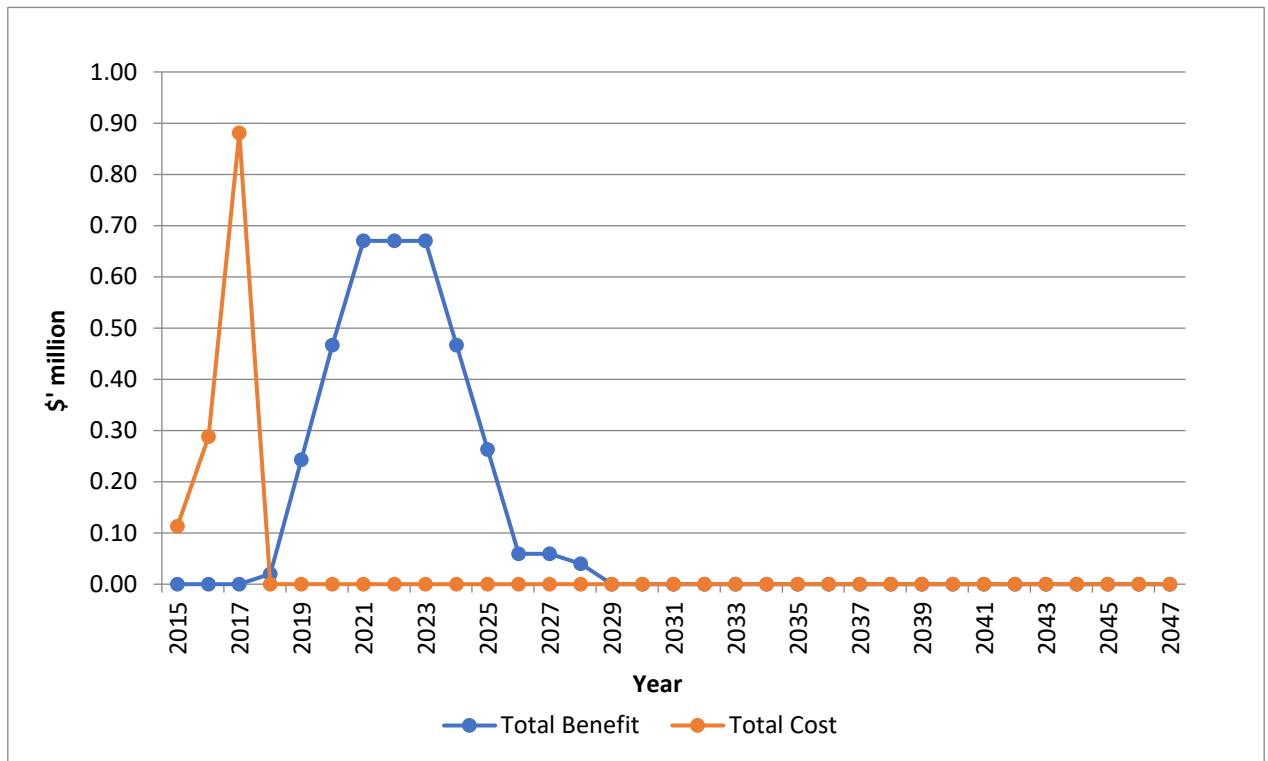


Table 8 shows the contribution of each impact to the total PVB.

Table 8: Contribution of Benefits

| Impact  | PVB (\$M) | % of Total PVB |
|---|-----------|----------------|
| Impact 1: Increased productivity and cost reduction from early adoption of technologies | 2.65      | 84.5%          |
| Impact 2: Better equipped industry leaders and industry decisions                       | 0.48      | 15.5%          |
| Total   | 3.13      | 100.0%         |

### Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 9 present the results. The results show a moderate sensitivity to the discount rate.

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

| Investment Criteria             | Discount rate |      |      |
|---------------------------------|---------------|------|------|
|                                 | 0%            | 5%   | 10%  |
| Present Value of Benefits (\$m) | 3.65          | 3.13 | 2.73 |
| Present Value of Costs (\$m)    | 1.29          | 1.46 | 1.63 |
| Net Present Value (\$m)         | 2.36          | 1.67 | 1.10 |
| Benefit-cost ratio              | 2.83          | 2.15 | 1.67 |

A sensitivity analysis was then undertaken for the assumed scaled adoption of cost saving technologies by growers associated with each adopting project participant who adopted a technology or improved management. With a more modest assumed level of adoption from growers associated with those participating growers who adopted cost saving technologies, to 3 growers, the project produces a positive return on investment – Table 10.

Table 10: Sensitivity to assumed scaling of technologies by growers associated with project participants<sup>(a)</sup>  
(Total investment, 30 years)

| Investment Criteria             | Adoption of cost reducing technologies by growers associated with participating growers <sup>1</sup> |           |           |
|---------------------------------|--|-----------|-----------|
|                                 | 3 growers  | 5 growers | 7 growers |
| Present Value of Benefits (\$m) | 2.07   | 3.13      | 4.19      |
| Present Value of Costs (\$m)    | 1.46   | 1.46      | 1.46      |
| Net Present Value (\$m)         | 0.62   | 1.67      | 2.73      |
| Benefit-cost ratio              | 1.42   | 2.15      | 2.88      |

(a) These are the participating growers who do adopt a cost saving technology or new management practice upon return from the tour estimated at 30% of the VG15703 participants.

At the request of Hort Innovation an additional sensitivity analysis was conducted proportion growers adopting a technology upon return from the tours, above the base case of 30% (and maintaining the spill-over to 5 growers per adopting participant) (Table 11). If half of tour participants adopt improved technologies as a result of the tours present value of project benefits increases from \$3.13m to \$4.89m and the BCR from 2.15 to 3.36.

Table 11: Sensitivity to level of adoption of new technologies by grower tour participants  
(Total investment, 30 years)

| Investment Criteria             | Adoption of cost reducing technologies by tour participating growers |      |      |
|---------------------------------|--|------|------|
|                                 | 30% <sup>1</sup>   | 50%  | 70%  |
| Present Value of Benefits (\$m) | 3.13   | 4.89 | 6.66 |
| Present Value of Costs (\$m)    | 1.46   | 1.46 | 1.46 |
| Net Present Value (\$m)         | 1.67   | 3.44 | 5.20 |
| Benefit-cost ratio              | 2.15   | 3.36 | 4.57 |

<sup>1</sup>The base case assumes 30% of participating growers adopt and adapt a technology or management practices following the tour.

A final sensitivity test examined the attribution of benefits from investment in VG15703 to the number of days volunteered towards the vegetable industry as a result of participation in the project (Table 12). Project returns remain positive at the lower level of 4 volunteer days.

Table 12: Sensitivity to Days volunteered to industry by VG15703 participants  
(Total investment, 30 years)

| Investment Criteria             | Days contributed to industry by VG15703 participants |        |         |
|---------------------------------|--|--------|---------|
|                                 | 4 days   | 9 days | 14 days |
| Present Value of Benefits (\$m) | 2.86   | 3.13   | 3.40    |
| Present Value of Costs (\$m)    | 1.46   | 1.46   | 1.46    |
| Net Present Value (\$m)         | 1.41   | 1.67   | 1.94    |
| Benefit-cost ratio              | 1.97   | 2.15   | 2.33    |

### 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 13). 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 13: Confidence in Analysis of Project

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

Coverage of benefits was assessed as medium-high. The two most important benefits (increased productivity through adoption and adaptation of technologies on the overseas tours and better equipped industry leaders and vegetable industry decisions) were quantified. Other benefits attributable to the project including environmental benefits from adoption environmentally sustainable practices and technologies and social impacts (increased networks domestically and internationally amongst vegetable industry participants, and increased satisfaction of growers from their involvement in the vegetable industry) were not valued. Consequently, the investment criteria as provided by the valued benefits are likely to be underestimated to some degree.

Confidence in assumptions was rated as medium. The approach used was similar to other independent impact assessment completed for Australian rural research and development corporations and a study completed for valuing a Wine Australia project for Future Leader development (AgEconPlus and Gillespie Economics 2017).

## Conclusion

The investment in VG15703 is likely to contribute to the earlier adoption of new technologies and management practices identified by some project participants of the *Vegetable Young Grower Development Mission and Women's Development Missions 2016-2018* to the selected overseas countries. Adoption and adaptation of the cost reducing technologies or management practices by Australian vegetable growers would occur earlier than in the absence of the project. Additionally, economic benefits of the project arise from the value of the voluntary contribution made by project participants in vegetable industry leadership roles. Increased leadership capacity obtained by participation by young growers and women in the industry will contribute to better industry decisions – more integrated, efficient and profitable supply chains, better allocation of public R&D and private marketing resources, along with capacity to shape favourable public policy outcomes.

Total funding from all sources for the project was \$1.46 million (present value terms) with Hort Innovation investment in the project totalling \$0.95 million. The investment produced estimated total expected benefits of \$3.13 million (present value terms). This gave a net present value of \$1.67 million, an estimated benefit-cost ratio of 2.15 to 1, an internal rate of return of 24.1% and a modified internal rate of return of 7.9%. Analysis results are dependent on assumptions made and results are positive for both core assumptions and sensitivity tests.

While environmental and several social impacts identified were not valued, the impacts were considered uncertain, indirect and/or minor compared with the impacts valued. Nevertheless, combined with conservative assumptions for the impacts valued, investment criteria as provided by the valuation may be underestimates of the actual performance of the investment.

## Glossary of Economic Terms

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

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## Abbreviations

|       |   |
|-------|---|
| CRRDC | Council of Research and Development Corporations                      |
| DAWR  | Department of Agriculture and Water Resources (Australian Government) |
| GDP   | Gross Domestic Product  |
| IRR   | Internal Rate of Return   |
| MIRR  | Modified Internal Rate of Return                                      |
| PVB   | Present Value of Benefits   |
| SIP   | Strategic Investment Plan   |