Papaya

STRATEGIC INVESTMENT PLAN

2017-2021

Hort Innovation
Strategic levy investment

PAPAYA FUND

Content

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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.

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 papaya growers.

The papaya SIP

Producers in the papaya 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 papaya that are produced in Australia and either sold by the producer or used by the producer in the production of other goods. The levy rate on fresh and export papaya is 2 cents per kilogram and processing papaya is 0.25 cents per kilogram.

Hort Innovation manages the papaya levy funds which are directed to R&D (fresh and export is 1 cent per kilogram and processing is 0.25 cents per kilogram) and marketing (1 cent per kilogram). In 2015/16 total papaya levy receipts were approximately $334,000: $167,000 of R&D levies and $167,000 of marketing levies.

Hort Innovation has developed this SIP to strategically invest the collected papaya levy funds in the priority areas identified and agreed by the papaya 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.

This plan represents the Australian papaya industry's collective view of its R&D and marketing needs over the next five years (2017 to 2021). This plan has been developed in consultation with Australian papaya levy payers through a synthesis of priority setting exercises, direct consultation, two workshops with Hort Innovation's papaya industry SIAP, and industry consultation. The process to develop this plan is fully described in ***Appendix 1***.

The papaya SIAP has responsibility for providing strategic investment advice to Hort Innovation. Both Hort Innovation and the advisory panel will be guided by the strategic investment priorities identified within this plan, focusing on those identified as being a higher priority. For more information on the papaya industry SIAP constituency please visit Hort Innovation's website at www.horticulture.com.au.

Papaya

STRATEGIC INVESTMENT PLAN 2017-2021 AT A GLANCE

POTENTIAL IMPACT OF THIS PLAN

$10 Million

Based on an estimated investment of $2.4 million over the next five years

OUTCOMES	STRATEGIES
Increased quality to ensure consistency of supply to the consumer	**Engage with consumers to identify preferred taste and bring this understanding back to farm so growers can consistently provide quality fruit meeting consumer expectations**
	Increase grower focus on quality through improved engagement and dissemination of best practice information
	Research and adopt improved postharvest packing, treatment protocols, storage, distribution and retailer processes to improve quality and increase shelf life
Access to new varieties and improved pest and disease management improves growers' productivity and profitability	Continue research, trials and adoption of chemical and other processes for effective pest and disease management
	Continue research and commercialisation of new genetically improved varieties that offer increased disease resistance and consumer appeal
	Develop and adopt an integrated pest and disease management (IPDM) plan
	Continue to research and refine agronomic practices to improve productivity, quality and environmental outcomes
Improved market access and increased consumer demand increases returns to growers	**Increase demand in existing domestic markets through understanding of consumer preference and targeted marketing around these preferences**
	Provide opportunities to access domestic and international new markets
	Support research, development, adoption of growing practices and marketing initiatives to position papaya as a naturally grown fruit with significant health benefits

Highest-priority strategies or activities for the initial stages of the plan are indicated in **bold**.

Papaya
STRATEGIC INVESTMENT PLAN 2017-2021 AT A GLANCE

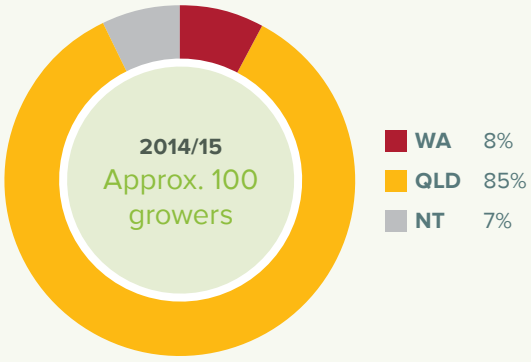
Major opportunities

- Improved industry information and data sharing to advance production methods, supply chain forecasting, handling techniques and biosecurity defences
- Links to and use of the research conducted in Fiji by Australian Centre for International Agricultural Research (ACIAR)
- Co-operative marketing campaign to raise awareness of the health benefits of papaya with melon and cross-category promotion
- Identify products that can be supplied consistently to target major retail markets
- Consistently adopt management practices that minimise the use of chemicals for pest and disease management and have low impact on the environment to enhance the acceptance of papaya as a health fruit.

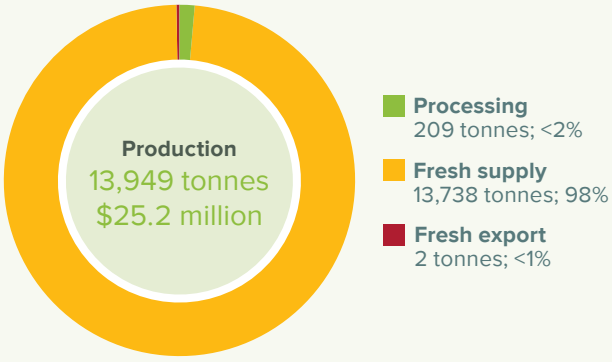
Major challenges

- Regulatory changes and compliance issues
- Extreme weather events such as cyclones and low rainfall
- Competition from other exotic tropical fruits
- Biosecurity breaches and the subsequent cost of quarantining against endemic and imported pests especially ringspot and fruit fly
- Increasing costs of supply chain with transportation being one of the major impacts on profitability
- Poor perception of fruit taste particularly in older demographic categories
- Supply chain and cold chain issues affecting quality of a fragile product
- Labour intensive harvesting practices
- No industry standard product for supply into main retail market and inconsistent quality.

Industry size and production distribution



Papaya supply chain and value 2014/15



SECTION ONE

Context

The Australian papaya industry

The Australian papaya industry has growers across Northern Australia from Queensland to Western Australian with production of 13,949 tonnes in 2015 for a value of $25.2 million. Over 90 per cent of production comes from Queensland with growers spread between Bundaberg and Lakeland, located in the Shire of Cook. Product is either yellow, referred to as papaw, or red fleshed, known as papaya. Papaya grows all year round and because of this the industry has the capacity to provide consistent supply of fruit to consumers and year-round income to growers.

There are over 130 growers in Australia but production is dominated by several large producers. Growers produce different varieties that include hybrids of both yellow and red breeds. Understanding consumer taste provides the best basis for determining how varieties should be developed through additional research such as the breeding program. Commercial lines and breeding lines will conduct taste trials to incorporate consumer preferences with the breeding project.

Production occurs in tropical areas and the crops are susceptible to a variety of pests and fungal disease. Some of these pests and diseases also affect other fruit varieties and there is opportunity for collaboration on research in these areas. Specific research in papaya to address ongoing improvements in production and development of varieties that are resistant to some of the pests and diseases will provide benefits across the industry.

Papaya is viewed as a fruit that has good opportunities to significantly expand within the domestic market but to do this the industry needs to develop a consistent product so the retailers and consumers have confidence in the ongoing quality and supply.

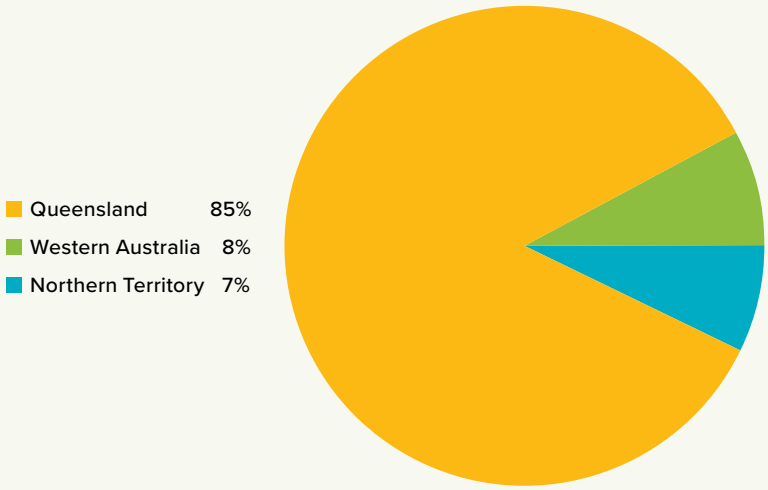
Products marketed

The terms papaya and papaw are referred to differentiate the product in the papaya industry[1]. Red papaya and yellow papaws are predominately grown in the warmer tropical climates areas of Tully, Mareeba, and Innisfail to Mosman in Far North Queensland. There are new plantings in Lakeland, North Queensland as well as in Darwin, Northern Territory and Kununurra, Western Australia[1]. Both are available all year round with increased supply during spring and autumn.

Currently papaw and papaya varieties are based on a range of commercially available Australian-produced hybrid varieties (papaw – 1B and 13, papaya – RB1, RB2, RB4), imported seed and grower-bred seed stock[2,3]. Red-fleshed Hybrid RB1, Sunrise Solo, Linda Solo and Sunset Solo are the most popular papaya varieties grown in North Queensland[4].

Papaya grown in Queensland can be transported to all Australian states and territories except Western Australia. Western Australia currently prohibits entry of Queensland papaya for pest and disease quarantine reasons.
Fruit consigned to Tasmania, Victoria, South Australia and certain areas within New South Wales must be produced and treated under specific Interstate Certification Assurance (ICA) schemes[4].

Figure 1: Fresh papaya production by state 2014/15 *(Source: Horticulture Innovation Australia, Australian Horticulture Statistics Handbook 2014/15[3])*



Transportation is through refrigerated road transport to wholesale markets. Wholesale transportation to retail is predominantly through unrefrigerated road transport[5]. The supply of premium quality fruits to distant interstate markets continues to be a challenge. Supply chain management research conducted by Agri-Science Queensland (DEEDI) with funding from Australian Centre for International Agricultural Research (ACIAR) is currently looking at the interaction of fruit maturity at harvest, post-harvest fungicide application and ripening and transport temperature on the out-turn of fruit[2].

The best storage and transport conditions for ripe papaya are 13° Celsius with a relative humidity of 90 per cent. The fruit is packed in a single layer cardboard or polystyrene carton with 30-litre cartons generally used for yellow papaw and 18-litre cartons for red papaya. Inside the box, the fruit is protected from damage with poly socks or paper wraps[4]. Fruit is ripened by storing between 20-25° Celsius[1].

Dependent on the year, between 30 to 60 per cent of the Australian crop will come from the two largest producers.

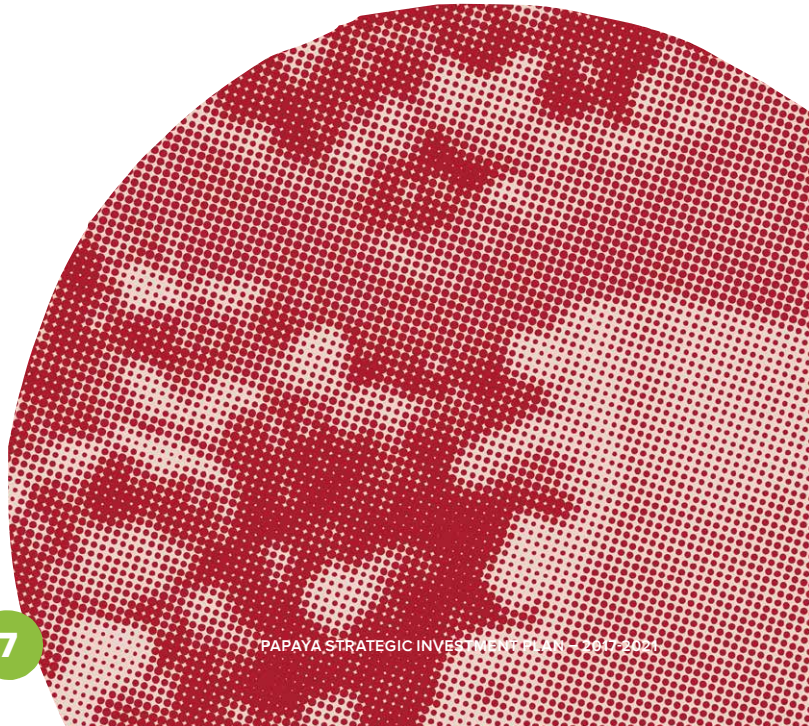
The majority of papaya is produced in Queensland (over 90 per cent in North Queensland) with smaller scale production in the Northern Territory, Western Australia and New South Wales.

Location and extent of production

The majority of papaya is produced in Queensland (over 90 per cent in North Queensland) with smaller scale production in the Northern Territory, Western Australia and New South Wales. The distribution of production in 2014/15 was 85 per cent in Queensland, eight per cent in Western Australia and seven per cent in the Northern Territory[3]. The 2015/16 production has been influenced by the lack of rain and higher temperatures[7].

The *Australian Horticulture Statistics Handbook 2014/15* states that the production volume of papaya was 13,949 tonnes for the year ending June 2015, which is an increase on the prior year.

The number of growers is estimated at around 130. There is a trend toward larger growing operations and fewer growers overall. A significant proportion of production enterprises are family farms[7].



Domestic markets

Market research indicated that the major growth has been in the red varieties[9]. In 2012, red-fleshed papaya lines occupied 35 to 40 per cent of the market with the traditional yellow-fleshed papaw occupying 60 to 65 per cent of the market. In 2016, around 75 per cent of the market was red and only 25 per cent was yellow[10]. This shows a rapid transition in the industry toward the higher taste, more visually appealing fruit.

Market	2012/13	2013/14	2014/15
Production volume (tonnes)	12,704	15,138	13,949
Production value ($ million)	$20	$24.9	$25.2
Fresh imports volume (tonnes)	0	244	162
Fresh imports value ($ million)	$0	$0.7	$0.5
Fresh exports volume (tonnes)	3	18	2
Fresh exports value ($ million)	<$0.1	<$0.1	<$0.1

Source: Horticulture Innovation Australia, Australian Horticulture Statistics Handbook 2014/15[3].

The cold chain relies on refrigerated road transport to wholesale market. There is a break in the cold chain which affects quality as wholesale to retail is predominantly through unrefrigerated road transport[5]. Growers also report that the rising cost of freight is the single highest expense for a farm[10] as the supply of premium quality fruits to distant interstate markets continues to be a challenge. Supply chain management research conducted by DEEDI with funding from ACIAR is currently looking at the interaction of fruit maturity at harvest, post-harvest fungicide application and ripening, and transport temperature on the quality of presented fruit[2].

Export markets

New Zealand is the largest importer of Australian papaya. The New Zealand Ministry of Agriculture and Forestry approved access to the New Zealand market for irradiated Australian papaya in 2006, however, only 14 tonnes have been exported to date with no exports between 2008 and 2012[5]. The *Australian Horticulture Statistics Handbook 2014/15* states that exports for the year ending June 2015 were two tonnes, with a value of less than $0.1 million. Of the exports for the year ending June 2015, 78 per cent were to New Zealand, and 11 per cent each to Singapore and Nauru.

Industry levy funds and Australian Government contributions have provided $330,000 to a Griffith University-led project which aims to increase the domestic market and export potential of Queensland papayas. It builds upon a breeding program that comprises the growth of 2000 papaya varieties and breeding lines on a farm in Mareeba, north Queensland. New varieties will consider the flavour profiles with the intention of more accurately marking the different flavours and building this into the breeding program. Other considerations are productivity, flesh colour and Papaya ringspot virus (PRSV) resistance. This also has the capacity to benefit other countries affected by Papaya Ringspot Virus including the United States, parts of Europe, Asia, the Middle East and South America[11].

Consumers and consumer research

The average papaya consumer purchases papaya every 34 days (compared to an average period of 44 days for the tropical fruit category). Like most tropical fruits, there is a high reliance on second time purchasers to drive category growth, with total volume of purchase driven by 10 to 20 per cent of the consumer households. A significant proportion of these consumers prefer to purchase pre-cut papaya (flesh exposed) primarily due to preference for smaller portion size, cost and a desire to see the quality and colour of flesh. Regular consumers are likely to be older (above 50 years of age)[5]. Consumer research found that overall younger consumers appear to be less adventurous in purchasing papaya than older consumers, however, they do appear to prefer the red varieties.

Key findings from this consumer research show that papaya is:

- Eaten predominantly for breakfast or as a dessert (small amount as green fruit in salads and cooking)[12]
- Healthy, exotic, distinctive and versatile
- High in nutritional benefit
- Tasty
- A digestion aid.

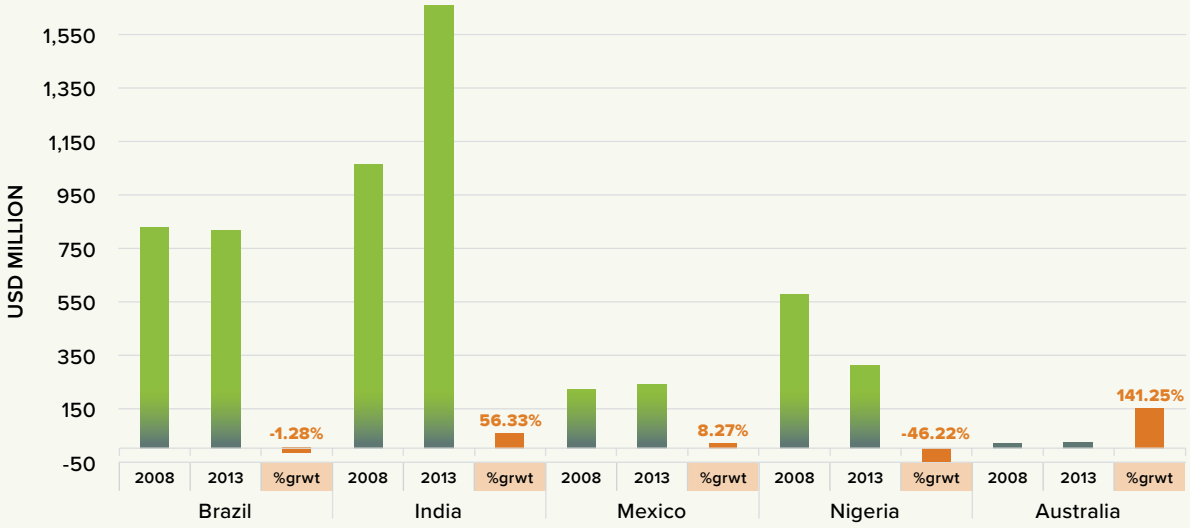
In 2014/15, 17 per cent of Australian households purchased fresh papaya and papaw, buying an average of 731 grams per shopping trip. The consumption per capita in 2014/15 was 585 grams, based on the volume supplied (*Australian Horticulture Statistics Handbook 2014/15*) which is less than 2014 at 650 grams but more than 2013 where 540 grams of fruit were eaten per capita[3].

Consumer benefits

Papaya and papaw are perceived as a healthy choice in the market as they have the following consumer benefits:

- Sweet, tasty – especially the red varieties
- Naturally contains a unique bundle of antioxidants – vitamin C and carotenoids
- Nearly a third of the recommended daily intake of vitamin A in one serve
- Good source of fibre which helps with digestive balance

Figure 2: Gross production value of papaya for major producers and Australia (2008, 2013 and five-year growth)
(Source: FAOSTAT, Value of Agricultural Production by Country (2015)[8])



- Considered one of the superfoods.

Competitors and the nature of competition

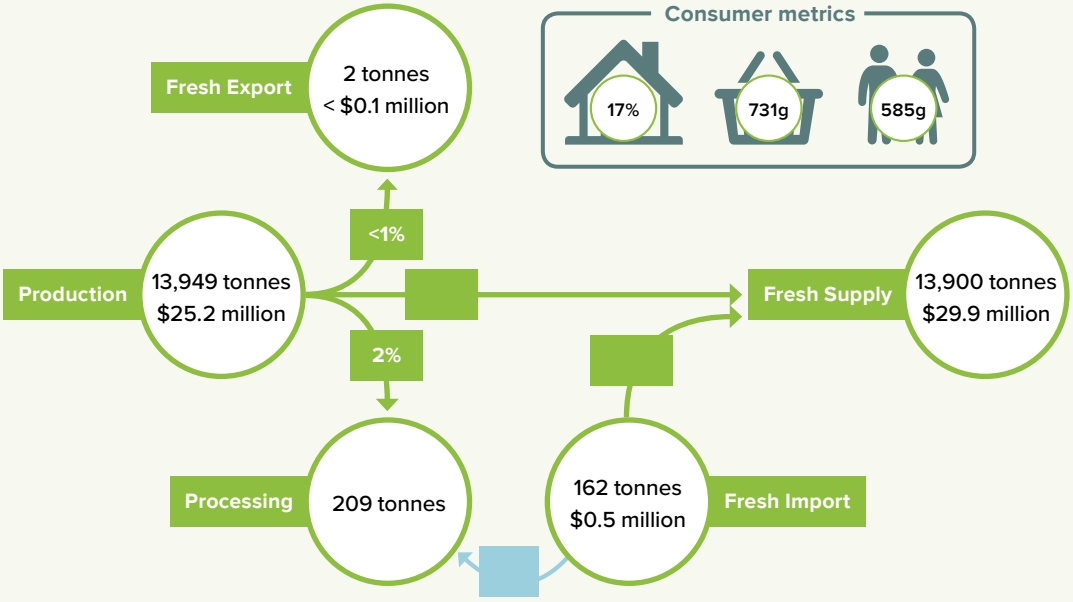
International papaya producers

The major countries that produce papaya are India, Brazil, Nigeria and Mexico[8]. Mexico, Belize (99 per cent of its production) and Brazil are major exporters. United States and then Singapore are the largest importers, mainly from other Asian countries[13]. ***Figure 2*** indicates the percentage growth of the value of production for the key papaya producers and its comparison to Australia, between 2008 and 2013. Although Australia's production value is substantially lower than that of the major producers, Australia's industry has increased at a greater rate than the other countries for the 2008 to 2013 period.

It is difficult for Australian growers to compete in most international markets because of the high cost of production in Australia compared to Asian competitors. An opportunity may exist to export to New Zealand, given its relative closeness and existing, although, historically, there have been small exports to this market.

Australia imported 162 tonnes of fresh product in 2014/15 mainly from Fiji[3,14] while only two tonnes were exported. In 2013 it was reported that Fijian papaya imports into Australia had ceased due to the prevalence of bacterial crown rot, although the Fijian industry and government remained committed to overcoming the biosecurity risk and regaining access to the Australian market[5]. The absence of Papaya ringspot virus (PRSV) in Fiji provides a major advantage compared with other competing papaya producing locations such as Hawaii, Philippines and Australia. Fiji consistently produces the Solo Sunrise red variety, combining exceptional sweetness and flavour[14].

Most processed products containing papaya are imported.



Source: Horticulture Innovation Australia, Australian Horticulture Statistics Handbook 2014/15[3]

Papain, an enzyme extracted from papaya is imported and used in food, leather, cosmetic and drug manufacturing.

Alternative products

Competitor products include other fruit categories such as mango, banana, orange and kiwifruit.

Barriers to consumption

Historically, the backyard-grown yellow papaya resulted in an image of poor quality fruit with a bad aftertaste. This perception is changing with the move to newer varieties, especially those with red fruit[6].

Barriers to consumption include a dislike of the taste, unattractive whole fruit, limited product knowledge, lack of availability and bruising[7].

Ease of entry

Papayas provide a viable new or diversification crop because of the short time between planting and fruit production (nine to 10 months), year round production and an average annual yield of five to six cartons per tree per year[4]. Given the appropriate tropical growing environment, establishment of a papaya farm is relatively easy. This means that expansion of production is less complex than a number of other crops.

Figure 3: Industry's supply chain

Operating systems

Production systems and processes

Papaya production is a labour intensive crop that requires harvesting and packing at least once a week all year round. In North Queensland, harvesting and packing is required twice a week across most of the year[4]. Minimal mechanisation is possible due to the delicate nature of the product. Consequently, production units are relatively small and intensive. The industry has exposure to risks from pests and extreme weather events such as cyclones creating a situation where continuity of supply is an ongoing risk for the industry.

Papaya ringspot disease is a major risk for the industry, however, it is currently restricted to South-East Queensland and is managed within a Pest Quarantine Area[16]. The two strains of ringspot are very closely related except that Type W cannot infect papaya. Type P infects cucurbits and papaya. Only the papaya strain (PRSV-P) is regulated in Queensland. Two species of fruit spotting bug (FSB) attack papaya, with the shoot feeder *Amblebelta lutescans* a major concern in northern Queensland, and the fruit feeder *A. nitida* of concern mainly in the south.

To assist in combating pest and disease, PHA developed an industry biosecurity plan in 2011 as well as developing a biosecurity manual which outlines procedures for protecting an individual farm[15]. DEEDI research funded by HAL (now Hort Innovation) developed an integrated approach to

disease control for two destructive papaya diseases, root rot (*Phytophthora palmivora*) and Black Spot (*Asperisporium caricae*)[2].

The papaya and melon industries are working together to find a solution as both are affected by the same disease and there is a multi-agency project, funded by Hort Innovation, on integrated management of FSB.

Marketing systems and structures

The following companies are major producers of papaya:

- Skybury Tropical Plantation (Mareeba)
- Lecker Farming (Mareeba)
- Mackays Marketing (Tully).

Operating environment

The papaya industry	
Strengths	• Healthy product available all year with tremendous nutritional benefits • Consumer awareness of the health benefits • Industry connections and communication • Good R&D expertise available with rapid time line to develop new varieties • Low cost of entry • Established, albeit small, levy program with federal support for use in R&D and marketing • Plentiful seed stock • Crops provide product year round.
Weaknesses	• Poor perception of fruit taste particularly in older demographic categories • Supply chain and cold chain issues affecting quality of a fragile product • Labour intensive harvesting practices • No industry standard product for supply into main retail market and inconsistent quality.
Opportunities	• Improved industry information and data sharing to advance production methods, supply chain forecasting, handling techniques and biosecurity defences • Links to and use of the research conducted in Fiji by ACIAR • Co-operative marketing campaign to raise awareness of the health benefits of papaya with melon and cross category promotion • Identify products that can be supplied consistently to target major retail markets.
Threats	• Regulatory changes such as the 'backpacker tax' and compliance with The Reef Water Quality Programme[19] • Extreme weather events such as cyclones and low rainfall • Competition from other exotic tropical fruits • Biosecurity breaches and the subsequent cost of quarantining against endemic and imported pests especially ringspot and fruit fly • Increasing costs of supply chain with transportation being one of the major impacts on profitability.

Promotion and market development

The following are the organisations involved with promotion and industry development:

- Papaya Australia Ltd (National peak body)
- Innisfail Papaw and Papaya Growers Association
- Mareeba District Fruit & Vegetable Growers Association Ltd
- Northern Territory Horticultural Association (NTHA) which represents horticulture producers in the Territory[7]
- Hort Innovation helps grow the Australian industry as a whole and has recently implemented a method of providing information through three channels – Growing Innovation, Hortlink and Grower Intel[12].

Hort Innovation reported in 2016 that a marketing campaign worth $129,330 included 109 in-store demonstrations in Coles and Woolworths and independent retailers by trained ambassadors. The campaign was designed to increase awareness and talk about the differences between papaw and papaya. It found that 73 per cent of buyers had previously tried it with health benefits being the primary reason for buying[12].

Levy funds collected for marketing are relatively small which limits the scope of promotional activity. Liaison with similar sized industries has been cost effective with co-operation between the persimmon, pineapple and papaya industries promoting together at the 2015 Sydney Royal Easter Show. The cost was reported to be four times less than traditional in-store demonstrations[18].

SECTION TWO

2

Papaya industry outcomes

The following outcomes have been identified by growers and **listed in order of priority as identified through the SIP logic process outlined in Section 4 of this plan.** These prioritised areas will be the focus areas of this plan.

OUTCOME 1

Increased quality to ensure consistency of supply to the consumer

While a number of growers are producing quality product, the lack of a standard product across the industry means that consumers cannot have confidence that quality and taste will be replicated between purchases. Adoption of standard product and product branding for both pawpaw and papaya to supply into retail chains could lift consistent demand for product and complement current niche marketing efforts by individual growers.

This combined with inconsistent harvest and postharvest practices result in poor uniformity along with reduced shelf life for up to 40 per cent of production. Research and adoption of best practice harvest and supply chain management processes is needed to ensure a high quality, consistent fruit reaches the consumer more often.

OUTCOME 2

Access to new varieties and improved pest and disease management improves growers' productivity and profitability

Effective pest and disease management is a challenge for the industry requiring ongoing investment. The industry plans to combat disease through improved access to effective chemicals, as well as the development of new varieties that appeal to the consumers and are resistant to disease and pests.

Consumer demand for healthy foods for themselves and their families are increasing. The industry needs to develop and adopt an IPDM plan including the development of organic processes to meet these consumer expectations.

By 2021, the industry would like to have developed two new superior varieties with advances in low impact/chemical-free plant health, disease, pest and environmental management.

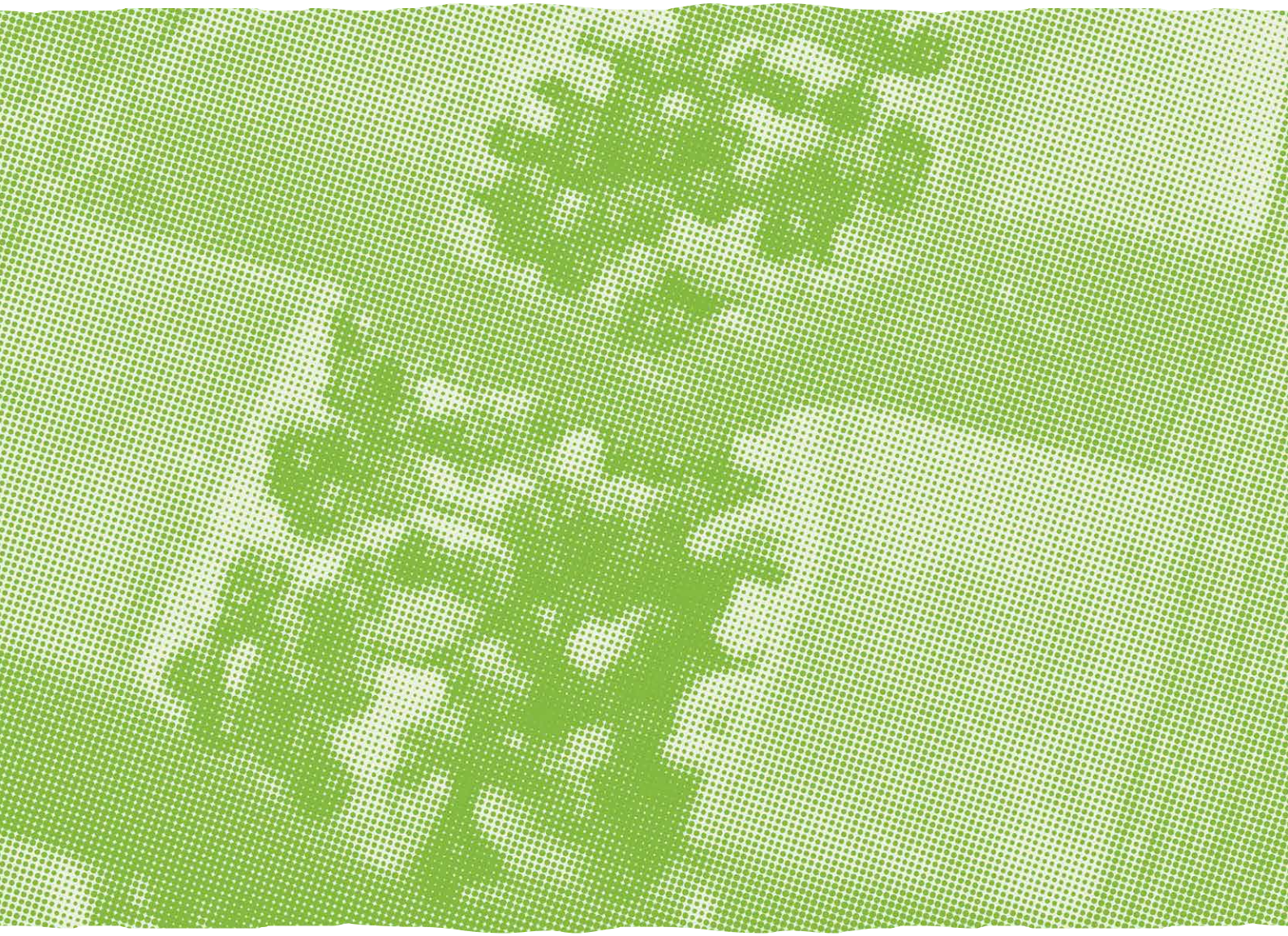
OUTCOME 3

Improved market access and increased consumer demand increases returns to growers

The health benefits of papaya are known by consumers who are familiar with the fruit, however, taste perceptions of older varieties and inconsistent quality have increased papaya price sensitivity and impacted consumer willingness to buy more frequently. To support demand and increase the frequency of purchases, marketing initiatives to debunk flavour perceptions and the potential uses of green, yellow and red papaya are being developed to help build on papaya's positive health image. Success in these areas could significantly increase demand in the eastern states.

Papaya does not currently have market access to Western Australia and Tasmania. Although the markets in these states are relatively small when compared to the potential growth in eastern states, establishing treatment protocol for Black Spot and compliance with the state quarantine protocols to access these states will assist growers to prepare for requirements related to the export market. While the industry would struggle to be competitive with Asian producers because of their low cost base, there are opportunities to export to New Zealand. In order to successfully and sustainably compete in export markets growers will need to commit to building a reliable supply so that when productions spikes there are channels in place to shift excess fruit.

As a result of improved quality, combined with effective marketing initiatives and improved market access, the industry expects prices to rise by 35 per cent to $2.16 per kilogram as production increases by over 50 per cent to 25,000 tonnes by 2021 which, if achieved, could double the value of the industry.



SECTION THREE

Papaya industry priorities

3

Industry investment priorities

The information below describes the outcomes, strategies and possible deliverables that will be the initial priorities of this plan. Highest-priority strategies or activities for the initial stages of the plan are indicated in **bold**. The ability to deliver on all the articulated strategies (and investments) will be determined by the ability of the statutory levy to provide the resources to do so. The priorities will lay the foundation for future investment and the implementation of this plan will require a balanced approach to ensure the industry has a high likelihood of success over the short-, medium- and long-term.

OUTCOME 1 – Increased quality to ensure consistency of supply to the consumer	
STRATEGIES	**POSSIBLE DELIVERABLES**
1.1 Engage with consumers to identify preferred taste and bring this understanding back to farm so growers can consistently provide quality fruit meeting consumer expectations	• Understanding of consumer taste and flavour preferences • Identified standard varieties that meet consumer preference to be supplied by industry through retail channels • Growers support industry-wide approach to variety adoption
1.2 Increase grower focus on quality through improved engagement and dissemination of best practice information	• Best management practices have been documented • Training and support is provided to growers to increase adoption rates of best practices
1.3 Research and adopt improved postharvest packing, treatment protocols, storage, distribution and retailer processes to improve quality and increase shelf life	• Guidelines on supply chain best practice have been developed and published • Provide training and support to help the supply chain adopt best practice storage and distribution

OUTCOME 2 – Access to new varieties and improved pest and disease management improves growers' productivity and profitability	
STRATEGIES	**POSSIBLE DELIVERABLES**
2.1 Continue research, trials and adoption of chemical and other processes use trials for effective pest and disease management	• New chemicals, processes and methods are identified for pest and disease management • Cost benefit analysis validates and encourages the adoption of new processes and methods • Training and support on how to adopt new processes is provided to growers • Registrations and permits for existing chemicals are maintained until they can be substituted effectively
2.2 Continue research and commercialisation of new genetically improved varieties that offer increased disease resistance and consumer appeal	• Varieties offering superior flavours, appearance and disease resistance are available to and marketed by growers
2.3 Develop and adopt an IPDM plan	• IPDM plan has been developed for the industry including how to produce organic papaya • Benefit cost analysis helps growers decide which approaches to implement for their business
2.4 Continue to research and refine agronomic practices to improve productivity, quality and environmental outcomes	• Research into improved soil, nutrition, water and plant management has been conducted and adopted by industry

OUTCOME 3 – Improved market access and increased consumer demand increases returns to growers	
STRATEGIES	**POSSIBLE DELIVERABLES**
3.1 Increase demand in existing domestic markets through understanding of consumer preference and targeted marketing around these preferences	• In collaboration with other industries, increase awareness through sampling and in-store marketing display and tasting activity • Marketing targeted at segments to maximise purchase volume
3.2 Provide opportunities to access domestic and international new markets	• Biosecurity issues for domestic and international market access have been identified and addressed • Export market development plans have been developed • Engage international supply chain stakeholders to identify grower led pathways for export
3.3 Support research, development, adoption of growing practices and marketing initiatives to position papaya a naturally grown fruit with significant health benefits	• Health benefits and potential health claims have been researched and validated so they can be used in marketing initiatives • Growers practices support development of a 'healthy product' marketing approach

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 4***. ***Figure 4*** also shows how each cross-sectoral investment theme relates to the five investment priorities.

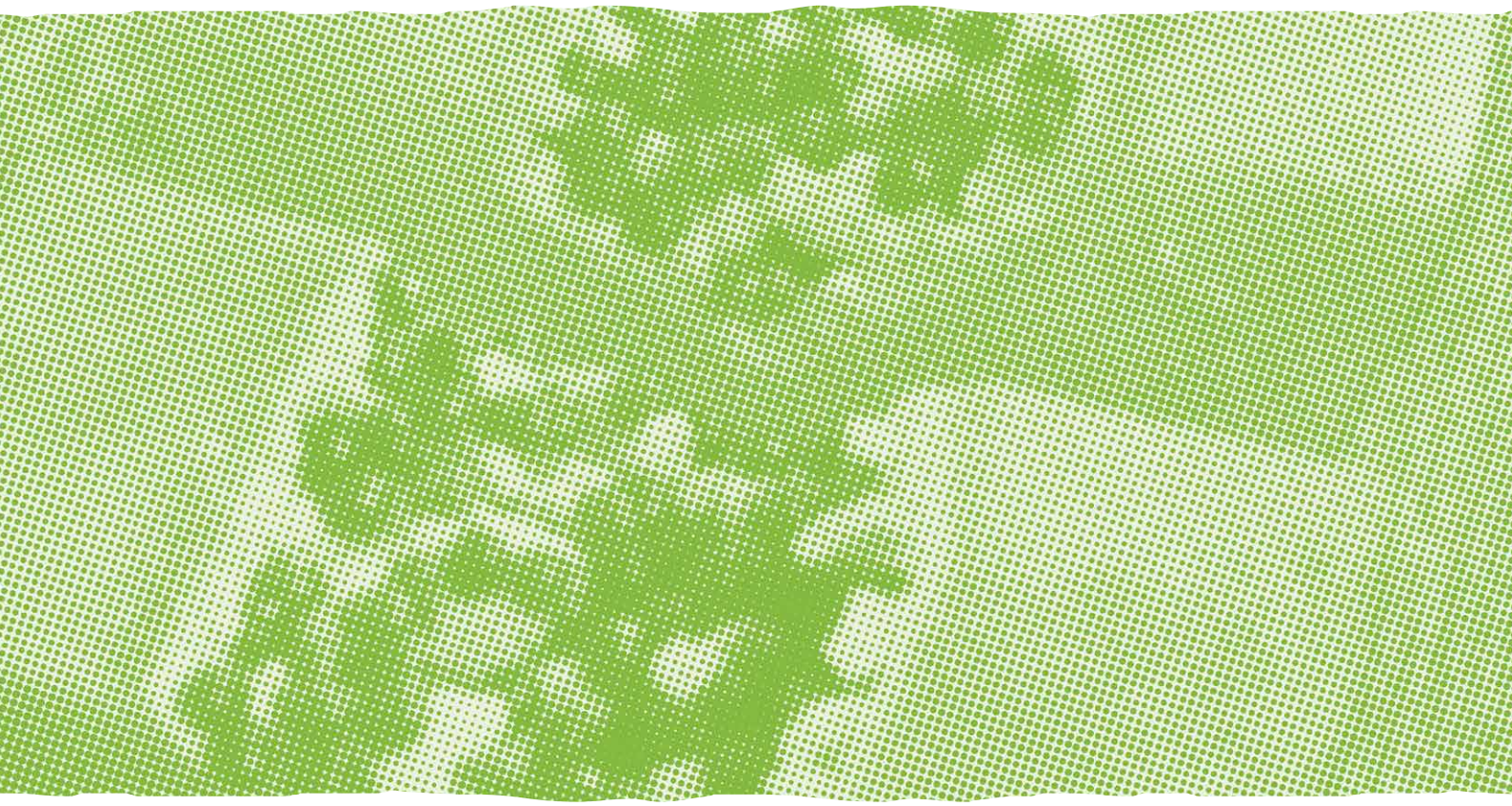
Figure 4: Hort Innovation's investment priorities

The identified investment priorities for papaya cover the five investment priorities for Hort Innovation through refining the industry focus in terms of varieties enabling the industry to improve productivity and efficiency but being more responsive to consumer demand. This approach will lead to an increase in domestic demand and mean position the industry to enter new domestic and export markets. A focus on improving variety resistance to disease and pests will enable it to present a healthier sustainable product improving its long-term sustainability. Development of better quality, consumer driven priorities will help in working with the supply chain to deliver better value chain outcomes.

The alignment of the papaya SIP outcomes to the Hort Innovation investment priorities, and consequently, the Australian Government's Rural RD&E Priorities and National Science and Research Priorities is shown in ***Table 1***.

Table 1: Papaya SIP outcomes alignment to the Hort Innovation investment priorities

Hort Innovation investment priorities	Papaya SIP outcomes
Support industry efficiency and sustainability	**Outcome 1:** Increased consistency and quality of papaya
	Outcome 2: Access to new varieties and improved pest and disease management improves growers' productivity and profitability
	Outcome 3: Improved market access and increased consumer demand increases returns to growers
Improve productivity of the supply chain	**Outcome 2:** Access to new varieties and improved pest and disease management improves growers' productivity and profitability
Grow the horticulture value chain capacity	**Outcome 1:** Increased consistency and quality of papaya
	Outcome 2: Access to new varieties and improved pest and disease management improves growers' productivity and profitability
Drive long-term domestic and export growth	**Outcome 1:** Increased consistency and quality of papaya
	Outcome 3: Improved market access and increased consumer demand increases returns to growers
Lead strategically to enhance the development of the Australian horticulture industry through operational excellence	Enabler



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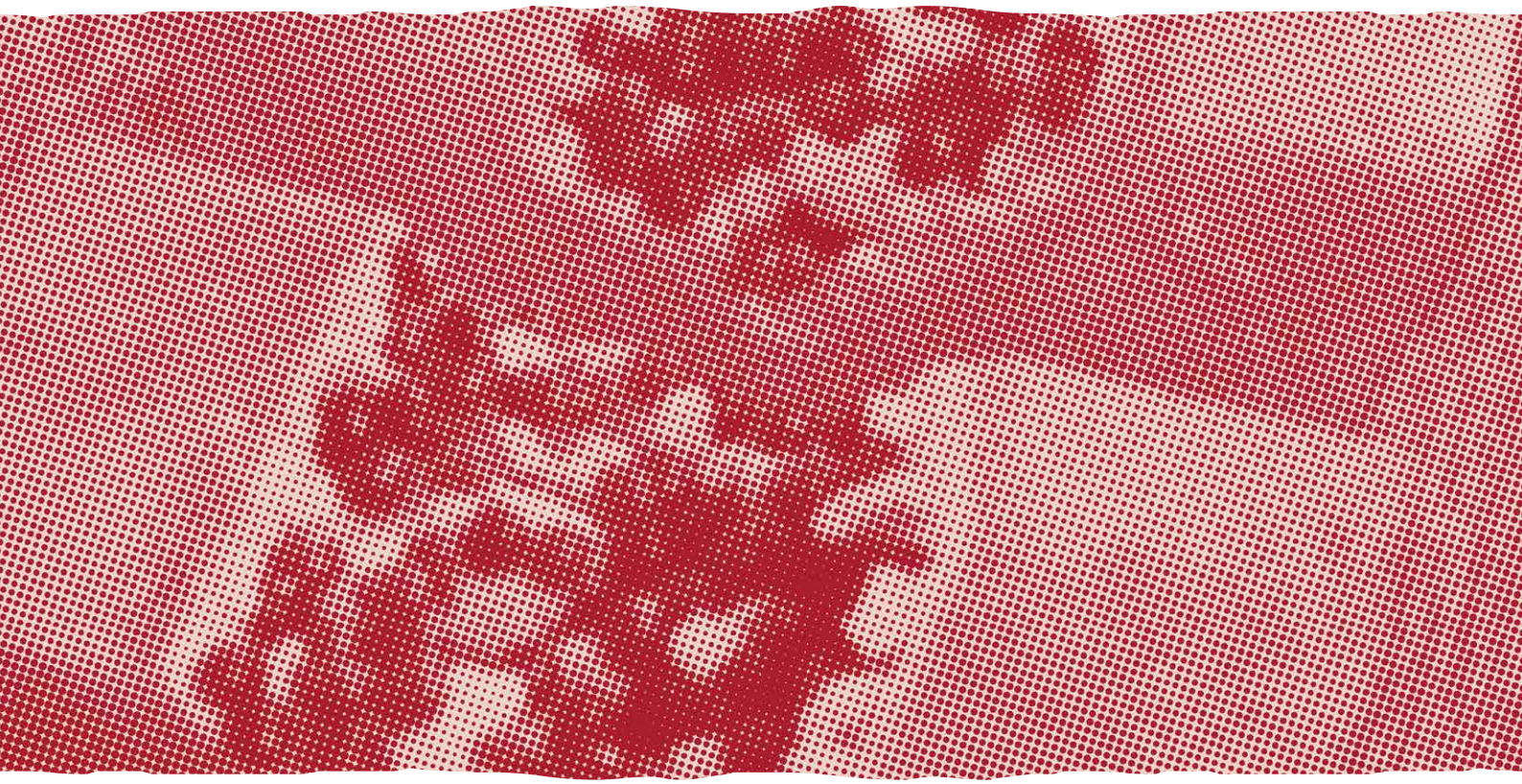
SECTION FOUR

Papaya monitoring and evaluation

Papaya SIP monitoring, evaluation and reporting

A SIP program logic and monitoring and evaluation (M&E) plan has been developed for the papaya 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.

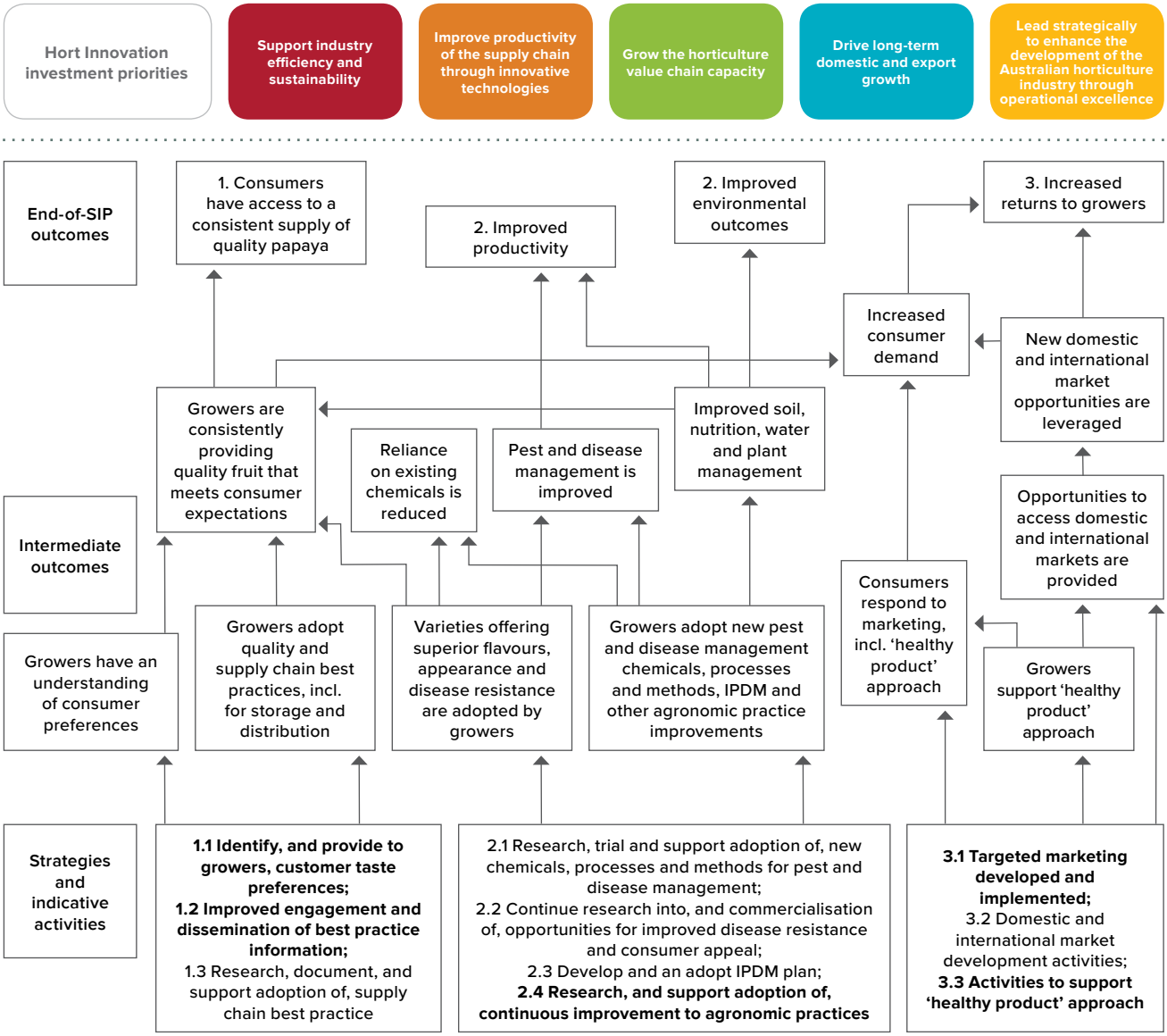
The SIP outcomes and strategies will be used to inform investments in individual projects to deliver on the SIP. The results of M&E will be used to reflect on the results of investments and in decision-making. Hort Innovation will facilitate the regular review of SIPs to ensure they remain relevant to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



Papaya SIP logic

An indicative papaya SIP program logic is shown in ***Figure 5***. The logic is based on the Hort Innovation SIP logic hierarchy (***Appendix 3***). The highest-priority strategies or activities in the deployment of the initial stages of the plan are indicated in **bold**.

Figure 5: Papaya SIP logic



Papaya SIP M&E plan

The papaya M&E plan is shown in ***Table 2***. 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. Highest-priority strategies or activities for the deployment of the SIP in the initial stages of the plan are indicated in **bold**.

Table 2: Monitoring and evaluation plan for the papaya SIP

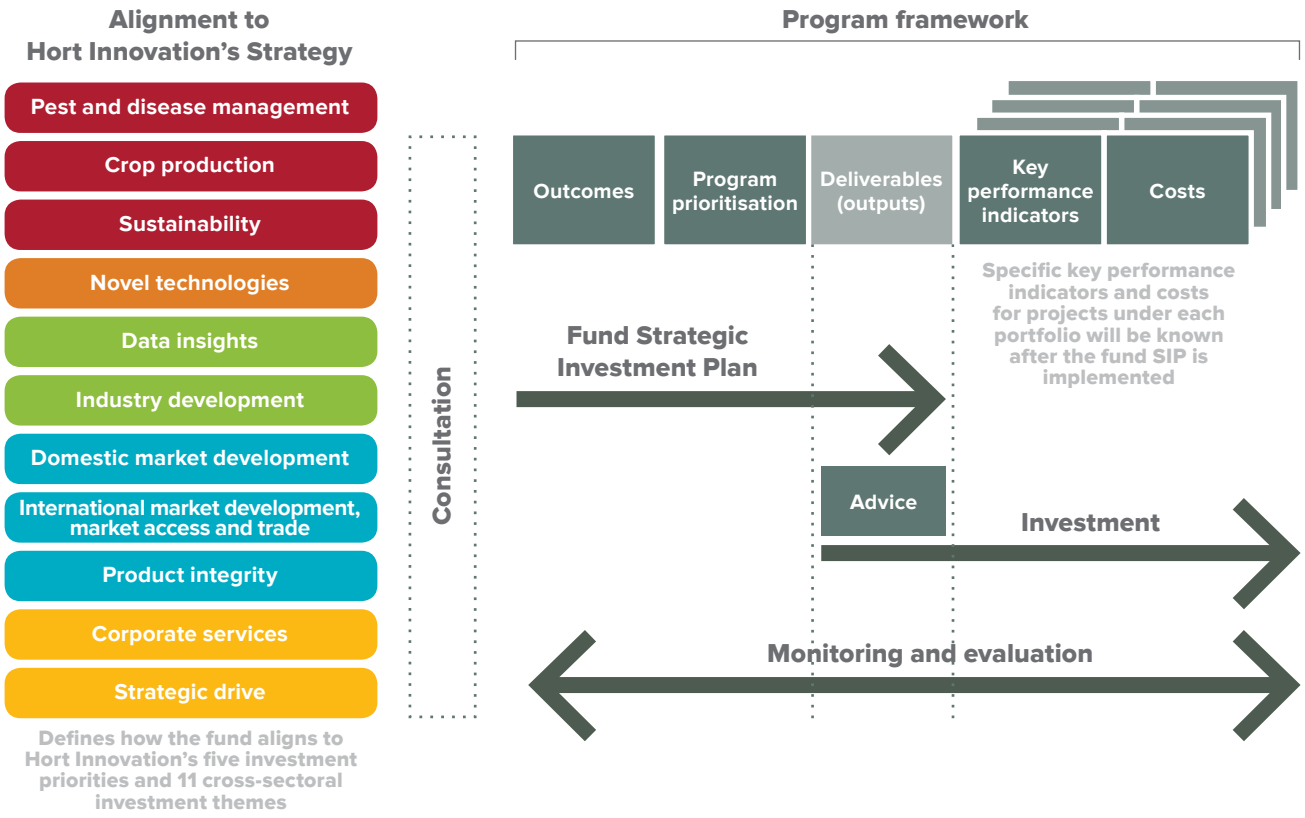
Outcome	Strategies	KPIs	Data collection methods and sources
OUTCOME 1: Increased consistency and quality of papaya	**1.1 Engage with consumers to identify preferred taste and bring this understanding back to farm so growers can consistently provide quality fruit meeting consumer expectations**	• Identification of nominated varieties to be industry standard • Industry providing increased volume of new varieties by 2021 • Adoption rates of supply chain best practice	• Agreement of industry representatives on varieties • Monitor of varieties sold through capital city wholesale markets • Annual survey of retail waste and consumer satisfaction • Grower/industry survey
	1.2 Increase grower focus on quality through improved engagement and dissemination of best practice information		
	1.3 Research and adopt improved postharvest packing, treatment protocols, storage, distribution and retailer processes to improve quality and increase shelf life		
OUTCOME 2: Access to new varieties and improved pest and disease management improves growers' productivity and profitability	2.1 Continue research, trials and adoption of, chemical and other processes use trials for effective pest and disease management	• Trials underway for three improved disease and pest resistant varieties by 2021 • Adoption of improved APDM and agronomic practices	• R&D project records • Production data • Grower survey
	2.2 Continue research and commercialisation of new genetically improved varieties that offer increased disease resistance and consumer appeal		
	2.3 Develop and adopt an IPDM plan		
	2.4 Continue to research and refine agronomic practices to improve productivity, quality and environmental outcomes		
OUTCOME 3: Improved market access and increased consumer demand increases returns to growers	**3.1 Increase demand in existing domestic markets through understanding of consumer preference and targeted marketing around these preferences**	• Evidence of improved industry understanding and meeting of consumer preferences • Evidence of improved understanding of export market opportunities and market access • An increase in exports to New Zealand • Path to commercialisation established for at least two certified varieties	• Retail and consumer insights data • Grower survey • Trade data • DAWR
	3.2 Provide opportunities to access domestic and international new markets		
	3.3 Support research, development, adoption of growing practices and marketing initiatives to position papaya as a naturally grown fruit with significant health benefits		

Reporting

The program framework in ***Figure 6*** 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 based on advice and available resources to 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 6: Hort Innovation's program framework

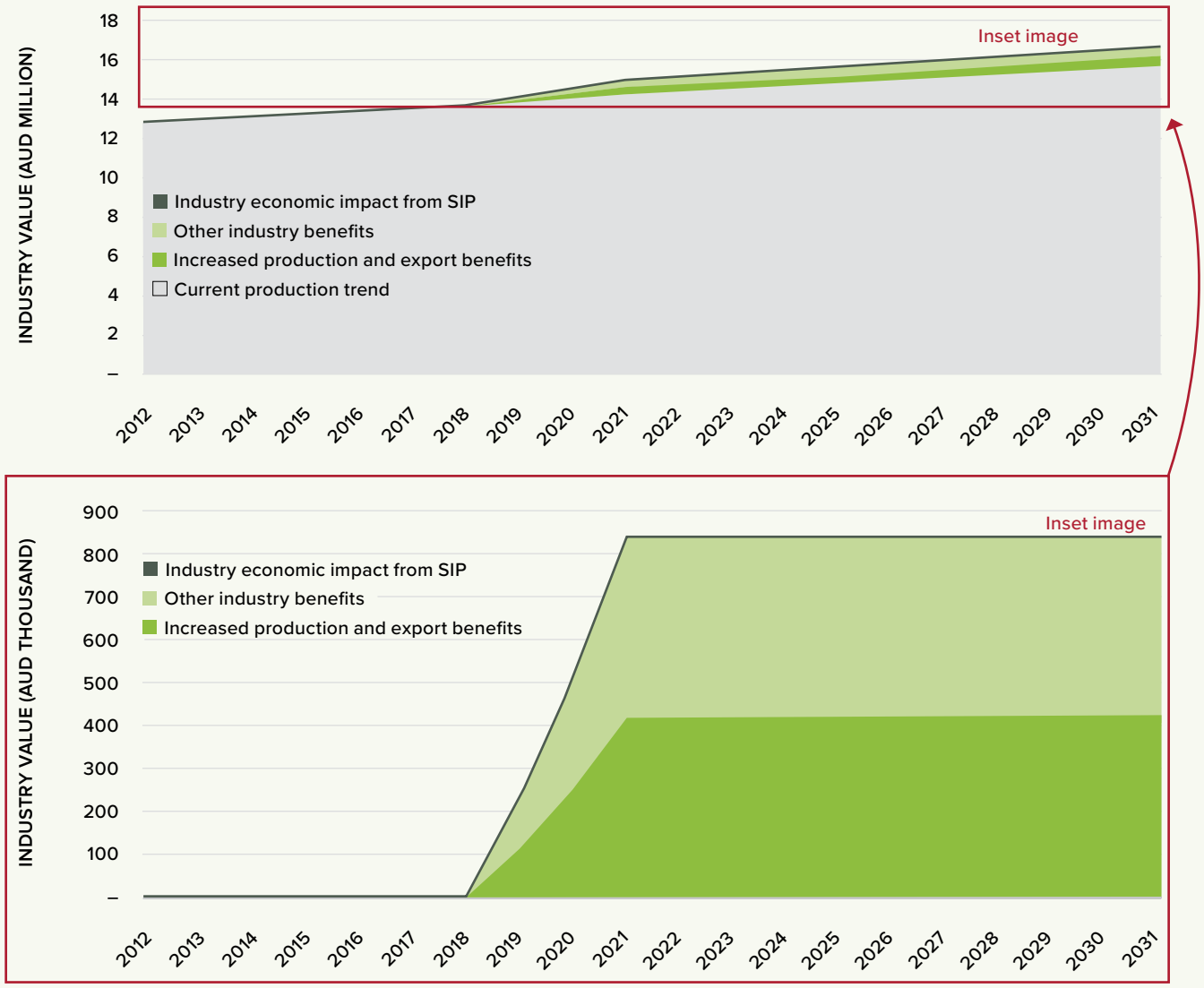


SECTION FIVE

5

Impact assessment

Figure 7: Economic benefit from investment in the papaya SIP



An independent assessment of the potential economic impacts from investment into the papaya SIP indicated a positive return on investment for the industry (***Figure 7***). The anticipated investment of $2.40 million over the next five years in R&D, extension and marketing activities is expected to generate $10.03 million in net benefits for the industry, representing a benefit cost ratio of 4.18 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 2016/17. A five per cent discount rate has been applied and all values are adjusted for inflation and presented in 2016/17 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.

Table 3 provides a summary of the impacts assessed for the SIP, their corresponding outcomes, net economic benefits and benefit cost ratio.

Table 3: Summary of assessed impacts for each SIP outcome

Outcome	Expected deliverables	Anticipated SIP investment (over five years)	Net benefits (over 15 years)	Benefit cost ratio
Outcome 1: Increased consistency and quality of papaya	• Necessary to drive quantified impacts	Incorporated below	N/A	N/A
Outcome 2: Access to new varieties and improved pest and disease management improves growers' productivity and productivity	• Increase in prices and increase in production sold	$2,401,507	$9,336,136	4.18
Outcome 3: Improved market access and increased consumer demand increases returns to growers	• Increase in exports sold, at projected prices		$696,614	
All impacts		**$2,401,507**	**$10,032,750**	**4.18**

The quantified impacts associated with the SIP Outcomes 2 and 3 include:

- An increase in prices to $2.16 by 2020/21
- Production sold increasing to 25,000 tonnes by 2020/21.
- An increase in exports to 200 tonnes by 2020/21, at current projected pricing.

In order to deliver increased production volumes, continued chemical pest and disease management research will be required, alongside integrated pest management strategies. The use of genetic improvement to develop disease resistant varieties will also enable the increased production.

In order to improve prices for these sales volumes, genetic improvement must also focus on consumer appeal, and targeted marketing strategies will be used to drive domestic demand, with a focus on the health benefits associated with papaya.

Sales to export markets will rely on provision of market access to both new and existing international markets.

Outcome 1 was not quantified, as it is a necessary precursor to delivery of Outcomes 2 and 3, and the associated quantified impacts. The identification of an industry standard that provides consistency and quality for consumers will enable the increase in both price and quantity in the domestic market, and the expansion of export volumes.

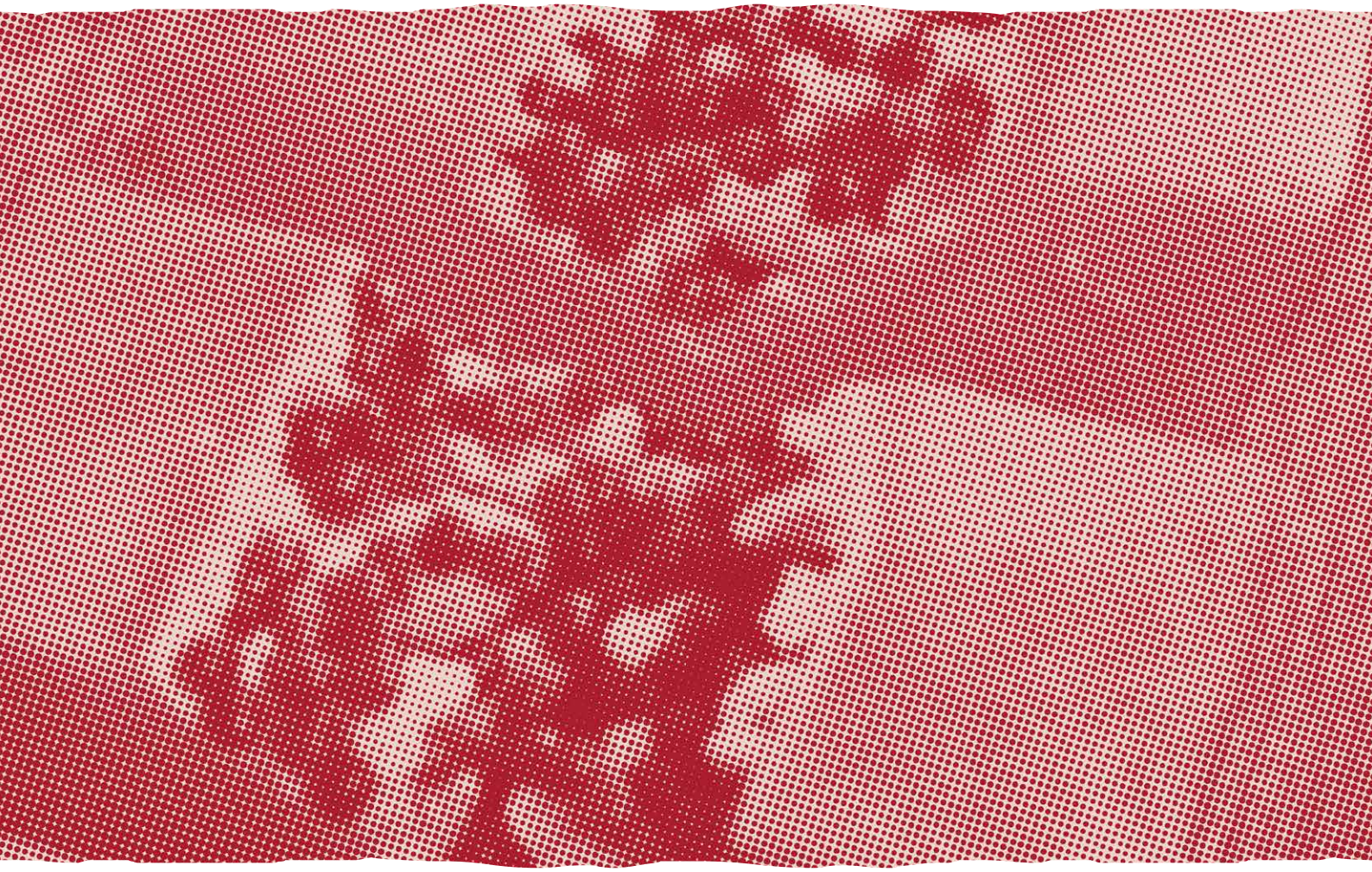
6

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.

Papaya growers are currently segmented into a few large growers and a number of smaller growers. This means that there are several growers with the resources to successfully grow their business through best practice management, variety selection and marketing. The lack of a widespread industry view limits potential overall growth because co-ordinated activity about variety selection, marketing, disease and pest management and other factors. The impacts of this lack of industry consistency needs to be understood and managed if identified outcomes are to be realised.



APPENDIX 1: Process to develop this plan

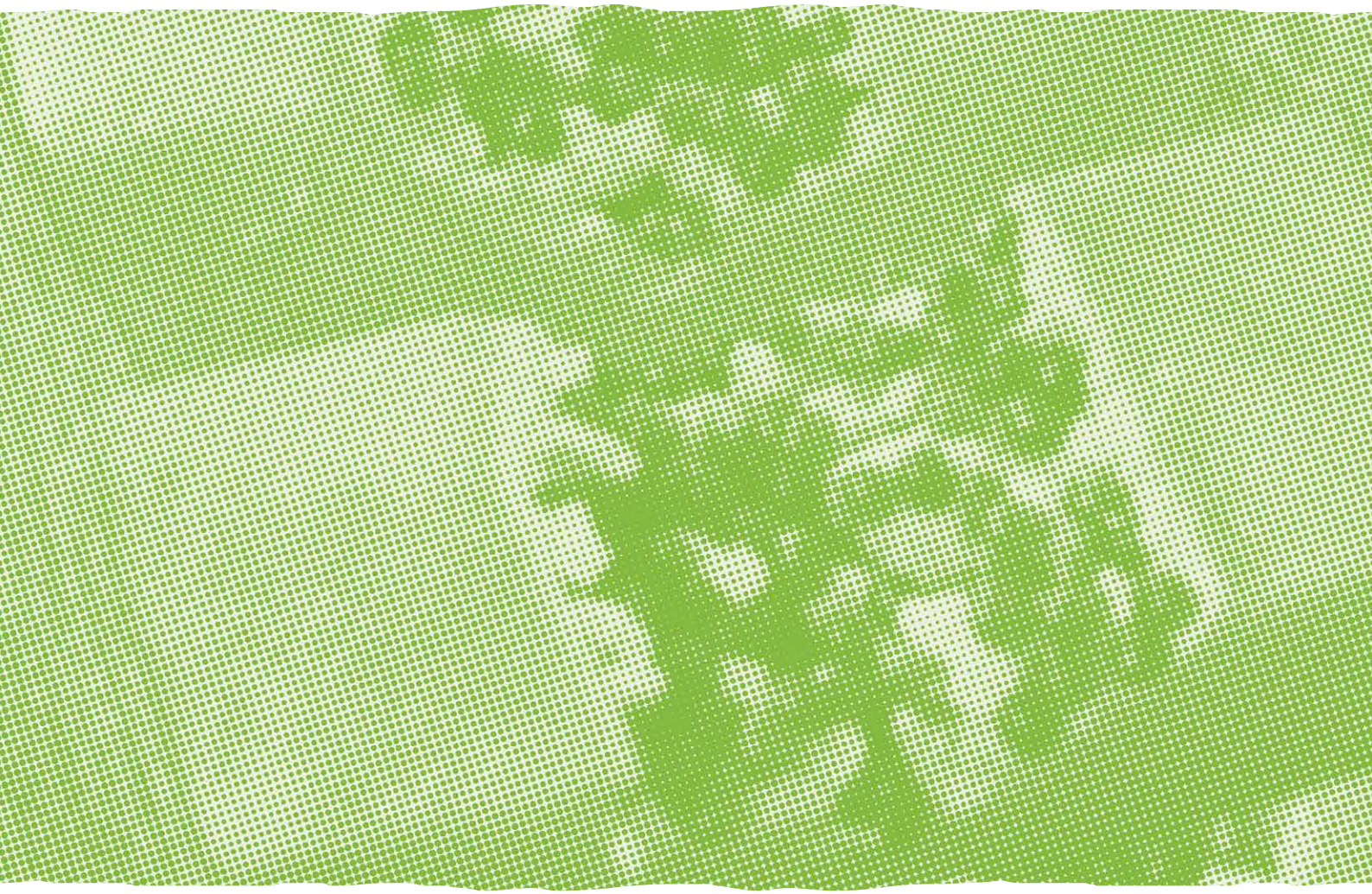
The process to develop the SIP was as follows:

1. ABCD analysis discussions were held at the inaugural SIAP meeting on July 18, 2016
2. The context was developed through desktop research and engagement with growers and researchers between October and December 2016
3. An industry-wide online survey was issued to gain greater feedback on identified outcomes and to identify any gaps in the requirements of the industry
4. The draft outcomes and strategies were validated with one on one phone calls to key growers and SIAP members in December 2016
5. The monitoring and evaluation analysis was conducted by Clear Horizons in December 2016
6. The impact assessment analysis was conducted by Consulting & Implementation Services (CIS).

APPENDIX 2: Consultation and validation

The following individuals contributed to the development of this SIP and their contribution is greatly appreciated.

Name	Industry Role
Gerard Kath	Papaya Australia President
Joe Zappala	Grower
Daniel Mackay	Grower
Mark MacLaughlin	Grower
Hayden Dazenervie	Grower
Yan Diczbalis	Queensland Department of Agriculture and Fisheries



APPENDIX 3:
Logic hierarchy

Vision			To grow the future of Australia's horticulture industries			Common for all Investment
Mission	Increased profitability of Australia's horticulture industries		Increased productivity of Australia's horticulture industries		Increased global competitiveness of Australia's horticulture industries	
Hort Innovation end-of-strategy outcomes	**Support industry efficiency and sustainability**	**Improve productivity of the supply chain**	**Grow the horticulture value chain capacity**	**Drive long-term domestic and export growth**	**Lead strategically**	
End-of-SIP outcomes	*The industry-specific outcomes of the SIP. The final desired result of SIP investment but may be achieved after the SIP time-frame. SIP investment may be just one contributing factor to the achievement of these outcomes. For example, incremental productivity, profitability and competitiveness improvements stimulated through R&D, changes in consumer awareness, marketing campaign reach and influence and increased recognition of Australian horticulture products.*					SIP specific
SIP intermediate outcomes	*Short- to medium-term changes brought about through the SIP, which will support the achievement of end-of-SIP outcomes. For example, practice changes, adoption, changes in grower knowledge, attitudes, skills and aspirations (KASA) and marketing reach.*					
SIP activities and outputs	*What is directly delivered by the SIP (R&D, extension and marketing activities and outputs, for example, products and services, and events and engagement) across the 11 horticulture cross-sectoral investment themes: Pest and Disease Management, Crop Production, Sustainability Improvements, Novel Technologies, Data Insights,Industry Development, Product Integrity, International Market Development, Market Access and Trade, Domestic Market Development, Strategic Drive and Corporate Services.*					
Foundational activities	*Preliminary or preparatory activities that are conducted before and during SIP delivery. Includes industry processes, infrastructure and resources that enable the SIP to be developed and delivered. Includes SIP planning, consultation, advisory meetings etc.*					

APPENDIX 4:
Reference documents

1. Papaya Australia Limited. *Papaya Australia*. 2016 8/11/2016]; Available from: http://australianpapaya.com.au/about/.
2. Yan Diczbalis, B.W., Mark Hickey, *Papaya*. 2012, National Horticultural Research Network.
3. Horticulture Innovation Australia and Freshlogic, *Australian Horticulture Statistics Handbook 2014/15*. 2016.
4. Queensland Department of Agriculture and Fisheries, T.S.o.Q.D.o.A.a. *Papaya*. 2013 8/11/2016]; Available from: https://www.daf.qld.gov.au/plants/fruit-and-vegetables/fruit-and-nuts/papaya.
5. Horticulture Australia Limited, *Papaya Industry Strategic investment Plan 2013/14-2017/18*. 2013: Horticulture Australia Limited.
6. Neales, S., *Pawpaw dreaming: try it, then love it ... and the sky's the limit*, in *The Weekly Times*. 2016, News Corp Australia.
7. Horticulture Innovation Australia, *Papaya*. 2016; Available from: http://horticulture.com.au/grower-focus/papaya/.
8. Food and Agriculture Organization of the United Nations, *Value of Agricultural Production by Country* 2015.
9. McKillop, C., *Record papaw production driven by drier, warmer weather and increased plantings*. 2015, ABC Rural.
10. Akers, T., *Queensland Business Monthly: Griffith University research puts papaya farms in sweet spot*, in *Courier Mail*. 2016.
11. Horticulture Innovation Australia, *Research to boost Queensland papaya quality, trade appeal*. 2016 8/11/2016]; Available from: http://horticulture.com.au/growing-innovation-issue4-papaya/.
12. Horticulture Innovation Australia, *Annual Report 2015/16: Breaking new ground*. 2016, Horticulture Innovation Australia Ltd.
13. Edward A. Evans, F.H.B., *An Overview of Global Papaya Production, Trade, and Consumption*. FE913 IFAS Extension, 2015.
14. Kalara McGregor, A.M., Lex Thomson and Kyle Stice, *Australian Market Analysis – Fiji and Pacific Island Papaya*. 2009.
15. Plant Health Australia Ltd, *Biosecurity Manual for the Papaya Industry V1.0 August 2013*. 2013, Plant Heath Australia.
16. Queensland, B., *Papaya ringspot disease*. 201, Department of Employment, Economic Development and Innovation, Queensland Government.
17. Department of Agriculture and Water Resources, A.G. *Papaya levy information*. 2016 8/11/2016]; Available from: http://www.agriculture.gov.au/ag-farm-food/levies/rates/papaya.
18. Horticulture Innovation Australia, *Pineapple, Papaya and Persimmon industries join forces at the Sydney Royal Easter Show*. 2015 10/11/2016]; Available from: http://horticulture.com.au/pineapple-papaya-and-persimmon/.
19. Australian Government National LandCare Programme. *The Australian Government Reef Programme*. 2016 26/10/2016]; Available from: http://www.nrm.gov.au/national/continuing-investment/reef-programme.

APPENDIX 5:
Outputs of industry engagement

ABCD Analysis – Papaya SIAP

VISION: WHERE DO WE WANT TO BE?

Price/kg >$2.16/kg (based on 2016 CPI) **Sydney wholesale sale price on stand therefore BNE $2.06 and Melb $2.26**	Export 12 pallets/week = 600T per year	Harvest 2M–2.5M cartons/year 25,000T

STRATEGY: HOW DO WE GET THERE?

ACTIONS DRIVEN BY STRATEGY

3-5 YEARS

Genetic Improvements

Chemical access

– Growing practices impact here and review of access and priorities with the SARP. Include dieback, FSB and Phytophthora in particular especially with more organic practices

1-2 YEARS

Breeding and industry development project

– Align taste profile with traits that are preferential and match with current commercial varieties and breeding program varieties then match this with consumer preferences

– Identify health benefits and possible claims that could be used in marketing – further research into the health profile of papaya

Chemical access

– Growing practices impact here and review of access and priorities with the SARP. Include dieback, FSB and Phytophthora in particular especially with more organic practices

0-6 MONTHS

Genetic Improvements

Post harvest – uniform consistency and shelf life

– Sometimes <40% impacted – confidence in shelf life of product. Need a good effective post harvest treatment – less breakdown

Chemical access

– Growing practices impact here and review of access and priorities with the SARP. Include dieback, FSB and Phytophthora in particular especially with more organic practices

Access to WA

– Treatment for blackspot accepted protocol

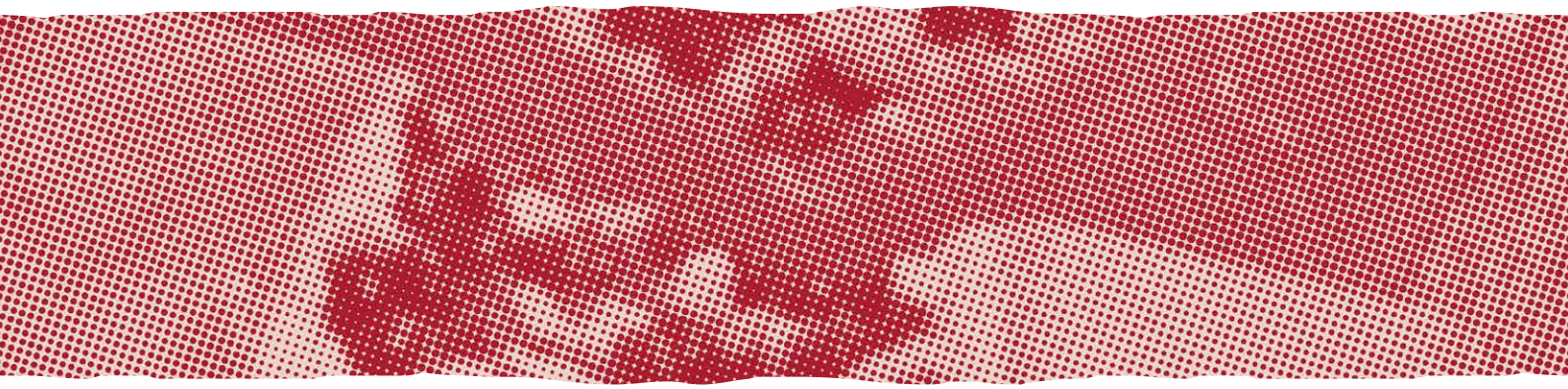
– Check interstate quarantine regulations e.g. Papaya into Tasmania from Melbourne

– Product Ranging – all retailers to do product range (only possible with access to Tasmania) – every store stocking papaya

TIME

WHERE ARE WE NOW?

Price/kg $1.60 BNE, $1.70/kg SYD and $1.80 Melb (2016)	Export tonnage/year driven by supply security = 200T/year 4 pallets/week	Harvest 1.5 M–1.6M cartons/year 16,000T



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