Industry-specific impact assessment program: apple and pear

Impact assessment report for project *Development of new pome fruit products* (AP09035)

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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 *AP09035: Development of new pome fruit products.* The project was funded by Hort Innovation over the period February 2010 to March 2014.

Methodology

The investment was first analysed qualitatively within a logical framework that included activities and outputs, outcomes and impacts. Actual and/or potential impacts then were categorised into a triple bottom line framework. Principal impacts identified were then considered for valuation in monetary terms (quantitative assessment). Past and future cash flows were expressed in 2017/18 dollar terms and were discounted to the year 2018/19 using a discount rate of 5% to estimate the investment criteria.

Results/key findings

The investment in AP09035 has contributed to the ongoing breeding program for apples and pears in Australasia managed by Prevar Ltd. Consequently, AP09035 is likely to have contributed to improved quality and value of Australian apple and pear production resulting in increased farm profits for Australian growers.

Investment Criteria

Total funding from all sources for the project was $16.79 million (present value terms). Though a number of economic, environmental and social impacts were identified, an in-depth cost-benefit analysis of the investment in AP09035 would require a significant amount of detailed information and data associated with the specific new Prevar apple and pear varieties released, and likely to be released, between 2009/10 and 2029.30. Obtaining such data is likely to be time and resource intensive and was beyond the scope of the current impact assessments under the Hort Innovation industry-specific impact assessment program. Thus, no impacts for AP09035 were valued in monetary terms.

Conclusions

The investment in AP09035 has contributed to the ongoing breeding program for apples and pears in Australasia managed by Prevar Ltd. Consequently, AP09035 is likely to have contributed to improved quality and value of Australian apple and pear production resulting in increased farm profits for Australian growers.

Keywords

Impact assessment, cost-benefit analysis, AP09035, pome, apple and pear, breeding, Prevar, profitability

Introduction

All research and development (R&D) and marketing levy investments undertaken by Horticulture Innovation Australia Limited (Hort Innovation) are guided and aligned to specific investment outcomes, defined through a Strategic Investment Plan (SIP). The SIP guides investment of the levy to achieve each industry's vision. The current industry SIPs apply for the financial years 2016/17 – 2020/21.

In accordance with the Organisational Evaluation Framework, Hort innovation has the obligation to evaluate the performance of its investment undertaken on behalf of industry.

This impact assessment program addresses this requirement through conducting a series of industry-specific ex-post independent impact assessments of the apple & pear (AP), avocado (AV), mushroom (MU) and table grape (TG) RD&E investment funds.

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

- Nine AP projects were chosen worth $15.46 million (nominal Hort Innovation investment) from an overall population of 19 projects worth an estimated $33.31 million,
- Seven AV projects worth $1.91 million (nominal Hort Innovation investment) from an overall population of 27 projects worth approximately $9.97 million,
- Five MU projects worth $1.75 million (nominal Hort Innovation investment) from a total population of 20 projects worth $7.94 million, and
- Six TG projects worth $2.84 million (nominal Hort Innovation investment) from an overall population of 11 projects worth $5.0 million.

The project population for each industry included projects where a final deliverable had been submitted in the five-year period from 1 July 2013 to 30 June 2018.

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.

Project *AP09035: Development of new pome fruit products* was randomly selected as one of *the* 22 unique MT18009 investments and was analysed in this report.

General Method

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

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

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

Background & Rationale

The Australian Apple and Pear Industry

Apples and pears are two of the main horticulture crops produced in Australia. Combined, the apple and pear industries produce more fresh fruit than any other fruit industry in Australia (APAL, 2019). The main production of apples and pears occurs in Victoria (at 45% and 88% of national production respectively), with major apple producers also located in all other states. Most Australian apples and pears are for fresh supply, but both also have significant production sent for processing (for juices and other value-added products).

In 2017/18, Australian apples had a farm gate value (FGV) of $418.3 million and production of 269,355 tonnes, while pears (including Nashi) had an FGV of $80.2 million and production of 103,748 tonnes (ABS, 2019). Domestic apple consumption has remained relatively stable over time, but per capita consumption has been falling (Hort Innovation, 2016). Fresh pear (excluding Nashi) per capita consumption has remained stable since 2002/03 (Hort Innovation, 2016).

Exports, while relatively small compared to domestic consumption, represent an important growth area for apples and pears. A total of 2,134 tonnes (or 1% of fresh production) of apples was exported in 2014/15 (Hort Innovation, 2016) with major markets being Papua New Guinea, United Kingdom, Sri Lanka, and Hong Kong S.A.R.

For pears, a total of 7,647 tonnes (7% of fresh production) was exported the same year (Hort Innovation, 2016), with major export markets being New Zealand, Indonesia, Canada, Singapore, and more recently India. Australia does allow imports of both apples and pears, but quantities are relatively small compared to domestic production.

There are both opportunities and challenges for the Australian apple and pear industry to improve in areas such as biosecurity, inconsistency of eating quality, export competition and market access, and an oversupply leading to lower prices (Hort Innovation, 2016).

The collective goal of the two industries is to increase the growth in domestic consumption of apples and pears, and to see growth in exports. The apple and pear industries have funded a number of projects, through Hort Innovation and industry RD&E investments, around improving access to the Asian export market, improved marketing of apples and pears, and improving industry productivity and quality (APAL, 2013).

Statutory levies are in place for both industries for Emergency Plant Pest Response, National Residue Testing, Plant Health Australia, Marketing and Research and Development (R&D). Marketing and R&D levies are managed by Hort Innovation. APAL is the apple and pear industries' representative body and non-profit membership organisation.

Apple and Pear Breeding

Since its inception in 2004, an international apple and pear breeding program has been managed by the apple and pear industries of Australia and New Zealand (NZ) through Premium Apple and Pear Products NZ (Prevar Ltd).

Prevar Ltd is an international joint venture company between Apple and Pear Australia Limited (APAL), Pipfruit NZ, and the PFR Institute NZ, and was originally established in 2004 (APAL, 2013). Prevar Ltd is responsible for the global commercialisation of new apple and pear varieties bred through the joint Australia and NZ pome fruit breeding program.

Funds from APAL are paid to Prevar Ltd via Hort Innovation against Hort Innovation milestones. The funds from Hort Innovation are used to purchase shares in Prevar Ltd for APAL. Prevar Ltd then contracts the Plant and Food Research (PFR) Institute NZ to undertake major apple and pear breeding activities. As of 30 June 2018, APAL owned a 45% share in Prevar Ltd (APAL, 2018).

Rationale

The Hort Innovation Apple and Pear Strategic Investment Plan 2017-2021 (2016) identified a number of major challenges for the industry including relatively low and viariable yields, inconsistent fruit quality, and a lack of export competitiveness and capability.

Commercial development of new apple and pear varities can take 15 to 20 years from the time of first cross. The breeding and commercialisation process also is time consuming and costly. Project AP09035 (*Development of new pome fruit products*) was funded to support the continued development and commercialisation of new and improved, internationally competitive apple and pear varieties for growers in Australia, NZ and other countries.

Project Details

Summary

Project Code: AP09035

Title: *Development of new pome fruit products*

Research Organisation: Apple and Pear Australia Limited

Principal Investigator: Garry Langford, Apple and Pear Australia Limited

Period of Funding: February 2010 to March 2014

Objectives

Project AP09035 was aimed primarily at developing and commercialising new pome fruit products that would provide the Australasian industry with a competitive advantage in international markets. As such, the objectives of the investment were to:

1. Fund, set targets for, interact with, and oversee the world-leading Plant and Food Research (PFR) apple and pear breeding program.
2. Distribute the cultivars arising from the PFR breeding program to Australasian growers and other territories.
3. Commercialise and manage the commercialisation of new varieties in New Zealand, Australia and other territories.

Logical Framework

Table 1 provides a description of AP09035 in a logical framework.

Table 1: Logical Framework for Project AP09035

Activities and Outputs	• Under project AP09035, Prevar Ltd contracted the PFR Institute NZ to undertake major apple and pear breeding activities between 2009/10 and 2013/14. • The breeding process undertaken by the PFR Institute NZ is shown in Appendix 1. • Each year, a comprehensive technical plan for the breeding program was prepared by PFR and reviewed and approved by Prevar. • Through this process, and further consultation with industry and researchers, a number of breeding program targets and themes were developed by Prevar for the ongoing breeding program (see Appendix 2). • During AP09035, the primary technical development in the PFR breeding program was the development of "Whole Genome Selection" (WGS) enabling a significant reduction in the length of the breeding cycle. • Prevar also contracted the Associated International Group of Nurseries (AIGN) to undertake quarantine, propagation and testing of varieties produced on a country by country basis. AIGN's member for Australia was the Australian Nurserymen's Fruit Improvement Company (ANFIC). • During AP09035, new apple and pear varieties were entered into quarantine in 10 countries. The varieties also were evaluated, licensed and bulked up for commercial planting. • Prevar Ltd then was also responsible for the commercialisation of new varieties in Australia, NZ and other countries (such as the Unites States and United Kingdom). • Licenses were negotiated with suitable commercial grower groups for the production, promotion and sale of fruit of the new varieties. • During AP09035, two new apple cultivars (Smitten® brand PremA17 and Rockit® brand PremA96) and two new pear cultivars (PIQA®BOO® brand PremP009 and PAPPLE® brand Prem109) were released by Prevar for commercialisation in Australia. • Varieties and other project outputs were communicated to the Australian and NZ apple

	and pear industry and the scientific community through grower magazine articles, field days, peer reviewed scientific publications, and other presentations. • Overall, since 2004, Prevar has commercialised four apple and six pear varieties in four main countires – NZ, Australia, the United States, and the United Kingdom (one variety only). A full description of varieties, licensing and commercial production of Prevar cultivars in Australia can be found in Appendix 3. • Globally, some 350,000 trees of Prevar varieties have been planted to date.
Outcomes	• PFR, with ongoing support from Prevar Ltd, continues to develop new and improved apple and pear varieties for Australia, NZ and other countries. • Prevar, in conjunction with PFR, has begun a 'near-commercial' evaluation of new varieties under a stage 3 testing program on commercial orchards within Australia. Prevar will contract the Australian Pome Fruit Improvement Program Ltd (APFIP) to conduct the required evaluations and leverage learnings from NZ. • Australasian growers have planted Prevar apple and pear varieties commercialised under AP09035. • Fruit from Prevar varieties have been exported from Australia and NZ to global apple and pear markets. An estimate of the number of trees planted for each Prevar variety (and a summary of production that has occurred from licensed Prevar varieties) can be found in Appendix 4. • Prevar estimated that royalty returns for 2013/14 were NZ$163,000 (made up of tree and production royalties and access fees). • Prevar forecasts that the number of trees of Prevar varieties will increase from 350,000 (2013/14) to approximately 1.7 million globally by 2018/19 with estimated royalty income of $1 million for the same year. A summary of the commercialisation stage of each Prevar variety in various countries can be found in Appendix 5.
Impacts	• Contribution to increased profitability for the Australian apple and pear industry through the development, commercialisation and adoption of new and improved apple and pear varieties. This impact is expected to be driven by: i. Improved disease resistance of new apple and pear varieties, ii. Earlier maturing trees, iii. Improved fruit quality (including colour, flavour and texture) contributing to increased average value and increased demand, and iv. Increased demand from overseas markets for novel apple and pear varieties (e.g. red flesh apples). • Some contribution to increased revenue for APAL from royalties received by Prevar through the licensing of new and improved apple and pear varieties in countries other than Australia[(a)]. • Potentially, some contribution to reduced breeding costs through the development and implementation of Whole Genome Selection (reducing the time to produce new varieties). • Contribution to increased capital value of apple and pear genetic material in the breeding program (as yet unexploited) between 2009/10 and 2013/14. • Potentially, some contribution to improved environmental outcomes through reduced reliance on chemical treatments for pests and diseases due to improved resistance of new varieties. • Increased knowledge and scientific capacity. • Potentially, some contribution to improved regional community well-being from spill-over benefits from more productive and profitable Australian apple and pear producers.

(a) Note: from an Australian economic perspective, any royalties paid by Australian companies/growers for Prevar apple and pear varieties grown in Australia are a transfer payment and are not considered a benefit of the AP09035 investment. Royalty payments represent a cost incurred by Australian growers but a source of revenue for Prevar Ltd (partially Australian owned). Though the royalties received by Prevar contribute to the ongoing success of the Australian and New Zealand apple and pear breeding program, the monetary value of the royalties is treated as a transfer payment for the purposes of cost-benefit analysis in Australia.

Project Investment

Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project AP09035 by Hort Innovation and APAL.

Table 2: Annual Investment in the Project AP09035 (nominal $)

Year ended 30 June	Hort Innovation ($)	APAL ($)	Total ($)
2010	472,650	3,032,325	3,504,975
2011	236,325	1,516,162	1,752,487
2012	236,325	1,516,162	1,752,487
2013	236,325	1,516,162	1,752,487
2014	236,325	1,516,162	1,752,487
Totals	1,417,950	9,096,974	10,514,924

Source: AP09035 Project Agreement and Variation documents supplied by Hort Innovation 2019

Program Management Costs

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

For the APAL investment, it was assumed that the management and administration costs were already included in the nominal values reported 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 Gross Domestic Product deflator index (ABS, 2018). No additional costs associated with project extension were incorporated as the project included a high level of industry participation and a number of extension activities. Results were communicated to Apple and Pear Australia Limited and to apple and pear growers as part of the project.

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 AP09035

Economic	• Contribution to increased profitability for the Australian apple and pear industry through the development, commercialisation and adoption of new and improved apple and pear varieties. This impact is expected to be driven by: i. Improved disease resistance of new apple and pear varieties, ii. Earlier maturing trees, iii. Improved fruit quality (including colour, flavour and texture) contributing to increased average value and increased demand, and iv. Increased demand from overseas markets for novel apple and pear varieties (e.g. red flesh apples). • Some contribution to increased revenue for APAL from royalties received by Prevar through the licensing of new and improved apple and pear varieties in countries other than Australia. • Potentially, some contribution to reduced breeding costs through the development and implementation of Whole Genome Selection (reducing the time to produce new varieties). • Contribution to increased capital value of apple and pear genetic material (as yet unexploited) in the breeding program between 2009/10 and 2013/14.
Environmental	• Potentially, some contribution to improved environmental outcomes through reduced reliance on chemical treatments for pests and diseases due to improved resistance of new varieties.
Social	• Increased knowledge and scientific capacity. • Potentially, some contribution to improved regional community well-being from spill-over benefits from more productive and profitable Australian apple and pear producers.

Public versus Private Impacts

Impacts identified in this evaluation are predominantly private in nature. Private benefits are likely to be realised by Australian apple and pear producers through a net increase farm profits from producing planting new and improved Prevar apple and pear varieties and royalties to APAL from licensed Prevar varieties grown overseas.

Also, growers may benefit from reduced costs from improved disease resistance of some new Prevar varieties and there likely has been an increase in the capital value of the PFR genetic material used in the apple and pear breeding program.

Some minor public benefits also may occur and include improved environmental outcomes (through reduced chemical use), increased scientific capacity as well as increased income in Australian apple and pear growing communities/regions associated with a more profitable industry.

Distribution of Private Impacts

This impact assessment focuses on the impact to Australia. The impacts on the Australian apple and pear industry from investment in project AP09035 will be shared along the apple and pear supply chains with input suppliers, growers, processors, transporters, wholesalers, retailers and consumers all sharing impacts produced by the project according to relevant supply and demand elasticities.

Impacts on Other Australian Industries

Impacts on industries other than the Australian apple and pear industry may include potential gains to other fruit tree industries (e.g. other pome fruit such as quince) via potential future spill-overs from the increase in knowledge and scientific capacity.

Impacts Overseas

Given the international collaboration at the heart of project AP09035, Australia, NZ and other countries are likely to benefit from the new and improved varieties attributable to the AP09035 investment. However, no significant or direct impacts for countries outside of Australasia were identified.

Also, the knowledge created by the project and shared through international scientific and industry networks may result in some positive impacts for apple and pear industries overseas where similar pome breeding programs are being undertaken.

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 to Rural RD&E Priority 1 with some contribution to Priority 3, and to Science and Research Priority 1 and 2.

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 6. Resources 7. Advanced Manufacturing 8. Environmental Change 9. Health

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

Alignment with the Apple and Pear Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the apple and pear industry are outlined in the Apple and Pear Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2017). Project AP09035 addressed Outcome 1 (Strategy 1.2).

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

Valuation of Impacts

The investment in AP09035 has produced a number of economic, environmental and social impacts, including contributions to increased profitability and productivity for the Australian apple and pear industries. However, after discussions between Hort Innovation and the evaluation team, a decision was made not to value any of the specific impacts described in Table 3 above. The impacts identified are complex and also may differ by variety and, potentially, by region.

A complete, in-depth cost-benefit analysis of the investment in AP09035 would require detailed information and data including, but not limited to:

- The specific Prevar varieties of apple and pear released, and likely to be released, between 2009/10 and 2029/30 (by year and by region/country)
- A detailed understanding of the breeding investment and time associated with each new variety (for attribution assumptions)
- What the particular impact of each prospective variety is likely to be in terms of type and magnitude (e.g. specific disease resistance resulting in reduced production losses for growers in Australia and New Zealand)
- The number of trees likely to be planted, for each new Prevar variety released over time (by year and by region)
- The original apple and pear varieties that the new Prevar varieties are likely to replace
- Any additional costs involved in the adoption of each of the new Prevar varieties (e.g. additional crop management costs)
- Identification of risk factors along the pathways to adoption and impact for each new Prevar variety
- The farm gate and/or export price/price premium for each new Prevar variety across product classes

Obtaining such data is likely to be time and resource intensive and was beyond the scope of the current impact assessments under the Hort Innovation industry-specific impact assessment program.

Results

All past costs were discounted to 2017/18 using a discount rate of 5%. No impacts were valued in monetary terms; thus, the investment criteria reported were limited to the Present Value of Costs (PVC). To ensure consistency with other Hort Innovation project analyses and reporting, the PVC was reported for the length of the project investment period plus 30 years from the last year of investment (2015/16) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

Table 5 shows the investment criteria estimated for different periods of benefit for the total investment. Table 6 shows the investment criteria estimated for different periods for the Hort Innovation only. Hort Innovation investment in project AP09035 was approximately 15.3% of the total investment.

Table 5: Investment Criteria for Total Investment in Project AP09035

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Costs ($m)	16.79	16.79	16.79	16.79	16.79	16.79	16.79

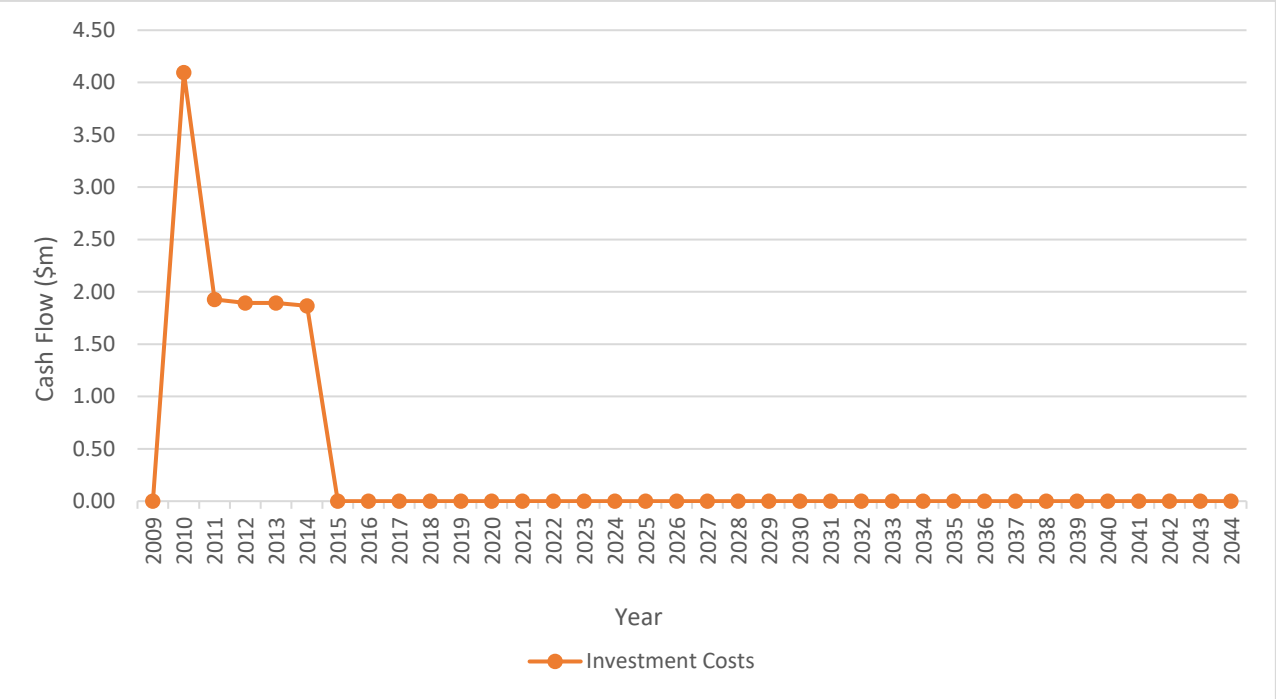
Table 6: Investment Criteria for Hort Innovation Investment in Project AP09035

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Costs ($m)	2.57	2.57	2.57	2.57	2.57	2.57	2.57

The annual undiscounted cost cash flows for the total investment for the duration of AP09035 investment plus 30 years from the last year of investment are shown in

Figure 1.

Figure 1: Annual Cash Flow of Undiscounted Total Investment Costs



Conclusion

Total funding from all sources for the project was $16.79 million (present value terms). Though a number of economic, environmental and social impacts were identified, an in-depth cost-benefit analysis of the investment in AP09035 would require a significant amount of detailed information and data associated with the specific new Prevar apple and pear varieties released, and likely to be released, between 2009/10 and 2029.30. Obtaining such data is likely to be time and resource intensive and was beyond the scope of the current impact assessments under the Hort Innovation industry-specific impact assessment program. Thus, no impacts for AP09035 were valued in monetary terms.

The investment in AP09035 has contributed to the ongoing breeding program for apples and pears in Australasia managed by Prevar Ltd. Consequently, AP09035 is likely to have contributed to improved quality and value of Australian apple and pear production resulting in increased farm profits for Australian growers.

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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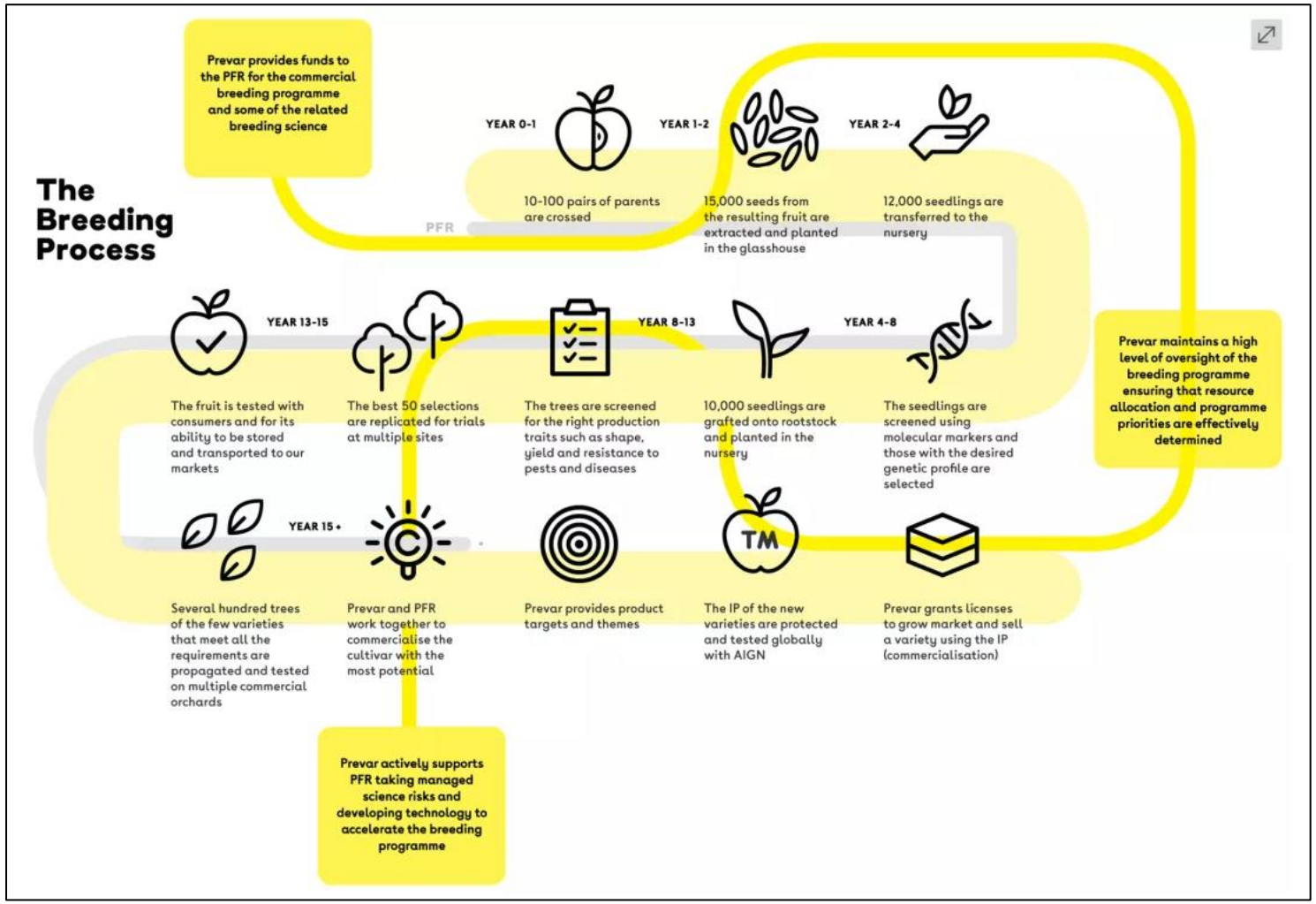
Brendan O'Keeffe, Analyst, Hort Innovation

Abbreviations

ABS	Australian Bureau of Statistics
AIGN	Associated International Group of Nurseries
ANFIC	Australian Nurserymen's Fruit Improvement Company
AP	Apple and Pear
APAL	Apple and Pear Australia Limited
APFIP	Australian Pome Fruit Improvement Program Ltd
AV	Avocado
CRC	Cooperative Research Centre
CRRDC	Council of Rural Research and Development Corporations
FGV	Farm Gate Value
Hort Innovation	Horticulture Innovation Australia Limited
MU	Mushroom
NZ	New Zealand
PFR	Plant and Food Research
R&D	Research and Development
RD&E	Research, Development and Extension
RDC	Research and Development Corporation
TG	Table Grape
WGS	Whole Genome Selection

Appendices

Appendix 1: Schematic of the PFR Institute NZ Breeding Process



Source: (Prevar Ltd, n.d.)

Appendix 2: Breeding Program Targets and Themes (AP09035 Final Report)

Figure 2: Breeding Program Targets and Themes

Apple product type	Delivery year	Projected
• Improved high quality x 3 (Achieved)	2004-2006	n/a
• Scab resistance with a range of red skin colour	2012	2013
• Improved quality, range of red skin colour	2013	2014
• Yellow skin, possibly with *Vf* resistance	2015	2017
• Early maturing, improved quality	2015	2017
• Type 2 red flesh x 2 – fast breeding	2017	2017
• Durable resistance to scab	2022	2022
• Super rich taste	2023	2023
• Type 2 red flesh – conventional breeding	2023	2023
• Type 1 red flesh – conventional breeding	2028	2028
Pear product type	**Delivery year**	
• Improved high quality x 3 (Achieved)	2004-2006	n/a
• Crisp texture + high flavour	2013	n/a
• Crisp texture + high flavour	2017	2013
• Crisp texture + high flavour + durable fire blight resistance	2022	2022
• Crisp texture + high flavour + durable fire blight resistance	2025	2025

In the table:

a) The "delivery year" was the year identified to the NZ Ministry of Business Innovation and Employment (MBIE) in the Pipfruit Research Consortium 2 (PRC2) funding application and was the target date for a cultivar to be made available to Prevar for licensing following stage 3 testing.

b) The "projected date" was the date that PFR estimated, as of May 2013 (incorporating actual test performance results to date).

Appendix 3: Summary of Licensing and Commercial Production of Prevar Cultivars in Australia

Cultivar Name	Licence Type	New Zealand	Australia	Northern Hemisphere
APPLES				
Sweetie Global	Open Release No licence is required as this cultivar has been commercially provided as "open release".	To date there are approx 12,000 Sweetie trees planted in NZ with the fruit marketed under the Genesis® trademark which is owned by Johnny Appleseed Holdings Ltd [JAS]. No further plantings in New Zealand are envisaged.	No plantings in Australia are envisaged.	There are approximately 50,000 Sweetie trees planted in the USA by Broetje's in Washington State, and approximately 10,000 trees planted in the EU. Further plantings are envisaged in both the UK and US.
Sweetie China	Non-exclusive/ brand management envisaged	n/a	n/a	In April 2010 a global master licence was granted to AIGN to further develop the commercial opportunity for this selection [AIGN, as part of the Prevar restructuring deal, retain all the Tree Royalty payments up to NZ$100K]. Prevar however, retains the commercialisation rights in China. Prevar has adopted a commercialisation project plan for Sweetie in China and in early 2011 completed some structured consumer market research in Shanghai. The Prevar Board have reviewed project progress reports on an annual basis.
Pinkie PremA119	Garden centre	An exclusive NZ licence for the garden centre has been signed with the NZFTC for this selection [known also as Pinkie]. This selection is not being actively promoted and IP protection maintenance by AIGN has been withdrawn.	n/a	n/a
PremA153	Exclusive NZ local	The NZ exclusive licensee is JAS	n/a	n/a

	market licence	under the Lemonade® trademark device which is owned by the Licensee. Some 25,000 trees are currently planted in the Hawkes Bay. [Total plantings were envisaged to reach 50,000 at the time the licence was taken out].		
Honeymoon® PremA153	Export	A number of NZ commercial entities had previously and formally indicated their interest in securing a non-exclusive export licence, but no licenses were agreed. Prevar owns the trade-mark Honeymoon® for NZ, Australia, the EU and US. Some larger count-size PremA153 apples are sold into the US and Canada by the NZ licensee under an annual licence extension agreement.	An exclusive [local market] and non-exclusive export licence has been signed with Australian Plant Management Ltd [APM]. The licensee has the right to withdraw without prejudice if they are unsatisfied with product storage life. This work will be undertaken from fruit obtained from new trees planted in 2013.	
Smitten® PremA17	Exclusive/brand management	A NZ licence has been concluded with the Seventeen Company which comprises 6 equal shareholders; namely: DM Palmer NZ Ltd, ENZA Limited, Heartland Group Ltd, Johnny Appleseed Holdings Ltd, Mr Apple New Zealand Ltd and PickMee Fruit Company Ltd. Some 110,000 trees have been planted. The 2013 actual fruit volume was 47,000 TCE. The trademark/logo Smitten® has been chosen and Prevar has sought registration in 43 countries [or in 16 territories outside but including EU27]. A brand style guide has been prepared and a website created for this selection.	An exclusive Australian licence has been concluded with Montague Fresh [Aust] Pty Ltd. • Montague's will take an inclusive approach by providing the opportunity for non-aligned growers to plant the variety. • A planting of 105,000 trees must be achieved by 31 October 2017. There is no maximum planting limit. • At any time after 31 March 2020, Prevar may instigate a tree planting review via a prescriptive process using an independent reviewer whose decision will be binding on both parties. Montague's will have the first opportunity to	A number of Northern Hemisphere Licenses have now been signed including: • Pegasus Premium Fruit Company, WA, USA have signed an exclusive licence for the US territory with prescribed plantings over the next decade. An initial planting of 50,000 trees was undertaken in 2013 . Total plantings of 250,000 are required by 2017; the licensee has a first option to increase plantings up to 750,000 by 2023. • World Wide Fruit Ltd and Empire World Trade; both located in the UK, have signed non-exclusive UK-territory licenses. They are required to

			either plant further trees [if this is the review outcome] or arrange for a third party to do so. • Montague's can withdraw without prejudice up to 3 years after signing; this provision supports ongoing cultivar testing. Prevar has the right to demand tree removal in such a circumstance.	plant a minimum of 15,000 trees by 2017 with a maximum planting of 50,000 trees.
PremA96	Exclusive	The Havelock North Fruit Company has an exclusive global licence to commercialize the high added-value, specialized market niche apple PremA96 with the trade-mark name Rockit® which is owned by the Licensee. The licensee has attracted angel investment to further protect its packaging and branding IP plus research and development funding from the NZ MBIE [formerly the Ministry of Science & Innovation]. The Licensee is currently negotiating sub-licenses in most of the major apple-growing territories in the world. A significant orchard-development is underway in NZ to increase the available production volumes to meet existing market demand. The licensee recently reworked approximately 85,000 trees to this cultivar on company-owned and leased properties	The Havelock North Fruit Co has exclusively sub-licensed Lenswood Cooperative with the rights to grow, market and sell the Rockit® brand PremA96 apple. 200,000 tree target.	Sublicenses have been granted in Belgium, Scandinavia, Italy and the USA. Licensing negotiations are making good progress in other parts of Europe.
PEARS				

Velvetine® PremP33	Non-exclusive/brand management	Prevar finalised a non-exclusive NZ licence for this pear with ENZA in early 2011. The pear will be marketed using the brand name Velvetine™. This trademark is currently owned by Prevar in NZ, Australia, and EU27 and is sought in the US.	APM have signed a non-exclusive licence; should variety trials be successful a comparatively small tree planting of 5,000 trees is required.	World Wide Fruit/ UK have signed a non-exclusive licence for the UK territory.
Interspecific Pears [ISP]	A brand name has been registered (PIQA®) that will be used with the family of interspecific pears being developed. PIQA will be used in the brand names for each of the new products e.g. PIQABOO etc. For PremP009 (to be sold as PIQA® BOO® negotiations are almost complete with Freshmax P/L for an exclusive Australian licence. The licence contemplates the planting of at least 200,000 trees over 7 years. Freshmax has the right to withdraw without prejudice for poor agronomic performance after 5 years. Prevar has concluded an exclusive 10 year testing and option licensing agreement for the interspecific pears with World Wide Fruit for the UK territory			
Papple® PremP109 & Interspecific Pears [ISP]	Exclusive/brand management	A global exclusive licence has been granted to AIGN as part of the Prevar restructuring. A branded, variety managed, programme will be undertaken with AIGN owning their own brand for this particular selection. The AIGN members in NZ and Australia will have marketing and growing plus sub-licensing rights.	ANFIC have concluded an exclusive licence with Silvadore Pty Ltd. 30000 trees of PremP109 are expected to be planted in the next few years with total tree numbers of 60000 to 80000 possible	AIGN have concluded an exclusive sub-licence with World Wide Fruit/UK for the PremP109 selection in this territory. Prevar has finalised an exclusive licence for the PremP003 and PremP027 pears in the US.

Source: AP09035 Final Report (March 2014)

Appendix 4: Global Tree Plantings and Estimated Fruit Production from Licensed Prevar Varieties

Variety	Australia	New Zealand	USA	EU	Total
Sweetie™	5,000	12,000	50,000	10,000	77,000
PremA17		110,000	40,000	5000	155,000
PremA153	3000	25,000			28,000
PremA193		nil			nil
PremA96		85,000			85,000
PremP109		4,500			4,500
PremP33		6,300			6,300
Total	**8,000**	**241,800**	**90,000**	**25,000**	**355,800**

Source: AP09035 Final Report (March 2014)

New Zealand is the only territory where licensed fruit production has occurred.

Table 6: fruit production from licensed Prevar varieties

Variety	***Estimated*** **Production for 2014**
PremA153	400 tonnes plus
PremA17	740 tonnes plus

Sweetie is an open release variety and there is no obligation on producers to report fruit production to Prevar so no volume report is available for this variety.

Source: AP09035 Final Report (March 2014)

Appendix 5: Summary of Commercialisation Stage for Prevar Varieties in Various Countries

DENOMINATION	TRADE MARK	AUSTRALIA		ARGENTINA		BELGIUM		FRANCE		CHILE		CHINA	
		CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.
PremA280	SWEETIE®	4	4	2a/2b	2a/2b	4	4	4		2a/2b	3a	3a	3b
PremA153	HONEYMOON®	2b	3a	2a/2b	2a/2b	3a	3a	3b		2a/2b	3a	0	0
	ENVY			2a/2b				0		1			
PremA96	ROCKIT®	2a	4	2a/2b	2a/2b	3a	4	3b	4	2a/2b	3a	2a	3a
PremA17	SMITTEN®	2a	2b	2a/2b	2a/2b	3b	4	4		1	2a/2b	2a	3a
	NELLIE	2a	2a	2a/2b	2a/2b	3a	3a	3a		1	2a/2b	0	0
PremP36	CRISPIE	2a	2a	2a/2b	2a/2b	3a	3a	3a	5	0	1	3a	3a
PremP45	MAXIE	2a	2a	2a/2b	2a/2b	2b	2b	3a	5	0	1	0	0
PremP33	VELVETINE®	2a	2a	2a/2b	2a/2b	2b	3b	3a	3b	2a/2b	3a	0	0
PremP109	PAPPLE®	2b	3a	0	1		3b	3a	3b	1	2a/2b	2a	3a

DENOMINATION	TRADE MARK	NEW ZEALAND		RSA		U.S.A.		URUGUAY		S. KOREA	
		CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.	CURRENT	ANTICIP.
PremA280	SWEETIE®	4	4	2b	2b	4	4			0	
PremA153	HONEYMOON®	4	4	2b	2b	3a	3a			0	
	ENVY			dead		2b					
PremA96	ROCKIT®	4	4	1	1	2b	4			1	
PremA17	SMITTEN®	4	4	2a	2b	3a	4	1	1	0	
	NELLIE	2b	2b	2a	2b	2b	3a			0	
PremP36	CRISPIE	4	4	0	0	3b	4			0	
PremP45	MAXIE	4	2b	2a	2b	3b	4			0	
PremP33	VELVETINE®	4	4	2a	2b	3a	3a			0	
PremP109	PAPPLE®	4	4	0	1	3a	4			1	2a

Source: AP09035 Final Report

Stage Codes:

- 0: not imported
- 1: Quarantine
- 2a: in Foundation Nursery
- 2b: Primary Test Site (Foundation Block)
- 3a: Secondary Test Sites
- 3b: Pre-commercial Test Sites (larger sites)
- 4: Fully commercial
- 5: Abandoned/Removed