Almond

STRATEGIC INVESTMENT PLAN

2017-2021

Horticulture Innovation Australia

Content

Communications Manager
Horticulture Innovation Australia Limited
Level 8, 1 Chifley Square
Sydney NSW 2000
Australia
Email: communications@horticulture.com.au
Telephone: 02 8295 2300

Introduction

This Strategic Investment Plan (SIP) is the roadmap that helps guide Hort Innovation's oversight and management of individual levy industry investment programs. The SIP lays the foundation for decision making in levy investments and represents the balanced interest of the particular industry from which the levy is collected. The very important function of the SIP is to make sure that levy investment decisions align with industry priorities.

Horticulture Innovation Australia Limited (Hort Innovation) is the not-for-profit, grower-owned research and development (R&D) and marketing company for Australia's $9 billion horticulture Industry.

As part of the role Hort Innovation plays as the industry services body for Australian horticulture, the organisation is tasked by the Australian Government with working alongside industry to produce a strategic plan for investment of levies in industry R&D and marketing activities.

Each individual levy industry investment strategy also speaks to the future growth and sustainability of the Australian horticulture industry, as a whole. The SIPs are produced under the umbrella of the Hort Innovation Strategic Plan, which takes a whole of industry view in setting its direction, as it considers broader agriculture government priorities for the advancement of Australian horticulture.

The process in preparing each SIP was managed by Hort Innovation and facilitated in partnership with Industry Representative Bodies and Strategic Investment Advisory Panels (SIAP). Independent consultants were engaged to run the consultation process, to gather the advice from stakeholders impartially and produce a plan against which each levy paying industry can be confident of its strategic intent.

Hort Innovation has valued the support, advice, time and commitment of all stakeholders that contributed to producing the SIPs, especially almond growers.

The almond SIP

Producers in the almond industry pay levies to the Department of Agriculture and Water Resources (DAWR), who is responsible for the collection, administration and disbursement of levies and charges on behalf of Australian agricultural industries.

Agricultural levies and charges are imposed on primary producers by government at the request of industry to collectively fund R&D, marketing, biosecurity and residue testing programs.

Levy is payable on almonds that are produced in Australia and either sold by the producer or used by the producer in the production of other goods.

Hort Innovation manages the almond levy funds which are directed to R&D investments. The R&D levy is set at a rate of 1 cent per kilogram for almond in shell, 2 cents per kilogram for shelled almonds and 1.5 cents per kilogram for almonds in shell (Nonpareil). In 2015/16 total almond R&D levy receipts were approximately $1.5 million. The R&D levy is matched by the Australian Government. The almond industry has a voluntary fund for marketing. The voluntary marketing levy is not managed by Hort Innovation and is not dealt with in this SIP.

In addition to levy funds for R&D the almond industry has established a Collective Industry Fund (CIF)[1] being an additional voluntary grower contribution to manage development of future production systems best suited to Australian growing conditions. External to Hort Innovation, contributions to this project are also being made by the South Australian and Victorian Governments with matching contributions by the Australian Government through the 'Rural Research for Profit' project *Advanced Production Systems for Temperate Nut Industries*.

Hort Innovation has developed this SIP to assist in strategically investing the collected almond levy funds in the priority areas identified and agreed by the almond industry. The ability to deliver on all the articulated strategies (and investments) in an impactful manner will be determined by the ability of the statutory levy to provide the resources to do so. The SIP is also mindful of R&D investments through other pools and programs.

This plan represents the Australian almond industry's collective view of its R&D needs over the next five years (2017 to 2021). This plan has been developed in consultation with Australian almond levy payers through a synthesis of pre-planning tailored for the almond industry, preparation including researching inputs for the strategy, execution to create the strategy and validation including the opportunity for levy payers to comment on the draft SIP.

The process used to develop this plan is fully described in ***Appendix 1***. The people consulted in the preparation of the plan are listed in ***Appendix 2*** and the documents referred to are listed in ***Appendix 3***.

The almond SIAP has responsibility for providing strategic investment advice to Hort Innovation. Both Hort Innovation and the panel will be guided by the strategic investment priorities identified within this plan. For more information on the almond industry SIAP constituency please visit Hort Innovation's website at www.horticulture.com.au.

1 The Collective Industry Fund is managed by Hort Innovation.

Almond

STRATEGIC INVESTMENT PLAN 2017-2021 AT A GLANCE

POTENTIAL IMPACT OF THIS PLAN

$183 Million

Based on an estimated investment of $14.53 million over the next five years.

Major opportunities

- Additional growth in Australian almond sales to Asia
- Further research and promotion of the health benefits of consuming almonds – almonds are an excellent source of protein, vitamin E, dietary fibre and mono-saturated fat
- Additional strategic links with the Californian and Spanish industries to shortcut technology evaluation and share almond production, processing and marketing knowledge.

Major challenges

- Increased production may threaten current profitable almond prices
- Volatile Australian dollar making Australian product expensive relative to that sourced from California
- Newly emerged pest and disease problem that has resulted in a major increase in serious defects in harvested almonds
- A heavy reliance on honey bee for pollination
- Significant user of irrigation water – 600 gigalitres per annum forecast by the time this plan has been fully implemented (ABA 2016).

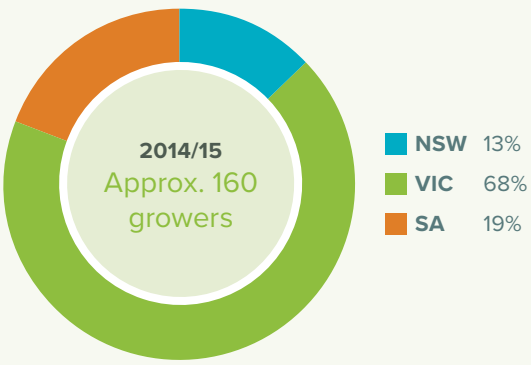
OUTCOMES	STRATEGIES
Pest and disease damage to almonds has been reduced through enhanced integrated pest management (IPM) and integrated pest disease management (IDM)	Reduce damage caused by pests by further enhancing the industry's IPM with a key R&D focus on Carpophilus Beetle, Carob Moth, emerging stored almond pests and orchard floor hygiene
	Reduce damage caused by diseases by further enhancing the industry's IDM, transferring knowledge from other industries and a key focus on Hull Rot
	Ensure IPM and IDM are adopted by growers that account for 90 per cent of almond volume
	Maintain industry's biosecurity preparedness
A major productivity gain in almond pollination by 2022 through a 25 per cent reduction in bee stocking rates with no loss in pollination efficiency (nut set)	Develop and maintain a robust honey bee pest and disease incursion response including efforts to keep Australia free of *Varroa destructor* and similar exotic honey bee pests
	Improve the productivity of honey bees as pollinators and the efficiency of almond pollination
	Develop pollination capacity in the honey bee industry

Almond
STRATEGIC INVESTMENT PLAN 2017-2021
AT A GLANCE

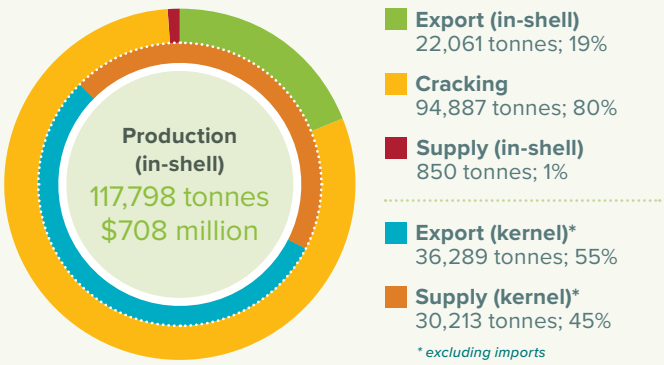
OUTCOMES	STRATEGIES
An almond industry crop production system that supports further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards and has lifted average industry yield from 3 to 4 tonnes per hectare. This will include new almond varieties featuring self-fertility and sealed shells, a new nursery accreditation scheme, 4 megalitres of irrigation water per tonne of almond kernel yield and proven 'shake and catch' harvesting and postharvest systems	Undertake an evaluation of varieties originating from the almond breeding program, direct import and older varieties from California. Evaluate rootstocks under Australian conditions
	Maintain disease free and diverse genetic material
	Develop a standard for trees sold by nurseries
	Ensure the nursery industry is accredited to supply quality trees consistent with the standard
	Continue to improve the on-farm efficiency of almond industry water use
	Understand the almond industry's future in relation to irrigation demand 'big picture'
	Deliver improved soil health to Australian almond orchards
	Support further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards to better understand how the combination of soil health, nutrition, tree architecture, plant physiology and orchard design is integrated
	Develop improved harvesting techniques
	Develop improved postharvest handling techniques
	Leverage R&D investment in other pools and programs to deliver novel technology relevant to the almond industry

OUTCOMES	STRATEGIES
An informed industry that adopts R&D outcomes and has the capacity to support current and future industry needs	Support adoption of R&D outcomes by effective extension
	Deliver meaningful data on production, planting, environmental performance, international supply and demand in a timely manner
	Ensure industry stakeholders remain engaged through an effective communications program
	Enhance skills and capacity to support current and future industry needs
	Engage with the international nut industry to maximise R&D and marketing innovation
Increased domestic consumption from 16,000 tonnes in 2016 to 27,500 tonnes in 2022. Increased export sales from 64,000 tonnes in 2016 to 110,000 tonnes in 2022. European Union inspections reduced from one in twenty containers to one in one hundred containers at destination by 2022	Invest in domestic and export market development
	Market research and insights to help industry increase domestic almond consumption
	Facilitate Australian almond exports through market research and improved market access
	Further enhance Australia's reputation for safe, high quality almonds

Industry size and production distribution



Almond supply chain and value 2014/15



1

SECTION ONE

Context

The Australian almond industry

Growing regions

- Australian almonds are predominantly grown along the Murray River corridor. Australia has five major almond producing regions. These are Adelaide Plains, SA; Riverland, SA; Riverina NSW; Sunraysia VIC; and the Swan Region, WA
- Almonds require a Mediterranean climate – cold winters during dormancy and warmer summers to develop the nut. Almonds must have access to suitable land and water. Production is dependent on access to managed honey bees for pollination. Worldwide there are limited regions where these prerequisites come together and almonds can be grown successfully on a commercial basis.

Growing season

- Australia's almond growing season commences with the almond blossom in August each year. Harvest takes place from February to April, with produce ready for the market from April (*Hort Innovation Working Paper 1*, June 2016).

Investment in almonds

- The Australian almond industry has approximately 160 growers farming 30,000 hectares (Almond Board of Australia (ABA) 2016). It includes small growers (less than 15 hectares of orchard) but output is dominated by large scale corporate investment. Small growers often require different solutions to industry issues (ABA 2016, personal communication). Small growers may be new to the industry and need training. Small growers bring skills from other industries that may benefit almond production. Corporate investment accounts for more than 90 per cent of Australian almond production.

Almond plantings

- Almond trees take three years to bear a crop and around seven years to reach mature production levels that average around 3 tonnes per hectare. With 7.9 per cent of plantings not yet bearing and 8.2 per cent of bearing trees not yet fully mature, the industry's production will continue to increase regardless of future plantings (*Almond Insights 2015-16*).

Industry growth

- Almond production area is forecast to increase from 30,000 hectares in 2016 to 45,000 hectares in 2019 – 14,200 hectares confirmed plus 4,000 hectares potential i.e. land and water set aside for almond production but trees not yet purchased (Ross Skinner, ABA June 2016). Almonds are one of the fastest growing horticultural industries in Australia. The Australian almond industry is one of the fastest growing in the world.

Almond production

- When the last SIP was prepared in 2009 the industry had a harvest of 36,500 tonnes. By 2015, almond harvest had increased to 75,000 tonnes (*Almond Insights 2015-16*). In March 2016, an 82,500 tonne crop was realised. A conservative forecast for the year 2020/21 crop is for an Australian almond harvest of 130,000 tonnes.

Value of almond industry

- The Australian almond industry is a significant sector in the Australian horticultural industry. In 2016, the farm-gate value of almonds was $1 billion (*Almond Insights 2015-16*). Current planted acreage and processing infrastructure represents a total investment of approximately $2.75 billion (*SIP update 2009*)
- The growing, harvesting, transporting, storage, processing, value adding and marketing of almonds is a major contributor to the economic and social wellbeing of the Sunraysia and Riverland districts (*Almond Strategic Plan 2010-15*).

Demand for almonds

- Global demand for almonds has increased from 400,000 tonnes in 2002 to more than 1,000,000 tonnes in 2016 (Ross Skinner, ABA June 2016). This growth trend is expected to continue over the life of the 2017-2021 SIP. Growth is driven by a strong positive health message combined with taste and use versatility in established markets and growing demand from developing markets. India, China and the Middle East are driving growth in world consumption.

- With this said the fundamentals of economics apply to the almond industry – a rapid rise in global price during 2015 was matched by a corresponding decline in sales (*Almond Insights 2015-16*)
- Almonds offer a unique mix of nutrients and have been clearly linked with improved heart health. Almonds are key ingredients in an array of products including snack foods, confectionery, baking goods, breakfast cereals and desserts
- In 2015/16 there were 297 new products launched in Australia using almonds as an ingredient. Almond milk outsells soy milk and is the largest selling plant based dairy substitute (*Almond Insights 2015-16*).

Value chain

- The Australian almond industry is comprised of a value chain that spans investors, almond growers through to end retail consumers and export markets
- A number of the larger Australian growers have become vertically integrated and encompass processing, packing, domestic and export marketing.

Global almond production

- Almond production is led by major world producer California and almost 80 per cent of world production originates in California. The Californian industry invests heavily in export development and Australia benefits from resultant market growth. Other significant global producers include Australia (7.7 per cent of world production), Spain (6.1 per cent) and Chile (1.2 per cent).

Growth in nut supply

- While large United States almond grower Wonderful (Paramount) removed 4,000 hectares of older orchard in 2015 and United States production has been affected by record drought, the market may have lost sight of the fact that 40,000 hectares of new almonds were also planted in California in 2015. When the drought breaks, the United States will generate a significant increase in world almond supply
- Spain has been a traditional low input, rain fed industry supported with subsidies. It is based on closed shell varieties which produce insect damage free, high quality almonds. The Spanish government has encouraged increased Spanish production including provision of a new dam with 30,000 hectares of irrigated land. A share of this new irrigated land will be planted to almonds. Consequently, industry should expect an increase in the supply of high quality nuts from Spain during the life of this plan
- With the rapid growth of the Australian, United States and Spanish almond industries underway in an environment of strong growth in other nut industries, there is a need to quickly build demand for Australian almonds and to compete with other nuts for manufacturer and consumer preference at viable prices (ABA 2016).

Markets and consumers

- Greater than 90 per cent of almonds consumed in Australia are grown, processed and packaged by Australian farmers (Hort Innovation *Working Paper 1*, June 2016)
- Domestic almond consumption has increased from 674 grams per capita in 2008 to 971 grams in 2015
- The industry has a strong export focus. In 2015 some 60,000 tonnes from a total production of 75,000 tonnes was exported and had a value of $745 million. Some 40 per cent of total sales went into Asia with the largest share directed to the Indian subcontinent. A further 40 per cent of Australian almond exports went to Europe. The Middle East and Africa accounted for 13 per cent of Australian almond exports and seven per cent were directed to the Americas (*Almond Insights 2015-16*).

Competitors

- Australian grown almonds can be substituted with almonds grown in California or Spain. Australia is able to differentiate its product on the basis of quality and seasonal freshness, offering fresh nuts when northern hemisphere supplies are not available
- The Australian almond industry is internationally competitive on quality and cost. The industry operates in international markets without production or export subsidy. There are no tariffs on imported almonds
- In the broadest sense, market place competition for Australian almonds includes products from other nut industries, snack foods of all types and even dairy (Ross Skinner, ABA June 2016).

Collaboration

- The Australian almond industry collaborates on joint projects with other temperate nut industries, for example, walnut, hazelnut and chestnut on 'Advanced Production Systems for Temperate Nut Industries', and marketing initiatives with additional nut industries, for example, 'Nuts for Life' (which includes subtropical species such as macadamia)
- The almond industry links with the Spanish and Californian industries. Collaboration with the Spanish industry includes the sharing of hard shell varieties and rootstocks. Work with the Almond Board of California includes access to United States research on human health benefits, food safety, honey bee hive health and pollination efficiency, tree nutrition and disease management.

Environmental scan

- The results of an environmental scan are shown in ***Appendix 5***. The environmental scan was completed through review and classification of issues brought to the attention of the ABA Board between August 2013 and May 2016
- Standout issues subsequently identified by the ABA include: pollination, food safety, pests and diseases which have emerged since the last SIP was prepared in 2011 (ABA 2016). Prior to 2011 drought, water allocation and water price drove almond cost of production.

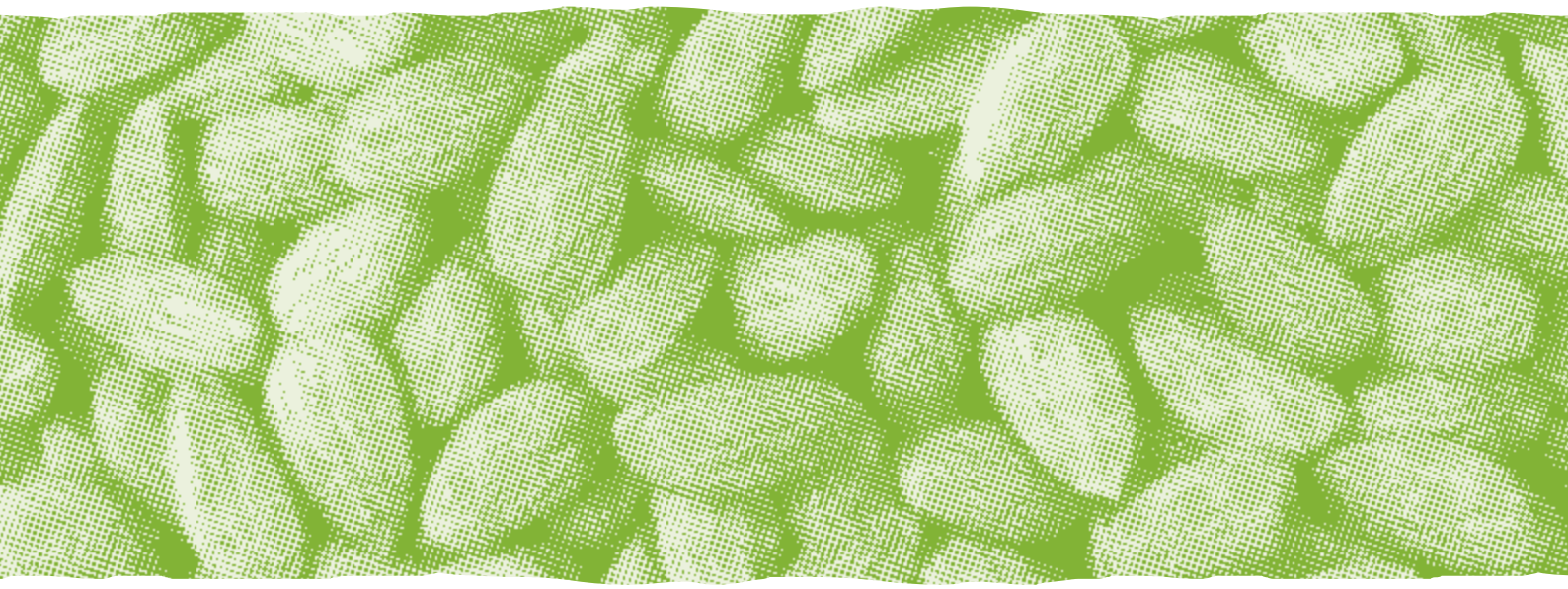
Almond industry risk analysis

Almond industry risks are summarised in ***Table 1***. The risk analysis was prepared following industry consultation and consideration of the risk summary table presented in the *Australian Almond Industry Strategic Plan 2010-2015*.

Critical industry risks most relevant to R&D and extension planning relate to pollination, water, growth in almond supply and a food safety/contamination event.

Table 1: Risk analysis

No.	Risk	Most likely scenario	Adverse scenario
1	A sustained increase in the cost of pollination arises	High	High
2	Constrained access to water	Medium	High
3	World supply of almonds grows significantly faster than demand	Medium	High
4	A major food safety/contamination issue with resultant public awareness	Medium	High
5	Significant increase in Californian production	Medium	High
6	Increase in the value of the Australian dollar	Medium	Medium
7	Supply of high quality planting material falls short of industry demand	Low	High
8	Availability of economically priced fertilisers/chemicals	Low	High
9	Pest/disease incursion	Low	High
10	Loss of R&D matching funding	Low	High
11	Inability to compete in international markets due to non-compliance	Low	High
12	A new low cost entrant changes global supply dynamics (for example, China)	Low	High
13	Inability to compete in export markets due to access/trade barriers	Low	High
14	Long-term climate change trend resulting in unsuitable weather conditions	Low	High
15	Shortage of skilled labour	Low	Medium
16	Shortage of unskilled labour	Low	Medium
17	Decline in international almond industry cooperation and collaboration	Low	Medium
18	Major interruption or supply problem in the supply chain	Low	Medium
19	Environmental lobby limits almond industry's 'licence to operate'	Low	Low
20	Industry fragmentation/lack of cohesion	Low	Low



Operating environment

The results of the industry summary, environmental scan and risk assessment are summarised in a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis – ***Table 2***.

Table 2: SWOT analysis results

The almond industry	
Strengths	• A Mediterranean climate with access to suitable supplies of water and land – these conditions are only available in a few locations anywhere in the world • Mechanised production that offsets the high cost of labour and holds back other Australian horticultural industries • An industry that is internationally competitive on cost. It operates in international markets without production or export subsidy. There are no tariffs on imported almonds • Comparative advantage on product quality compared to California (but partially eroded by insect damage, product staining and food safety concerns post-2011 (ABA 2016)) • Production and processing owned by well-resourced, organised and cooperative corporate entities • An effective industry development program (extension) and data sets that deliver industry insight • Linkages with Spain and the Almond Board of California – collaborative research, knowledge sharing and leadership to drive international marketing (ABA 2016) • An industry with innovative drive that attracts collaboration, staff and funding resources (ABA 2016) • A product with high integrity – the industry is open and honest with its customers and takes seriously concerns about food safety.
Weaknesses	• A newly emerged pest and disease problem that has resulted in a major increase in serious defects in harvested almonds • A heavy reliance on the honey bee pollination which is vulnerable to pests (*Varroa destructor*) and diseases (American Foulbrood), is of variable quality and is increasing in cost • Cost disadvantage compared to the California almond industry on some key inputs (chemicals, fuel, energy, water, fertiliser, machinery, transport), services, interest rates and exchange rate volatility (ABA 2016) • Current production systems developed in California and unsuited in a number of ways to Australian growing conditions (ABA 2016) • Significant user of irrigation water – 600 gigalitres per annum forecast by the time this plan has been fully implemented (ABA 2016) • A harvest that is long, inefficient and conducive to food safety problems.
Opportunities	• Additional growth in Australian almond sales to Asia • Further research and promotion of the health benefits of consuming almonds – almonds are an excellent source of protein, vitamin E, dietary fibre and mono-saturated fat • Additional strategic links with the Californian and Spanish industries to shortcut technology evaluation and share almond production, processing and marketing knowledge.
Threats	• Increased production may threaten current profitable almond prices • A major new producing country emerges with a very low cost of production • Almonds may have reached their maximum 'share of stomach' in Australia at almost 1 kilogram per capita (additional sales will continue to come from export markets) • Return to a high Australian dollar making Australian product expensive relative to that sourced from California • High reliance on water availability.

Horizon 1, 2 and 3

Horizon analysis developed by the ABA provides additional insight into the industry's longer term thinking and a guide for R&D and extension planning:

- Horizon 1 – improving the current production system that dominates existing plantings. Current system based on Californian varieties and technologies
- Horizon 2 – development of a production system based on twice the density of trees down a row that offers higher returns earlier in an orchard's life
- Horizon 3 – development of a production system best suited to Australian growing conditions that improves yields and input efficiency whilst reducing risks.

Three horizon investment planning requires a long-term holistic approach rather than simply addressing problems as they emerge in current orchards. The three horizon approach has been considered in developing the almond SIP 2017-2021 and has at its core an Australian Government 'Rural Research for Profit' project jointly funded by the Australian Government, an industry CIF and the Victorian and South Australian Governments. The 'Rural Research for Profit' project is titled *Advanced Production Systems for the Temperate Nut Industries* and will be used to establish the Almond Centre Experimental Orchard.

The Almond Centre Experimental Orchard will become the focal point for orchard research:

- Accelerating the evaluation of new varieties – including closed shell varieties
- Rootstocks – especially dwarfing types for creation of smaller trees/intensive orchards
- Planting densities – higher densities for ease of management and resource use efficiency
- Soil health – orchard floor management, ideal soil, soil ameliorates, the potential for incorporation of hull waste to improve water holding capacity
- Improve nutrient management – nutrition efficiency trials
- Water use efficiency – irrigation efficiency trials
- Capacity to manage a variable climate and extreme weather events
- Intensive orchards – smaller trees, ultra-high density plantings, advanced tree architecture, managed on a vertical plane to maximise sunlight interception
- Improved harvesting – on-farm hulling, use of smaller 'shake and catch' machines along with investigation of alternative harvesting technologies
- Postharvest techniques – to enhance product quality
- Climate change and extreme weather events.

This SIP recognises the importance of these planned investments.

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SECTION TWO

Almond industry outcomes

Industry outcomes

The key aspiration of the almond industry is to lead as a profitable industry in the efficient production, processing and marketing of quality almonds and secure a position of preferred supplier. This SIP aims to optimise profitability through innovation. Outcome statements have been prepared for five key areas identified and prioritised by the almond industry.

OUTCOME 1

Pest and disease damage to almonds has been reduced through enhanced IPM and IDM

- Pest and disease pressure can reduce almond yields below the threshold for profitable crops
- Australia's historical low pest and disease threshold is an important source of cost advantage
- Insect pest damage produces serious defects, reduces prices received by growers and the premium paid for Australian almonds
- Australia is used to receiving a premium for its almonds and while this premium is less significant when world supplies are tight, it will become vital when world production increases
- Industry has confidence it can reduce serious defects to internationally competitive levels with appropriate R&D, similar technologies have been developed for the summerfruit industry
- Infrastructure is in place to easily measure reduction in serious nut quality defects. Baseline defect levels are available but have not been included in this document as they are commercially sensitive
- Past and present research has addressed pest and disease management but continuous investment is required to deliver the outcome sought by industry
- Grower consultation revealed that R&D to reduce serious defects in almonds postharvest would have the highest impact on profitability and is critical to the future competitive position of the industry
- Pest and disease management was identified as one of the three highest SIP program priorities

OUTCOME 2

A major productivity gain in almond pollination by 2022 through a 25 per cent reduction in bee stocking rates with no loss in pollination efficiency (nut set)

- In the absence of honey bee pollination, nut set is minimal and no commercial yield is achieved
- Pollination services are a significant and increasing cost to almond growers and the supply of hives and their productivity is inconsistent. There is scope to make major improvements in pollination efficiency
- The biosecurity threat of *Varroa destructor*, similar exotic pests and pest bees cannot be overstated
- The almond industry has been a major funder of honey bee biosecurity and pollination research and further investment both inside and outside the levy funded program was identified as a priority by industry. Levy funded R&D provides a vital link between efforts in other programs and realisation of a major productivity gain in almond pollination
- Ongoing and substantial investment in pollination productivity aimed at improving colony strength and reducing honey bee stocking rates is particularly important given the high share of managed hives the almond industry already draws on for pollination and planned industry growth
- Growers consulted in the preparation of this SIP indicated that levy funding of pollination R&D was the highest program priority for their industry
- Pollination was identified as one of the three highest SIP program priorities.

OUTCOME 3

An almond industry crop production system that supports further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards and has lifted average industry yield from 3 to 4 tonnes per hectare. This will include new almond varieties featuring self-fertility and sealed shells, a new nursery accreditation scheme, 4 megalitres of irrigation water per tonne of almond kernel yield and proven 'shake and catch' harvesting and postharvest systems

- Crop production from planting to postharvest management encompasses:
  - » Evaluation of new varieties already generated by the levy funded almond breeding program
  - » Further incremental improvements in on-farm water use efficiency – a major crop production cost for the almond industry
  - » Improved and consistent quality nursery stock to shorten the time between tree purchase and production and increase grower return on investment
  - » Improvement to harvest and postharvest systems to move from a ground based recovery operation with its attendant food safety risks to integrated 'shake and catch', product dehydration and storage in 'food safe' silos/sheds
  - » Continuous monitoring of innovative sensor and mechanisation research that may have potential for large 'game changing' industry productivity benefits
- Investment in this outcome will further improve Horizon 1 production systems while accelerating the commercial viability of Horizon 3 production systems
- Crop production was identified as a medium SIP program priority. Product integrity/food safety was described as one of three highest SIP program priorities.

OUTCOME 4

An informed industry that adopts R&D outcomes and has the capacity to support current and future industry needs

- Industry development and data insights encompasses:
  - Adoption of knowledge and technologies using successful systems and proven pathways
  - Insightful and established data collection and reporting protocols with the addition of environmental performance reporting to assist with the marketing of the Australian almond crop
  - Continuation of engaging communication programs that are well regarded by growers
  - Skill and capacity development to meet the industry's growing needs and with particular emphasis on training future orchard managers
  - Maintaining the quality of international networking and the personal and industry insights that are gained from funding international study trips. Funding opportunities need to be made available to smaller growers who have less capacity to self-fund
- The building of an innovation culture within the Australian almond industry is noted as is the recognition of the strong relationships between Australia, the United States and Spain that facilitates the exchange of knowledge and drives innovation that moves the global industry forward
- The Australian almond industry being a collegiate and high performing industry continues to invest in skills and leadership development. The industry understands that human capacity is vital to profitable performance
- Industry development and data insights were identified as a high program priority.

OUTCOME 5

Increased domestic consumption from 16,000 tonnes in 2016 to 27,500 tonnes in 2022
Increased export sales from 64,000 tonnes in 2016 to 110,000 tonnes in 2022
European Union inspections reduced from one in 20 containers to one in 100 containers at destination by 2022

- Market research informs industry marketing programs which increase the value and volume of Australian almond sales. The R&D levy does not fund marketing programs
- The almond industry has achieved strong growth in the value and volume of its sales. In 2014/15 the Australian almond industry reached a farm-gate value of $1 billion. Further market growth is essential if the industry is to find profitable buyers for known supply increases 2016 to 2022
- Known supply increases will originate in Australia, Spain and particularly the United States where drought recovery combined with the recent large orchard expansion in California will work to reduce prices unless demand can be developed. Grower viability is largely dependent on developing markets. Unlike the past, when demand has grown strongly to keep up with the increased supply, future market development will occur during a period when the global production volumes of all nut varieties will be increasing rapidly
- Research completed to achieve market growth/product integrity will address the:
  - Domestic market especially the creation of the knowledge base needed to communicate the health benefit of almond consumption
  - International market with a focus on understanding emerging almond buyers and improved market access
  - Product integrity especially research to further understand and address bacterial and aflatoxin food safety risks. Product integrity research may include packaging to improve shelf-life and consumer satisfaction
- Domestic and export market growth was identified as a high program priority by growers. The program of work described in this SIP for product integrity/food safety was identified as one of three highest SIP program priorities.

SECTION THREE

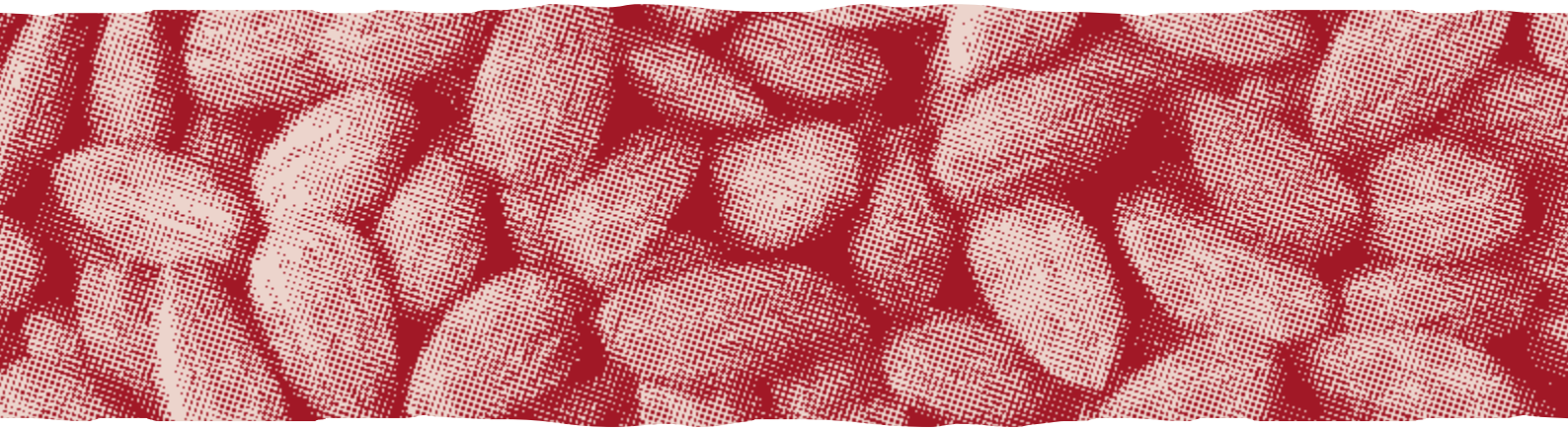
3 Almond industry priorities

Industry investment priorities

Strategies and possible deliverables associated with each industry outcome are provided in this section. The ability to deliver on all the articulated strategies (and investments) in an impactful manner will be determined by the ability of the statutory levy to provide the resources to do so.

OUTCOME 1 – Pest and disease damage to almonds has been reduced through enhanced IPM and IDM	
STRATEGIES	**POSSIBLE DELIVERABLES**
Reduce damage caused by pests by further enhancing the industry's IPM with a key R&D focus on Carpophilus Beetle, Carob Moth, emerging stored almond pests and orchard floor hygiene	• IPM for Carpophilus Beetle which augments current chemical spray (Talstar) and better protects beneficial insects • Cost effective IPM for Carob Moth • Effective and safe postharvest handling and fumigation techniques to reduce serious defects arising from existing pests and pests emerging from grain storage, for example Rust Red Flour Beetle, Indian Meal Moth • Techniques to manage orchard floor hygiene that better control Carpophilus Beetle and Carob Moth in large orchards
Reduce damage caused by diseases by further enhancing the industry's IDM, transferring knowledge from other industries and a key focus on Hull Rot	• Techniques that reflect a critical understanding of Hull Rot and development of innovative and effective solutions for the disease • A survey of disease prevalence in almond orchards to understand causes of tree damage and yield loss – foundation knowledge for IDM • An IDM that includes disease identification • Solutions over and above soil sterilisation techniques to address soil disease management when replanting into old orchard areas • Technologies including chemical and/or mechanical/robotic tools to cost effectively remove 'stick-tights' which reduce yield and harbour disease
Ensure IPM and IDM are adopted by growers that account for 90 per cent of almond volume	• IPM and IDM strategies to consider approaches used successfully in other industries, for example wine grapes, summerfruit • Development of an IPM and IDM adoption strategy • Ongoing investment in minor use chemical permit applications
Maintain industry's biosecurity preparedness	• Adopt diagnostic tools that identify viruses linked to imported prunus • Ensure pest and disease identification tools are up to date and well distributed within industry • An up to date almond industry biosecurity plan • Ensure control options including registration of effective chemicals are in place for high impact high probability pest/disease incursions.

OUTCOME 2 – A major productivity gain in almond pollination by 2022 through a 25 per cent reduction in bee stocking rates with no loss in pollination efficiency (nut set)	
STRATEGIES	**POSSIBLE DELIVERABLES**
Develop and maintain a robust honey bee pest and disease incursion response including efforts to keep Australia free of *Varroa destructor* and similar exotic honey bee pests	• An understanding of the policy dimension of a full-scale *Varroa destructor* incursion, or similar, including state border protection measures that manage the movement of hives into and out of almond production areas • An understanding of the future financial cost of pollination 'with' and 'without' *Varroa destructor* including the almond industry's exposure to a shortage of hives
Improve the productivity of honey bees as pollinators and the efficiency of almond pollination	• Optimal orchard layout to maximise honey bee pollination – build on work completed by CSIRO between 2014 and 2016. The almond industry needs to achieve pollination outcomes with fewer honey bees • An understanding of the actions required for the almond industry to reduce its monoculture risks and provide forage opportunities for honey bees, for example, planting inter-row canola crops, re-establishing native vegetation forage resources • A review and refinement of strategies for post-*Varroa destructor* management, for example, is it possible to establish honey bee colonies and euthanise them after pollination has been completed • An understanding of artificial supplementary pollination and its role in increasing nut set and quality, how can these techniques be used to overcome variations in hive numbers and strength? Gain lessons from the New Zealand kiwifruit industry • An understanding of pollination alternatives – is it possible to replace honey bees with other pollinators/pollination techniques? • An understanding of the pollination requirements of new self-fertile almond varieties including the variety 'Independence' • An understanding of the relationship between pollination and nut retention – why many almond flowers are pollinated but fewer nuts are retained through to harvest
Develop pollination capacity in the honey bee industry	• An understanding of hive quality indicators – develop a technology that will allow almond growers to easily, quickly, cheaply and non-destructively score hive quality with a view to improving pollination outcomes • Develop an education program and standards for beekeepers to ensure hives meet quality requirements before they are delivered for pollination • Support development of the national honey bee inspection service to ensure healthy hives for pollination, for example, hives free of endemic American Foulbrood.

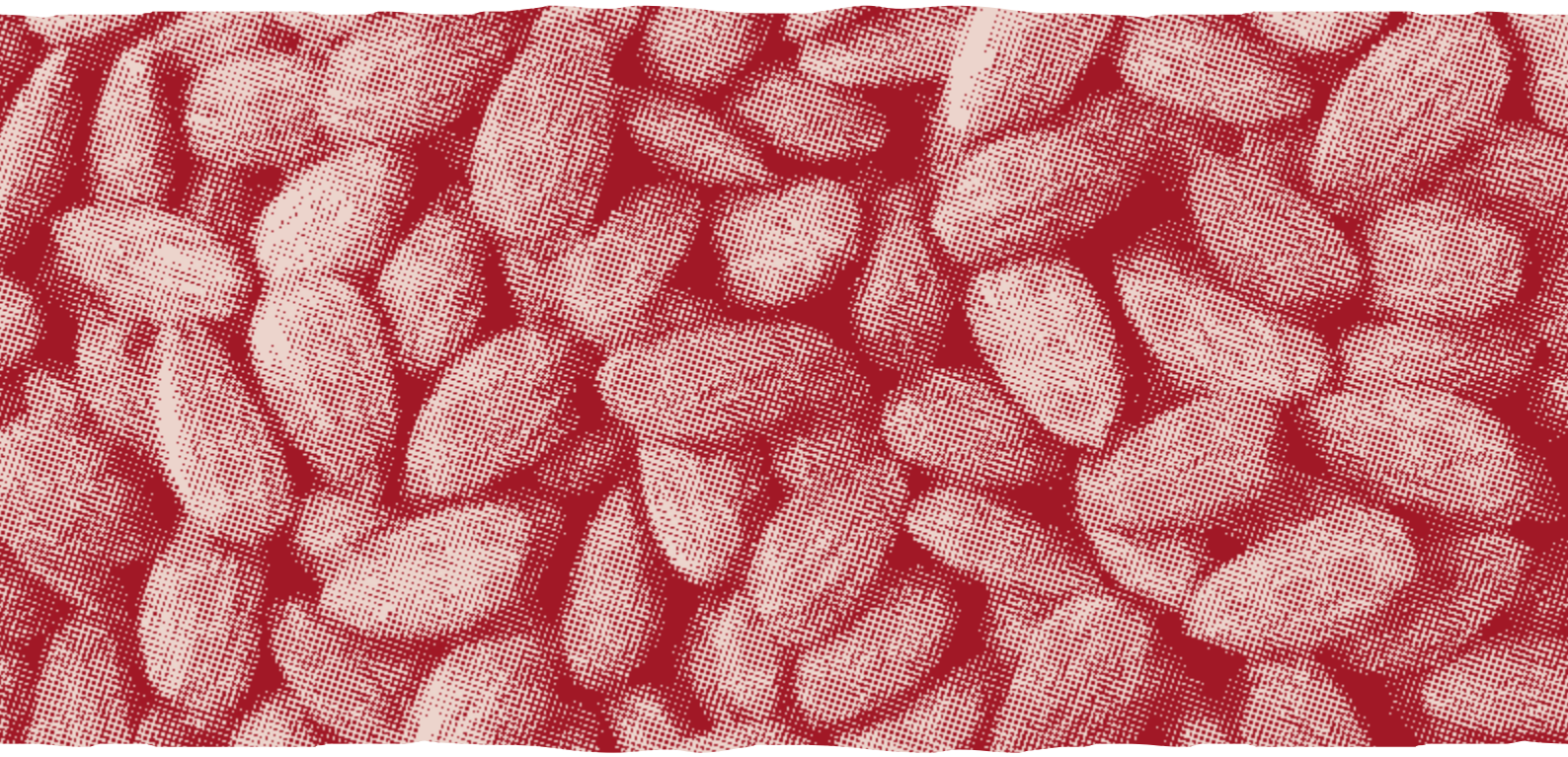


OUTCOME 3 – An almond industry crop production system that supports further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards and has lifted average industry yield from 3 to 4 tonnes per hectare. This will include new almond varieties featuring self-fertility and sealed shells, a new nursery accreditation scheme, 4 megalitres of irrigation water per tonne of almond kernel yield and proven 'shake and catch' harvesting and postharvest systems

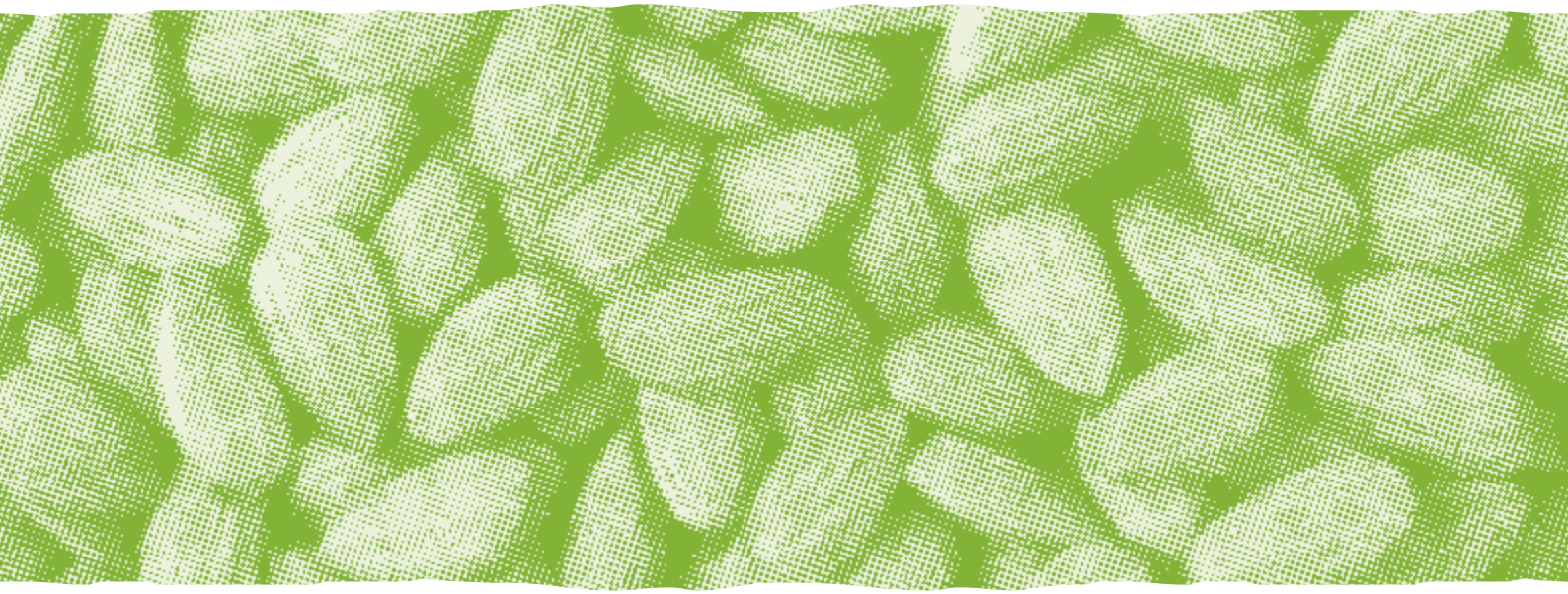
STRATEGIES	POSSIBLE DELIVERABLES
Undertake an evaluation of varieties originating from the almond breeding program, direct import and older varieties from California. Evaluate rootstocks under Australian conditions	• A commercially focussed evaluation program for new Australian bred varieties • Objective evaluation of all almond varieties – bred in Australia, direct import and older Californian types that are the mainstay of the Australian industry • An evaluation of rootstock performance under Australian conditions • Substantial progress with the development of varieties and rootstocks suitable for Horizon 3 production
Maintain disease free and diverse genetic material	• High health status mother plantings which decrease contamination risk and ensure varieties are true to type • Support a secure variety and rootstock germplasm repository for almonds through the new Almond Centre Experimental Orchard
Develop a standard for trees sold by nurseries	• A fully functional and widely adopted quality standard for almond nursery trees
Ensure the nursery industry is accredited to supply quality trees consistent with the standard	• Nursery industry educated and encouraged to adopt an accreditation scheme that delivers the quality standard for almond nursery trees • The accreditation scheme delivers better planting material and provides recourse for growers when nursery trees do not meet accreditation standards
Continue to improve the on-farm efficiency of almond industry water use	• Additional understanding of ways to improve water use efficiency • Knowledge to inform on-farm irrigation system maintenance – maintaining drip irrigation, making drip more efficient, getting the water losses out of the system • Additional knowledge on fertigation and water modelling to further improve on-farm efficiency • An understanding of the role of micro-sprays in creating a micro-climate useful for managing humidity and almond disease
Understand the almond industry's future in relation to irrigation demand 'big picture'	• An understanding of planned growth in Murray Valley irrigation industries • Planned irrigation growth communicated to almond growers to assist with almond industry planning
Deliver improved soil health to Australian almond orchards	• Knowledge on the use of hulls as a soil ameliorant to reduce fertiliser inputs, improve soil structure, improve moisture holding capacity and provide a reservoir for moisture release during extreme heat events • Use of composts, organic and inorganic fertiliser combinations to reduce disease pressure • An understanding of whether diseases are being introduced to the orchard through purchased mulches • Best management practices to enhance soil biology and manage soil health as the industry expands into more marginal areas and replants into the same, possibly depleted, orchard soil • Additional knowledge to mitigate the impact of salinity and soil acidification

OUTCOME 3 – Continued	
STRATEGIES	**POSSIBLE DELIVERABLES**
Support further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards to better understand how the combination of soil health, nutrition, tree architecture, plant physiology and orchard design is integrated	• Pruning, nutrition and irrigation optimisation for Horizon 1 orchards and new varieties • Knowledge on the precision application of nutrients to orchards where variable cropping requires different application rates • Improved understanding of tree architecture and plant physiology to assist with productive orchards and the management of extreme heat wave events, each almond varieties new growing requirements, plant densities and possible relocation of the industry to cooler growing areas • Improved understanding of orchard design including optimal layouts to improve yield and reduce production cost
Develop improved harvesting techniques	• Knowledge of alternative harvesting technologies not currently employed in any almond industry • 'Shake and catch' technology suitable for Australian almonds • Dehydration technology to marry with 'shake and catch' harvesting • Design of harvest systems that integrate 'shake and catch' and dehydration that are resilient enough to cope with wet harvest years
Develop improved postharvest handling techniques	• Improved knowledge of the linkages between almond storage conditions on-farm and throughout the supply chain: hull and kernel moisture levels; and customer quality requirements • Investigation of the technical and economic feasibility of emulating the Spanish industry's use of storage silos to enhance product protection • On-farm and in-field hulling research to increase bulk density, cut down transport costs and aid development of silo based storage
Leverage R&D investment in other pools and programs to deliver novel technology relevant to the almond industry	• Precision agriculture systems for the almond industry that use sensors and imaging to map and deliver productivity enhancing measures, for example, yield and pest maps • Mechanisation research that further reduces on-farm labour demand, for example, bird scaring drones.

OUTCOME 4 – An informed industry that adopts R&D outcomes and has the capacity to support current and future industry needs	
STRATEGIES	**POSSIBLE DELIVERABLES**
Support adoption of R&D outcomes by effective extension	• Extension program that includes fact sheets, field days, field trials, workshops, training, project updates in newsletters, online copies of final reports and regular surveys of stakeholders to gauge uptake • Additional Industry Development Officer capacity, two or three in total, to support extension and small/new grower training
Deliver meaningful data on production, planting, environmental performance, international supply and demand in a timely manner	• Almond industry statistics and data collection – covering 2016 to 2021 • Almond industry data that records the Australian almond industry's performance with respect to energy use, carbon footprint, carbon sequestration and water use efficiency using guides developed by the Californian almond industry that will, once collected, assist with the marketing of Australian almonds • Australian almond plantings database/world planting trends • Annual international supply and demand data sets
Ensure industry stakeholders remain engaged through an effective communications program	• A communications plan and program supported with either an annual industry conference or marketing forum
Enhance skills and capacity to support current and future industry needs	• Capacity building investment – including students, irrigation staff, 2ICs, technical officers, middle managers and farm managers who can lead large and complex businesses, young leaders and researchers. Focus directed to the transition from irrigation to farm manager
Engage with the international nut industry to maximise R&D and marketing innovation	• International study trips and support for the international networking initiative – with priority for international study trip funding to be given to small growers who do not have the capacity to self-fund.



OUTCOME 5 – Increased domestic consumption from 16,000 tonnes in 2016 to 27,500 tonnes in 2022 Increased export sales from 64,000 tonnes in 2016 to 110,000 tonnes in 2022 European Union inspections reduced from one in 20 containers to one in 100 containers at destination by 2022	
STRATEGIES	**POSSIBLE DELIVERABLES**
Invest in domestic and export market development	• An improved understanding of almond markets • Education of almond traders • Building of relationships in the domestic and world market
Market research and insights to help industry Increase domestic almond consumption	• Health research outcomes that link almond consumption to improved human health communicated to health professionals. Health research outcomes will be based on new Australian research and summaries of the international literature • Fundamental and up to date quantitative and qualitative domestic market research • An understanding of the feasibility of differentiating Australian almonds that might lead to efficacious brand development in the same way that the honey industry has been able to differentiate Manuka Honey
Facilitate Australian almond exports through market research and improved market access	• Quantitative and qualitative research on emerging almond markets • Data on new products developed with almonds/nuts as an ingredient • An interpretation of supply and demand balance in light of increasing supply from California, Australia and Spain • Successful 'Australia Fresh' trade shows • Market access solutions – India tariffs, inspection issues, fumigation; European Union inspection regimes and science-based Korean maximum residue limits (MRLs)
Further enhance Australia's reputation for safe, high quality almonds	• Product integrity research outcomes that may include packaging to improve shelf-life and consumer satisfaction • A better understanding of the causes of bacterial and fungal contamination – E coli, salmonella and aflatoxins and these food safety issues are no longer a concern in either wet and dry years • Best practice fumigation along the supply chain – research that has addressed the poor performance of existing fumigants, lures for trapping pests and emerging issues such as Red Rust Flour Beetle and Indian Meal Moth.



Aligning to Hort Innovation investment priorities

In establishing investment priorities, Hort Innovation analysed both historical and current levy and co-investment portfolios and priorities. From this analysis, we identified 11 cross-sectoral investment themes. We consolidated these themes further and considered their alignment with the Australian Government's Rural RD&E Priorities and National Science and Research Priorities, to arrive at five investment priorities outlined in ***Figure 1***. ***Figure 1*** also shows how each cross-sectoral investment theme relates to the five investment priorities.

Figure 1: Hort Innovation's investment priorities

The alignment of almond SIP alignment to the Hort Innovation investment priorities and as a consequence the Australian Government's Rural RD&E Priorities and National Science and Research Priorities is shown in ***Table 3***.

Table 3: Alignment of almond SIP outcomes to the Hort Innovation investment priorities

Hort Innovation investment priorities	Almond SIP outcomes
Support Industry efficiency and sustainability	Pest and disease damage to almonds has been reduced through enhanced IPM and IDM
	An almond industry crop production system that supports further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards
Improve productivity of the supply chain	A major productivity gain in almond pollination
Grow the horticulture value chain capacity	An informed industry that adopts R&D outcomes and has the capacity to support current and future industry needs
Drive long-term domestic and export growth	Increased domestic consumption, export sales and product integrity
Lead strategically to enhance the development of the Australian horticulture industry through operational excellence	Enabler

4

SECTION FOUR

Almond industry monitoring and evaluation

Almond SIP monitoring, evaluation and reporting

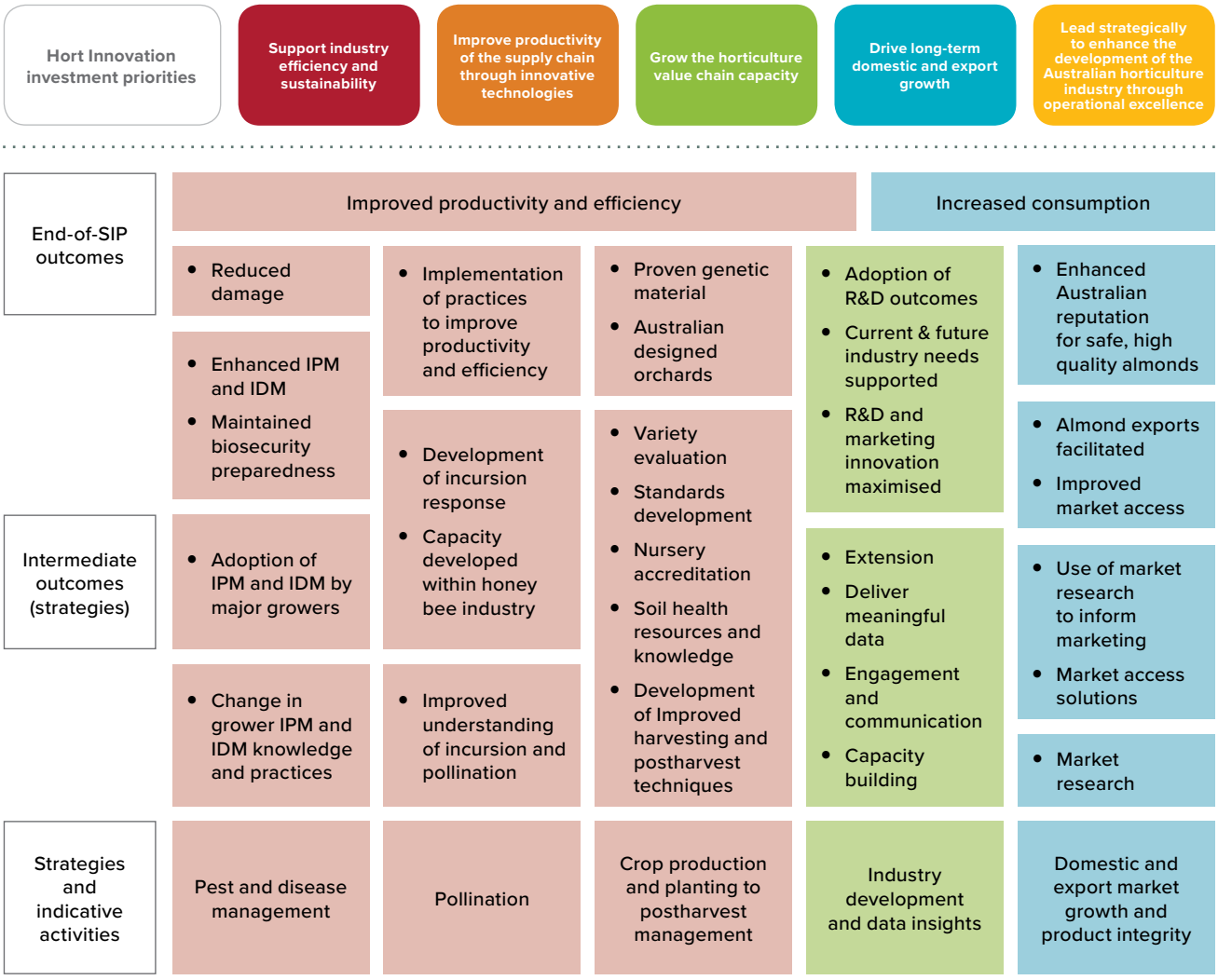
A SIP program logic and monitoring and evaluation (M&E) plan has been developed for the Almond SIP. These are informed by the Hort Innovation Organisational Evaluation Framework. The logic maps a series of expected consequences of SIP investment. The M&E plan shows the performance measures that will be measured to demonstrate progress against the SIP and what data will be collected. Progress against the SIP will be reported in Hort Innovation publications and at industry SIAP meetings.

The SIP outcomes and strategies will be used to inform investments in individual projects to deliver on the SIP. The results of M&E will be used to reflect on the results of investments and in decision-making. Hort Innovation will facilitate the regular review of SIPs to ensure they remain relevant to industry.

Almond SIP logic

An indicative Almond SIP program logic is shown below in ***Figure 2***. The logic is based on the Hort Innovation SIP logic hierarchy (***Appendix 4***).

Figure 2: Almond SIP logic



Almond industry SIP M&E plan

The almond M&E plan is shown in ***Table 4***. The table includes key performance indicators (KPIs) and data collection methods both at a macro/industry (trend) level and at more specific SIP level/s.

Table 4: Monitoring and evaluation plan for the almond SIP

Outcomes	Strategies	KPIs	Data collection methods and sources
Pest and disease damage to almonds has been reduced through enhanced IPM and IDM	Reduce damage caused by pests by further enhancing the industry's IPM with a key R&D focus on Carpophilus Beetle, Carob Moth, emerging stored almond pests and orchard floor hygiene Reduce damage caused by diseases by further enhancing the industry's IDM, transferring knowledge from other industries and a key focus on Hull Rot Ensure IPM and IDM are adopted by growers that account for 90 per cent of almond volume Maintain industry's biosecurity preparedness	• Serious defects of harvested almonds reduced to less than two per cent at weighbridge • Cost effective solutions for hull rot by 2022 • Greater than 95 per cent approval rate for any new minor use permit applications • Increased grower knowledge and awareness of IPM and IDM compared to the baseline survey of 2017 • Adoption of IPM and IDM by growers that account for 90 per cent of almond volume • Biosecurity controls are in place	• Survey of weighbridge operators completed to determine serious defect levels at start of SIP, in 2019 and end of SIP • Survey of growers to determine cost effectiveness of hull rot management in 2019 and end of SIP • Review of Hort Innovation data on the success of minor use permit applications • Survey of growers to determine adoption of IDM and IPM
A major productivity gain in almond pollination by 2022 through a 25 per cent reduction in bee stocking rates with no loss in pollination efficiency (nut set)	Develop and maintain a robust honey bee pest and disease incursion response including efforts to keep Australia free of *Varroa destructor* and similar exotic honey bee pests Improve the productivity of honey bees as pollinators and the efficiency of almond pollination Develop pollination capacity in the honey bee industry	• A 25 per cent reduction in bee stocking rates from six hives per hectare (2016) with no loss in pollination efficiency (nut set) • Increased knowledge and ability within the honey bee industry • Incursion response developed	• Survey of growers completed at start of SIP, in 2019 and end of SIP to determine bee stocking rate and pollination efficiency (nut set) • Survey of honey bee industry representatives to determine influence on capacity

Outcomes	Strategies	KPIs	Data collection methods and sources
An almond industry crop production system that supports further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards and has lifted average industry yield from 3 to 4 tonnes per hectare. This will include new almond varieties featuring self-fertility and sealed shells, a new nursery accreditation scheme, 4 megalitres of irrigation water per tonne of almond kernel yield and proven 'shake and catch' harvesting and postharvest systems	Undertake an evaluation of varieties originating from the almond breeding program, direct import and older varieties from California. Evaluate rootstocks under Australian conditions Maintain disease free and diverse genetic material Develop a standard for trees sold by nurseries Ensure the nursery industry is accredited to supply quality trees consistent with the standard Continue to improve the on-farm efficiency of almond industry water use Understand the almond industry's future in relation to irrigation demand 'big picture' Deliver improved soil health to Australian almond orchards Support further efficiencies in Horizon 1 orchards and the development of Horizon 3 orchards to better understand how the combination of soil health, nutrition, tree architecture, plant physiology and orchard design is integrated Develop improved harvesting techniques Develop improved postharvest handling techniques Leverage R&D investment in other pools and programs to deliver novel technology relevant to the almond industry	• Substantial progress with Horizon 3 orchards by 2022; Horizon 3 orchards will allow the industry to move from 3 to 4 tonnes per hectare • New almond varieties with higher yield, self-fertility, sealed shells and market acceptability by 2022 • An industry approved quality standard for almond nursery trees and a nursery accreditation scheme by 2019 • Adoption of standard and accreditation by 80 per cent nurseries • 4 megalitres per tonne of almond kernel yield by 2022 • Feasibility of 'shake and catch' harvesting techniques established for the almond industry by 2022 • Feasibility of moving stored almonds from temporary stockpiles to storage silos/sheds assessed by 2022	• Industry production data • Review of relevant progress and evaluation reports from Almond Centre Experimental Orchard • Review of Almond Industry University of Adelaide breeding program progress reports • Advice from breeders about the performance of new varieties including market acceptability • Consult with ABA on success of quality standard and nursery accreditation scheme • Survey of growers to determine water use efficiency at start of SIP and end of SIP (and at appropriate intervals) • Review of relevant progress and evaluation reports from the Almond Centre Experimental Orchard on feasibility of 'shake and catch' harvesting techniques and industry use of storage silos/sheds at end of SIP • Final evaluation at end of SIP to determine relative specific contribution of SIP investment towards productivity and efficiency

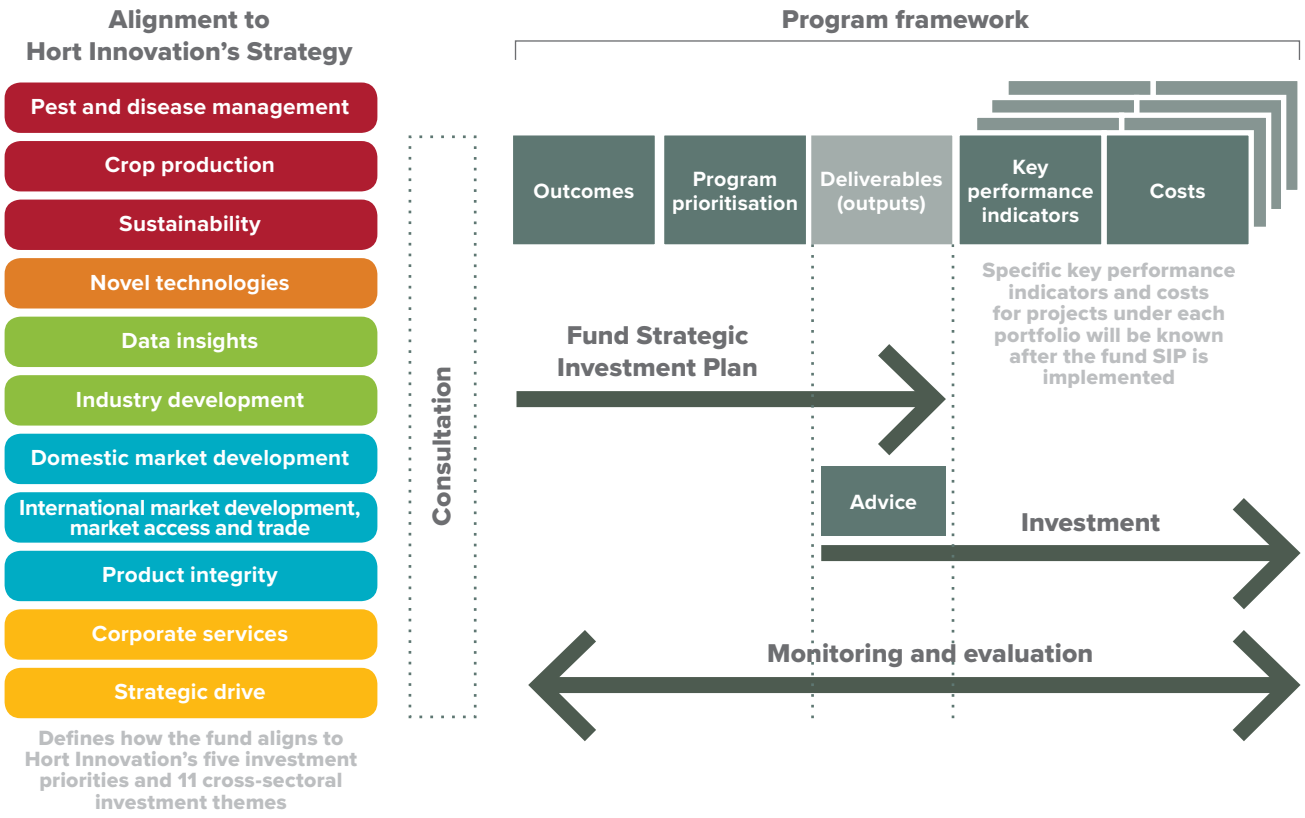
Outcomes	Strategies	KPIs	Data collection methods and sources
An informed industry that adopts R&D outcomes and has the capacity to support current and future industry needs	Support adoption of R&D outcomes by effective extension Deliver meaningful data on production, planting, environmental performance, international supply and demand in a timely manner Ensure industry stakeholders remain engaged through an effective communications program Enhance skills and capacity to support current and future industry needs Engage with the international nut industry to maximise R&D and marketing innovation	• Growers representing 90 per cent of production volume are aware and informed of relevant R&D projects and are intending to adopt proven research outcomes • Data delivered by the R&D program is used in grower and industry decision making • Five promising irrigation managers trained in whole-farm management with funding from the R&D program by 2022 • Annual study tours are completed by levy paying growers with priority to be given to small growers and 90 per cent of participants provide a satisfaction rating of high or very high (satisfaction measured as 'developed valuable networks', 'learnt new information', 'intending to implement new learnings on farm')	• Identification of adoption gaps at start of SIP by Almond IDM project • Survey of growers to determine R&D project awareness and willingness to adopt/adoption of new practices at start and end of SIP (and at appropriate intervals) • Survey of growers and the supply chain to determine the value of R&D project developed data at start and at and end of SIP (and at appropriate intervals) • Feedback survey of irrigation managers trained • Online study tour satisfaction survey completed after each tour • Extension records
Increased domestic consumption from 16,000 tonnes in 2016 to 27,500 tonnes in 2022 Increased export sales from 64,000 tonnes in 2016 to 110,000 tonnes in 2022 European Union inspections reduced from one in 20 containers to one in 100 containers at destination by 2022	Market research and insights to help industry increase domestic almond consumption	• Increased domestic consumption from 16,000 tonnes in 2016 to 27,500 tonnes in 2022 • Increased export sales from 64,000 tonnes in 2016 to 110,000 tonnes in 2022 • Reduction in European Union inspections from one in 20 containers to one in 100 containers at destination by 2022 • Market research products/ output • One new market accessed	• Review ABA's annual Almond Insights publication to determine domestic consumption and export sales • Review rates of European Union inspection with the ABA Marketing Committee in 2022 • Global Trade Atlas and consumer behaviour data • Evaluation to determine relative contribution of SIP investment towards growth in consumption and sales (end of SIP)

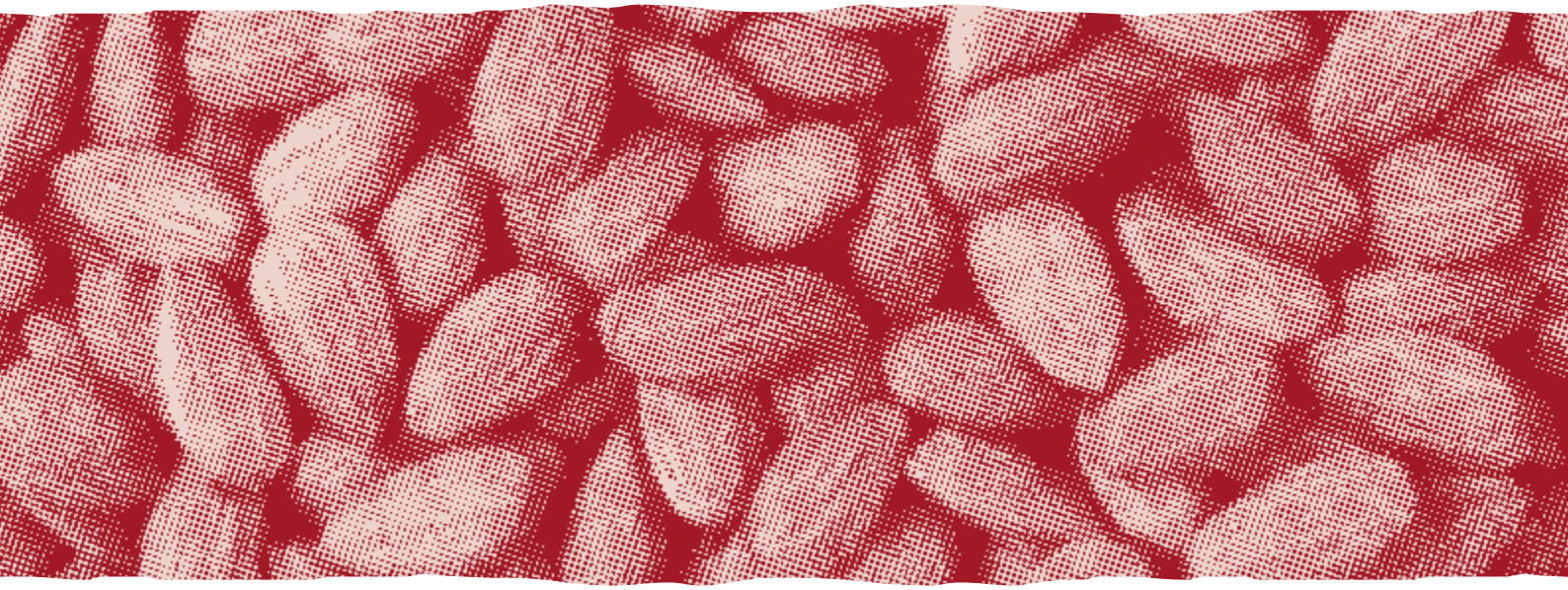
Reporting

The program framework in ***Figure 3*** is the mechanism that links Hort Innovation's strategy and investment priorities to the investment process through the industry SIP. SIPs assist Hort Innovation to prioritise and implement the specific industry R&D, extension and marketing programs.

Hort Innovation will use dynamic reporting against our monitoring and evaluation framework to report on investment progress. The contribution of investments to each industry outcome will be reported regularly, including through industry Annual Reports, Hort Innovation's Annual Report and Hort Innovation's Annual Operating Plan.

Figure 3: Hort Innovation's program framework

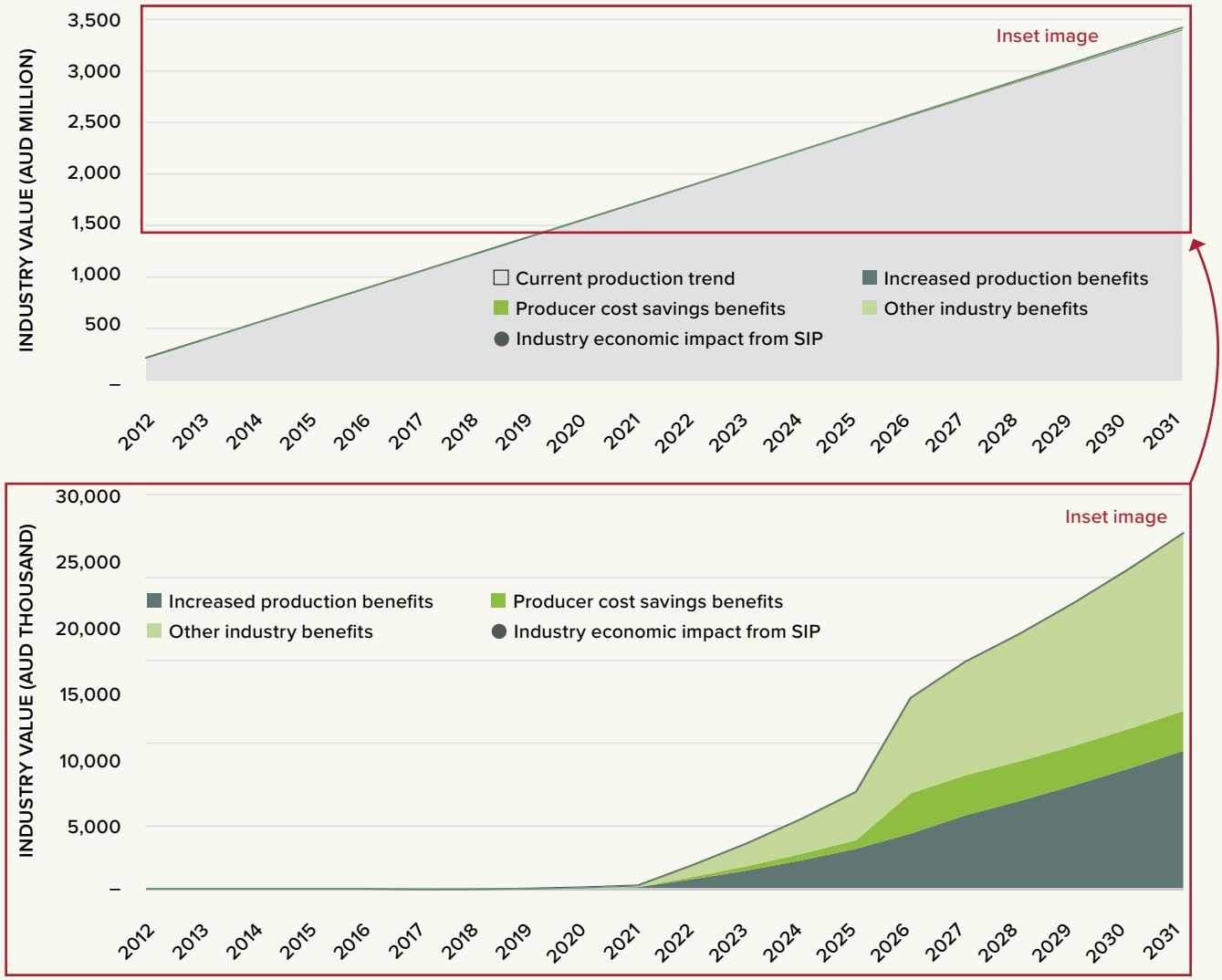




SECTION FIVE

5 Impact assessment

Figure 4: Economic benefit from investment in the SIP



An independent assessment of the potential economic impacts from investment into the almond SIP indicated a positive return on investment for the industry (***Figure 4***). The anticipated investment of $14.53 million over the next five years in R&D and extension activities is expected to generate $182.74 million in net benefits for the industry, representing a benefit cost ratio of 12.58 times to growers and service providers along the value chain.

The assessment draws from a wide range of available data sources, and projects economic impacts over a 15-year period starting from 2016/2017. A five per cent discount rate has been applied and all values are adjusted for inflation and presented in 2016/2017 dollar terms. The assessment takes a highly conservative approach and the presented figures have been adjusted to account for risks associated with achieving research outputs, expected adoption and impacts[2].

2 The Almond Industry would typically contribute to SIP projects, on a case by case basis. This funding has not been taken into account in the assessment.

Table 5 provides a summary of the assessed impacts for each outcome identified in the SIP, the anticipated deliverables, net economic benefits and benefit cost ratio.

Table 5: Overview of impacts assessed and alignment with SIP targets

Outcome	Expected deliverables *Refer section 3 for further details*	Anticipated SIP investment (over five years)	Net benefits (over 15 years)	Benefit cost ratio
Pest and disease management	• IPDM strategies for pests such as the Carpophilus Beetle Moth • IPDM strategies for diseases such as Hull Rot • IPDM adoption strategies • Biosecurity plan and tools	$2,905,953	$35,081,041	12.07
Pollination	• Honey bee pest and disease incursion response • New pollination techniques • Greater honey bee industry capacity to support pollination	$2,905,953	$44,100,576	15.18
Crop production from planting to postharvest management	• New almond varieties • Accredited nursery industry • On-farm irrigation improvements • New soil management techniques • Advanced production systems • New harvesting and postharvest handling techniques • Novel technologies relevant to the almond industry	$2,905,953	$38,295,915	13.18
Industry development and data insights	• Extension and communication activities • Industry statistics and data collection • Industry skills development program • International study trips	$2,905,953	$30,644,855	10.55
Domestic and export market growth and product integrity	• Domestic almond market research • Greater market access for Australian almonds • Food safety initiatives	$2,905,953	$34,617,229	11.91

The quantified impacts associated with Outcome 1 include:

- Reductions in crop losses and increases in yield due to improvements in IPDM with a focus acting on the most significant threats including Carpophilus Beetle, Carob Moth and Hull Rot
- Improvements in the benefits generated by the IPDM strategies from increasing adoption rates through the development of an IPDM adoption strategy
- Reductions in biosecurity impacts for the industry due to a greater capacity for the industry to identify and manage biosecurity threats.

The quantified impacts from Outcome 2 include:

- Insurance against the potential costs associated with a honey bee pest and disease incursion such as the *Varroa destructor*. The anticipated costs include price increases for pollination services and a decline in almond production
- Production yields sustained and yield increases from new pollination techniques such as artificial pollination and other insect pollinators
- Production yields sustained and yield increases from improvements in the quality of honey bee health through the implementation of a quality standard for bee keepers.

The quantified impacts from Outcome 3 include:

- Yield improvements and market expansion from the introduction of new almond varieties with favourable grower and consumer related traits
- Price premiums and reduction in production costs by improving the quality of nursery trees through industry accreditation
- Reductions in water use and yield improvements from the implementation of on-farm irrigation efficiencies
- Reduction in fertiliser use and yield improvements from the implementation of new soil management techniques
- Increases in yields and reductions in production costs from the implementation of advance production systems such as intensive cropping
- Reductions in production costs from new harvesting and post harvesting techniques such as the 'shake and catch' technology
- Reductions in production costs from the implementation of novel on-farm technologies including precision agriculture.

The quantified impacts from Outcome 4 include:

- Increased adoption of levy funded research outcomes from the implementation of extension and communication activities for the industry
- Market expansion, price premiums and reductions in the cost of production from better alignment to consumer needs through the use of industry statistics and data
- Human capital improvement from upskilling the workforce through an industry skills development program
- Market expansion, price premiums and reductions in the cost of production from the use of overseas knowledge, learnings and best practices.

The quantified impacts from Outcome 5 include:

- Increased consumption per capita and price premiums from better alignment to consumer needs in the domestic market
- Market expansion and price premiums from increasing exports into markets such as India, Spain and the United States
- Reduced impacts from health safety issues for the industry through the implementation of food safety initiatives.

The net economic impact (NPV) is based on estimates projected over a 15-year period, starting from 2016/17.

6

SECTION SIX

Risk management

The purpose of this risk section is to highlight any unique or specific risks that qualify the SIP. This is not intended to be an exhaustive risk review of the industry risks which in part are considered in the SWOT. This is also not reflective of the general investment risks which will be considered in the project investment process.

Risks relevant to implementation of the SIP are limited to:

- Adequate funding and contracting of the Almond Centre Experimental Orchard – many of the strategies described in this plan are reliant on the go-ahead of this major almond industry project.

Figure A1: SIP development process

APPENDIX 1: SIP development process

The SIP was developed by the Australian almond industry through the four stage process formulated by Hort Innovation and illustrated in ***Figure A1***.

Pre-planning activities included review of relevant literature, analysis of past investments, preparation of an industry profile, engagement with the SIAP and Industry Representative Body – Almond Board of Australia and formulation of a consultation strategy with ABA's assistance. The SIP development team had its first meeting with the SIAP in Mildura on June 14, 2016.

Literature review focussed on the *Australian almond industry Strategic Plan 2010-15*, the *Australian Almonds Strategic R&D Plan 2011-16*, the *Statement of Almond Industry R&D Priorities 2017-21* prepared by the ABA (ABA 2016) and *Almond Insights 2015-16*.

Preparation tasks included gathering input and data to inform the SIP, completion of an environmental scan, review of consumer and retailer trends and a scan of innovative technology relevant to the almond industry. Initial strategic engagement and consultation was completed with large and small almond growers, processors, marketers and researchers. Individuals contacted included members of the SIAP, ABA Board, ABA Committees including Production and Processing/Marketing, key researchers and pollination supply and pollination R&D specialists. An online version of the consultation survey was posted on SurveyMonkey and notification of the opportunity to contribute was made through the ABA Newsletter.

Early insights on the SIP were presented to the Almond Industry Conference, Pullman Hotel Melbourne, November 10, 2016. A discussion paper was distributed to conference attendees wishing to contribute to direction setting.

Subsequent SIP execution and validation included a SIAP/ABA Board workshop to review priorities. The workshop was held in Don's Room Mildura Grande Hotel November 18, 2016. Workshop objectives included review of investment needs as described in a Discussion Paper circulated October 7, 2016; agree priorities for investment; estimate benefits to growers from investment in each research need; and generation of data for use in a benefit cost analysis of each research need. The workshop confirmed levy investment priorities developed through comprehensive consultation.

A draft almond industry SIP was prepared in late November. SIP preparation included formulation of strategy, testing of strategy using benefit cost analysis, preparation of a monitoring and evaluation framework, development or relevant summaries and a SIP Communication Plan.

Validation was completed through a range of subsequent forums in December 2016 and January 2017.

The workshop confirmed levy investment priorities developed through comprehensive consultation.

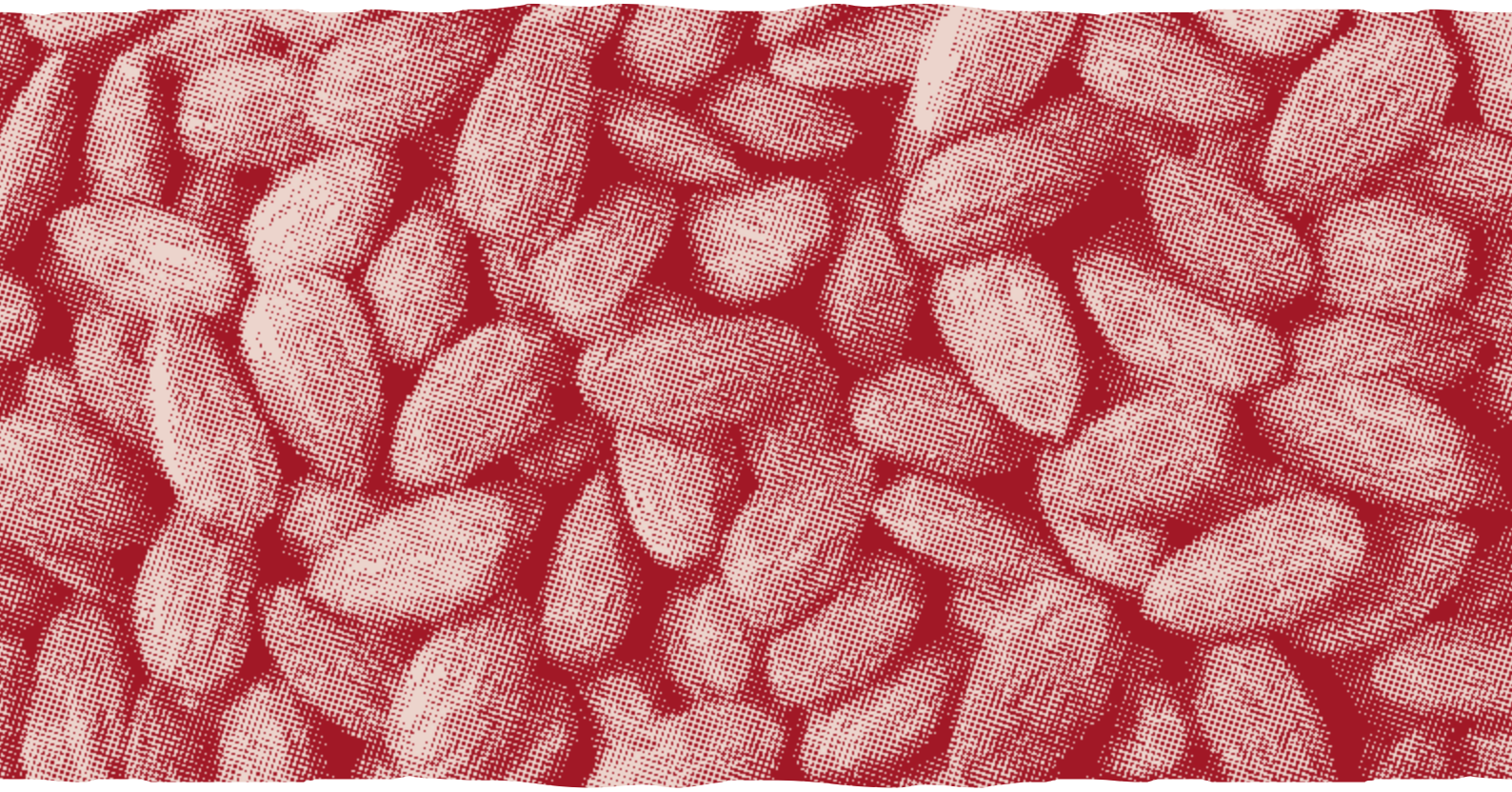
APPENDIX 2: Consultation

The following people are acknowledged for their contribution to the Australian almond SIP process.

Name	Industry Role
Brendan Sidhu	SIAP
Paul Martin	SIAP
Domenic Cavallaro	SIAP
Craig Simes	SIAP
Toby Smith	SIAP
Ben Brown	SIAP
Troy Richman	SIAP
Ross Skinner	SIAP
Neale Bennett	ABA Board
Damien Houlahan	ABA Board
Tim Orr	ABA Board
John Maragozidis	ABA Board

Name	Industry Role
Peter Cavallaro	ABA Board
Denis Dinicola	ABA Board
Robert Wheatley	Production Committee
Peter Ross	Production Committee
Ben Robinson	Production Committee
Drew Martin	Production Committee
John Kennedy	Production Committee
Brenton Paige	Processing Committee
Russell Wickstein	Processing Committee
Mark Webber	Processing Committee
Tom Martin	Processing Committee
Tony Costa	Processing Committee
Nigel Carey	Processing Committee

In addition, two confidential responses to the online survey have been received via SurveyMonkey.
Eighteen copies of the draft Discussion Paper were distributed at the Almond Conference on November 8, 9 and 10, 2016.



APPENDIX 3: References

ABA (2009), *Australian Almond Industry Strategic Plan 2010-15*

ABA and HAL (2010), *The Australian Almonds Strategic R&D Plan 2011-16*

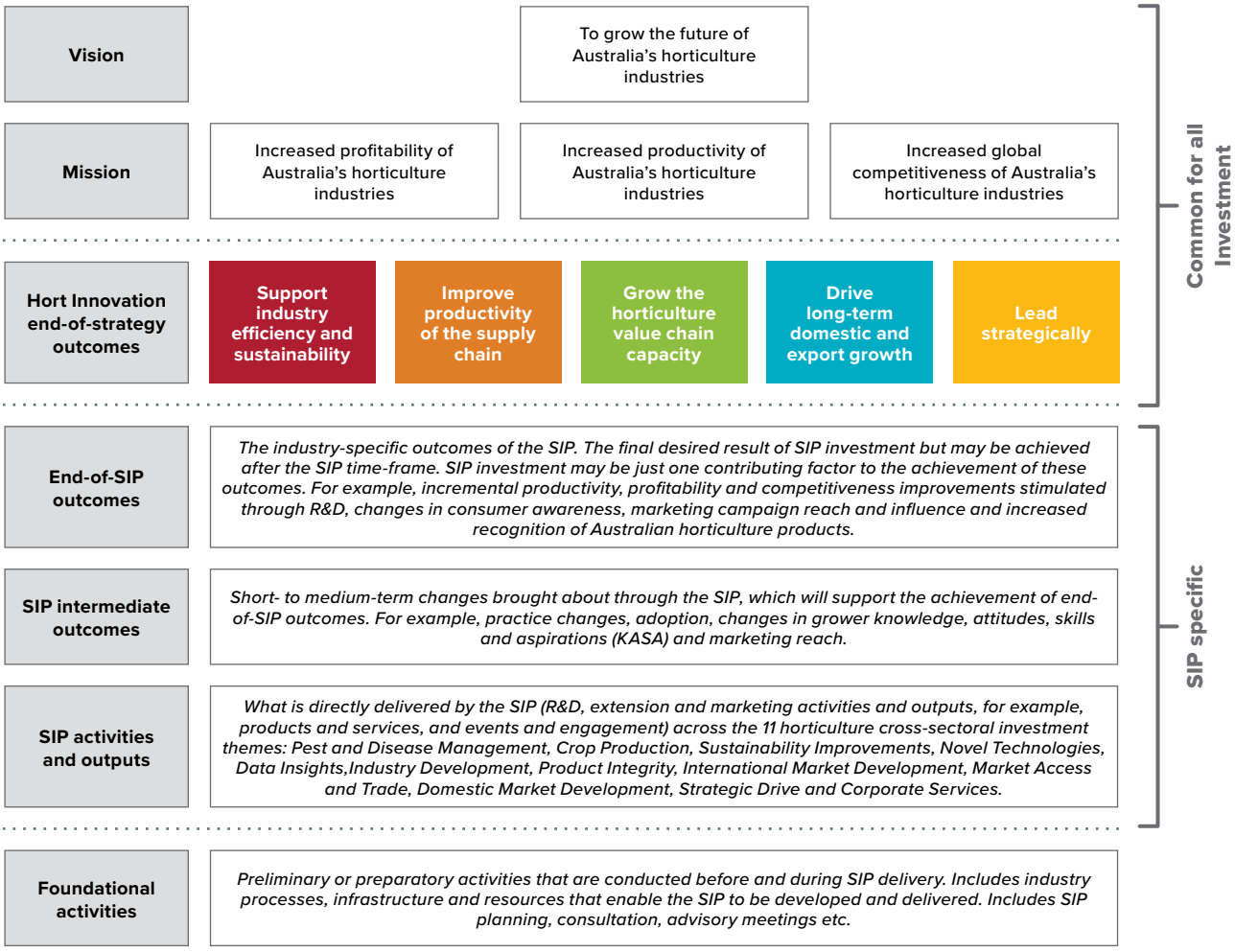
ABA (2016), *Statement of Almond Industry R&D Priorities 2017-21*

ABA (2016), *Almond Insights 2015-16*

AgEconPlus (2016), *Discussion Paper to Inform Development of the Almond Strategic Investment Plan 2017-21*

Hort Innovation, *Working Paper 1*, June 2016

APPENDIX 4: Logic hierarchy



APPENDIX 5:
Environmental scan results

Pest and disease management	• Carob moth research • Bird control • Med Fly risk • Lower Limb Dieback • Agvet chemical legislation • Chemical availability, Agvet Reform • Canopy spray coverage
Crop production	• Plant Improvement • Almond physiology • Rootstock trials • Budwood 2015-16 • Monash and Colbinabbin Budwood Blocks • Tissue culture facility (rootstocks) • New varieties • Almond Tree Trademark Certification Scheme and Nursery Contract • Pollination efficiency and strategy, Varroa workshop, contracts, NSW bee sites • Pollination strategy for almond industry – PHA proposal • OrchardNet – orchard management software • Bureau of Meteorology seasonal updates • Dopler Radar Mildura (weather forecasts)
Novel technologies	• Robotics
Data insights	• Aust Crop Estimate Report • Season Review • Almond Insights/Industry Profile Booklet • Crop estimate reporting
Industry development	• Extension program update • 2014-15 R&D priorities • GrowSmart Report (horticultural science careers) • Almond Conference • Industry Awards – Phil Watters, Hall of Fame • Almond Centre • Almond Industry Strategic Plan • US Almond Industry Conference • ABA website • Israel study tour
Domestic market development	• Mandatory pasteurisation of domestic almonds • FSANZ application mandatory bacterial treatment of almonds domestic market • Domestic sales statistics
International market development, market access and trade	• Export shipping/sales statistics • Marketing program update • Global price movements, US crop review • US expansion and drought update • US nursery sales • Trade access issues • Bacterial treatment of almonds • Bright light almonds – voluntary marketing levy • Fosetyl–Al MRL Europe (fungicide) • Aflatoxin A EU Testing (cancer causing mould) • International Nut Congress/Spanish Research Trip
Product integrity and processing	• National residue testing program • Postharvest quality • Visit by US Food Safety researcher, review of food safety • Profume Fumigation Indian Exports (alternative to methyl bromide) • Khapra beetle • Almond waste
Government and policy	• Horticulture Modern Award, backpacker tax • Murray Darling Basin Plan • National Irrigators' Council Report • Aust Nut Industry Council (ANIC) Report • Government White Paper Agricultural Competitiveness • Voice of Horticulture • Agriculture Victoria 5-year R&D Plan

Source: ABA Board Papers, August 2013 to May 2016

Horticulture Innovation Australia Limited
ACN 602 100 149
Level 8, 1 Chifley Square
Sydney NSW 2000
Telephone 02 9295 2300
Fax 02 8295 2399
www.horticulture.com.au