NORTHERN HEALTH SERVICE DELIVERY

TRADITIONAL OWNER-LED DEVELOPMENT

AGRICULTURE & FOOD

Evaluation of the potential to expand horticultural industries in Northern Australia

Research report output- Project A.1.1718014

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DEVELOPING NORTHERN AUSTRALIA

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The author(s) confirm(s) that this document has been reviewed and approved by the project's steering committee and by its program leader. These reviewers evaluated its:

- originality
- methodology
- rigour
- compliance with ethical guidelines
- conclusions against results
- conformity with the principles of the Australian Code for the Responsible Conduct of Research (NHMRC 2018),

and provided constructive feedback which was considered and addressed by the author(s).

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Acronyms

NA	Northern Australia
NAIF	Northern Australia Infrastructure Facility
QLD	Queensland
WA	Western Australia
NT	Northern Territory
AMIA	Australian Mango Industry Association
AA	Avocados Australia
ALGA	Australian Lychee Grower Association
DPIRD	Department of Primary Industries and Regional Development
HIA	Hort Innovation Australia
DAWR	Department of Agriculture and Water Resources
FAO	Food and Agriculture Organization
SFFC	Southern Forests Food Council
AFPA	Australian Fresh Produce Alliance
ULMA	United Lychee Marketing Association
DAWE	Department of Agriculture, Water and the Environment
DAF	Department of Agriculture and Fisheries
QCMD	Queensland Cabinet and Ministerial Directory
VTPA	Vietnam Trade Promotion Agency
AVA	Agri-Food and Veterinary Authority
AQSIQ	Administration of Quality Supervision, Inspection and Quarantine
IRF	Industry Research Framework
VHT	Vapour Heat Treatment
AOMs	Asian open markets
APMs	Asian protocol markets
KP	Kensington Pride
O2O	Offline to Offline
ITA	International Trade Administration
CIF	Cost, Insurance and Freight
ICF	Industry Collaboration Framework
MRL	Maximum residue limit

Project participants

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Queensland Department of Agriculture and Fisheries (DAF)

Northern Territory Department of Primary Industry and Resources (NTDPIR)

Western Australian Department of Primary Industries and Rural Development (WADPIRD)

Executive summary

This project developed an industry research framework to evaluate the potential to expand horticultural industries in northern Australia. In discussion with the project partners, three major research themes – supply intelligence, market intelligence and supply chain intelligence – were identified as key priorities for action. The analytical results of the project were expected to provide an evidence-base to support decision-making in regional and market investment.

Focal industries: Three horticultural industries: one newer industry – lychees, and two established industries – mangoes and avocados across north QLD, NT and WA were selected based on industry characteristics and inputs from regional industry partners. To capture the potential for exporting mangoes, avocados and lychees from northern Australia into Asian markets, five markets were focused on in this project. This includes Hong Kong and Singapore which are open markets and China, Japan and South Korea which are protocol markets. Australian mangoes, avocados and lychees have established their market position in Hong Kong and Singapore, which are regarded as marginal markets. However, continuous efforts are required to maintain market competitiveness and expand market share by offering quality products through innovative value chain configurations. In contrast, China, Japan and South Korea are regarded as high-margin markets where Australian avocados and lychees (mangoes excluded) have not yet gained full market access.

Main recommendations: One of the key findings is that the voice of the consumer in the Asian markets analysed is not being heard by most growers. Most smaller growers do not have the resources and are not integrated into a supply chain sufficiently to have the awareness or understanding of consumer needs and behaviour in key Asian regional and city markets. What has been suggested is a stronger long-term solution, supported and enabled by new governance structures and technology.

1. To mimic the digital and data platforms that have been developed and are in place for and by the lead growers and exporters over the last ten years, to establish a digital market and supply chain intelligence platform that is accessible to small and medium growers. The focus then is to digitally transform and strengthen existing supply chain governance and collaboration arrangements across the three industries with respect to northern Australia (or nationally). The governance arrangements should necessarily involve all the key parties, requiring strong industry leadership with government agency support. This shared

collaboration model would spread benefits further across the industry, reducing barriers to market entry and penetration. Increasing the responsiveness of the entire industry to rapidly changing needs and behaviours of consumers in markets has the potential to be much more lucrative than what is currently being accessed for all supply chain participants.

2. To support the first goal, it's recommended the establishment of an Export Development Decision Support System (EDDSS) that will enable a large number of supply chain participants from across the producing regions and international markets to extensively interact while capturing increasingly current data on transactions and activities at each stage of the movement of goods, and associated actions and outcomes across the entire export-import process. The upstream voice of both growers and exporters and the downstream voices of importers and consumers in international markets can become a key element of holistic export development strategies. Specifically, the development of an upstream participatory decision support system which makes full use of the transactional and trade data of the EDDSS will improve the decision-making capability of growers and exporters, improving export development and regional export strategies. The development of a downstream participatory decision support system with the involvement of importers and retailers will increase the capacity to promote the benefits and value of northern Australia's mangoes, avocados and lychees in large and expanding city and regional level markets. The enhanced data capture, curation, analysis and dissemination is focussed on increasing international market access, and increased market development through improved margins for all supply chain participants.
3. Within the Export Development Decision Support System, establish a **digital export and knowledge hub** that the blockchain technology and systems can feed into, that systematically builds the high-quality information base needed for growers to make better decisions about their product, about markets and also where and how much they can innovate. Successful larger growers and exporters have had similar systems in place. Smaller growers have not had the margins to invest in such sophisticated systems until now. The reality, however, is that with minimal industry investment, coupled with investment support for lead agencies such as Hort Innovation and each of the three State and Territory Governments, small and medium growers can begin to gain the advantages that, until now, have only been afforded to larger growers and exporters. This pooled approach is one of the only ways that a boost in competitiveness in the targeted export strategy can realistically achieved. What is proposed is a program of work over a number of years that builds direct real-time data on products out of northern Australia, including following and sustaining its provenance through to the consumer, as well as a direct communication channel from the

consumer to growers so that improvements can be made to both the supply and demand side of the equation simultaneously. This mechanism will also increase supply chain transparency and the visibility of product movement along the supply chain through to consumers. By opening two-way communication, the hub will enable more rapid value creation at the grower end, value delivery along the supply chain, and value capture by all supply chain participants.

4. A cross-border collaborative research and development framework should be established to increase collaboration between those in industry, research and consumer market settings to improve the planning around R&D priorities. New product development utilising emerging genetic technologies is increasingly key to market competitiveness for horticultural products. Breeding and development of new plant varieties through embracing innovation in breeding targets, technology and propagation techniques could increase speed to market of new varieties and the development of products that will find a high-value market due to their attractiveness to consumers.

There are excellent examples of this happening already for the large growers; however, these are only examples and are not indicative of behaviours and practices across these industries and other horticultural industries. The major finding found in this particular study is for horticultural growers to use the enabling technologies that other industries have been using for considerable time and which larger growers have been using for at least ten years in the mango and avocado industries. The upside of this approach is that most technology that will need to be adopted is already proven, so are not new to the industry, it is only new to the grower.

Methodology: The research was conducted through the combination of a stakeholder workshop, desktop analysis of production, trade and market data, and in-depth field discussions with industry bodies, growers and exporters in northern Australia and importers, wholesalers and retailers in Hong Kong, Singapore and China. Specifically, 29 field interviews with growers and exporters involved in the mango, avocado and lychee industries, within the boundary of northern Australia were conducted, while secondary data was gathered from industry partners. More than 30 companies, including importers and retailers, were interviewed in Singapore, Hong Kong and China during two-rounds of field studies. Field studies were not conducted in South Korea and Japan, but desktop research was conducted instead to capture supply chain and market insights for these countries.

To gather primary data, assistance from industry partners, industry bodies and Austrade were sourced to increase participants in the field-studies at home and abroad. Despite this, a relatively small number of companies in Australia and Asian markets (Hong Kong, Singapore and China)

agreed to participate in the interviews. This experience indicated that consulting with participants at various stages of the cross-border supply chain was a challenging task. As noted by Lane (2015), sourcing participants who are willing to engage in the interview and/or provide potentially sensitive business information is a challenge. Despite the constraints in interview numbers, the results indicate there is a need for exports from northern Australia, identify the opportunities and challenges in export development from northern Australia and provide market perspectives. Based on this research, findings were developed for expanding the exports of horticultural products (mangoes, avocados and lychees) from northern Australia, and pathways identified for tapping into premium channels in targeted Asian markets.

Results: Research analysis identified the key elements that drive both export growth and constraints in export development from a regional and industrial perspective. Market opportunities, supply chain strategies, potential competition and successful models deployed by competitors were also investigated through primary and secondary data gathered from this research into targeted markets. Presented are results for each industry and target country. However, results are constrained, in part due to lack of secondary data, but also because in-field studies were not conducted in Japan and South Korea. Therefore, results for (e.g.) entry channel, fruit storage and sales regions in Japan and South Korea are not available in this report.

Introduction

Northern Australia has long been regarded as an important gateway to the Asian market. However, due to Australia's focus on supplying the domestic market, horticultural industries in the region have yet to take full advantage of international market opportunities. This project has undertaken an assessment of the production and supply capacity of the horticultural industry in northern Australia (i.e. north QLD, NT and WA), and sought to match that with the market and logistical dynamics of imported mangoes, avocados and lychees in targeted Asian markets.

The objective of this CRCNA-funded project is to provide an evidence base for decisions on the expansion of exports of high-value horticultural products from northern Australia to high margin Asian markets by integrating market dynamics and supply capacity with efficient and innovative value chains.

The focus of the project, as an exploratory study, evaluated three horticultural industries: one smaller emerging industry – lychees and two established industries – mangoes and avocados across north QLD, NT and WA. The market analysis focussed on five Asian markets, Hong Kong and Singapore which are open markets, and China, Japan and Korea which are protocol markets.

The research activities and specific objectives of this project are presented as follows:

- To design a knowledge sharing and learning platform that supports export growth. The intent was to guide firms to optimise their supply chains, based on evidence; and for industry bodies to support cost-effective and compliant industry export supply chains to boost export development of the northern Australia's horticultural industry.
- Conduct a market and supply chain analysis to improve the knowledge of the market for mangoes, avocados and lychees in the five targeted Asian markets. These market insights should support Australian producers in capturing market potential and supplying the products valued by customers. The evidence comes from an investigation of supply chain strategies and operational models that are implemented by importers, including wholesalers and retailers. This includes cultural knowledge of supply chain governance relationships as well as operational strategies. The dynamic nature of the industry and markets requires the identification of evolutions in premium channels to tap into with innovative products.
- Complete a benchmark analysis to evaluate performance against international competitors across stages of production, market and cross-border supply chains. This is to identify opportunities in production processes, market development and supply chain operations.

- Identify the key elements driving success and problems along the supply chain for targeted Asian markets. The results will also support government, industry peak bodies and HIA with evidence-based industry and regional policy and investment decisions in northern Australia to facilitate exports of innovative products.
- Improve supply (value) chains productivity across the global supply chain through market-oriented production, where the consumer's voice is clearly heard and not obscured.
- Strengthen communication channels across supply chains for the identified markets in the Asian region, by both shortening supply chains and shifting from transactional relationships to strategic partnerships.

Section 1 Industry Research Framework (IRF)

The Industry research framework (IRF) as illustrated in Figure 1 was developed with input from research participants during the first stakeholder meeting.

The IRF can be easily understood across the following four layers:

I. An analytical framework of production and supply, as well as supply chain and market intelligence, agreed upon by industry stakeholders

II. Industry transparency through a co-learning database based on sectoral and cross-industry analysis following the analytical framework of supply, supply chain and market intelligence

III. Benchmarking based on the benchmarking criteria agreed by industry stakeholders

IV. Support industry stakeholders to prioritise strategic development and investment strategies by integrating initial and later dynamic results and benchmarking.

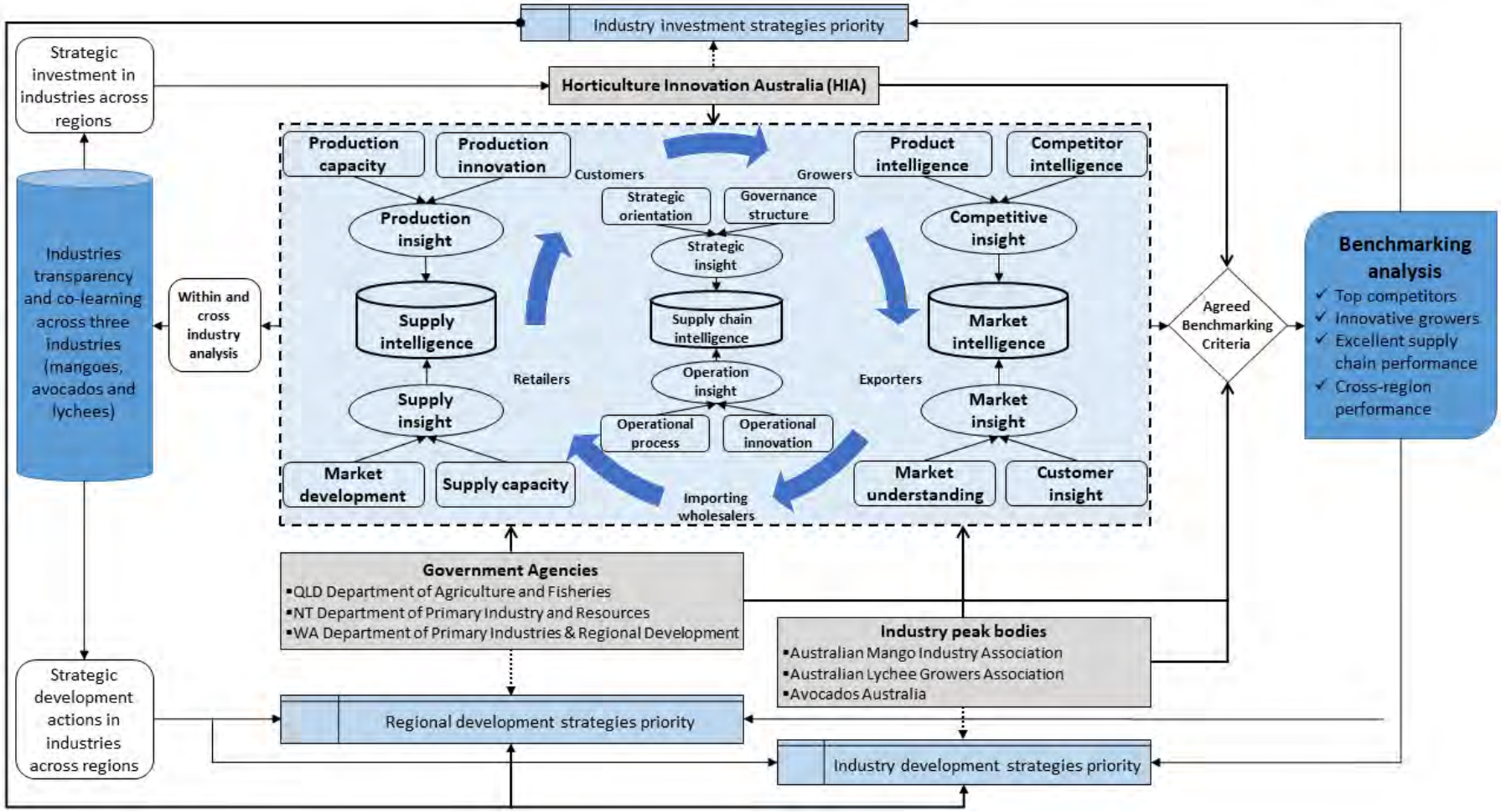

Figure 1 Industry research framework

Section 2 Research scope and regions

2.1 Industry selection

This project evaluates three horticultural industries in northern Australia. This includes lychees, a newer industry with sufficient success to have a foothold in new markets, as well as two established industries – mangoes and avocados. In these established industries innovative growers are looking for new sources of revenue through pre- and postharvest innovations that can open the door to higher margins.

2.2 Producing regions

The boundary of northern Australia is illustrated in Figure 2. The whole region of WA is considered in this project given that avocados are mainly produced in the south of WA.

Figure 2 CRCNA's area of operation
Source: https://crcna.com.au/about

2.3 International market selection

Asia is the major region for lychee and mango production as well as consumption. Asian imports accounted for over one-fifth of global mango imports between 2013 and 2017 (Figure 3). Avocado imports only account for under 10% of global imports. However, the import of avocado into Asia increased 83.31% between 2013 and 2017. Lychee import data is not available, but Asian imports of lychees *(081090 - Fresh tamarinds, cashew apples, jackfruit, lychees etc.) accounting for more than 70% of global imports between 2013 and 2017. Given Australia's counter-seasonal production and supply to most Asian countries as well as its proximity, promising opportunities will persist for

mangoes, avocado and lychee. Lychees offer substantial opportunity to export to countries beyond China in Asia.

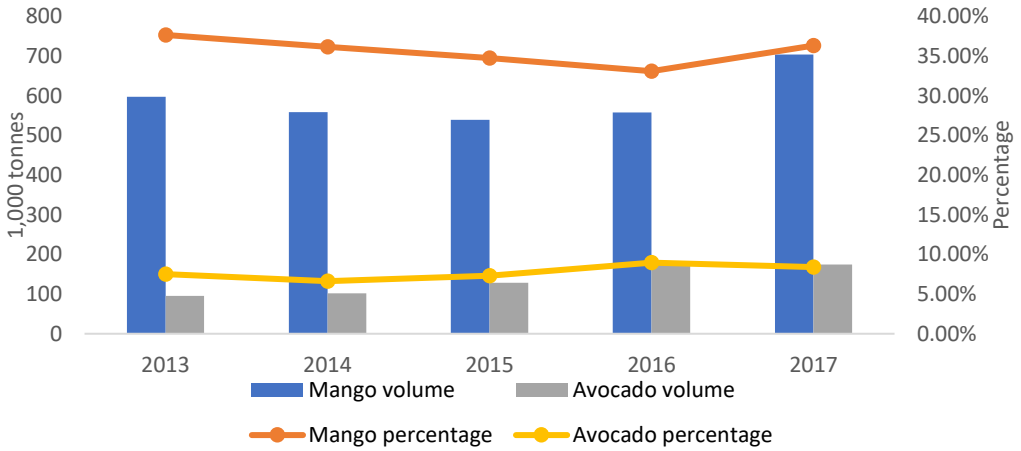

Figure 3 Changes in Asia's imports of mangoes and avocado

Source: Trade Maps; Note: Product code 080450 (Fresh or dried guavas, mangoes and mangosteens); 080440 (Fresh or dried avocados).

To investigate the potential to expand Australia's exports of mangoes, avocado and lychee into Asia, five markets were focused in this project, including Hong Kong and Singapore which are open markets, and China, Japan and Korea which are protocol markets. The ranking of the top 10 countries for importing mango, avocado and lychee in Asia in 2017 is shown in Table 1.

Table 1 Top 10 importers for mangoes, avocados and lychees in Asia in 2017

Product	Country and import share
Mango	Vietnam (25.53%); United Arab Emirates (12.43%); **China (10.93%)**; Saudi Arabia (9.88%); Malaysia (8.72%); Thailand (4.25%); Iran (3.18%); **Singapore (3.09%)**; Oman (2.92%)
Avocado	**Japan (34.69%)**; **China (18.38%)**; **Hong Kong (12.21%)**; Saudi Arabia (11.70%); United Arab Emirates (9.47%); **Korea (3.42%)**; **Singapore (3.28%)**; Malaysia (1.68%); Kuwait (1.34%); Turkey (0.57%)
Lychee	**China (44.41%)**; Vietnam (19.60%); **Hong Kong (8.75%)**; Indonesia (4.56%); Iraq (4.54%); Saudi Arabia (2.75%); United Arab Emirates (2.45%); Malaysia (1.64%); Thailand (1.47%); Nepal (1.27%)

Source: Trade Maps; Note: Product code 080450 (Fresh or dried guavas, mangoes and mangosteens); 080440 (Fresh or dried avocados); *No lychee data, the data are from 081090 (Fresh tamarinds, cashew apples, jackfruit, lychees etc.)

All five target markets are in the top 10 avocado importers in Asia, while China and Singapore are in the top 10 mango importers, and China and Hong Kong are in the top 10 lychee importers. The rationales for selecting the five markets are presented as follows. Firstly, Hong Kong and Singapore, which are unregulated markets, are already the main export markets for Australian mangoes, avocado and lychee. As a result, it is of importance to investigate the potential for further exports.

Second, Hong Kong is one of Asia's major ports and a front door to China, with a high proportion of fruit imports being re-exported to neighbouring countries, including China. Third, China, Japan and Korea are protocol markets with defined access conditions but are regarded as premium markets for mango, avocado and lychee as their unit import price is higher than the Asian average. Fourth, Australian mangoes have seen increased export volumes to China, Japan and Korea since gaining the official market access. The analysis of mango performance in China, Japan and Korea as well as supply chain operations provides insights for Australian avocado and lychee growers and industry investors.

Section 3 Research Methodology

The project employed desktop research and field studies to gain insights from both regional and international perspectives. Specifically, 29 field interviews with growers and exporters who are involved in the mango, avocado and lychee industries within the boundary of northern Australia were conducted, along with secondary data gathered from industry partners.

Table 2 Profile of companies interviewed in northern Australia

Cluster	Actor	Category	Region			Number of participants
			NT	NQ	WA	
Cluster 1	Grower	Indirect export to Asian open markets (AOMs)	G_M_NT	G_A_QLD_1, G_A_QLD_2, G_A_QLD_3, G_MAL_QLD, G_M_QLD_1, G_M_QLD_3, G_M_QLD_4, G_MA_QLD	G_M_WA	10
		Indirect export to Asian open & protocol markets (APMs)	×	G_M_QLD_2	×	1
Cluster 2	Exporter	Export to Asian open markets (AOM)	×	E_MA_QLD_1, E_MA_QLD_2, E_MAL_QLD_1, E_M_QLD_2, E_MAL_QLD_2, E_A_QLD	E_MA_WA_1 E_MA_WA_2	8
		Export to AOMs & POMs	×	E_M_QLD_1	E_A_WA_1	2
Cluster 3	Grower exporter	Export to Asian open markets only	GE_M_NT_1, GE_M_NT_2, GE_M_NT_3, GE_M_NT_4	×	×	4
		Export to Asian protocol markets only	GE_M_NT & QLD	GE_M_NT & QLD	×	1
		Exports to AOMs & POMs		GE_M_QLD_1, GE_M_QLD_2	GE_A_WA_2	3

Building on the secondary data analysis, more than 30 companies, including importers and retailers, were interviewed in Singapore, Hong Kong and China during two-rounds of field studies. While field studies were not conducted in South Korea and Japan, in-depth desktop research was conducted to capture market insight from Japan and South Korea.

Table 3 Profile of companies interviewed and observed onsite in targeted Asian markets

Country /City	Business type	On-site observation	Retailer observed onsite		
			General merchandise store	Premium supermarket	Convenience store
Singapore	Importer & retailer	Pasir Panjang Wholesale Centre	Shengsiong Fair price	Cold storage, Fair price finest	
	Importer & wholesaler				
	International company				
	International company				
	Importer & wholesaler				
Hong Kong	Importer & retailer	Yau Mai Tei Wholesale market	Wellcome, Parknshop	City super, Fusion, Marks & Spencer, Taste, Yata	Veggie & Fruit store
	Importer & wholesaler				
	Importer & wholesaler				
	Importer & retailer				
	Importer & retailer				
Shenzhen	Importer and retailer		Rainbow, Sam Club, Walmart,	BLT, Super Species, YH Bravo, Ole	Pagoda
	Supply chain company				
Guangzhou	Importer & wholesaler	Jiangnan Wholesale market	Trust-Mart, Vanguard	Ole, Super Species	Loving, E-Fresh Guoduoduo, Tiande tianyan,
	Importer & wholesaler				
	Importer & wholesaler				
Shanghai	Customs broker	Huizhan Wholesale market	Carrefour, Metro, Lianhua, Lotus	City Shop, Ole, Fresh Mart, Hema Fresh, Well fruit	Xianfeng, Pagoda Xinchang Jiao Luyuan Fruit
	Importer & wholesale retailer				
	Service provider & Importer				
	Importer & wholesaler				
	Importer and retailer				
	Importer & chain retailer				
	Importer & wholesaler				
	Importer and retailer				
Beijing	Importer and retailer	Xinfadi Wholesale market	Walmart, Wumart	Hema Fresh, Blt, BHG, 7 Fresh, City Shop, Aeon	Jenny Lou's, April Gourmet Jingjie Fresh
	Importer & retailer				
	Importer & wholesaler				
	Importer & wholesaler				
Guangzhou*	Importer & wholesaler	Jiangnan wholesale market			
	Importer & wholesaler				
	Import agent & distributor				
Shanghai*	Import agent & distributor	Huizhan wholesale market		Ole	
	Import customs broker				
	Online and offline retailer				
	Import business developer				

Note: *indicates second-round field studies.

In each case, a native speaker was used to gather and compile the information to build the data analysis. This provided a greater degree of access along with:

- Desktop research
  - Published reports and statistics from a wide range of sources
  - Fresh produce, industry and trade magazines – e.g. Fresh Plaza, Fresh Fruit Portal

- Secondary data from project partners (Hort Innovation, Ag department, Peak Industry body and Regional industry body)

- Extensive industry discussions
  - Agri state representatives (QLD Department of Agriculture and Fisheries, NT Department of Primary Industry and Resources and WA Department of Primary Industries and Regional Development)
  - Peak industry bodies (Australian Mango Industry Association, Australian Lychee Growers Association, and Avocados Australia)
  - Industry researchers and academics (Peter Hofman from Department of Agriculture and Fisheries, QLD, Robin Elaine Roberts from Griffith University)
- Field study
  - Australian growers and exporters
  - Asian wholesalers and retailers – Singapore, Hong Kong and China

Section 4 Supply intelligence in northern Australia

4.1 Production insight in north Australia

4.1.1 Production capacity

The production capacity of mangoes, avocados and lychees in northern Australia was analysed in terms of the producing regions and trends in planting and production.

4.1.1.1 Producing regions in northern Australia

Northern Australia is a major producing region for mangoes, avocados and lychees. The mango industry is characterised by the diverse geographical spread across northern Australia, most mangoes are produced throughout northern Australia (Frolov, 2017). The avocado industry is also widespread across Australia, but around half of the national production is in QLD (AA, 2018). The lychee industry is a small but gradually emerging industry, with more than 99% of national lychee production in tropical and subtropical regions of QLD (HIA, 2018). The main producing regions of mangoes, avocados and lychees within the boundaries of northern Australia are shown in Table 4.

Table 4 Main production regions of mango, avocado and lychee in northern Australia

State	Industry Availability	Main production regions within northern Australia
QLD	Mangoes	Burdekin/Bowen, Mareeba/Dimbulah
	Avocado	Atherton Tablelands, Mareeba/Dimbulah, Rockhampton
	Lychee	Cairns, Ingham, Atherton Tablelands, Rockhampton
WA	Mangoes	Kununurra, Carnarvon, West Kimberley
	Avocado	Carnarvon
	Lychee	X
NT	Mangoes	Darwin, Katherine & Mataranka
	Avocado	No commercial production, with trial planting
	Lychee	X

Note: X indicates no-production regions

Mareeba/Dimbulah, Burdekin/Bowen in QLD and Darwin/Katherine in NT are the leading regions for mango production in northern Australia. Carnarvon and Kununurra in WA are smaller but important mango production regions (Frolov, 2019; HIA, 2017). Due to the geography of WA, it is possible to produce fruit from September through to April with Kununurra producing the earliest fruit, followed by Broome, Carnarvon and Gingin (Slaven, 2020). QLD avocados are mainly grown in the Atherton Tablelands, Bundaberg-Childers, Toowoomba and the Sunshine Coast and are commonly grown in regions further south of QLD (AA, 2018). WA produces more than 20% of the national avocado

supply (AA, 2018). However, only about 3% of Australia's avocado production lies within the area of northern Australia (DPIRNT, 2018). Lychee production in QLD is mainly on the north coast (i.e. Ingham, Cardwell, Coolbie, Tully, Garbutt, Murray Upper, Cairns, and Gordonvale), Atherton Tablelands and Rockhampton, making up about 50% of the QLD's total production (ALGA, 2018). The lychee industry has not yet developed in WA and the NT.

4.1.1.2 Planting and production trends

4.1.1.2.1 Mango

The total planting area of mangoes in Australia was 18,806 hectares in 2017-18, with respective planting in QLD, NT and WA at 53.07%, 38.63% and 6.85% (AMIA, 2019). The Australian mango industry is now going through a consolidation phase as it awaits production from the plantings. Table 5 shows the estimated number of mango trees between 2013-14 and 2016-17. In 2016-2017, the total number of mango trees (producing and non-producing) was 1,354,450 – a minor increase of 0.14% compared to 2013-14. The slow increase was mainly due to the decrease in QLD and WA. In contrast, NT has been expanding plantings at a rapid rate from 2013-14 to 2016-17.

Table 5 Mango planted trees by region (Hectares)

Region	2013-14			2016-17		
	Trees not yet bearing	Trees bearing	Total trees	Trees not yet bearing	Trees bearing	Total trees
National Total	158,641	1,193,854	1,352,495	176,653	1,177,796	1,354,450
QLD	118,300	781,317	899,617	101,932	715,302	817,234
Burdekin/Bowen	7,717	185,832	193,549	-	-	-
Mareeba/Dimbulah	-	-	-	-	-	-
NT	32,554	268,208	300,762	55,543	344,501	400,043
Darwin	26,832	208,884	235,716	40,955	252,490	293,445
Katherine	-	-	-	-	-	-
WA	5,602	126,551	132,153	2,024	99,791	101,815
Kununurra*	-	-	-	-	-	-
Carnarvon*	-	-	-	-	-	-

Source: ABS estimate and WADPIRD.

While Kensington Pride (also known as KP) is still the dominant variety in northern Australia, other varieties have expanded over recent years. Calypso have performed well during these adverse climatic conditions (Johnson and Bennett, 2017). Several Australian bred varieties, such as R2E2, Calypso and Honey Gold, have been planted and now produce significant volumes through the season (Frolov, 2018). It is reported that more than 500 hectares of Calypso mangoes are planted in Darwin, Katherine and Mataranka and a further 300 hectares of mango orchards can be developed

(Schlesinger, 2017). The planting of Honey Gold mango has also increased. For example, third-party farms of Piñata Farms at Mareeba increased plantings by some 4,000 trees in late 2015 (Fresh Plaza, 2016a) and further expanded plantings by 9,000 trees late 2016 (Piñata, 2018). Piñata Farms will also plant more than 18,000 Honey Gold trees at its NT farms, and additional trees will be planted at Darwin and Katherine for production by 2021 (Piñata, 2018). Additionally, other international varieties, such as Keitt, Kent and Palmer are also grown in Australia, with the majority of production in QLD (Frolov, 2018).

The production of mangoes in Australia is shown in Table 6. The Australian mango industry produced over 60,000 tonnes of fresh mangoes each season between 2015/16 and 2016/17. The high rate of production is attributed to the full production of many newly planted trees. It is expected that more Honey Gold Mango will be produced in the coming years as more than 16,000 trees at Piñata's joint venture farm with LaManna Premier Group at Humpty Doo near Darwin were expected to produce next season (Piñata, 2018).

QLD and the NT are the two leading production regions for Australian mangoes, together accounting for about 95% of the nation-wide production. Burdekin/Bowen and Mareeba/Dimbulah are the largest producing areas in QLD, where production in 2017-18 peaked at 11,143 and 15,659 tonnes respectively. Darwin produced the most mangoes (41.25%) compared to 28.27% in Katherine in NT in 2015-16. However, Katherine overtook Darwin in 2017-18, by almost 2,000 tonnes. In contrast, WA is a small producing region with around 3% of Australia's total production. Kununurra produced just under 30,000 tonnes in 2017-18, accounting for about half of WA's production.

Table 6 Mango production volumes by main producing region (Tonnes)

Region	2015/16	2016/17	2017/18
National total*	63,791	61,474	-
QLD*	31,898	30,737	-
Burdekin/Bowen	6,144	8,970	11,143
Mareeba/Dimbulah	11,820	7,168	15,658
NT *	28,870	27,891	-
Darwin	11,909	14,839	16,114
Katherine	8,161	8,970	18,038
WA*	1,914	1,844	-
Kununurra	861	NA	2,997
Carnarvon**	538	1,497	

Note: Australian Mango Industry Association (AMIA); * indicates the data from the Australian Horticulture Statistics Handbook; ** indicates the data from statistics from Carnarvon.

4.1.1.2.2 Avocado

Avocado planting has been dramatically increasing across all producing regions. Due to continuous planting over recent years, the national area of avocado (producing and non-producing) peaked at 9,741 hectares in 2018, an increase of 20.16% over 2016. North QLD also significantly increased by 38.01% between 2016 and 2018, compared to 13.01% across QLD.

Avocado planting area by region is shown in Table 7. North QLD accounts for more than 20% of the national planting; with WA accounting for 22%. Apart from the mature trees (6 + years), a large number of younger trees (0-5 years) have been planted from 2016 to 2018. In 2017-2018, northern QLD planted 39,208 new trees across 171 hectares, representing 7% total coverage (AA, 2018). WA planted 294,928 new trees across 975 hectares, representing 39% of new plantings nationally (AA, 2018). The large expansions can be attributed to new growers exiting other industries and entering the avocado industry, along with existing growers who have increased plantings as well (Johnston, 2018a). In contrast, no commercial avocado production is planted in NT (DPIRNT, 2018). While avocado is a possible crop for all five NT precincts, including Tennant Creek, Western Davenport, Ti Tree, Alice Springs and the Great Artesian Basin (Beavan, 2017), trial planting has not yet been successful. It is reported that the Calypso and Schuller avocados are newly bred wet season fruit to be planted in the NT (Brann, 2018a).

Table 7 Avocado planting areas by region (Hectares)

Region	**2016**				**2018 (at 1 August)**			
	0-5yrs	6yrs+	Total	%	0-5yrs	6yrs	Total	%
National	2,663.6	5,443.2	8,106.9	100	5,643	4,098	9,741	100
QLD	1,613.3	3,405.7	5,019	62	2,988	2,684	5,672	58
North QLD	653.2	1,036.5	1,689.7	21	1,696	636	2,332	24
WA	-	-	-	-	1,456	676	2,132	22
Carnarvon*	-	-	-	-	-	-	13	-

Source: Avocados Australia's Orchard Info Report (Data at 1 August); * indicates data from WADPIRD obtained only as total area.

New plantings of avocados in 2017-18 covered 2,529 hectares across Australia (Table 8). While a number of varieties have been planted, Hass and Shepard are still the main new planting varieties. In 2017-18, the 171 hectares of new planting in north QLD included Shepard, Hass, Maluma (Hass like) and Edrinol; with Shepard and Hass at 45% and 33% respectively. 99.73% of WA's 975 hectares of new plantings were Hass.

Table 8 Avocado planting area by variety in 2017-18 (Hectare)

	Hectare	**Hass**	**Shepard**	**Maluma Hass**	**Edrinol**	**Lamb Hass**	**Ettinger**	**Others**
National	2,529	87.94%	9.23%	1.69%	0.45%	0.07%	0.20%	0.74%

QLD	1,002	71.79%	23.00%	4.08%	1.13%			
North Qld	171	33%	45%	23%	2%			
WA	975	99.73%	0.27%					

Source: Avocados Australia's Orchard Info Report

The Australian avocado industry experienced a significant increase of 40% in production from 2012-13 to 2017-18, with annual production up from 54,877 tonnes to 77,032 tonnes (Table 9). It is projected by 2025 the industry will be producing in excess of 100,000 tonnes per annum as new plantings come into full production (Beavan, 2017).

While avocado is produced across all regions in QLD, north QLD is a large and important producing region, where production increased by around 70% between 2012-13 and 2016-17. This was attributed to new growers in the Mareeba, Dimbulah and Atherton Tableland and new trees bearing fruit (Johnston, 2018b). North QLD's production is expected to rise substantially as avocado trees take five years to produce their first fruit (Fresh Plaza, 2018a). WA is also an important avocado growing region with expanding production (some 'off years' excluded), making up 28.04% of national average production in 2012-2018. For the NT the variety Calypso produces fruits between the middle of December and early February, and the Schuller fruit is available from mid-January to March (Brann, 2018a).

Table 9 Avocado production volume by region (Tonnes)

	2012-13	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**% in 12-18**
National total	54,877	48,715	57,595	66,716	65,992	77,032	100
QLD	30,193	33,901	27,994	32,864	41,846	33,594	54.02
North QLD	10,399	10,859	12,310	12,285	17,599	12,346	20.43
WA	18,575	6,163	21,824	23,771	13,483	20,180	28.04
Carnarvon*	32.5	30.83	11.53	3.81	10.52	-	

Source: 2017-18 Avocados Australia Facts at a Glance and WADPIRD.*indicate the data from Carnarvon Statistics.

4.1.1.2.3 Lychee

QLD has seen an increase in lychee planting over the past four years, up by 11.1% from 2017-2018 (Figure 10). Around 70% of QLD's lychee plants are grown in north QLD. Rockhampton is the major producing region for lychee in QLD, planting over 400 hectares, albeit with a small reduction in recent years. The north QLD coast is consistently the second-highest producing region over the years. In particular, there has been a rapid expansion in the Atherton Tablelands, with the total planting area increasing from 250 Hectares in 2014-15 to 390 hectares in 2017-18.

Table 10 Lychee Planted Areas by region in Nth QLD (Hectares)

	2014-15	2015-16	2016-17	2017-18
Australia	1,535	1,620	1,646	1,742
North QLD	1,480	1,565	1,585	1,645
Atherton	250	350	380	390
Rockhampton	410	410	400	400
North Coast*	325	325	325	325

Source: Australia Lychee Grower Association (Estimated data)

Note: *includes Ingham, Cardwell, Coolbie, Tully, Garbutt, Murray Upper, Cairns, Gordonvale, etc.

QLD is the dominant producer of lychees. In the past four years, QLD's annual production has ranged from 2,232 to 2660 tonnes. Total production volume by region in QLD is shown in Table 11.

Table 11 Lychee production by region in Nth QLD (Tonnes)

	2014-15	2015-16	2016-17	2017-18
Australia	2,250	2,700	2,378	2,426
North QLD	2,232	2,660	2,353	2,388
Atherton	374	435	313	293
Rockhampton	438	620	585	598
North Coast*	251	325	271	267

Source: Australia Lychee Grower Association (Estimated data).

Note: *includes Ingham, Cardwell, Coolbie, Tully, Garbutt, Murray Upper, Cairns, Gordonvale, etc.

4.1.1.3 Organic production

Organic mangoes are grown in most growing regions of Australia and are identified as a promising crop for organic production (DPIRD, 2019). According to DPIRD (2019), organic mangoes are mainly produced in small mixed orchards; however, some larger orchards are now involved in the production of organic mangoes. WA has a number of certified organic producers in Broome, Carnarvon and Gingin (DPIRD, 2019).

4.1.2 Production constraints

Constraints on the production of mangoes, avocados and lychees in northern Australia have been identified through interviews with mango, avocado and lychee growers. Figure 4 shows the key 12 production constraint factors reported by 17 growers.

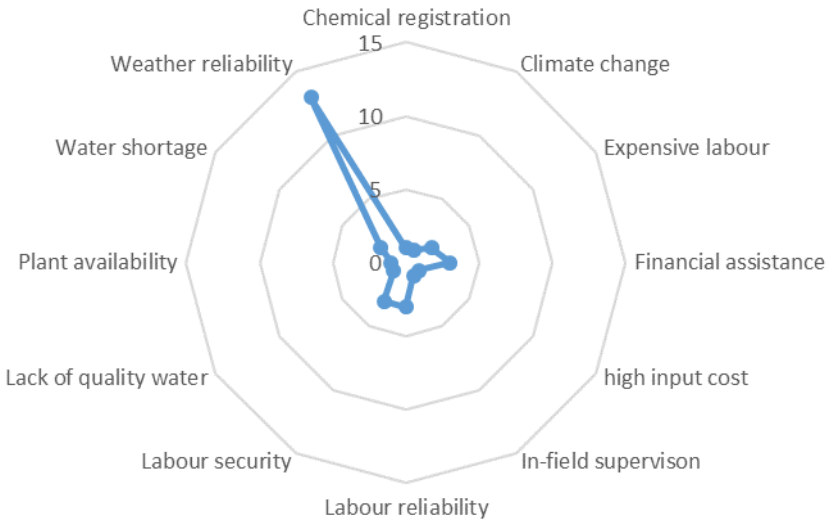

Figure 4 Frequency of production constraint factors

Source: In-field interview data collation, as per table 2.

Weather, and to a lesser extent labour were identified as the two major constraints for mango, avocado and lychee production in northern Australia. Most production constraints are prevalent across industries and regions in NT (Figure 5). Weather reliability, indicated by mango, avocado and lychee growers across the three research regions, is a common production constraint in northern Australia. Labour security is also a wide production constraint in northern Australia as it was listed by mango growers across the three regions. Additionally, financial assistance, labour reliability and expensive labour are regarded across regions as production constraints. These results should be treated as indicative only given the small sample size.

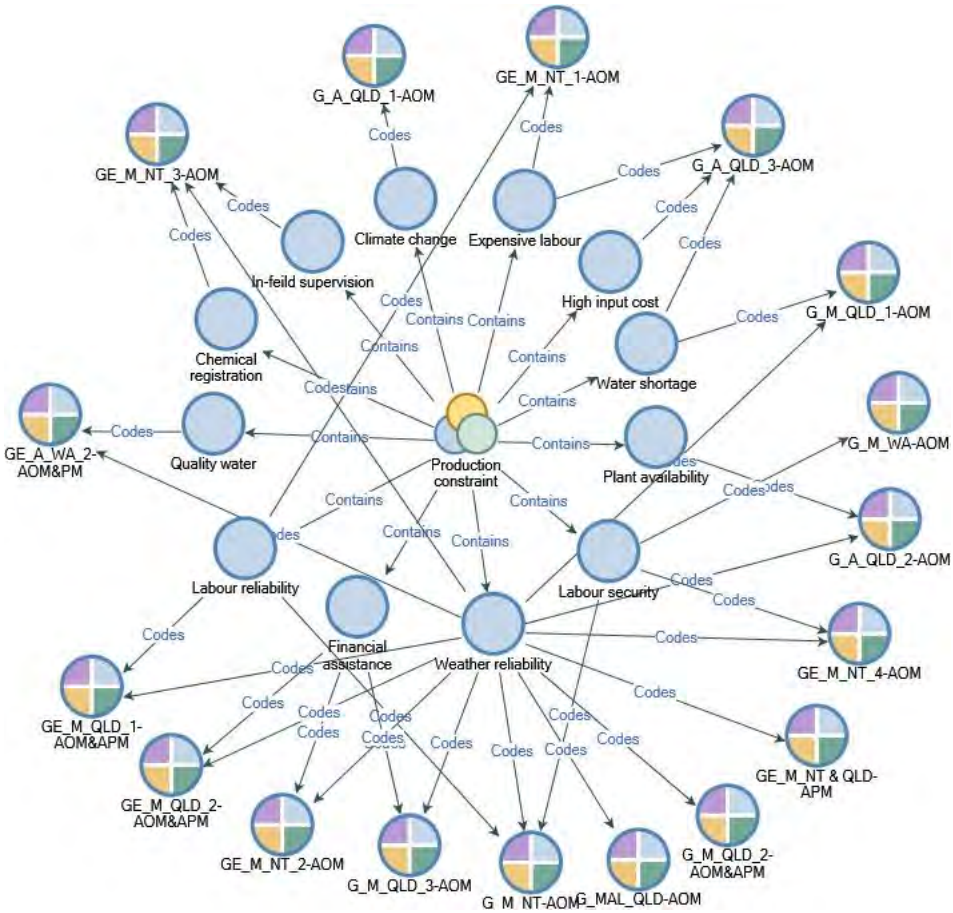

Figure 5 Relationship map of production constraints and reported growers

Source: In-field interview data collation, as per table 2.

4.2. Supply insight in northern Australia

Analysis of supply into Asian markets is analysed in this section in terms of export development and supply capacity.

4.2.1 Export development

The focal industries currently concentrate on the domestic market (HIA, 2018), with fresh exports accounting for 11.58% (mangoes), 3.51% (avocado) and 16.99% (lychee). However, the three industries have already identified one of the key strategies for export growth by developing existing markets and penetrating new export markets (de Vos, 2010; Allen, 2008; Noller; 2015). Several projects funded by Hort innovation, such as de Vos (2010), Barnard (2014) and Noller (2015), were conducted to identify the market potential of Australian mangoes, avocados and lychees. In addition, several marketing campaigns, such as 'Taste Australia', have been launched to promote Australia's quality produce in international markets. Export markets have increased in the past few years with the establishment of free trade agreements. The international markets that have been entered by northern Australian mangoes, avocados and lychees can be categorized into the open market and phytosanitary markets.

4.2.1.1 Market development

4.2.1.1.1 Open markets (non- phytosanitary)

Open markets are those with no phytosanitary requirements (AMIA, 2017). Hong Kong and Singapore are open markets, where exports of mangoes, avocados and lychees do not need a phytosanitary certificate (AMIA, 2017). There are other markets (for example Canada) that have no treatment stipulations but do require a phytosanitary certificate.

Open markets, including Hong Kong, Singapore and Malaysia, are the leading export markets for Australian mangoes and avocados, absorbing more than half of Australia's export. Percentages of mango and avocado exports to major open markets between 2016 and 2018 are shown in Table 12. Mangoes grown in QLD are mainly (60%) exported to Hong Kong and Singapore. QLD's avocados are mainly (80%) exported to Singapore and Malaysia. Singapore and Malaysia account for 90% of WA's avocado exports.

Table 12 Percentage of exports to major open markets

Region	Year	Mango's export market			Avocado's export market		
		Hong Kong	Singapore	Sub-total	Singapore	Malaysia	Sub-total
QLD	2016	44.29%	16.75%	61.04%	47.02%	34.09%	81.11%
	2017	42.19%	19.72%	61.92%	41.63%	41.37%	83.00%
	2018	27.93%	24.90%	52.83%	38.90%	46.05%	84.95%
NT	2016	54.32%	8.08%	62.39%	NA	NA	NA

	2017	32.47%	23.44%	55.92%	NA	NA	NA
	2018	17.56%	21.82%	39.38%	NA	NA	NA
WA	2016	99.26%	0.74%	100.00%	35.28%	57.23%	92.52%
	2017	67.36%	21.60%	88.96%	38.53%	56.31%	94.84%
	2018	89.63%	10.37%	100%	34.90%	58.06%	92.96%
Australia	2016	43.22%	15.00%	58.22%	41.64%	38.04%	79.68%
	2017	40.21%	19.72%	59.93%	39.57%	41.16%	44.12%
	2018	25.81%	24.30%	50.11%	38.66%	45.93%	84.59%

Source: calculated with World Trade Atlas data supplied by Hort Innovation Australia.

The Australian lychee industry mainly exports to the open Asian countries including Hong Kong, Singapore and Malaysia thanks to efforts by the ALGA and the Australian lychee industry.

4.2.1.1.2 'Phyto' (phytosanitary) markets

'Phyto' markets are those that require phytosanitary certificates for fruit exports. Treatment markets are those that require treatment and a phytosanitary certificate. China, Japan, and South Korea require vapour heat treatment (VHT) for fruit fly while the United Arab Emirates has a phytosanitary protocol which requires a cut test to demonstrate consignment freedom from mango seed weevil (AMIA, 2017). The phytosanitary requirements on Australian mangoes by key international markets are shown in Table 13.

Table 13 Phytosanitary requirements on Australian mango by key overseas markets

Country	Orchard approval by DAWR	Packhouse approval by DAWR	Approved crop monitoring program	Treatment facilities	Vapour Heat Treatment (Fruit Fly)	Irradiation (Fruit Fly & other arthropod pests)	Mango Seed Weevil (Freedom)
Indonesia (subject to Import permit) *					✓	✓	
Japan		✓		✓	✓		
Malaysia						✓	
New Zealand						✓	
China	✓	✓	✓	✓	✓		✓
South Korea	✓	✓	✓	✓	✓		✓
The US	✓	✓	✓	✓		✓	

United Arab Emirates							✓

Prepared with the materials from AMIA (2017) and MICoR.
Note: orchard, packhouse and crop monitoring program are approved annually.

China and South Korea have different requirements compared with other phyto markets. In addition to VHT and weevil tests, orchard, packhouse, and treatment facilities must be registered and crop monitoring must be undertaken annually. The USA is also a strict market, with the same requirements as China and South Korea, except for differing fruit treatments and not requiring weevil control. Indonesia is the only country that accepts either VHT or irradiation. New Zealand and Malaysia require irradiation only, while the United Arab Emirates requires weevil inspection only.

New Zealand and Thailand are examples of protocol markets for Australian avocados, which require cold disinfestation on-shore immediately prior to export or in-transit. Japan is a newly approved protocol market, which released a new protocol agreement for Hass avocado fruit to Japan in May 2018. As per the protocol agreement, only fresh avocado fruit of the 'Hass' cultivar meeting the "hard mature condition" can be packed for export to Japan, and growers and packhouses intending to export avocado to Japan must be accredited by the Australian Department of Agriculture and Water Resources (DAWR) prior to export. Furthermore, avocados must only be sourced from officially recognised areas free from QLD fruit fly, which include WA, Riverland (South Australia) and Tasmania. This means that WA is the only state within northern Australia's boundary that has official market access to Japan (DAWE, 2018).

Australian lychees are not exported to mainland China, Japan, Taiwan, Korea, Thailand or Vietnam currently. However, the Australian lychee industry has seen the use of irradiation as an effective pest disinfestation treatment for market access (Tiberi, 2009). New Zealand and the USA are examples of protocol markets for Australian lychees with irradiation treatment prior to export. New Zealand granted market access to Australian lychees in 2008, while Australian lychees were given the all-clear to export to America in 2015. Due to different maximum residue limit (MRL) requirements and pesticide restrictions by the USA on imported fruit, Australia's first shipment of fresh lychees into the USA landed in December 2016 (McKillop and McCarthy, 2016). The USA has much stricter requirements than New Zealand in that the orchard, packhouse and treatment facility must be registered (DAWR, 2018a).

4.2.1.2 Drivers of export success

4.2.1.2.1 Indirect export from growers

Drivers of export success as reported by growers who engage in exports, via an intermediary, is illustrated in Figure 6. This indicative figure shows the responses from ten growers across the

mango, avocado and lychee industries who responded on eight key elements which contribute to their success in exporting to Asian markets with exporters.

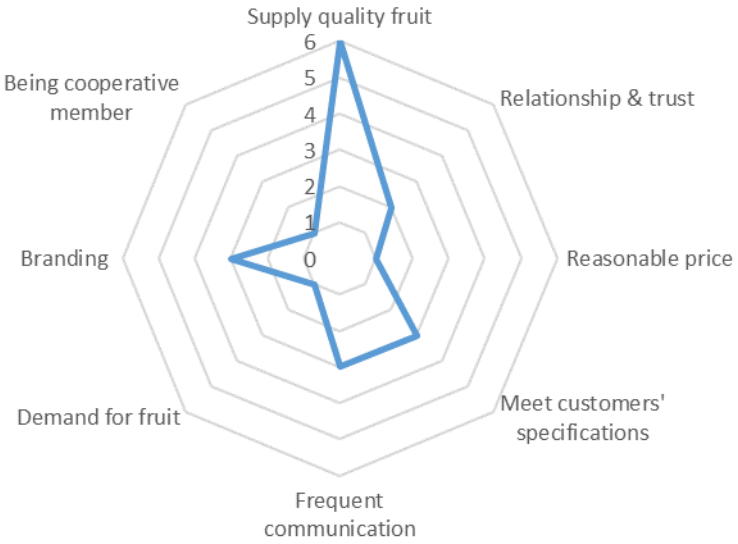

Figure 6 Driver of export success in indirect export reported by growers

Source: In-field interview data collation, as per table 2.

The supply of quality fruit is seen as a leading element, followed by branding, frequency of communication and meeting customers specifications. Relationship & trust is thought to be a key element by only two growers – despite these being key factors in building resilient long-term relationships and robust supply chains. Of the ten growers, eight growers are from QLD, one grower is from the NT and one grower is from WA (Figure 7). As such the regional responses are in line with the aggregated responses.

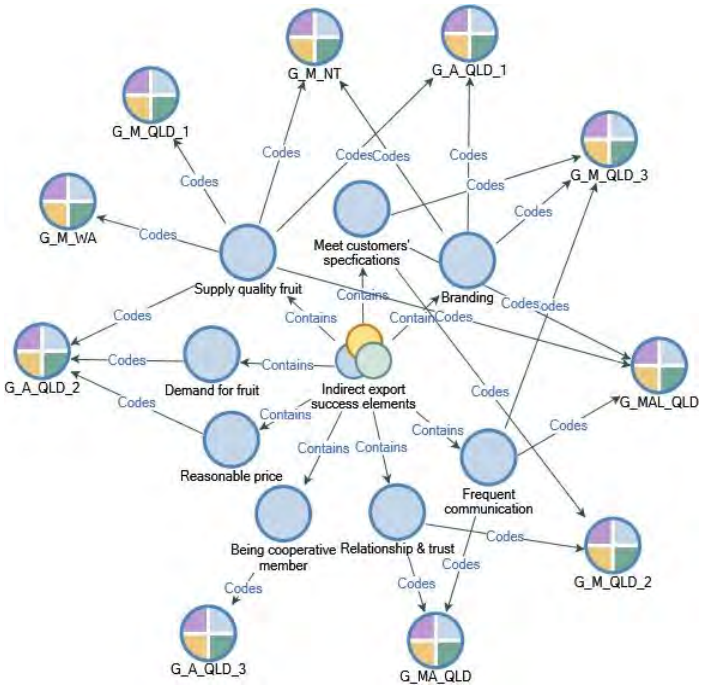

Figure 7 Relationship map of drivers of indirect export success and reported growers

Source: in-field interview data collation, as per table 2.

4.2.1.2.2 Direct export from growers and exporters

Drivers of export success reported by exporters with sales to Asian markets is provided in Figure 8. Fifteen exporters, including six grower exporters, reported 18 key elements for their success in exporting to Asian markets.

Although the 18 key elements for export success is quite diverse, they can be broadly categorized into (a) high perception of Australian fruit from the market, (b) consistent quality and supply at a reasonable price, (c) responsive and flexible supply chain, a good relationship with customers, and (d) market and consumer understanding. Relationship and trust top the list, quality fruit commitment and competitive price are the next two elements, while consistent quality comes third.

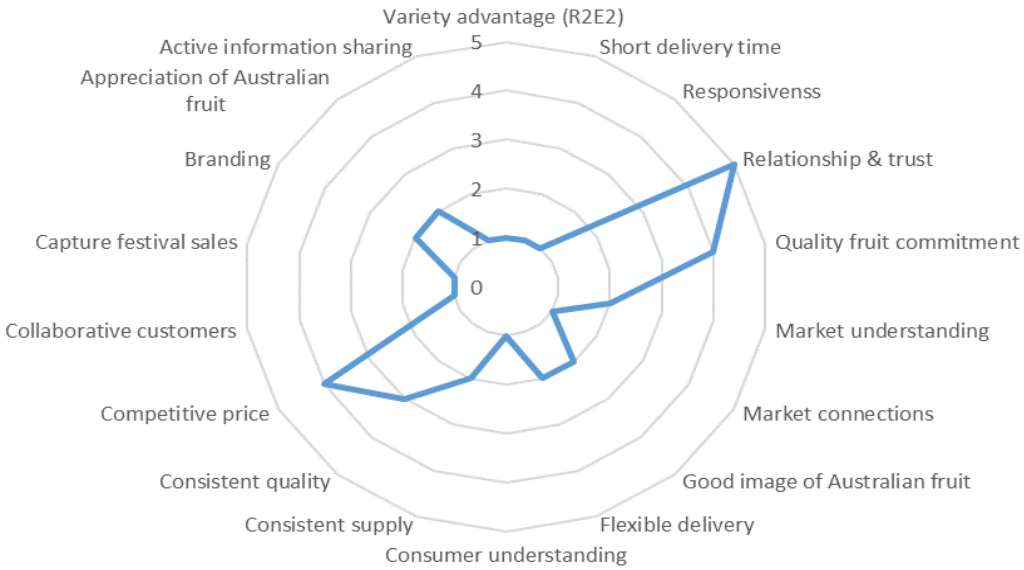

Figure 8 Driver of export success in direct export reported by exporters

Source: in-field interview data collation, as per table 2.

Marketing understanding, relationship and trust, and quality fruit commitment are common elements for export development across industries and regions as reported by both merchant exporters and grower exporters who handle fruit exports from northern Australia (Figure 9). Mango growers from QLD with direct exports to Asia's open and protocol markets also reported that appreciation of Australian fruit and active information sharing are key elements for their exports into Asia. While some exporters mentioned that a good image for Australian fruit and variety advantage (R2E2 in particular) are key elements for export development, most exporters mainly considered quality consistency, supply chain responsiveness and delivery advantage (i.e., flexible delivery, short

delivery time). Exporters with direct exports to Asian open and protocol markets indicated that consistent supply and capturing festival time are another two elements for export development.

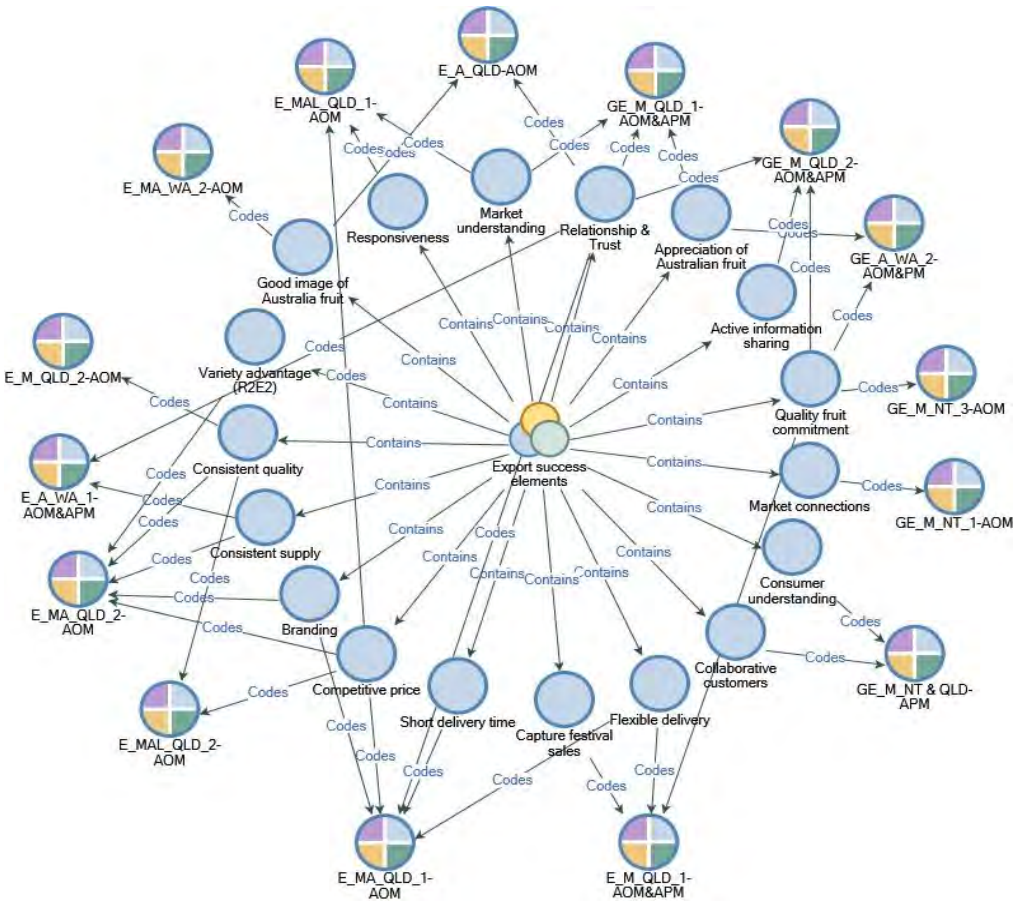

Figure 9 Relationship between elements of direct export success and reported exporters

Source: in-field interview data collation, as per table 2.

4.2.2 Supply capacity

Australia's mango, avocado and lychee industries are based on supplying fresh fruits, with lower grade fruits often processed as a means of value-adding for the industries. The capacity of supplying mangoes, avocados and lychees from northern Australia to international markets is analysed in terms of variety and seasonality, grade and package and treatment facilities.

4.2.2.1 Variety and seasonality

While several commercial mango varieties are grown in northern Australia, fresh mango is dominated by 4 main varieties, Kensington Pride (KP), Calypso, R2E2 and Honey Gold (HIA, 2018). KP and R2E2 are available in the major producing regions, while Calypso is mainly available in NT and Mareeba/Dimbulah, QLD. Apart from these main varieties, there are several varieties, including Kent, Pearl, Brooks, Keitt, Tommy Atkins, Palmer and Nam Dok Mai, which together accounted for 5% of total production (HIA, 2018). While all mango varieties produced in Australia can be supplied

to international markets, including China and Korea (DAWR,2017a; DAWA, 2017c), only five mango varieties – Kensington, Keitt, Kent, R2E2 and Palmer are permitted into Japan (DAWR,2017b). Australia's mango harvest season generally commences in August/September and runs until February/March (Frolov, 2018), with the earliest harvest in the NT. While the supply window varies from year to year depending on seasonal variations, northern Australia's mango supply generally starts in Darwin in August and ends in Mareeba/Dimbulah in March. Table 14 shows northern Australia's supply seasonality by producing region and variety. The supply window for fresh mangoes usually starts with KP then R2E2 and Calypso (B74) are mid-season (DAF). Keitt is a late variety, with supply windows running from January to March in Mareeba/Dimbulah.

Table 14 Mango Supply Seasonality by region and variety in northern Australia

Region and Variety	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
NT								
Darwin								
Kensington Pride								
R2E2								
Calypso (B74)								
Katherine/Mataranka								
Kensington Pride								
R2E2								
Calypso (B74)								
Honey Gold								
WA								
Kununurra								
Kensington Pride								
R2E2								
Carnarvon								
QLD								
Bowen/Burdekin								
Kensington Pride								
R2E2								
Honey Gold								
Mareeba/Dimbulah								
Kensington Pride								
R2E2								
Calypso (B74)								
Honey Gold								

Keitt								

Source: AMIA Crop forecast 2018 and DPIRDWA (https://www.agric.wa.gov.au/mangoes/mangoes-western-australia)

For avocados, while Hass and Shepard are the two major varieties in northern Australia, there are still a number of other varieties, such as Furtede, Maluma Hass and Tuner Hass.

WA can supply avocado year-round, except in April. However, a small number of avocados are available from WA due to limited production in Carnarvon. North QLD can supply avocados from February to July and in September. Avocado supply periods by region and variety in northern Australia are shown in Table 15. Hass produced in the Atherton Tablelands enters the market when the season finishes in WA. Shepard are harvested first in the Atherton Tablelands in far north QLD through to the end of March before the Hass variety reaches maturity and is harvested through to the end of June (Johnston, 2018a).

Table 15 Avocado supply periods by region and variety in northern Australia

Variety	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
WA												
Hass												
North QLD												
Hass												
Shepard												
NT	X											

Source: Avocados Australia (2018)

The main varieties of lychee grown in north and central QLD are Kwai May Pink, Tai So, Fei zi Xiao (Fay Zee Siu), Souey Tung, Kaimana, Salathiel and Wai Chee, although more than 40 varieties are grown in Australia. Kwai May Pink is the major variety supplied across all regions, whereas Wai Chee is a late fruiting variety grown in South-East QLD and NSW only. The supply windows of the main varieties grown in north QLD is shown in Table 16.

Table 16 Lychee seasonality in north QLD by the leading varieties

Variety	OCT	Nov	Dec	JAN	FEB	MAR	Apr
Souey Tung							
Fei zi xiao							
Kaimana							
Tai So							
Kwai May Pink							
Sah Keng							
Salathiel							
Bengal							

Source: AGAL (https://www.australianlychee.com.au/about-lychees/varieties).

The lychee supply in north and central QLD generally lasts for five months a year, starting with 'Souey Tung' in October and ending with Kwai May Pink in February. However, some varieties have the same supply windows - Fei zi xiao and Kaimana are available between November and December, while Sah Keng, Salathiel and Bengal are available between December and January.

4.2.2.2 Grading and packaging

Fresh mangoes are generally graded into two classes: Class 1 and Class 2 following the Australian mango industry grading guide. However, mango growers and packers often pack and sell their mangoes into four classes – Premium, Class 1, Class 2 and composite. External appearance is the main factor in differentiating the quality grades from industry and mango businesses. The difference between Premium and Class 1 is that premium fruits have clean skin, while Class 1 fruit have a small mark on their skin. As the size is not a factor for grading, each tray could contain different numbers of mangoes as shown in Table 17.

Table 17 Mango size description in terms of variety and grade

<table>
<tr><th colspan="2">Weight and Class</th><th>Kensington Pride</th><th>Calypso</th><th>R2E2</th><th>Honey Gold</th></tr>
<tr><td rowspan="4">7 kg tray</td><td>Premium</td><td rowspan="3">ExLarge <14; Large 14-16; Medium 18-20; Small >20;</td><td>Large 14-16; Medium 18-20</td><td rowspan="3">ExLarge <8; Large 8-10; Medium 11-12</td><td rowspan="3">ExLarge <14; Large 14-16;</td></tr>
<tr><td>Grade 1</td><td rowspan="2">X</td></tr>
<tr><td>Grade 2</td></tr>
<tr><td>Composite</td><td colspan="4">Unspecified</td></tr>
<tr><td rowspan="3">18 LCtn (10 kg)</td><td>Premium</td><td>X</td><td>X</td><td>X</td><td rowspan="3">X</td></tr>
<tr><td>Grade 1</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>Grade 2</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>15 kg CTN</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>

Australian mangoes usually come in a 7 kg single layer tray, although 10 kg trays and 15 kg cartons are available for different varieties and grading classes. 18 kg large cartons are usually used to pack Grade 2 fruits, although they are also packed with 7 kg trays. Additionally, 5 kg trays are available for specific export markets (Austrade, 2014). Depending on the variety, sizes in each tray vary by large, medium and small fruit, with larger varieties (i.e. R2E2) having 8-14 pieces of fruit per 7 kg net tray.

Avocados are hand-graded for quality as fruit passes over rollers. The quality grades are Premium, Class 1 and Class 2, differentiated mainly by external appearance. Anything below Class 2 usually goes for processing. As the grade is specifically related to the appearance of the fruit, size and grade are two separate descriptors. This means that premium count can range from 14 (the largest) through to count 30 (the smallest size packed into a single layer tray). The size description of different grades and packages are shown in Table 18.

Table 18 Avocado size description in terms of variety and grade

Weight and Grade		Hass	Shepard
5.5 kg tray	Premium	Large size, counts of 14-18; Mid-size, counts of 20-23; Small-size, counts of 25-30	
	Class 1		
	Class 2		
10 kg tray	Bulk (lower grade/value and small fruits)	Large size, counts of 50-55; Mid-size, counts of 60-65; Small-size, counts of 70-75	

Avocados are generally packed with two types of cardboard trays in Australia. The standard package used for domestic and export marketing is a single layer tray holding 5.5 kg of fruit per tray. The other is a bulk box that can be filled with 10 kg. The bulk box is usually filled with the lower grade/lower value fruit and often the smaller fruit (>count 30). Often the smaller fruit is packed into a prepacked punnet or net bag. The premium packed smaller fruit (count 30+) traditionally has been the main type sent to export markets, but this is changing with a range of sizes marketed into different segments. Australia's exporters can also pre-pack avocados with store labels, supply a foodservice grade, and develop custom packing (Austrade, 2014).

The Australian lychee grading guide completed in 2018 defines the specifications for first grade, premium and export fruit, and fruit into second-grade cartons. Although lychees can come in two grades, they are generally packed with a single layer tray, which holds 5.5 kg fruit. The grading specifications are shown in Table 19, which ensures the lychee industry consistently supplies quality fruit to domestic and export markets.

Table 19 Australian lychee grading description

Weight and Grade		Appearance		Size
2 or 5 kg tray	Premium, export and first grade	Fruit should be clean with no pulled stems or stings The skin colour should be typical of the variety of fruit being harvested	• Fruit should have minimal dark blemish – no more than 5% dark blemish over the entire fruit • Fruit surface should have no more than 25% of light blemish, silvering or light browning • The fruit surface should have no more than 25% of yellowing	• Fruit must be at least 30 mm diameter across the widest part of the fruit • Small seeded varieties should be at least 25 mm diameter across the widest part of the fruit
	Second grade		• Fruit should have no more than 10% dark blemish • Fruit surface should have no more than 50% of light blemish, silvering or light browning • The fruit surface should have no more than 50% of yellowing	• Wai Chee must be at least 30 mm diameter across the widest part of the fruit • All other varieties should be at least 25 mm

				diameter across the widest part of the fruit

Source: Australian Lychee Growers Association (2018)

Different from the grade systems of mango and avocado, lychee grades are simultaneously determined by the size and physical appearance of the fruit. The premium, export and first grade require a larger size and better appearance compared with the second grade.

4.2.2.3 Export treatment facilities

Export capacity to protocol markets is affected by the availability of vapour heat treatment (VHT) and/or irradiation facilities as special treatments are required before exporting fresh mango, avocado and lychee. The distribution of treatment facilities by state is shown in Table 20.

Table 20 On-shore treatment facilities in northern Australia by state

State/Territory	Vapour Heat Treatment facility	Irradiation facility
QLD	Brisbane (Hannay Douglas) – in construction Brisbane (Perfection Fresh) Giru (Manbulloo) Mareeba (Diamond star)	Narangba QLD (Steritech)
NT	Darwin (Construction in 2019)	X
WA	X	X

Source: Information gathered in field studies.

The Irradiation facility in Narangba/Deception Bay, QLD can irradiate food and is run by a private company, Steritech Pty Ltd., which also owns another two facilities in Dandenong, Victoria and Wetherill Park, New South Wales. The VHT facilities are used to treat mangoes shipped to protocol markets. Manbulloo's VHT facility in Giru, QLD and Diamond Star's near Mareeba, QLD were built and approved for treating consignments to China, Japan and Korea. Manbulloo's facility, operated on the Horseshoe Lagoon farm, was approved in 2009 (QCMD, 2010a). Diamond Star's facility is owned by a Japanese company which focuses on the Korean and Japanese markets. A new facility in Brisbane has been recently built by Perfection Fresh, who market the Calypso brand. It is reported that Hannay Douglas is building a VHT plant near the Brisbane Market at Rocklea. Given the locations of these VHT facilities, mangoes grown in north QLD have to be transported to Giru or Brisbane for treatment, which can add extra cost (depending on the port) when exporting to protocol markets. As VHT facilities are not yet available in NT and WA, mangoes produced there must be transported in refrigerated trucks to QLD for treatment before being exported to protocol markets.

This impost may affect export capacity from NT and WA. A Freight and Education Hub, that includes a large cold storage area, and a small VHT processing section has commenced construction, and should be completed just before the wet season (September/October 2020) in Darwin, NT, which will allow NT mangoes to be sent to export markets in a timely manner and in a better condition, where capacity is available, thereby enhancing export competitiveness for the most rapidly growing region in Australia.

4.2.3 Constraints on export development

4.2.3.1 Export commitment

Constraints on export commitment have been identified through the interviews with respondents across the three industries. Figure 10 shows the frequency of eight export commitment constraints reported by growers and exporters.

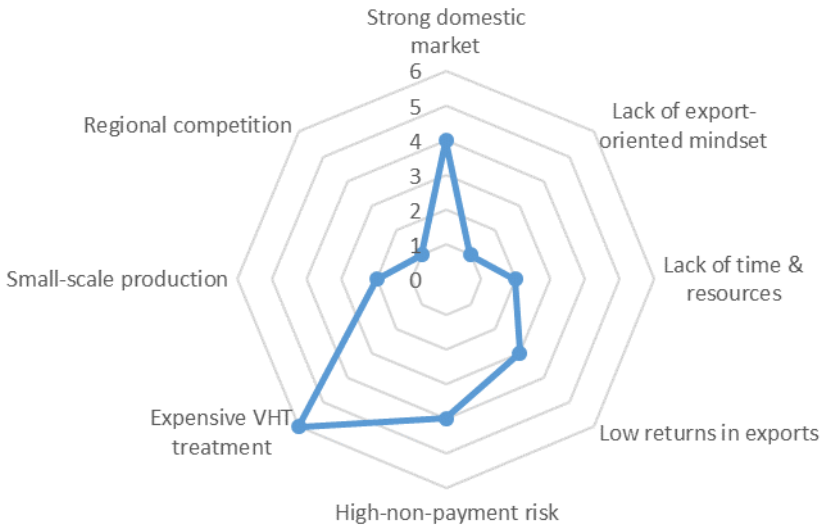

Figure 10 Frequency of export commitment constraints

Source: in-field interview data collation, as per table 2.

The additional cost of VHT is the largest constraint for exports into phyto markets, followed by strong domestic markets and high non-payment risk. Expensive VHT treatment, high non-payment risk and strong domestic markets are prevalent constraints for export commitments across regions in northern Australia as reported by growers and exporters (Figure 11). Low returns in exports and small-scale production are reported by both growers and grower exporters from the NT and QLD.

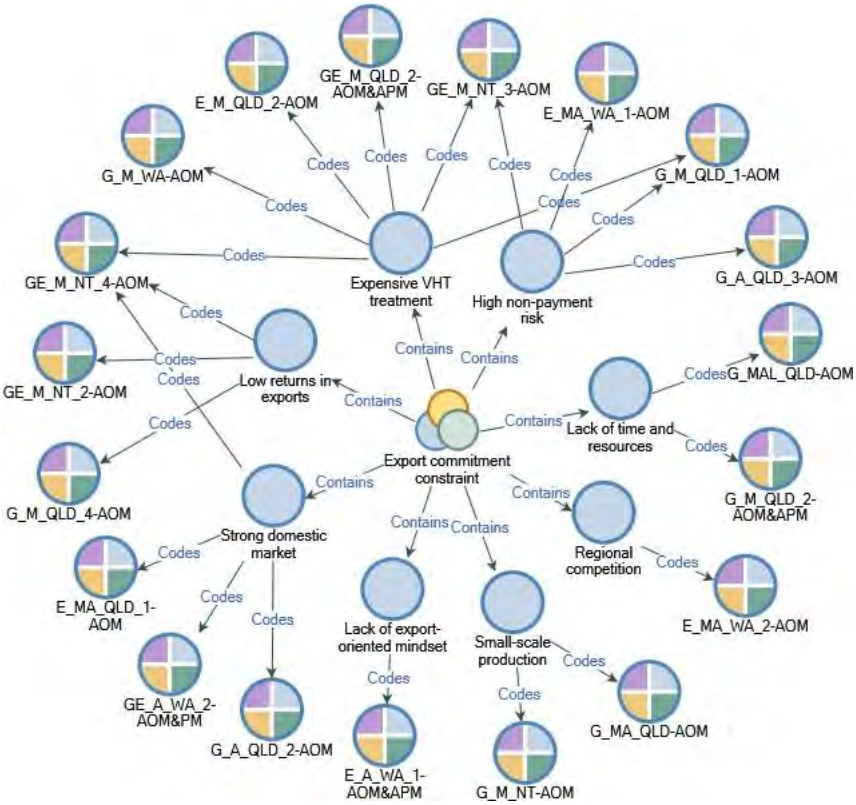

Figure 11 Relationship between export commitment constraints and reported interviewees

Source: in-field interview data collation, as per table 2.

4.2.3.2 Export facilitation

Constraints on export facilitation in northern Australia have been identified through the interviews - Figure 12.

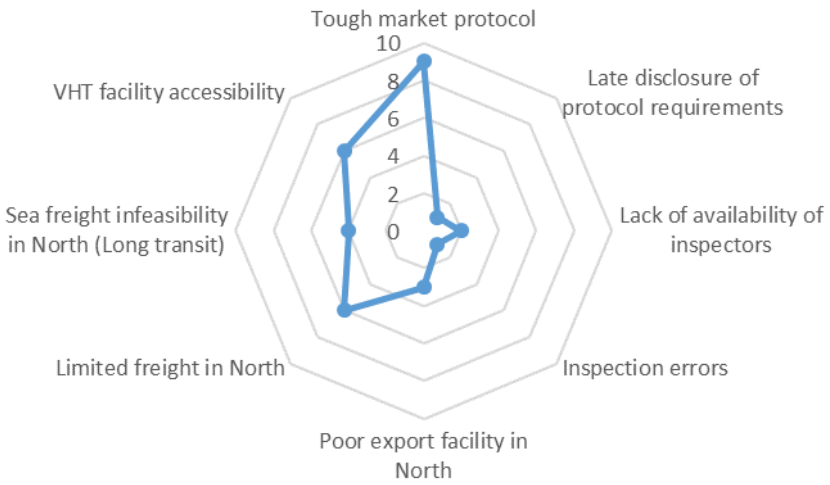

Figure 12 Frequency of export facilitation constraints

Source: in-field interview data collation, as per table 2.

A tough market protocol, as identified by 9 out of 16 interviewees, is the most reported constraint on export facilitation, followed by VHT facility accessibility and limited freight in the north. The unfeasibility of sea freight because of long transits, poor export facilities in the north and limited availability of inspectors, are also issues.

Tough market protocol and sea freight difficulties are also prevalent across regions (Figure 13). VHT facility accessibility is an export facilitation constraint for mango growers from QLD and the NT, who have direct exports or work with a middleman for exporters. Grower exporters with exports to protocol markets in QLD indicated that the lack of availability of inspectors is a constraint for their export facilitation. Interviewees from QLD and NT also reported limited freight in the north and poor export facilities.

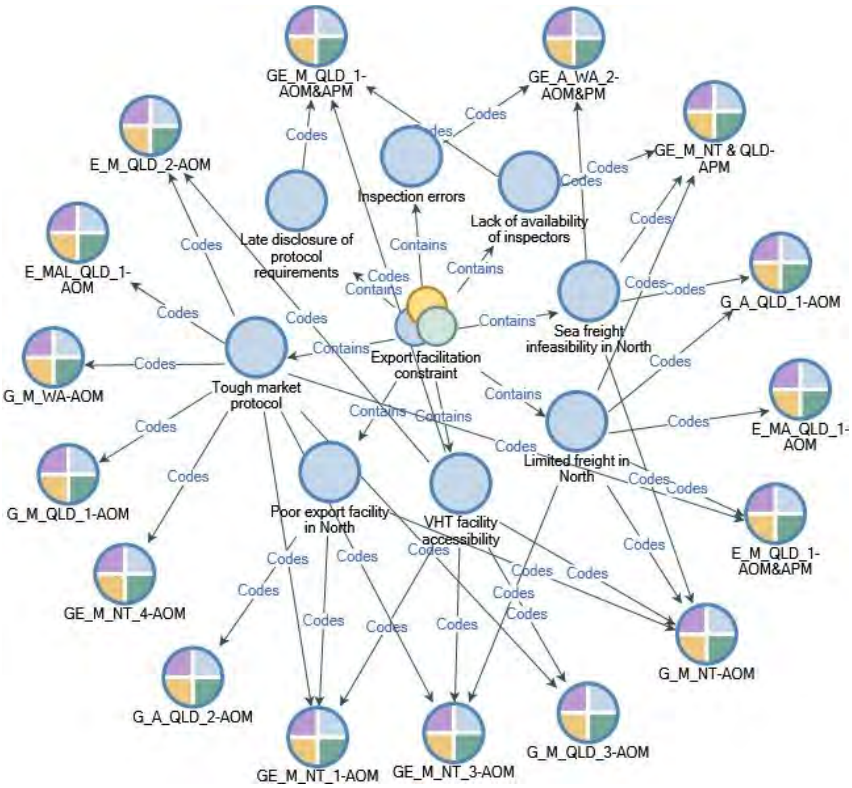

Figure 13 Relationship between export facilitation constraints and reported interviewees

Source: in-field interview data collation, as per table 2.

4.2.3.3 Market development

The frequency of constraints on market development in Asian markets has also been identified through the interviews (Figure 14). Fierce market competition is the top constraint for market development, followed by homogeneous size specification. Other less common concerns include lack of market access, a high requirement on fruit quality, lack of information to locate customers, and competition among Australian exporters.

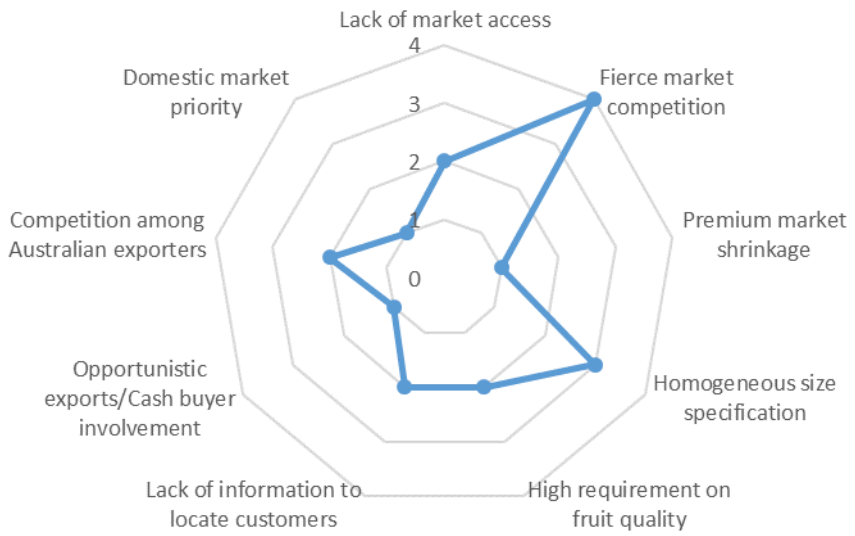

Figure 14 Frequency of market development constraints

Source: in-field interview data collation, as per table 2.

Fierce market competition was raised by two mango grower exporters from QLD and NT with exports to Asian open and protocol markets, and two merchant exporters from QLD and WA with exports of mangoes, avocados and lychees to Asian open markets (Figure 15). Homogeneous size specification is particularly important for avocado exports and is reported by one grower exporter in WA and two exporters with exports to Asian open markets. Lack of market access and lack of information to locate customers are indicated by QLD interviewees. The lack of market access is reported by one avocado grower and one exporter of mango and avocado, while lack of information to locate customers was raised by a mango exporter and a mango grower. Opportunistic exports, domestic market priority and premium market shrinkage are reported by individual interviewees from each region.

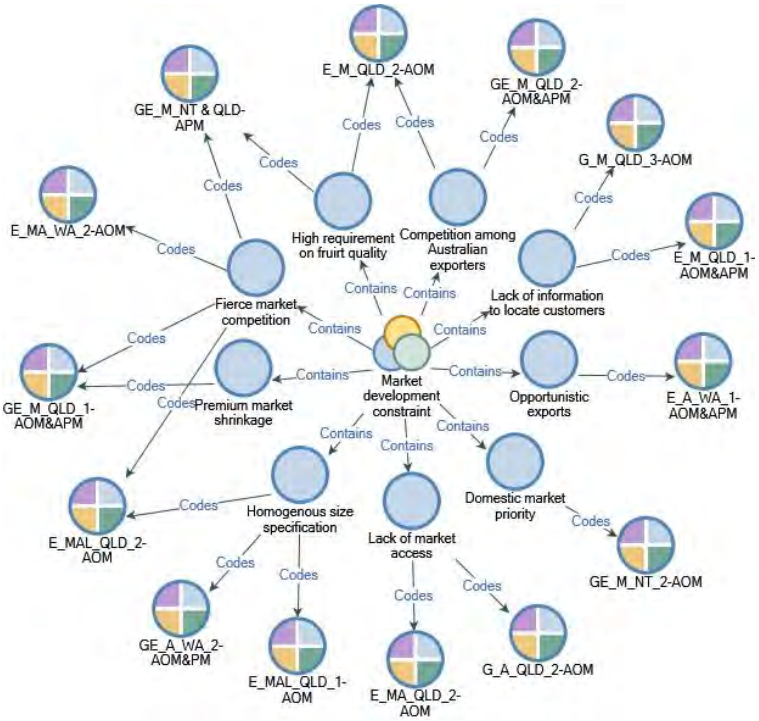

Figure 15 Relationships between market development constraints and interviewees

Source: in-field interview data collation, as per table 2.

4.3 Benchmarking production and supply

4.3.1 Country comparison

4.3.1.1.1 Production distribution

World production of mangoes is concentrated in the northern hemisphere, where the top 10 producing countries accounted for 74% of world production in 2016 (Table 21). India, China, Thailand, and Mexico are the leading producing countries in the northern hemisphere, of which India and China together produce around half of the world production. Indonesia is the largest producer in the Southern Hemisphere at just 5% of world production. Australia is a relatively small mango producer, ranked 41st worldwide and 10th in the Southern Hemisphere, with 42,515 tonnes produced in 2016, or less than 1% of world production.

Table 21 World distribution of mango production in 2016

Country	Production (Tonnes)	Share of world production (%)
Northern Hemisphere Top 10 (74%)		
India	18,643,000	38.49
China	4,699,877	9.70
Thailand	3,314,948	6.84
Mexico	2,197,313	4.54

Pakistan	1,627,546	3.36
Bangladesh	1,375,993	2.84
Egypt	1,305,134	2.69
Nigeria	922,463	1.90
Philippines	827,075	1.71
Mali	808,040	1.67
Southern hemisphere Top 10 (13%)		
Indonesia*	2,184,399	4.51
Brazil*	1,417,448	2.93
Malawi	1,284,630	2.65
Tanzania	427,766	0.88
Peru	377,382	0.78
Madagascar	287,575	0.59
Congo (Republic of)	235,893	0.49
Ecuador	82,246	0.17
South Africa	72,499	0.15
Australia	42,515	0.09
Others (13%)	6,306,620	
Total production	48,440,362	100

Source: FAOSTAT; *indicates countries categorized based on their most parts in either Northern or Southern hemisphere.

World avocado production is also concentrated in the northern hemisphere, where the top 10 producing countries accounted for 65% of world production in 2016. The world distribution of avocado production in 2016 is shown in Table 22. Mexico (33.65%) and Dominican Republic (10.71%) are the two largest producers in the northern hemisphere. Colombia is the third-largest producer, producing 5.24% of the world's avocados. In contrast, 24% of avocados are produced by the top 7 producing countries in the Southern Hemisphere. Peru tops the list with 455,394 tonnes of production (8.11%) and Indonesia is the second-largest producer (5.43%). Compared with leading producers in the northern and southern hemisphere, Australia is a small avocado producer, ranked 19th worldwide and 7th in the southern hemisphere with 67,600 tonnes produced in 2016. This accounts for just over 1% of world production.

Table 22 World distribution of avocado production in 2016

Country	Production (Tonnes)	Share of world production (%)
Northern hemisphere Top 10 (65%)		
Mexico	1,889,354	33.65
Dominican Republic	601,349	10.71

Colombia*	294,389	5.24
Kenya*	176,045	3.14
Venezuela	130,290	2.32
United States of America	124,860	2.22
China, mainland	122,875	2.19
Guatemala	122,184	2.18
Israel	101,500	1.81
Haiti	93,017	1.66
Southern hemisphere Top 7 (24%)		
Peru	455,394	8.11
Indonesia*	304,938	5.43
Brazil*	196,422	3.50
Chile	140,558	2.50
South Africa	89,440	1.59
Malawi	86,769	1.55
Australia	67,600	1.20
Others (11%)	617,663	11.00
Total production	5,614,647	100

Source: FAOSTAT; *indicates countries categorized based on their most parts in either northern or southern hemisphere.

The world's production of lychees is also concentrated in the northern hemisphere, with 93% produced in the top 11 producing countries and just 3% in the southern hemisphere. The world distribution of lychee production is shown in Table 23. China is the home of the lychee and the world's largest producer, producing approximately 60% of the world's lychees. India accounts for 24%, followed by Vietnam at 6%. In contrast, Madagascar is the largest producer in the Southern hemisphere, with 3.85% of world production, slightly higher than that of Taiwan (4th in the northern hemisphere). The Australian lychee industry accounts for just 0.1% of world production. However, this is one reason why lychees were selected to study, as it is a foothold industry which can learn from the experiences from the other two industries.

Table 23 World distribution of Lychee production

Country	Production (Tonnes)	Share of world production (%)
Northern hemisphere (93%)		
China	1,482,000	57
India	624,000	24
Vietnam	156,000	6

Taiwan	80,000	3.08
Thailand	43,000	1.65
Nepal	14,000	0.54
Bangladesh	13,000	0.5
Pakistan	4,000	0.15
Mexico	3,000	0.12
Israel	1,200	0.05
USA	600	0.02
Southern hemisphere (5%)		
Madagascar	100,000	3.85
Réunion	12,000	0.46
South Africa	8,600	0.33
Mauritius	4,500	0.17
Australia	2,500	0.1
Others (2%)	51,600	1.98
Total production	2,600,000	100

Source: VTPA (2014).

4.3.1.1.2 Production capacity

World production of mangoes is 40 million tonnes and continues to expand. Production increased by 12.65% from 43 to 48.44 million tonnes between 2012 and 2016 (Table 24). This increase can be attributed to improving yield as the harvested area only increased by 1.68%. All the major producing countries in the northern hemisphere (Pakistan excluded) increased production from 2012 to 2016, with Mexico having the most noticeable increase of 24.81%. India and China, the two largest global producers, increased production by 15.11% and 8.43% respectively. The production pattern in the Southern Hemisphere is quite different. Indonesia, Brazil and Australia have decreased production, while Tanzania, Peru and Malawi have increased production. Indonesia, the largest producer in the Southern Hemisphere saw the largest decrease of -21.28%, mainly due to the decrease in harvested area. Malawi has the largest increase in production by 1,017.17%, although its harvested area dropped by 5.61% indicating maturing crops. Compared with all the major producing countries, Australia has significantly increased the harvested area by 900.84%. However, its total production volume has dropped by 5.41% largely due to the immaturity of the crops. This points to a dramatic increase in production volumes in Australia in coming years – offering substantial export opportunities.

Table 24 Mango harvested area and production by country

		Harvested area (1,000 Hectare)	Production volume (Million tonnes)

Hemisphere	Country	2012	2016	% growth	2012	2016	% growth
	World	5,479.755	5,571.981	1.68%	43.00	48.44	12.65%
North	India	2,378.00	2,209.00	-7.11%	16.20	18.64	15.11%
	China	534.78	579.09	8.29%	4.33	4.70	8.43%
	Thailand	398.37	399.99	0.41%	3.30	3.31	0.59%
	Mexico	195.67	206.42	5.49%	1.76	2.20	24.81%
	Pakistan	172.38	167.93	-2.59%	1.70	1.63	-4.26%
South	Indonesia	219.67	169.43	-22.87%	2.77	2.18	-21.28%
	Brazil	88.48	78.99	-10.73%	1.52	1.42	-6.81%
	Tanzania	35.00	33.37	-4.65%	0.41	0.43	4.33%
	Peru	26.95	23.07	-14.38%	0.19	0.38	99.68%
	Malawi	9.60	9.06	-5.61%	0.12	1.28	1,017.07%
	Australia	7.00	70.06	900.84%	0.04	0.04	-5.41%

Source: FAO STAT.

World production of avocados was over four million tonnes in 2012 and the harvested area and production consistently grew, peaking at 571.88 thousand hectares and 5.61 million tonnes respectively in 2016 (Table 25). All the major producing countries in the northern hemisphere (Kenya excluded) saw increases in both harvested area and production volume from 2012 to 2016. Mexico is the only country in the northern hemisphere with a higher increase than the world average in both harvested area and production volume, at 38.55% and 43.56% respectively. Colombia had the largest increase in harvested area at 44.58%, while the Dominican Republic has the largest increase in production volume at 107.35%. The production pattern in the Southern Hemisphere is quite similar. All major producing countries in the Southern hemisphere (Chile excluded) saw increases in both harvested area and production volume from 2012 to 2016. Peru has higher increases in both harvested area (75.21%) and production volume (69.59%) than both the world average and Mexican rates. While small, Australia has experienced significant increases in both harvested area and production volume of 41.07% and 43.56% respectively. This is much higher than most major countries in both the northern and southern hemisphere.

Table 25 Avocado harvested area and production by country (Million Tonnes)

		Harvested area (1,000 Hectare)			Production volume (Million tonnes)		
Hemisphere	Country	2012	2016	% growth	2012	2016	% growth
	World	462.31	571.88	23.70%	4.41	5.61	27.44%
	Mexico	130.31	180.54	38.55%	1.32	1.89	43.56%
	Dominican Republic	11.18	13.38	19.59%	0.29	0.60	107.35%

North	Colombia	27.71	40.06	44.58%	0.26	0.29	15.27%
	Kenya	11.02	10.31	-6.50%	0.17	0.18	5.45%
	Venezuela	9.76	11.88	21.67%	0.12	0.13	11.39%
South	Peru	21.62	37.87	75.21%	0.27	0.46	69.59%
	Indonesia	20.99	23.81	13.43%	0.29	0.30	3.65%
	Brazil	9.57	10.91	13.99%	0.16	0.20	22.84%
	Chile	36.39	29.93	-17.73%	0.16	0.14	-12.15%
	South Africa	16.50	17.03	3.18%	0.09	0.09	27.44%
	Australia	10.00	14.11	41.07%	0.05	0.07	43.56%

Source: FAO STAT.

In 2015, China's total lychee planting area was 0.55 million hectares, from which 2.23 million tonnes of lychee were produced. It is estimated that 2.88 million tonnes of lychee were produced in China in 2018 (Fresh Plaza, 2018d), with an increase of 25.6% over 2015.

4.3.1.1.3 Crop productivity

World productivity of mangoes has increased on average by 10.79% pa between 2012 and 2016 (Table 26). Although India and China, the top 2 producers worldwide, have experienced yield increases from 2012 to 2016, their increases are much lower compared with the world average for most years. In contrast, Mexico and Pakistan have much higher yields than other major producing countries in the northern hemisphere, producing 10.64 and 9.69 tonnes per hectare. All major producing countries in the southern hemisphere (Australia excluded) have higher yields than their counterparts in the northern hemisphere, and their yields continued to increase between 2012 and 2016. The yields in 2016 for Malawi, Brazil and Peru peaked at 18.34, 17.95 and 16.36 tonnes per hectare respectively, double the world average. Australia has the lowest yield compared with all other major producing countries, producing less than 5 tonnes per hectare. This is largely indicative of a young crop, yet to reach maturity.

Table 26 Mango yield change by country (Tonnes per Hectare)

Hemisphere	Country	2012	2013	2014	2015	2016	5-year change
	World	7.85	8.08	8.19	8.85	8.69	10.79%
North	India	6.81	7.20	7.33	8.57	8.44	23.92%
	China	8.10	8.07	8.07	8.09	8.12	0.14%
	Thailand	8.27	8.56	8.76	8.17	8.29	0.18%
	Mexico	9.00	9.56	8.94	10.18	10.64	18.31%
	Pakistan	9.86	9.68	10.06	9.61	9.69	-1.72%
	Indonesia	12.63	12.14	10.89	12.12	12.89	2.07%
	Brazil	17.19	17.72	17.32	17.10	17.95	4.39%

South	Tanzania	11.71	12.82	12.58	12.62	12.82	9.42%
	Peru	7.01	14.10	11.81	11.39	16.36	133.20%
	Malawi	16.43	17.60	18.63	17.77	18.34	11.61%
	Australia	4.68	4.39	4.41	4.58	4.69	0.22%

Source: FAO STAT.

World productivity of avocados saw an average growth of 3.02% between 2012 and 2016 (Table 27). Mexico, Dominican Republic and Kenya in the northern hemisphere increased their yields, with the Dominican Republic having the highest increase at 73.39%, peaking at 44.96 tonnes per hectare. Peru, Indonesia and Brazil are the three major producers in the southern hemisphere, with higher yields than the world average, although yields continued to decline in Peru and Indonesia. Chile, South Africa and Australia's yields are about half of the world average. While Chile has seen increasing yields, South Africa and Australia have seen falling yields.

Table 27 Avocado yield change by country (Tonnes per Hectare)

Hemisphere	Country	2012	2013	2014	2015	2016	5-year change
	World	9.53	9.34	9.70	9.73	9.82	3.02%
North	Mexico	10.10	10.18	9.89	9.85	10.47	3.62%
	Dominican Republic	25.93	29.99	39.76	40.15	44.96	73.39%
	Colombia	9.22	9.19	8.37	8.50	7.35	-20.27%
	Kenya	15.15	15.54	18.88	16.08	17.08	12.78%
	Venezuela	11.98	11.32	11.05	11.36	10.97	-8.45%
South	Peru	12.42	11.20	11.52	10.93	12.02	-3.21%
	Indonesia	14.02	13.79	13.06	12.89	12.81	-8.62%
	Brazil	16.71	16.30	16.58	17.44	18.01	7.76%
	Chile	4.40	4.54	5.04	4.96	4.70	6.79%
	South Africa	5.55	5.23	5.36	5.23	5.25	-5.37%
	Australia	4.90	4.82	4.89	4.83	4.79	-2.11%

Source: FAO STAT.

China produced lychees at 4.05 tonnes per hectare in 2015. This figure is higher than Australia's yield, which ranges between 1.71 and 2.01 tonnes per hectare between 2015 and 2018 (ALGA, 2019).

4.3.1.2 Supply by country

4.3.1.2.1 Supply seasonality

Year-round mango supplies can be achieved when sourcing from various origins throughout the year. The supply season across major producing countries in the northern and southern hemisphere

follows a pattern as shown in Table 28. Northern Hemisphere producers can ensure a year-round supply, but the supply window is mainly concentrated between March and September. In contrast, the supply window from southern hemisphere countries is in the early and late parts of the year. Compared with other major producing countries in the southern hemisphere, Australia has longer mango supply windows, commencing in August and running until March. This indicates that Australian mangoes face limited competition from northern hemisphere countries, but strong competition from southern hemisphere countries.

Table 28 Supply calendar of major mango producing countries

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern hemisphere												
India				X	X	X	X	X				
China*			X	X	X	X	X	X	X			
Thailand			X	X	X							
Mexico				X	X	X	X	X				
Pakistan					X	X	X	X				
Bangladesh*	X	X									X	X
Egypt								X	X	X		
Nigeria*		X	X	X								
Philippines	X	X	X	X	X							
Mali**				X	X	X	X					
Viet Nam		X	X	X	X	X	X	X	X			
Jamaica					X	X	X	X				
Malaysia					X	X	X	X				
Venezuela			X	X	X	X	X					
Southern hemisphere												
Indonesia										X	X	
Brazil	X	X									X	X
Malawi*	X									X	X	X
Tanzania	X	X	X									X
Peru	X	X	X									X
Madagascar*										X	X	X
Ecuador*	X	X								X	X	X
South Africa	X	X	X									X
Australia*	X	X	X					X	X	X	X	X

Source: CBI (2009); **indicates the update with additional sources.

The supply windows of major avocado producing countries in the northern and southern Hemisphere are shown in Table 29. Mexico and the Dominican Republic are the two largest producers worldwide, which can supply avocado all year with different varieties from different producing regions in the northern hemisphere (Fresh plaza, 2015, 2018c). By contrast, Australia is the only country in the Southern Hemisphere which can currently produce avocados all year from existing production regions. Production regions extend from the far north of QLD down the east coast, through the Sunraysia Riverland area and down to south-west WA (Beavan, 2017). However, Australia has a tight supply period around January and February when it struggles to supply adequate volumes to meet demand (Beavan, 2017).

Table 29 Supply calendar of major avocado producing countries

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Country												
Northern hemisphere												
Mexico	X	X	X	X	X	X	X	X	X	X	X	X
Dominican Republic*	X	X	X	X	X	X	X	X	X	X	X	X
Colombia	X	X	X							X	X	X
Kenya						X	X	X	X	X		
Venezuela												
USA		X	X	X	X	X	X	X	X			
China						X	X	X	X	X	X	X
Guatemala	X	X	X				X	X	X	X		X
Israel	X	X	X	X								X
Southern hemisphere												
Peru			X	X	X	X	X	X	X			
Indonesia*	X	X	X	X	X					X	X	X
Brazil*			X	X	X	X						
Chile	X							X	X	X	X	X
South Africa				X	X	X	X	X	X			
Australia	X	X	X	X	X	X	X	X	X	X	X	X

Source: CBI (2008) and *indicates the update with additional sources

Lychee supply windows are quite concentrated across major producing countries, which makes it difficult for a year-round supply on a large scale (Liu, 2017). The supply windows of the major producing countries in the northern and southern hemisphere are shown in Table 30. Australian lychees run from October in far north QLD to early April in northern New South Wales thanks to the introduction of earlier and later fruiting varieties, and extensive production zones in tropical to

temperate climates (ALGA, 2019). Australia has an advantage in international markets with production during the northern hemisphere "off-season" including the lucrative Christmas and Chinese New Year festivities (Menze, 2002). However, Australian lychee has some overlapping supply windows with major Southern Hemisphere competitors, such as Réunion, Madagascar, Mauritius and South Africa.

Table 30 Supply calendar of major lychee producing countries

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
North hemisphere												
China			X	X	X							
India			X	X								
Taiwan				X	X							
Thailand	X	X	X	X								
Vietnam			X	X								
Nepal			X	X								
Bangladesh			X	X								
USA			X	X								
Mexico			X	X	X	X						
Israel					X	X	X					
Spain						X	X					
South hemisphere												
Réunion									X	X	X	
Mauritius									X	X		
Madagascar									X	X	X	X
South Africa									X	X	X	X
Australia*	X	X						X	X	X	X	X

Source: Jahiel et al (2014); *indicates the data is updated.

4.3.1.2.2 Export intensity

World mango production is mainly consumed domestically and only a small proportion of production (less than 4%) is exported. Table 31 shows mango exports as a percentage of production by country. Mexico has the highest export ratio in the northern hemisphere, with over 16% exported. This is followed by Thailand and Pakistan, with 6% and 5% respectively. India and China have rather limited exports compared with other producers, despite being such large producers. India exports just over 1% of production compared to less than 0.2% in China. In contrast, Peru exported more than 40% of its produce in 2016. Brazil and Australia also have a relatively high export ratio, at 10.89% and 10.98% respectively in 2016. However, exports from Indonesia, the largest producer in the Southern Hemisphere, make up only 5%.

Table 31 Mango exports as a percentage of production by country

Hemisphere	Country	2012	2013	2014	2015	2016

	World	3.45%	3.60%	3.43%	3.27%	3.45%
North	India	1.33%	1.47%	1.14%	0.94%	1.04%
	China	0.11%	0.18%	0.21%	0.03%	0.09%
	Thailand	5.96%	7.39%	6.86%	6.57%	5.53%
	Mexico	16.89%	17.78%	16.51%	16.00%	16.81%
	Pakistan	5.95%	5.96%	4.50%	2.67%	5.08%
South	Indonesia	0.05%	0.04%	0.04%	0.06%	0.02%
	Brazil	8.36%	8.08%	8.93%	11.18%	10.89%
	Tanzania	0.12%	0.05%	0.01%	0.01%	0
	Peru	52.80%	27.50%	31.76%	37.77%	41.62%
	Australia*	N/A	8.05%	10.33%	10.61%	10.98%
	Malawi	0	0.01%	0.00%	0.00%	0.00%

Source: FAO STAT; *indicate the FAO data is missing and alternative data for the financial year is used.

Although many of the major producers of avocados are also major consumers (Barnard, 2014), more than 20% of world production is sold to international markets (Table 32). Exports as a percentage of world production continued to increase between 2012 and 2016, from 23.90% to 34.08%. Mexico is the largest producer worldwide and also a significant player in the international market, with exports as a percentage of production up from 37.57% in 2012 to 49.04% in 2016. Kenya also saw a rising export ratio, peaking at 31.94% in 2015. Colombia saw a rapid increase in the export ratio, from 0 in 2012 to 6.18% in 2016. In the Southern Hemisphere, Chile and South Africa export roughly 60% of their production, while Peru exports 40%. Australia's export ratio is approximately 4%.

Table 32 Avocado exports as a percentage of production by country

Hemisphere	Country	2012	2013	2014	2015	2016
	World	23.90%	26.27%	28.65%	31.49%	34.08%
North	Mexico	37.57%	38.39%	38.39%	52.52%	49.04%
	Dominican Republic	5.88%	5.32%	5.32%	2.78%	3.94%
	Colombia	0.00%	0.18%	0.18%	1.79%	6.18%
	Kenya	N/A	14.06%	14.06%	31.94%	23.74%
	Venezuela	0.16%	0.32%	0.32%	0.34%	0.24%
South	Peru	31.12%	39.71%	39.71%	47.84%	42.62%
	Indonesia	0.03%	0.08%	0.08%	0.01%	0.02%
	Brazil	2.67%	2.74%	2.74%	2.56%	2.52%
	Chile	57.20%	53.55%	53.55%	60.63%	**NA**
	South Africa	59.50%	60.61%	60.61%	56.62%	64.70%
	Australia	4.70%	3.87%	3.87%	3.09%	3.62%

	New Zealand	43.44%	50.76%	128.44%	80.38%	106.17%

Source: FAO STAT. The production data for New Zealand are estimated by FAO, and the export data are official data.

Lychee sales mainly focus on local markets (Liu, 2017). As a result, trade volumes of fresh lychee are relatively low, at approximately 0.12 Million tonnes (Liu, 2017). While most lychee produced in China and India is consumed domestically, Vietnam exports up to 40% of the country's total production. Australia's export intensity sits at 15%.

4.3.1.2.3 Export performance

Although Australia's mango industry had a low share of global exports between 2013 and 2017, at 0.4%, Australian mangoes attract the highest export price compared to all other major exporters, at 3.15 USD per kg. Mexico has the highest export share at 18.3%, but its export unit price is only 0.99 USD per kg, which is higher than Pakistan (0.83 USD per kg), Ecuador (0.7 USD per kg) and Indonesia (0.63 USD per kg).

The three largest mango exporters in the northern hemisphere are Mexico, Thailand and India, which export to North America, Asia and the Middle East respectively (Table 33). The two largest mango exporters in the Southern Hemisphere are Brazil and Peru, which export to North America and Europe. Southeast Asia is the largest market for Australian mangoes, while New Zealand, UAE and Lebanon are important export markets.

Table 33 Major mango supplying the country's export position, price and top five markets

Hemisphere	Country and export share (%)	Export price ($USD/KG)	Top 5 export markets and share (%)
North	India (11.1)	1.00	Saudi Arabia (23.73), UAE (17.67), Yemen (11.62), Netherlands (7.4), Kuwait (4.91),
	China (0.8)	1.63	Viet Nam (63.17), Hong Kong (27.94), Macao (4.76), Russia (2.61), Malaysia (0.78)
	Thailand (12.4)	0.87	Viet Nam (51.40), China (31.91), Hong Kong (4.53), Malaysia (3.39), Korea (2.08)
	Mexico (18.3)	0.99	USA (86.18), Canada (9.88), France (2.2), Japan (0.77), Netherlands (0.3)
	Pakistan (4.2)	0.83	United Arab Emirates (51.21), United Kingdom (11.27), Oman (10.74), Saudi Arabia (6.79), Azerbaijan (6.55)
	Netherlands* (6.3)	2.08	Germany (46.88), France (6.56), United Kingdom (5.78), Belgium (5.43), Norway (5.40)
	Vietnam*(3.2)	1.52	China (93.85), Korea (2.72), Canada (0.57), Japan (0.50), Australia (0.41)
	Indonesia (1.3)	0.63	Malaysia (44.08), Thailand (19.51), Hong Kong (14.91), Viet Nam (9.32), UAE (4.55)

South	Brazil (7.8)	1.19	Netherlands (45.69), USA (18.75), Spain (12.83), United Kingdom (7.11), Portugal (5.93)
	Peru (7.5)	1.21	Netherlands (41.15), USA (30.69), United Kingdom 99.58), Spain (4.38), Canada (3.73)
	Ecuador*(3.0)	0.7	USA (80.8), Colombia (8.37), Canada (4.14), Netherlands (1.89), New Zealand (1.19)
	Australia (0.4)	3.15	Hong Kong (41.02), Singapore (15.15), New Zealand (12.51), UAE (11.93), Lebanon (4.18)

Source: Trademap (Product: HS Code 080450 Fresh or dried guavas, mangoes and mangosteens).
Note: Export share, price and market share were calculated with data from 2013 to 2017.
*indicates not a top producer, but with high global export share.

The comparison of avocado export performance between Australia and major exporting countries is shown in Table 34. Australian avocados face a much lower export price (at 1.37 USD per kg) compared with almost all other major exporters. Mexico, the largest avocado exporter in the northern hemisphere and worldwide, accounts for almost half of global exports with unit prices at 2.30 USD per kg - lower than the US, Netherlands and Spain. The USA is the largest market for Mexican avocados, although Japan, Canada, France and El Salvador are also important markets. Peru is the largest exporter in the Southern Hemisphere and the second largest worldwide, exporting to North America and Europe, but with the lowest export price at 0.42 USD per kg. New Zealand is a smaller avocado producer, but it has a larger export volume and higher export unit price than Australia. Australian avocados will face increasing competition in Asia from New Zealand as it concentrates its market in Asia. Australia also faces competition from Mexico and the USA in the Japanese market. It should be noted that Thailand was previously an important market for Australian avocados, but it was closed in 2014.

Table 34 Major avocado supplying the country's export position, price and top 5 markets

Hemisphere	Country and export share (%)	Export Price ($USD/KG)	Top 5 export markets and share (2013-2017 average)
North	Mexico (48.1)	2.30	USA (77.18), Japan (7.19), Canada (6.88), France (1.39), Salvador (1.31)
	Dominican Republic (1.2)	1.57	USA (71.31), Netherlands (9.31), France (6.40), United Kingdom (4.55), Panama (2.49)
	Colombia (0.7)	1.97	Netherlands (41.78), United Kingdom (29.09), Spain (26.99), Belgium (9.86), France (8.13)
	Kenya (2.4)	1.33	UAE (29.85), France (21.32), Netherlands (17.37), United Kingdom (11.48), Saudi Arabia (6.60)
	USA*(2.7)	2.74	Canada (80.03), Japan (6.62), Chile (4.40), Korea (3.51), Belgium (2.28)
	Israel*(2.1)	2.29	France (34.52), Netherlands (21.72), United Kingdom 915.13%), Russia (14.46), Slovenia (3.96)

	Netherlands*(7.9)	3.05	Germany (27.49), Sweden (11.64), Norway (8.12), Denmark (7.70), France (6.76)
	Spain*(5.2)	2.76	France (37.39), Netherlands (10.86), Germany (10.74), United Kingdom (7.79), Morocco (8.83)
South	Peru (11.3)	0.42	Netherlands (38.01), USA (25.53), Spain (19.66), United Kingdom (8.78), Chile (2.84)
	Brazil (0.3)	1.92	Netherlands (54.75), Spain (30.58), France (9.40), Canada (2.40), Morocco (1.99)
	Chile (7.6)	0.82	Netherlands (39.89), USA (22.53), United Kingdom (10.58), Argentina (10.36), China (6.30)
	South Africa (3.4)	1.49	Netherlands (67.88), United Kingdom (19.96), France (3.43), Spain (3.05), Russia (1.41)
	New Zealand*(1.3)	2.26	Australia (81.95), USA (8.28), Japan (4.75), Singapore (3.23), Korea (2.91)
	Australia (0.1)	1.37	Singapore (48.83), Malaysia (32.24), Hong Kong (5.52), Thailand (4.66), Kuwait (2.31),

Source: Trademap (Product: HS Code 080440 Fresh or dried avocados).
Note: Export share, price and market share were calculated with data from 2013 to 2017.
*indicates not a top producer, but with high global export share.

Australian lychees have a small global export share of 0.03%, linked to high domestic sales volumes and a high domestic market price, but has the highest export unit price by concentrating on markets in Southeast Asia, the Middle East and New Zealand. Similarly, Mauritius has the lowest export share among all major producing countries but enjoys the second-highest export unit price by concentrating on the European market. Taiwan, China and Vietnam are the next three exporters with relatively high export unit prices (Table 35). In terms of the global market share, Thailand is the largest lychee exporter at 33%, followed by Vietnam at 14.75%. However, Vietnam's export unit price is 2.12 USD per kg, nearly three times that of Thailand. The higher export price is mainly due to the fact that the quality of Vietnamese lychee has been gradually improving with the appearance and uniformity favoured by Chinese consumers (VTPA, 2014).

Table 35 Major lychee supplying the country's export position, price and top 5 markets

Hemisphere	Country and export share (%)	Export price ($USD/KG)	Top 5 export markets and share (%) (2013-2017 average)
	China (4.6)	2.27	Viet Nam (53.25), Thailand (25.48), Hong Kong (8.41), Malaysia (4.71), USA (3.93)
	India (3.4)	1.31	UAE (31.17), Nepal (18.64), Bangladesh (16.39), Saudi Arabia (5.87), Malaysia (2.80)
	Vietnam (14.75)	2.12	China (84.38), USA (2.5), Thailand (2.37), Hong Kong (1.41), Indonesia (1.38)
	Taiwan (0.8)	2.28	China (86.08), Hong Kong (5.75), USA (3.84), Canada (2.16), Singapore (0.98)

North	Thailand (30.6)	0.77	Viet Nam (43.07), China (29.32), Indonesia (11.88), Hong Kong (8.81), Malaysia (1.29)
	Turkey* (8.6)	0.71	Iraq (25.39), Russia (22.29), Ukraine (8.14), Germany (7.92), Belarus (6.67)
	Hong Kong* (7.3)	1.06	China (97.65), Macao (1.25), Philippines (0.85), Viet Nam (0.19), United Kingdom (0.05)
South	Madagasca(0.03)	1.47	Pakistan (45.04), India (27.72), France (22.17), Netherlands (2.61)
	South Africa (1.2)	1.81	Netherlands (24.91), Kenya (13.44), Namibia (9.18), United Kingdom (8.46), Mozambique (5.94)
	Mauritius (0.02)	4.41	France (59.04), United Kingdom (24.61), Switzerland (4.46), Italy (4.41)
	Australia (0.03)	5.03	Hong Kong (40.11), Singapore (13.42), UAE (11.32), New Zealand (7.17), Saudi Arabia (4.60)

Source: Trademap (Product: HS 081090 Fresh tamarinds, cashew apples, jackfruit, lychees, etc.).
Note: Export share, price and market share were calculated with data from 2013 to 2017.
*indicates countries are not top producers, but with high global export shares.

4.3.2 Regional comparison

4.3.2.1 Production by region

4.3.2.1.1 Growing and packing patterns

Farm acquisitions in northern Australia have been widely reported in recent years in the mango and avocado industries. This has often been implemented by large growers/marketers to scale up production, expand their geographic range as a product, climate, seasonal spread or diversity strategy. For example, one of Australia's top mango producers, Manbulloo acquired three new mango plantations in 2017 to expand their supply windows (Fresh Plaza, 2018c). Nutrano, a fresh food distributor, acquired seven properties in 2016 (Hey, 2016). Costa Group which grows, markets and ripens avocados, purchased two avocado farms at Fisherman’s Reach and Comboyne to advance their vertical integration (Pascoe, 2018).

The expansion of large producers and marketers has shaped growing patterns across regions. For example, Manbulloo’s mango farms at Katherine, NT, near Townsville, QLD, and outside Cairns, QLD (Fresh Plaza, 2016b), enables them to increase supply and widen their seasonal coverage to achieve continuity of supply to Asian markets (Austrade, 2017). Table 36 shows the number of growers and packing facilities for mango, avocado and lychee industries within the boundary of northern Australia by region.

Table 36 Number of mango, avocado and lychee growers and packing facilities by region

State/ Territory	Product	Region	Number of growers	Number of packing facilities
NT	Mango	Katherine & Mataranka	20*	10*

		Darwin	105*	25*
QLD	Mango	Mareeba/Dimbulah	180	100
		Bowen/Burdekin	-	60
	Avocado	Far North QLD (incl. Atherton Tablelands and Mareeba/Dimbulah)	98	50
		Rockhampton	1	1
	Lychee	Atherton Tablelands	50	50
		North QLD Coast (incl. Ingham, Cardwell, Coolbie, Tully, Garbutt, Murray Upper, Cairns and Gordonvale)	45	45
		Rockhampton	45	45
WA	Mango	Kununurra	40	?
		Carnarvon	34	34
	Avocado	Carnarvon	30	30

Source: Mango data from DAF (2018), DPIRWA (2018), DPIRNT (2016); Avocado data from AA (2018) and DPIRWA (2018); Lychee data from ALGA (2018).
Note: * indicate the data in 2016, while others in 2018

NT's mango industry comprises approx. 125 growers, of which 20 are in Katherine & Mataranka and 105 around Darwin. Contract packing is quite common in NT with 10 packhouses in Katherine & Mataranka and 25 in Darwin. For example, Berry Springs packs for about 25% of Darwin growers, Lake Bennet and Pine Creek packs for growers in Katherine, and Nutrano packs for Pinata (DPIRNT, 2018). QLD's mango industry also employs contract packing. While there are roughly 180 mango growers at Mareeba, there are about 100 packhouses in Mareeba and 60 in Bowen/Burdekin (DAF, 2018). The number of packhouses in Mareeba may reduce due to the development of large pack-houses with Compaq and MAF NIR auto-grading systems (DAF, 2018). WA's mango industry also uses contract packing, but only in Kununurra as all mango growers in Carnarvon have their own packhouses (DPIRWA, 2018).

There are 98 avocado growers in far north QLD (including Atherton Tablelands and Mareeba/Dimbulah) (AA, 2018) and 30 growers in Carnarvon, WA (DPIRWA, 2018) in 2018/19, accounting for 33.71% and 16.85% of growers in QLD and WA respectively. Contract packing has emerged for the avocado industry in far north QLD with 50 packhouses. Avocado growers in Carnarvon, WA and Rockhampton, QLD have their own packing lines.

All lychee growers undertake their own packing.

4.3.2.1.2 Crop productivity

QLD had the highest average mango yield between 2013-14 and 2016-17, at 39.05 tonnes per hectare, roughly 10% higher than NT and 50% high than WA (Table 37). Burdekin/Bowen is the most

productive region for mangoes. However, QLD has faced declines in yield over recent years, while NT and WA have increased yields as their more recent plantings mature and produce fruit.

Table 37 Australia's mango productivity breakdown by region

Region	Tonnes/Hectare				
	2013-14	2014-15	2015-16	2016-17	4 years average
National Total	35.0	36.7	34.9	37.1	35.93
QLD	41.0	41.5	37.6	36.1	39.05
Burdekin/Bowen	60.0	49.9	39.0	NA	49.63
NT	33.0	32.2	35.6	40.7	35.38
Darwin	36.0	35.4	33.0	40.3	36.18
WA	9.0	15.2	16.0	37.8	19.50

Note: Estimated values from the Australian Bureau of Statistics (ABS).

Hass grown in WA and north QLD are more productive than the national production (Table 38). WA's three-year average yield is 41.53% higher than northern QLD's. However, WA's yields from Hass have plummeted over the past three years. In contrast, north QLD's yield has seen a gradual increase. In terms of Shepard production, north QLD is more productive with an average of 10.23 tonnes per hectare, with an increase from 8.3 to 11.3 tonnes per hectare over three years.

Table 38 Australia's Avocado productivity breakdown by region and main variety

Variety	Region	Tonnes/Hectare			
		2015-16	2016-17	2017-18	3 year average
Hass	National	13.4	9.3	8.3	10.33
	North QLD	11.2	12	12.4	11.87
	WA	27.2	16.2	7	16.80
Shepard	National	9.2	9.3	8	8.83
	North QLD	8.3	11.1	11.3	10.23

Source: Avocados Australia's OrchardInfo Report.

Most regions have yields from lychee ranging from 1.61 to 2.76 tonnes per hectare (Table 39). This compares well to NSW's low yields of 0.48 tonnes per hectare.

Table 39 Australia's lychee productivity breakdown by region

Region	Tonnes/Hectare				
	2014-15	2015-16	2016-17	2017-18	4 year average
National total	1.71	2.01	1.77	1.81	1.83
QLD	1.77	2.07	1.83	1.91	1.90
Atherton	1.90	1.92	1.30	1.33	1.61
North Coast*	0.99	1.27	1.08	1.19	1.13

Rockhampton	1.25	1.68	1.75	1.79	1.61
Bundaberg	2.65	2.72	2.43	2.43	2.56
Sunshine Coast	2.44	3.13	2.70	2.79	2.76
New South Wales	0.33	0.73	0.45	0.39	0.48

Source: Estimated data from Australia Lychee Grower Association (ALGA).
Note: *includes Ingham, Cardwell, Coolbie, Tully, Garbutt, Murray Upper, Cairns, and Gordonvale etc

4.3.2.1.3 Costs of production

The operating costs (excluding interest and depreciation) of mango, avocado and lychee production are presented by region in Table 40.

Mareeba/Dimbulah's operating cost for mango production is higher 50.76% than Burdekin and 10.30% higher than the NT. In terms of avocado production, WA has 25.27% higher operating costs than north QLD. The cost of lychee production ranges from $1200 -1800 per tonne, which is dependent on several factors, including location, size, age of the trees, the slope of the land, weather conditions and experience and quality of picking & grading staff (ALGA, 2019).

Table 40 Operating costs of mango, avocado and lychee production by region

State/ Territory	Product	Region	Operating cost ($ per tonne)
NT	Mango	Darwin and Katherine	2,533.81
QLD	Mango	Mareeba/Dimbulah	2,794.76
		Burdekin	1,853.81
	Avocado	All four producing regions	3,107.27
		North QLD	2,885.45
	Lychee	Atherton Tablelands, North QLD Coast, Rockhampton	1,200-1,800
WA	Avocado	Carnarvon in the north and Esperance in the south	3,614.55

Note: Mango costs are based three-year averages (2010-11 to 2012-13) gathered from Mango Industry Benchmarking; Avocado costs are based on four-year averages (2011-12 to 2014-15) gathered from Australian Avocado Benchmarking Program; Lychee costs are from ALGA (2018).

4.3.2.2 Supply by region

4.3.2.2.1 Export intensity

Mango export as a percentage of production in northern Australia is relatively small (Table 41).

Table 41 Export as a percentage of production by region

Product	Year	National total	QLD	NT	WA
Mango	2013/14	10.33%			
	2014/15	10.61%	10.91%	5.62%	0.05%
	2015/16	10.98%	17.70%	2.39%	0.16%
	2016/17	11.58%	17.33%	2.63%	2.11%

Avocado	2013/14	2.69%			
	2014/15	2.23%	2.71%	-	1.84%
	2015/16	2.32%	2.77%	-	1.70%
	2016/17	3.51%	3.57%	-	0.11%
Lychee	2013/14	NA		-	-
	2014/15	14.94%		-	-
	2015/16	16.30%		-	-
	2016/17	16.99%		-	-

Source: Hort Innovation Australia.

QLD's mango export intensity is higher than the national average (11.58% in 2016-17), while NT and WA's exports ratios only stand at 2.63% and 2.11% in 2016-17 respectively. NT has a decreasing mango export intensity from 2014-15 to 2016-17. In contrast, WA's export ratio was up from 0.05% to 2.11%. The increase from WA may come from Kununurra, where high-quality fruits with a long shelf life, ideally suited for export, are produced due to lower disease risk than other regions (Johnson and Bennett, 2017).

QLD's avocado export intensity is also higher than the national average and continued to rise, from 2.71% in 2014-15 to 3.57% in 2016-17. In contrast, WA's avocado export intensity is lower than the national average and dropped from 1.84% to 0.11% in the same period.

As of 2016-17, more than 16% of national production was exported with 99% of national production coming from QLD (HIA, 2018).

4.3.2.2.2 Export share

Australia's exports of mangoes and avocados mainly come from QLD, NT and WA, making up around 90% of national mango and avocado exports combined. Table 42 shows the regional export percentage of mangoes, avocados and lychees.

Table 42 Regional export percentage by product

Product	Year	National total	QLD	NT	WA	Sub-total
Mango	2013/14	5,275				
	2014/15	7,012	77.81%	10.35%	0.01%	88.17%
	2015/16	7,006	80.57%	9.85%	0.04%	90.46%
	2016/17	7,120	74.82%	10.27%	0.55%	85.64%
Avocado	2013/14	1,310				
	2014/15	1,287	60.68%	-	31.16%	91.84%
	2015/16	1,546	62.03%	-	26.13%	88.16%
	2016/17	2,315	70.37%		0.56%	70.93%
	2013/14	295		-	-	

Lychee	2014/15	NA		-	-	
	2015/16	440		-	-	
	2016/17	411		-	-	

Source: Hort Innovation Australia.

The majority of Australian mangoes shipped into international markets are from QLD, accounting for around 80% of national exports, with NT accounting for around 10%. Despite a smaller supply from WA, their export share increased between 2014-15 and 2016-17, from 0.01% to 0.55%.

Australian avocado exports are mainly from QLD and WA, although WA's export share plunged to 0.56% in 2016-17. QLD and WA's avocado exports accounted for around 60% and 30% of national exports from 2014-15 to 2015-16. Noticeably, QLD's export share continues to increase, peaking at 70.37% in 2016-17.

4.3.2.2.3 Export price

The comparison of mango exports and wholesale prices across regions from 2016-2018 is shown in Figure 16. Mangoes from the NT and WA generally have better export and domestic wholesale prices compared with QLD mangoes. NT mangoes often have a much better sales performance than WA's as they are the first mangoes to start the season in Australia. However, both NT and WA's mangoes had lower export prices than domestic wholesale prices. The largest price gap between export and wholesale mangoes for NT and WA was in 2018, with $0.56 and $1.95 per kg respectively. In contrast, QLD's mangoes have a much better export performance compared with domestic wholesale as export prices are higher than the wholesale market in 2016 and 2017.

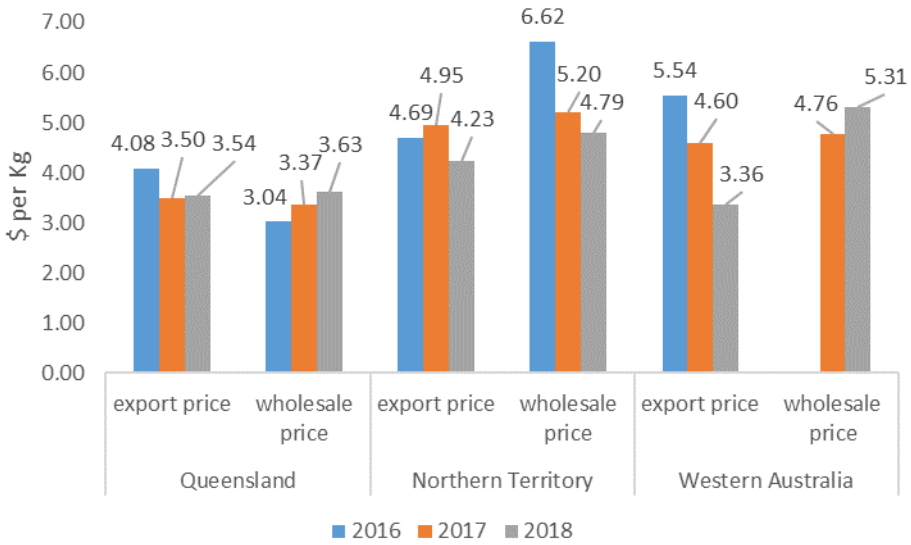

Figure 16 Mango export and wholesale price breakdown by region

Source: Export price was calculated with World Trade Atlas data supplied by Hort Innovation Australia, while the wholesale price was calculated with Brisbane, Sydney and Melbourne wholesale market data gathered from Ausmarket Consultants.

Export and wholesale prices for QLD and WA avocados from 2016-2018 are compared in Figure 17. The year 2017 saw a large price gap between export and wholesale of $ 1.05 per kg. In contrast, WA's avocados have a stronger domestic market performance as wholesale prices were higher than export prices in 2017 and 2018. The negative price gap between wholesale and export of $0.97 per kg in 2017 upholds the argument in Barnard (2014) that growers frequently sell avocados for export at lower prices than could be achieved on the domestic market. There could be multiple reasons for this phenomenon, including taking a loss-leader approach to access export markets, sales of excess volume at a lower price and unfavourable export contracts.

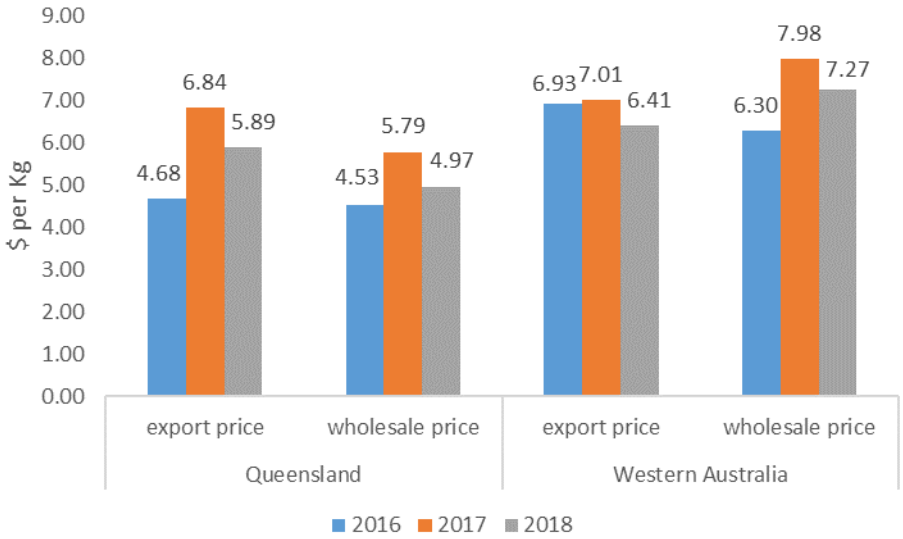

Figure 17 Avocado export and wholesale price breakdown by region

Source: export price was calculated with World Trade Atlas data supplied by Hort Innovation Australia, while the wholesale price was calculated with Brisbane, Sydney and Melbourne wholesale market data gathered from Ausmarket Consultants.

The wholesale price for QLD lychee is shown in Figure 18. The export price is unavailable for QLD's fresh lychee, therefore, a comparison with wholesale prices can not be made. However, as noted by some growers, the export prices to the USA are slightly better than the domestic market and the feedback has been good (Fresh Plaza, 2017).

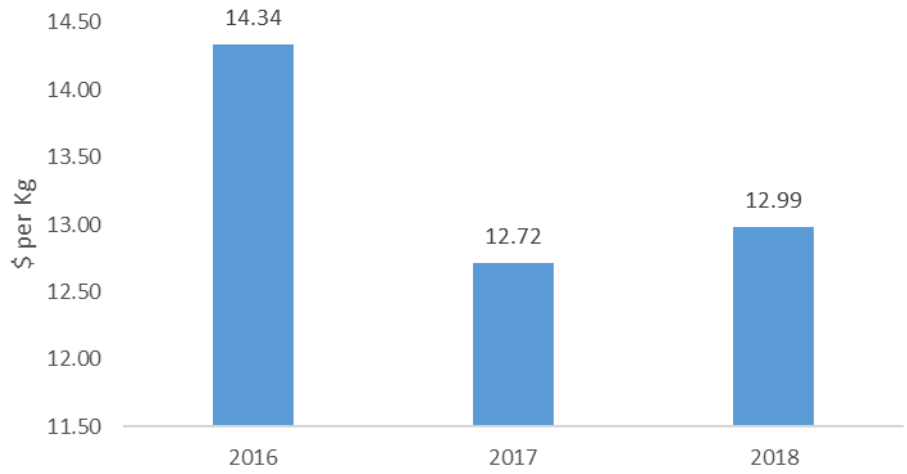

Figure 18 QLD's lychee wholesaler price

Source: Wholesale price was calculated with Brisbane, Sydney and Melbourne wholesale market data gathered from Ausmarket Consultants.

4.3.3 Benchmarking Analysis

4.3.3.1 Country benchmarking

World production of mangoes, avocados and lychees is concentrated in the northern hemisphere, while Australia is a small producer of mango, avocado and lychee in the southern hemisphere. Australia's mango and avocado production account for around 1% of global production respectively, while Australia's lychee production only make up 0.1% of world production.

World production of mangoes and avocados continues to expand. Australia has significantly increased its harvest area for mangoes and avocado from 2012 to 2016, with an increase of 900.84% for mango and 41.07% for avocado. This increase is noticeably higher than the major competitors in both the northern and southern Hemisphere. Australia's lychee industry has also seen a slight increase of 1.97% from 2015-2018.

World productivity of mangoes and avocados has increased between 2012 and 2016, peaking at 9.82 tonnes per hectare. Australia's mango yield has increased 0.22% in the same period; however, it still stands at below 5 tonnes per hectare, which is about half the world average. Australia's avocado yields are also about half the world average and continue to fall. Australia's lychee yield is also lower than the world average and about half that of China.

Australian mangoes face limited global competition with the main producing countries in the northern hemisphere because of its counter season production advantage. While Australia has competition from major mango producing countries in the Southern Hemisphere, Australia has longer mango supply windows providing an unparalleled advantage.

Australia is the only country in the Southern Hemisphere that can produce avocados year round. However, Australian avocados have continuous global competition with Mexico and the Dominican Republic, the two largest global producers with year-round supplies. Australian lychees also have an advantage in the international market due to their counter seasonality. However, Australia faces competition with the major lychee producers in the Southern Hemisphere, such as Réunion, Madagascar, Mauritius and South Africa due to some overlapping supply windows.

Australia's mango industry had an export ratio of 10.98% in 2016, significantly higher than the world average of 3.45%, but much lower than Mexico (16.81%) and Peru (41.62%). The global export intensity of avocado is greater than mangoes, standing at 34.08% in 2016, compared with 3.45% for mangoes. Australia's avocado export intensity stands at a low 4%. Australia's lychees have a relatively high export intensity of 15%.

Australian mangoes have a higher export price than other major exporters, at 3.15 USD per kg and are mainly exported to Southeast Asia, New Zealand, UAE and to a lesser extent the spot market in Lebanon. Australian mangoes do not compete well in price in Asia as major producing and exporting countries, for example, China, Thailand, Vietnam and Indonesia, have a much lower export price. Interestingly, Australian avocado's export unit price is lower than for all major exporters (Kenya excluded) in the northern hemisphere and only higher than Chile and Peru in the Southern Hemisphere. This indicates room to manoeuvre on price where a brand and some form of geographic identification can be built. Australian avocados will face competition in Asia from New Zealand as it concentrates its market across the region. It will also face competition from Mexico and USA in the Japanese market. Australian lychee has the highest export unit price, particularly in markets in Southeast Asia, the Middle East and New Zealand.

4.3.3.2 Regional benchmarking

Large growers/marketers have become more involved in the mango and avocado industries within northern Australia. Contract packing has become common in major mango producing regions and has also become more common in the avocado industry in north QLD.

QLD is generally producing more mangoes than the NT and WA. Burdekin/Bowen is the most productive region; however, its yields have fallen in recent years, while NT and WA's yields have increased and overtaken QLD. Hass growing in WA is generally more productive in than north QLD. However, WA's yields from Hass plummeted from 2015-16 to 2017-18, while north QLD's yields gradually increased. QLD's yields from lychee are also higher than the national level; however, Atherton, the NQ Coast and Rockhampton are less productive regions (yields are increasing on the NQ Coast and Rockhampton).

Mareeba/Dimbulah's average operating cost for mango production is 50.76% higher than Burdekin and 10.30% higher than the NT. WA has higher average operating costs for avocado production at $3,614.55 per tonne, 25.27% higher than north QLD.

QLD's mango exports as a percentage of production were 17.33% in 2016-17, higher than NT (2.63%) and WA (2.11%). NT's export intensity was decreasing from 2014-15 to 2016-17, while WA's was up from 0.05% to 2.11%. QLD's avocado export intensity is also higher than WA and continued to rise, up from 2.71% in 2014-15 to 3.57% in 2016-17. In contrast, WA's avocado export intensity dropped from 1.84% to 0.11% in the same period. QLD's lychee export intensity is similar to mangoes.

80% of Australian mangoes exported are from QLD and 10% are from the NT. Australian avocados are exported mainly from QLD and WA, making up around 60% and 30% of national exports. Noticeably, QLD's export share continues to increase, peaking at 70.37% in 2016-17, while WA's export share plunged to 0.56% in 2016-17. Nearly all of Australia's lychees are exported from QLD as it is the dominant region for lychee production.

Mangoes from the NT and WA generally have a better export and domestic market performance than QLD's mangoes, but their wholesale prices are often higher than export prices. The favourable price in Australian markets generally makes export unattractive for mango growers from the NT and WA. In contrast, QLD's mangoes generally gain higher export prices than domestic. Similarly, QLD's avocado export prices outperform domestic wholesale prices, while WA has higher domestic prices than export prices. Some lychee growers report export prices to the USA are slightly better than the domestic market.

Section 5 Market intelligence

Consumer tastes and purchasing behaviour are changing in developing countries, particularly those in Asia, which are predicted to consume half the world's food by 2030 (Anderson and Strutt, 2014). The imported fruit and vegetable markets in Asia are very competitive. Many countries and regions from outside are striving to send their products to these markets, including US, South Africa, South American countries, European countries, Israel, New Zealand and Australia. In addition, importing and exporting occurs between Asian countries (Sun, 2016).

5. 1 Market insight

5.1.1 Market understanding

5.1.1.1 Local production

The availability of locally produced mangoes, avocados and lychees in targeted Asian markets is shown in Table 43. Hong Kong's local agricultural production is minimal due to land constraints, resulting in a dependence on imports for 95% of its food requirements (Li et al., 2017). Singapore is a small nation-state with inadequate land for agriculture production, thus more than 90% of its food consumption relies on imports from other countries (AVA, 2017). Due to their land constraints, Hong Kong and Singapore do not produce mangoes, avocados and lychees. In contrast, locally produced mangoes, avocados and lychees are available in both China and Japan. While South Korea does not produce avocados and lychees, mangoes are locally produced through cultivation in greenhouses. Test cultivation of avocados at the Agricultural Technology Centre has been carried out in Goheung since 2011; however, cultivation of avocados is still unavailable in South Korea (Lim and Kwak, 2017).

Table 43 Availability of local produced mangoes, avocados and lychees

	Hong Kong	Singapore	China	Japan	South Korea
Mango	X	X	✓	✓	✓
Avocado	X	X	✓	✓	X
Lychee	X	X	✓	✓	X

Note: ✓ – local production; X – No local production.

5.1.1.1.1 Mango production

China's mango production is distributed in seven provinces, including Hainan, Guangxi, Guandong, Yunan, Sichuan, Fujian and Guizhou (Liu, 2017). Figure 19 shows the distribution of China's mango production and varieties in the top 6 producing regions. China's mango production has increased in both volume and quality in recent years due to expanding plantations, improved breeds and the introduction of popular varieties from other countries and regions, including Taiwan, Thailand,

Vietnam and Australia. In 2017, China's total mango production peaked at 1.98 million tonnes. Currently, a wide range of local and foreign varieties are available in China. Notably, locally produced Australian R2E2 mangoes are available in Hainan, Guangxi and Yunnan.

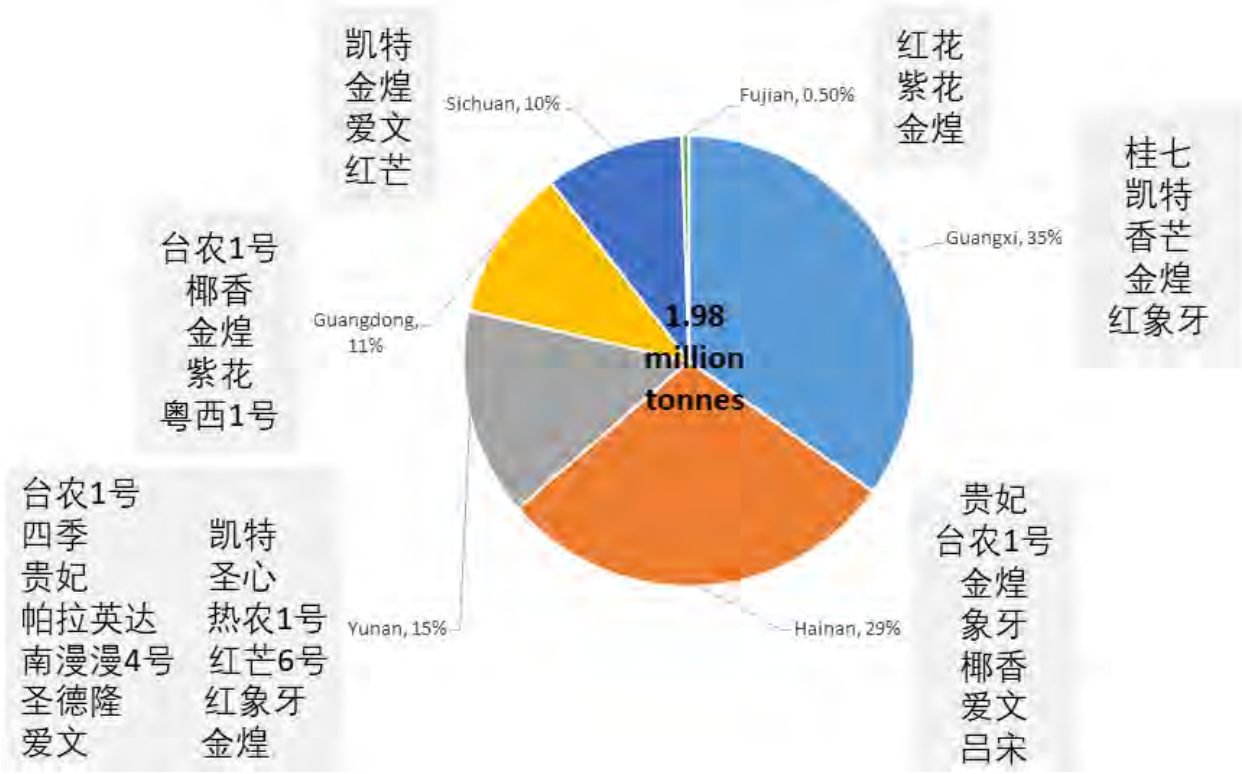

Figure 19 China's mango production and variety by major producing areas in 2017

(Source: Qianzhan Industry Research Institute)

Note: variety names are given in Chinese.

Thanks to scattered production across regions and continuous product improvement, supply windows of locally produced mangoes have extended over the past years (Table 44). China's local mangoes have already achieved year-round supply, albeit with limited supply in some months. The supply window starts with Hainan where early maturing varieties are available from November to June, and ends with Sichuan, where mid and late-maturing varieties are harvested from July to December. Among the leading producing regions, Hainan and Yunnan have the longest supply windows.

Table 44 Mango supply windows in China's major producing area

Producing region	Main variety	Previous supply window (month)	Current Supply window (month)	Remark
Hainan	Early maturity	3-6	11-6	Counter-season from Feb to Apr
Guangdong	Early-mid-maturity	5-7	5-8	
Guangxi	Mid-late-maturity	6-9	6-9	

Yunnan	Mid-late-maturity	6-8	5-11	
Sichuan	Mid and late-maturity	7-10	7-12	
Fujian	Late maturity	8-10	8-10	

Source: Qianzhan Industry Research Institute, and updated with wholesalers' input.

Japan's mango production has gradually increased between 2013 and 2016, with a peak occurring in 2015 (Table 45). Yet local production still accounts for only about 25% of the total distribution volume in Japan. Okinawa, which is located around 1500km south of Tokyo, is ideal for mango production as it is experiencing a transformation to a more subtropical climate. Mangoes produced in Okinawa are in-season from mid-June throughout to mid-August. Miyazaki has a famous premium brand of mango, which is widely known among Japanese consumers. The main variety of Mango produced in Japan is Irwin, whose characteristics are red skin and an average weight of 400g. Mangoes are also produced in greenhouses on the Japanese island of Hokkaido. According to Fresh Plaza (2016e), a 750 square meter greenhouse in Tokachi, which is surrounded by snow, is heated using geothermal energy, and has 50 mango trees producing some 2,300 pieces of fruit each year since 2014. Their fruit, sold under the brand "Sun in the snow", reach their peak in popularity around Christmas, when Japanese executives give and receive exclusive gifts as a sign of courtesy (Fresh Plaza, 2016e).

Table 45 Local production for mango in Japan (Tonnes)

Prefecture	**Variety**	**Seasonality**	**2012**	**2013**	**2014**	**2015**	**2016**
Okinawa	Keitt, Irwin	May-Sep	1,277	1,597	1,931	2,035	1,297
Miyazaki	Irwin	Apr-Aug	1,140	1,126	1,244	1,188	1,097
Kagoshima	Irwin	Apr-Jul	375	446	451	421	407
Total	-	-	2,880	3,327	3,804	3,805	2,923

Source: the Ministry of Agriculture, Forestry and Fisheries.

All Korean mangoes are cultivated in greenhouses, given the need for heat culture, even if they are cultivated in a warm region of Korea (Lim and Kwak, 2017). Mango cultivation was initially introduced with seedlings grown in Taiwan and planted by a nursery farm in Namwon-eup, Seogwipo-si, Jeju Special Self-Governing Province in 1993 (Source: http://nongsaro.go.kr). Ever since mangoes were successfully grown in Jedu, they have been cultivated in several regions of the tropics and subtropics, including Gyeongbuk, Jeonnam, and Jeonbuk (Yonhap News, 2016). The number of mango farms is gradually increasing (Table 46). In 2011, a total of 59 farm households were cultivating a total of 25.5 hectares of mangoes. By 2015, the number had increased to 79 farm households with a cultivation area of 32.5 hectares.

Table 46 Local production for mango in South Korea

Province	2014			2015		
	Number of farmhouses	Cultivation area (Hectare)	Production (tonnes)	Number of farmhouses	Cultivation area (hectare)	Production (Tonnes)
Gyeonggi	1	0.2	0.0	1	0.2	0.4
Gyeongnam	3	0.9	7.0	5	1.9	9.5
Gyeongbuk	-	-	-	1	0.3	0.0
Jeonman	5	0.6	8.9	9	1.3	11.7
Jeonbuk	-	-	-	1	0.1	0.0
Jeju	50	23.8	326.6	60	27.9	375.4
Chungbuk	-	-	-	2	0.8	1.0
Total	59	25.5	342.5	79	32.5	398.0

Sourced from Korea Rural Economic Institute.
Available at: http://library.krei.re.kr/pyxis-api/1/digital-files/605ba745-b3ca-2a94-e054-b09928988b3c.

Locally produced mangoes are harvested and distributed from April to October. Generally, early-heating mangoes are harvested from April to June, normal-heating mangoes from June to August and late-heating mangoes from August to October (Lim and Kwak, 2017). Irwin mangoes, better known as “apple mango” due to its reddish colour (Koreaherald, 2010), are grown in Korea and also produced and exported from Taiwan (Lim and Kwak, 2017).

5.1.1.1.2 Avocado production

Commercial production of avocados is still in the early stage in China. Yunnan Lüyin Agriculture Development Co - one of the largest avocado planters in China - has already grown avocados in 500 hectares of farmlands in Yunnan's Menglian county and supplied 200 tonnes of avocados to the market in 2017. With a rapid increase in demand for avocado from China's growing health-conscious middle class, companies have been introducing the variety Hass and plantation technology from Mexico and Chile (Tina, 2018a) and rushing to produce seedlings and plant avocado trees since 2017 (Li, 2019). For example, Menglian county plans to have about 6,670 hectares of avocados planted by 2025 (Xinhua, 2017). Given that the tropical climate is suitable for avocado planting, farmers in South China's Hainan, Guangdong and Guangxi Zhuang Autonomous Region, as well as Southwest China's Yunnan, have either shifted to seedling or fruit production (Li, 2019).

Japan’s avocado production started in 2013 in Wakayama and Ehime prefectures, both with geothermal resources. Local production of avocados in Japan is shown in Table 47. Due to the short history of avocado production in Japan, local farmers are still developing cultivation methods and production know-how. Avocados are grown organically in Japan, as agricultural chemicals for avocado are not well developed. The most common variety of avocado produced in Japan is Bacon,

which is larger than Hass and has a creamy and smooth textured flesh. However, it is rarely sold in supermarkets.

Table 47 Local production for Avocado in Japan (Tonnes)

Area	Variety	Seasonality	2012	2013	2014	2015	2016
Wakayama	Bacon	Nov-Dec				4	7
Ehime	Bacon, Pinkerton	Nov-Dec			0.2	1	1
Total	-	-			0.2	5	6

Sourced: the Ministry of Agriculture, Forestry and Fisheries.

5.1.1.1.3 Lychee production

China's total lychee planting area was 0.55 million hectares in 2015, from which 2.23 million tonnes of lychee was produced (Liu, 2017). China's lychee production is distributed in China's South East and South-West regions, including Guangdong, Guangxi, Fujian, Hainan, Sichuan, Yunan and Guizhou (Liu, 2017), with Guangdong producing 50% of the national production in 2018 (Houser, 2018). The main varieties grown in China include the early cultivars Sanyuehong, Baitangying, Baila and Feizixiao, the middle cultivars Feizixiao and Heiye, and the later cultivars Guiwei, Nuomici, Huaizhi and Shuangjianyuhebao (Chen, 2018). The supply window of local lychee is short, running from May to August. Generally, the season starts in Hainan, West Guangdong, followed by middle and East Guangdong, Guangxi and South Fujian, and ends with north Fujian and Sichuan (Chen, 2018).

Japan has limited local production of lychee (Table 48). Local production ranged from 13 tonnes in 2013 to 17 tonnes in 2016. Local production comprises only 5% of the market share and is available only from mid-June to mid-July. Because of its scarcity, local lychee is sold as a premium variety. Lychees which weigh over 50g and have brix levels over 20, produced in Miyazaki especially, have a high value and can be ordered by consumers directly from the producers.

Table 48 Local production for lychee in Japan

Prefecture	Variety	Seasonality	2012	2013	2014	2015	2016
Kagoshima	Ryugan	Jun	4	9	8	8	8
Miyazaki		Jun	2	4	4	5	9
Okinawa		Jun	0.1	0.1	2	0	0
Total		-	6.1	13.1	14	13	17

Source: the Ministry of Agriculture, Forestry and Fisheries, 2018.

5.1.1.2 Import regulation

Hong Kong and Singapore operate under a free market without any tariff or quota on agricultural imports and with no restrictions or controls on the consumption of imported fresh fruit (Fresh Plaza,

2018b; Kwek, 2019). In contrast, China, Japan and Korea are protocol markets, which have stricter regulations over imported fruits. Supplying countries that have official market access for exporting mangoes, avocados and lychees into China, Japan and South Korea are listed in Table 49.

Table 49 Supplying countries approved to export mango, avocado and lychee to China

Fruit	China	Japan	South Korea
Mango	Thailand, Philippines, Vietnam, Myanmar (entry from Ruili and Daluo land ports in Yunnan only), India, Pakistan, Taiwan, Ecuador, Peru, Australia	Mexico, Thailand (1987), Peru (2010), Taiwan, Philippine, Brazil (2004), Pakistan, India (2006), Australia, USA, Vietnam (2015)	Taiwan, Philippines, Thailand, Australia, Pakistan, Vietnam (Mekong Delta), Peru, Brazil (2017), India (2017), Cambodia (2019)
Avocado	Mexico (2005), Chile (2014), Peru (2015), New Zealand (2018)	Mexico, Peru (2015), USA, New Zealand (2001), Chile, China, Australia (2018)	United States (excluding Hawaii, Texas, and Florida) New Zealand, Mexico, Peru (2019)
Lychee	Thailand, Malaysia, Vietnam; Myanmar	Taiwan (1980), China, Mexico, USA	-

Note: China source: General Administration of Customs, P. R. China (updated on 16 January 2019). Available at: http://www.customs.gov.cn/customs/jyjy/dzwjyjy/qymd/zwjcp/2169866/index.html
Japan source: the Plant Protection Station Japan.
South Korea source: the plant and animal quarantine agency; available at: https://www.qia.go.kr/plant/imQua/plant_fruit_cond.jsp

As of 15 January 2019, ten countries can legally export mangoes to China, together with four countries for avocados and lychees respectively. According to China's General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), which has been recently restructured to state administration for market regulation, mangoes from Australia, Philippines, India, Peru, Pakistan and Ecuador should undertake Vapour Heat Treatment (VHT) before exporting to China. Japan has permitted the import of mangoes from ten supplying countries and avocados from seven supplying countries. As per the protocol, all mangoes for export to Japan must undergo VHT as a phytosanitary measure for fruit flies (DAWR, 2017b). Taiwan, China, Mexico and the USA are the four countries and regions that were approved for direct export of lychees into Japan. Similarly, ten mango supplying countries have gained official market access into Korea, of which India, Brazil and Cambodia were approved since 2017. While both hot water treatment (HWT) and VHT are accepted by Korea for mango treatment before shipment, most countries, except Pakistan and Peru, were approved with VHT. The US, New Zealand, Mexico and Peru are the four countries that have gained approval for exporting avocados into Korea (Peru was approved in 2019).

5.1.1.3 Market demand

5.1.1.3.1 Hong Kong import

Hong Kong's mango imports have significantly shrunk in volume over recent years, with imports decreasing from 95,400 tonnes in 2013 to 32,400 tonnes in 2017 for reasons that cannot be identifed

(Trade Maps, 2018). Figure 20 shows the changes in Hong Kong's mango imports from the top six supplying countries from 2013 to 2017. The decrease in mango imports has been seen in the major supplying countries (Australia excluded), of which Malaysia, Indonesia and Thailand have seen significant decreases in 2013-2017, with their volumes dropping by 96%, 89% and 76% respectively. Despite the shrinking import market volume for mangoes in Hong Kong, there is a strong demand for Australian mangoes, with imports increasing by 60% over the same time, up from 2,300 tonnes to 3,500 tonnes.

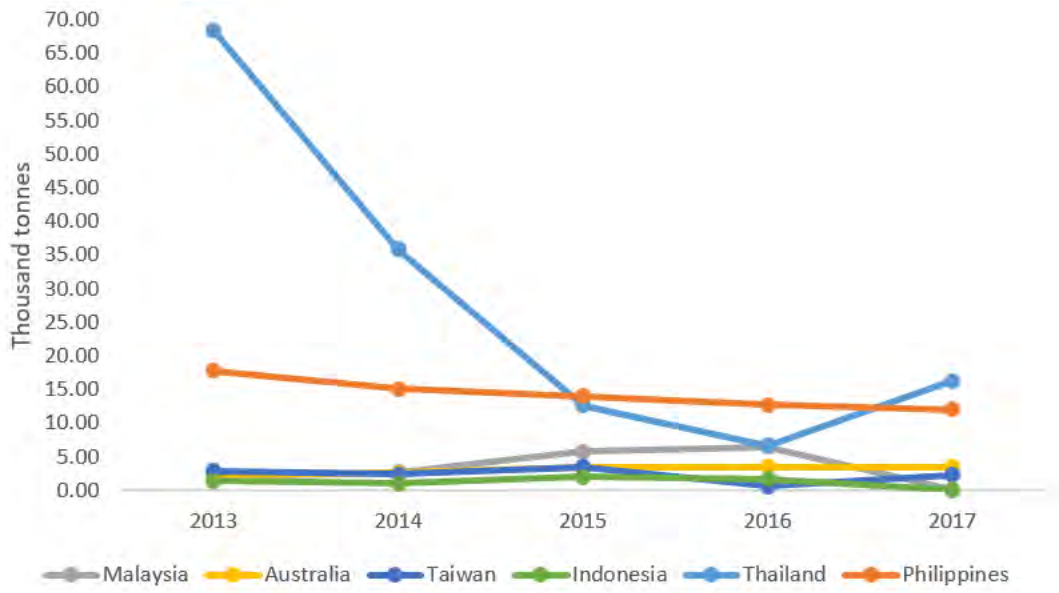

Figure 20 Hong Kong's mango imports from the top six supplying countries in 2013-14
Source: Trade Maps; Mangoes (HS080450)

Hong Kong's avocado imports have seen rapid growth over recent years, with imports climbing from 2.66 tonnes in 2013 to 21.02 tonnes in 2017. Figure 21 shows the changes in Hong Kong's avocado imports from the top six supplying countries from 2013-2017. An increase in avocado imports into Hong Kong has occurred for all the top six supplying countries. Imports from Mexico have seen significant growth since 2014 but plateaued between 2015 and 2017. The most growth is seen with imports from Peru, since 2015 the import volume has rocketed up to a peak at 12.91 tonnes in 2017, accounting for over 60% of Hong Kong's total imports. While imports from the other four top suppliers fluctuate from 2013 to 2017, their volumes all increased since 2013.

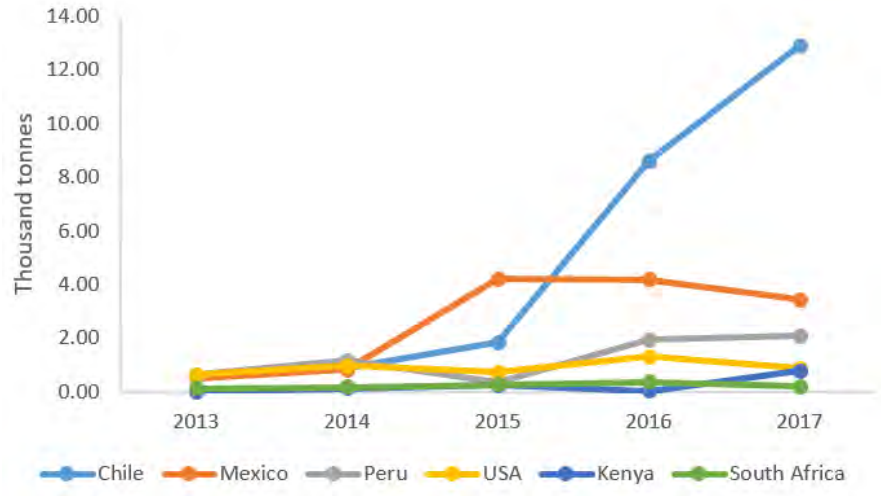

Figure 21 Hong Hong's avocado imports from the top six supplying countries in 2013-17

Source: Trade Maps; Avocado (HS080440)

Hong Kong's lychee imports have decreased greatly from 2010 to 2014, with imports down by 143.56%, from 5,767.12 tonnes to 577.32 tonnes. Figure 22 shows the changes in Hong Kong's lychee imports from the top four supplying countries in 2010-2014. Although Thailand is still the dominant lychee supplier for Hong Kong, Hong Kong's imports from Thailand have decreased from 2010 to 2013, down from 5,307.65 tonnes to 147.90 tonnes. However, Hong Kong's imports from Australia increased in the same period, albeit with a slight reduction between 2013 and 2014. This indicates the market potential for Australian lychees.

Figure 22 Hong Hong's Lychee imports from the top six supplying countries in 2010-14

Source: Trade Maps; lychees (HS*081090)*

5.1.1.3.2 Singapore import

Singapore's imports of mangoes, in volume, experienced slow growth from 2013 to 2017, increasing by 2.78% from 13,677 tonnes in 2013 to 15,163 tonnes in 2017. Figure 23 shows the changes in

imports from the top six supplying countries. Imports from all supplying countries, except Taiwan and the Philippines, have increased over the period, albeit at different rates. Australian mangoes have increased more than other countries, with the volume up from 686 tonnes in 2013 to 1,738 tonnes in 2017.

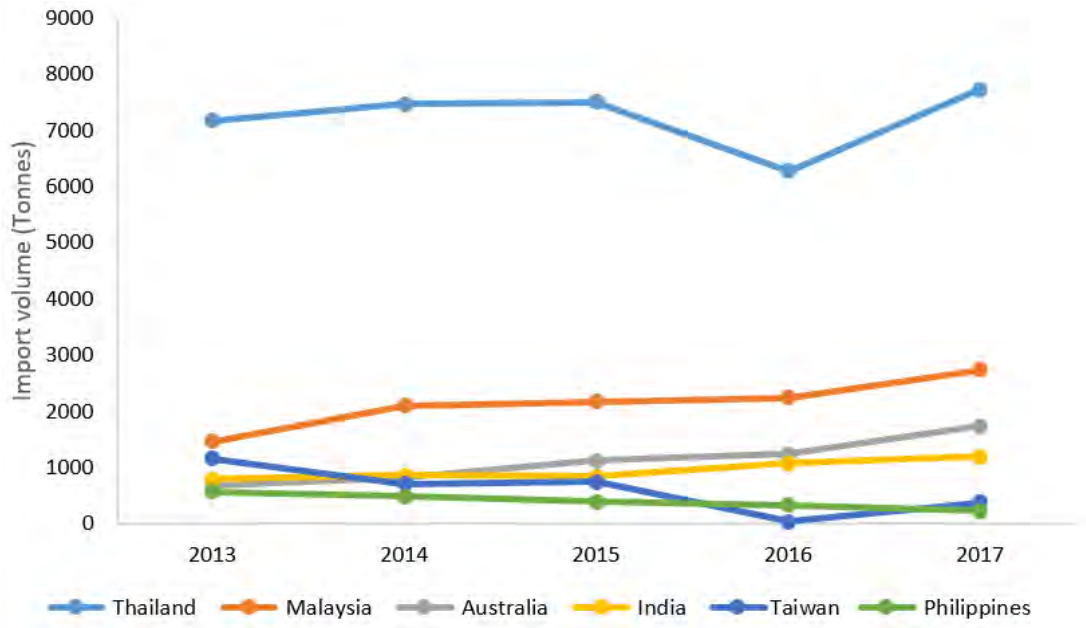

Figure 23 Singapore's mango imports from the top six supplying countries during 2008-17
Source: Trade Maps; HS08045020 (Mangoes fresh or dried)

Avocados have become popular in Singapore in recent years. The demand for avocados in the Singapore market has increased by 28.4%, up from 1,691 tonnes in 2013 to 5,737 tonnes in 2017. Figure 24 shows the changes in imports from the top six supplying countries. Australia is the largest supplier in the Singapore market, supplying 980 tonnes in 2013. However, Mexico has seen a rapid increase in volume since 2015, to become the leading supplier in 2017, at 1,872 tonnes compared with Australia's 1,524 tonnes. New Zealand, the second largest supplier in 2012, has had fluctuating supplies into Singapore over the period, ending as the fourth-largest supplier in 2017. The USA and Kenya are the two suppliers with more stable growth over the period, supplying 1,102 tonnes and 423 tonnes in 2017, although Kenya is a relatively small supplier. South Africa is the only supplier with no noticeable increase in volume from 2013 to 2017.

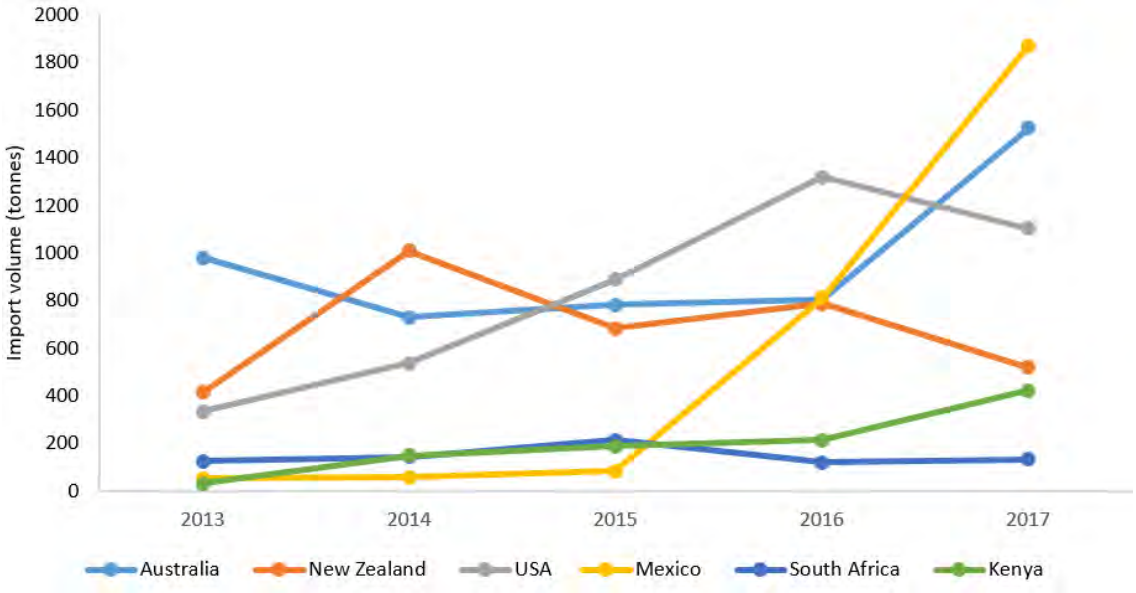

Figure 24 Singapore's avocado imports from top six supplying countries during 2008-2017
Source: Trade Maps; HS080440 (fresh or dried avocados)

Lychee imports into Singapore have increased marginally by 5.26%, up from 1,438 tonnes in 2013 to 1,494 tonnes in 2017, albeit with fluctuations in some years. This may be because China is a major producer and buyer, so Singapore would be largely circumvented for the Chinese domestic market. Figure 25 shows the changes in the imports from the top six supplying countries. China is the leading supplier for the Singapore lychee market; however, imports from China fluctuated over the period, with the lowest figure at 910 tonnes in 2016. In contrast, imports from Thailand have declined from 2014 to 144 tonnes in 2017. Imports from Taiwan have decreased rapidly, from 156 tonnes in 2013 to four tonnes in 2017. Imports from other countries are insignificant, although Malaysia and Australia are larger than the USA. Imports from Australia fluctuated from 13 tonnes to 26 tonnes between 2013 and 2017.

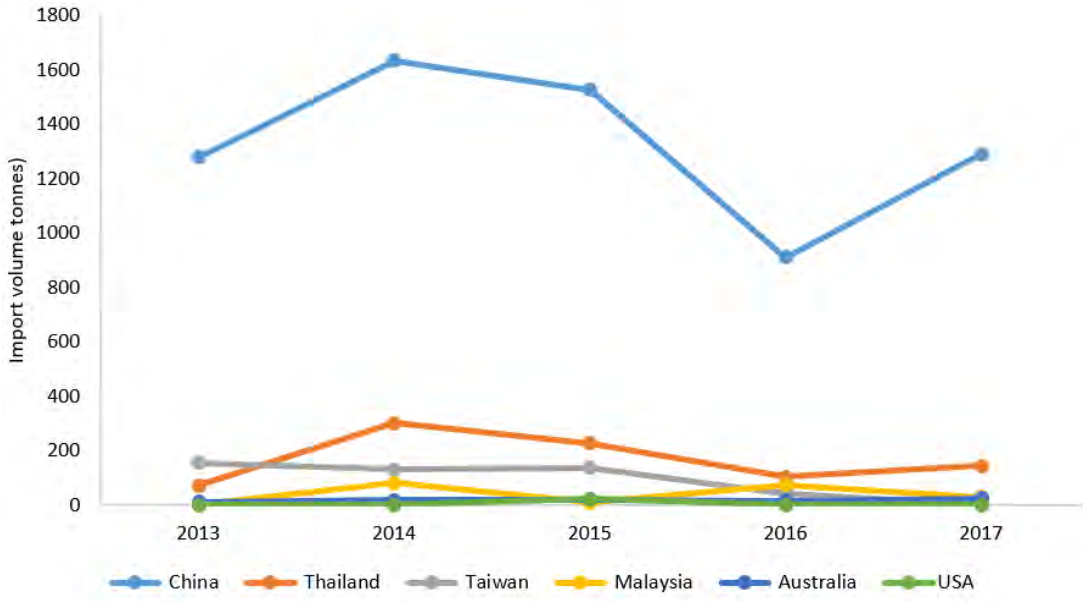

Figure 25 Singapore's lychee imports from top six supplying countries in 2013-2017

Source: Trade Maps; HS08109020 (Lychees fresh)

5.1.1.3.3 China import

China's total mango imports have dramatically dropped over the past six years (Figure 26), decreasing by 81.4% from 27,557 tonnes in 2002 to 5,126 tonnes in 2017. The import plunge is mainly due to the decrease in imports from Myanmar, Thailand and Taiwan in recent years. The import reduction from these neighbour producing countries/regions is not only because their mangoes have overlapping supply windows with local mangoes, but also because they are not competitive any more as a result of the improved production and quality of local mangoes. Despite this, China still imports a relatively small volume of mangoes from Thailand, Vietnam and Taiwan. This mainly includes varieties that are not available in Chinese markets, such as Nam Dok Mai from Thailand and Green mango from Vietnam. As opposed to the reduced imports from neighbour countries/regions, China has expanded their imports from Australia, Peru and Ecuador, which have counter-seasonable production with China and can fulfil market demand from October to February when local mangoes are unavailable. As mangoes from Australia, Peru and Ecuador are imported into China over the same period, Australia's mango industry faces competition from Peru and Ecuador.

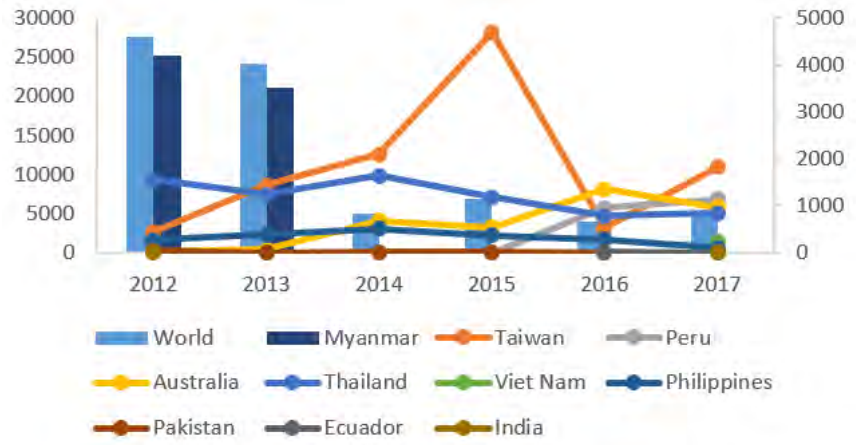

Figure 26 China's mango imports in 2012-2017 (Tonnes)Source: Trade Map; Product Code HS 08045020 (Mangoes, fresh or dried)

China's avocado imports have seen a staggering increase from 2012 to 2017, up from 154 to 32,137 tonnes (Figure 27). Currently, Mexico, Chile and Peru are the three major avocado suppliers for the Chinese market, with New Zealand gaining market access in late 2018. Mexico was the first country approved to export avocados to China as early as 2005; however, its export volume was relatively low from 2005-2011 due to low market acceptance (Tina, 2018a). Along with the continuous promotion and increased recognition among consumers, Mexico's avocado exports to China have shown a quick increase from 2012, peaking at 13,582 tonnes in 2015. Chile was the second country to gain market access into China in 2014, followed by Peru in 2015. Since then, Peru and Chile's exports to China have shown rapid growth. Increased imports from Chile and Peru have resulted in a reduction in imports from Mexico. In 2016, Chile replaced Mexico to become the largest avocado supplier in China, supplying 16,707 tonnes in 2017, which is 1.91 and 2.51 times more than the imports from Mexico and Peru respectively.

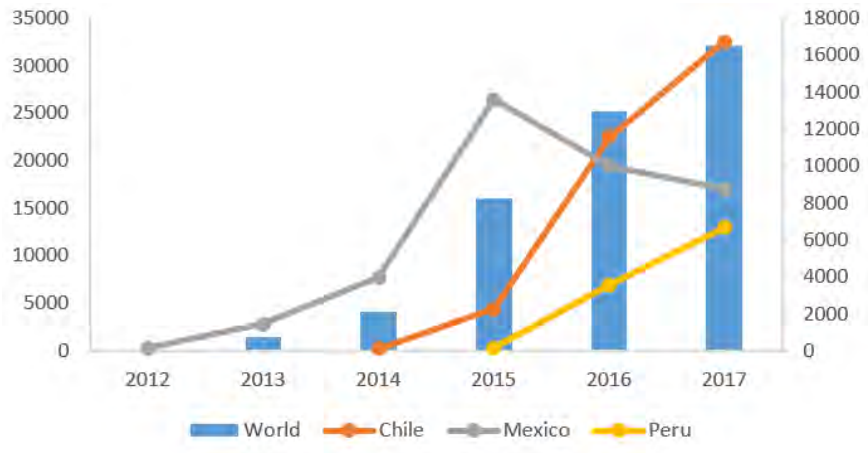

Figure 27 China's avocado imports in 2012-2017 (Tonnes)
Source: Trade Map; Product Code HS 080440 (Fresh or dried avocados)

China's lychee imports fluctuated between 2012 and 2017 with the highest import volumes of 68,740 tonnes in 2016 and the lowest import volumes of 14,037 tonnes in 2017 (Figure 28). Although Thailand, Malaysia, Vietnam and Myanmar have gained market access into China, currently China only imports lychee from Vietnam and Thailand. Vietnam is the dominant lychee supplier in China, accounting for 75-95% of China's total imports during the past six years. As Vietnam and Thailand have overlapping supply seasons with China, China imports to mainly fill the domestic demand gap.

Figure 28 China's lychee import changes in 2012-2017 (Tonnes)
Source: Trade Map; Product Code HS 08109010 (Lychee, fresh)

5.1.1.3.4 Japan import

The import volume of fresh mango has slightly decreased for 2013 to 2018 (Figure 29) despite mango related processed foods being very typical in Japan e.g. sweets such as ice cream, cake, pudding, syrup, etc. The reduction in the import of mangoes is potentially because of an increase in the popularity of domestic products after Miyazaki prefecture developed their local brand. According to Ohta (2014), Miyazaki prefecture promotes the local brands to consumers by presenting its appearance and tastes, boosting their mangoes presence in the domestic market. Mexico, Thailand, Philippines and Taiwan are the four major mango suppliers. Mexico is the largest mango supplier in the Japanese market, albeit with a slight reduction in volume in recent years. Thailand is the second-largest, with a slight increase in volume due to premium supermarkets promoting other varieties imported from Thailand (Ohta, 2014). However, imports from the Philippines have dramatically decreased. In 2018, Thai mangoes had 26% of the market share, whereas Filipino mangoes had only 4.5% of the market share. Australia is the smallest supplier, behind Brazil and Peru, with only 0.41% of the market share in 2018.

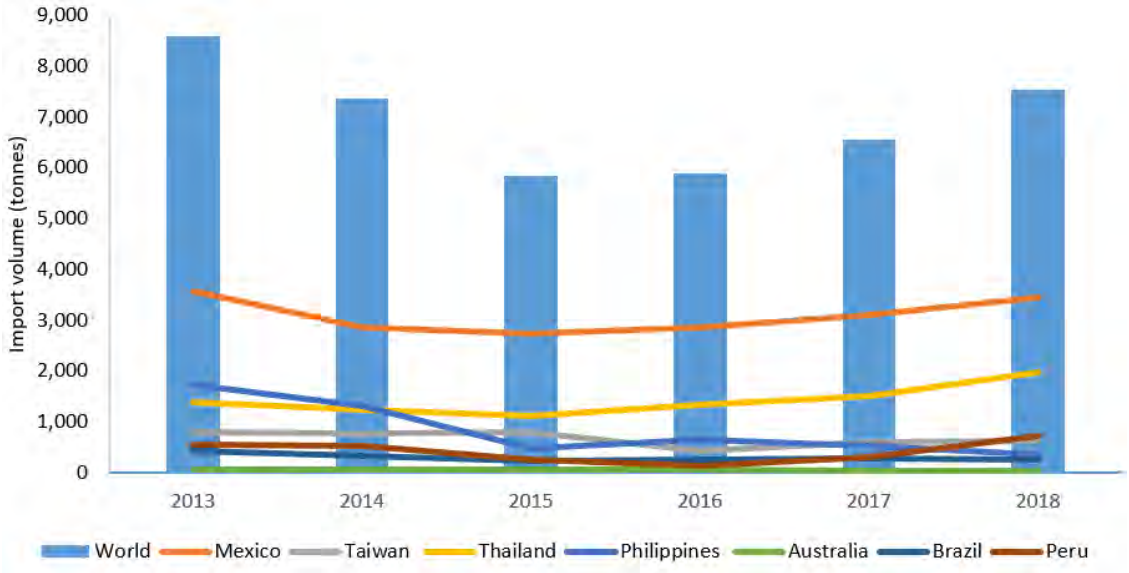

Figure 29 Import volume of mango in Japan from 2013 to 2018
Sourced from Trade Statistics of Japan (HS code: 0804.50.011)

Avocados are not typically consumed in Japan. However, after its introduction to Japan, import volume has significantly increased in line with the global trend toward health and nutrition and the appeal of exotic products (Motomura, 2018). It is now no longer uncommon to find avocados in supermarkets or even in some local restaurants. Since Japan's production of avocados is negligible, Japan is wholly dependent on avocado imports for its national supply. Figure 30 shows the import volume of avocados by country of origin. Mexico is the largest supplier, contributing 85% of the market supply. Since market access was gained in 2015, import volumes from Peru have been increasing, claiming the second position in the Japanese market ahead of the USA and New Zealand in 2018.

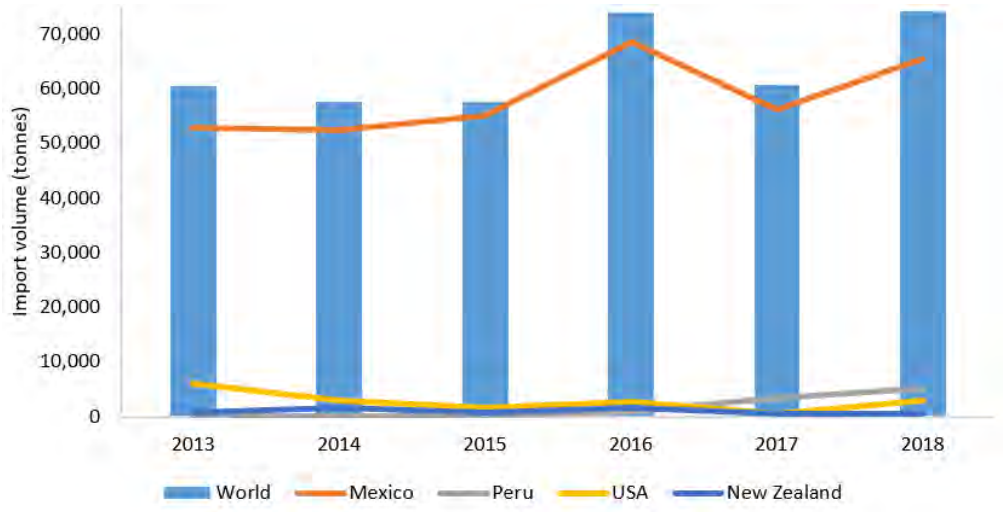

Figure 30 Import volume of Avocado in Japan from 2013 to 2018
Sourced from Trade Statistics of Japan (HS code: 0804.40.010)

Lychee imports into Japan have gradually reduced, as shown in Figure 31, although there is little local production in Japan. Japan mainly imports lychees from Taiwan and China. China was the largest supplier in 2013, however, imports from China have decreased by 51.95%, from 256 tonnes to 123 tonnes in 2018. In contrast, imports from Taiwan have increased by 23.02%, overtaking China to be the largest supplier in 2018. Mexico is ranked third. The USA is the smallest supplier with fluctuating imports into Japan, with its volume ranging between 0.6 tonnes and 0.15 tonnes.

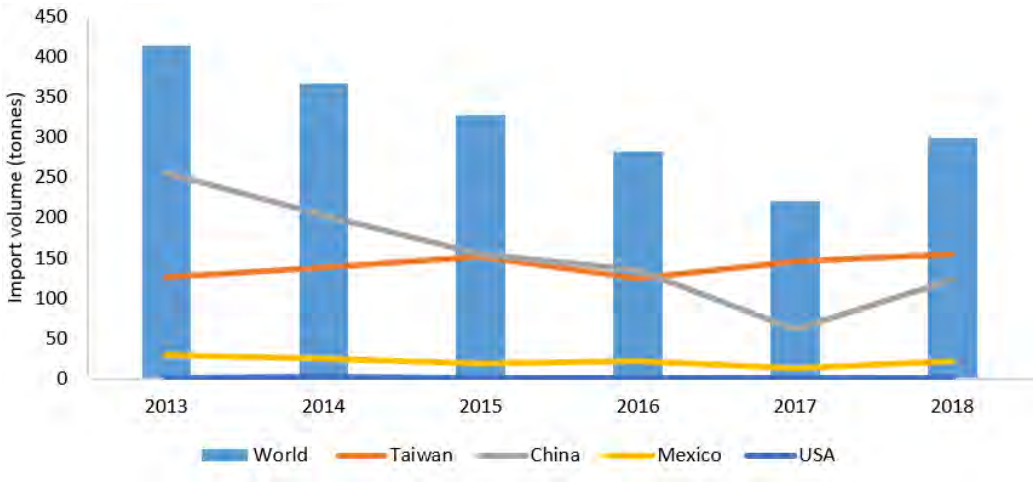

Figure 31 Import volume of lychee in Japan from 2013 to 2018
Sourced from Trade Statistics of Japan (HS code: 0810.90.210)

5.1.1.3.5 South Korea import

South Korea's total mango imports and the imports from the top eight supplying countries from 2015 to 2019 (August) are shown in Figure 32. Given that South Korea produces small volumes of mangoes, the market is dominated by imports to meet increasing market demands. Fresh mango imports into South Korea have increased by 24.9% between 2015 and 2018, from 13,917.4 tonnes to 17,383.3 tonnes. Increases will continue in 2019 with 15,734.4 tonnes already imported by August. The Philippines and Thailand were the two largest mango suppliers into the Korean market in 2015. Imports from Thailand continued to increase from 2015 to 2018, whereas imports from the Philippines dropped to 1,374.5 tonnes over the same period. While Australia is a relatively smaller player in Korea's mango market, imports from Australia increased, peaking at 135 tonnes in 2019.

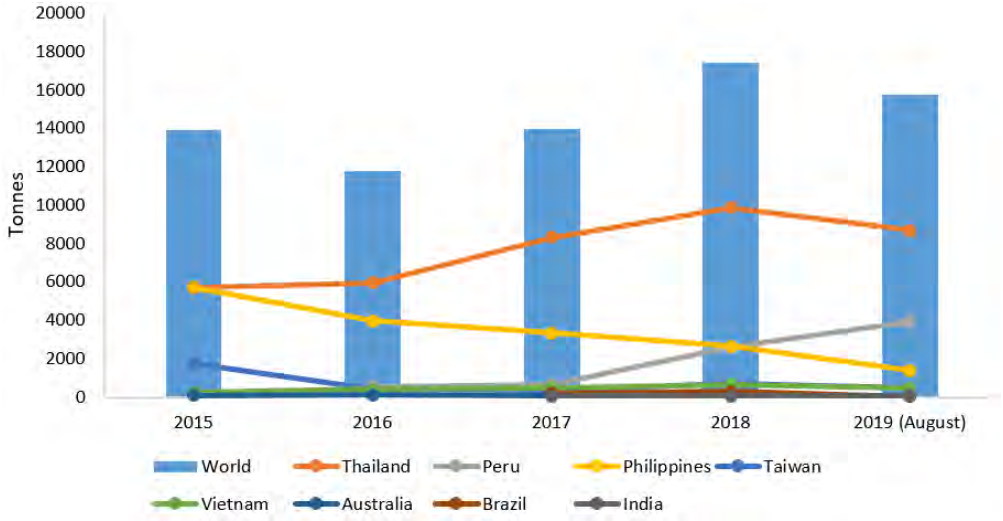

Figure 32 Import volume of mango in Korea from 2015 to 2019 (August)

Sourced from trade statistics of Korea (HS code: 0804502000)

Note: 2019 data is constrained to August only as year data is not yet available

South Korea's imports of avocados have increased dramatically in recent years due to the rising popularity of the fruit for its versatility in cuisine and its health benefits (Fresh Plaza, 2017). The changes in South Korea's avocado imports are shown in Figure 33. As of 2018, the total imports stood at 11,559.8 tonnes, an almost eightfold increase compared to 1,515.4 tonnes in 2015. In 2019, 5,827.4 tonnes had been imported as of August. The Korean avocado market is currently dominantly supplied by the US, Mexico and New Zealand. The USA is the largest avocado supplier to the Korean market and its exports continue to rapidly increase. Peru is a new player, which has gained market access in 2019. Since a growing number of South Koreans are discovering the value of avocados (Korea Herald, 2018), market demand is likely to increase.

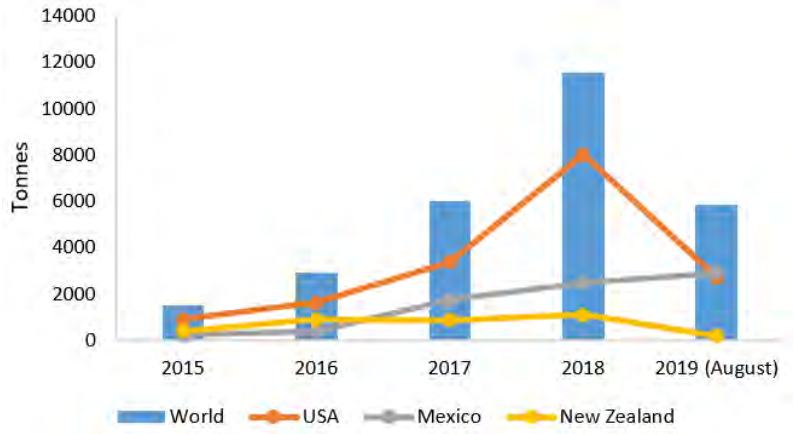

Figure 33 Import volume of avocado in South Korea from 2015 to 2019 (August)

Sourced from trade statistics of Korea (HS code: 0804400000)

Note: 2019 data is constrained to August only as year data is not yet available

5.1.1.4 Market preference

5.1.1.4.1 Hong Kong

Hong Kong imports mangoes (HS080450) from over 40 countries and regions across the globe. Thailand, the Philippines, Malaysia, Australia, Taiwan and Indonesia are the top six supplying countries and regions by average volume in 2013-2017 (Trade Maps, 2018), together accounting for 98.57% of the 2013-2017 average imports. Thailand and the Philippines are the two largest mango suppliers to Hong Kong, making up 53.54% and 25.88% respectively. The Hong Kong market mainly consumes Australian R2E2 and Calypso, although some other varieties are available, such as Kent and Keitt. R2E2 is the most popular variety in the Hong Kong market due to its large size and blush colour. The Hong Kong market prefers large fruit and the most popular size for R2E2 is 7-9 and for Calypso mango 16-18. Class 1 fruit is predominantly imported into Hong Kong from Australia, and occasionally Class 2 fruit. No matter what class of fruit, Hong Kong always has high requirements for fruit appearance - a high blush ratio without any blemishes.

Hong Kong imports avocados (HS080440) from over 30 countries and regions across the globe. Chile, Mexico, Peru, USA, Kenya and South Africa are the top six supplying countries and regions by average volume in 2013-2017 (Trade Maps), together accounting for 97.24% of the 2013-2017 average imports. Chile, Mexico and Peru are the three leading mango suppliers to Hong Kong, making up 47.32%, 25.12% and 11.78% respectively. Hong Kong mainly imports premium avocados from Australia, which are recognised as having better quality compared with other supplying countries. One high-end retailer pointed out “Australian avocados are better than that of Mexico and USA in terms of eating quality”. As a result, Australian avocados are often targeted at high-end channels in Hong Kong. Hong Kong wholesalers and high-end retailers often prefer large size Australian avocados over those from Mexico, the USA and other supplying countries, though small and medium-sized fruit are available in grocery chain stores, such as Wellcome and Parknshop. Given that Hass is a globally accepted variety, it is also the most popular variety imported from Australia, where the size counts 14-18 per 5.5 kg tray are commonly found in wholesale markets, high-end supermarkets and community convenience stores.

Hong Kong imports lychees (HS08109010 – Lychees, fresh) from a few countries and regions across the globe. Thailand, China, Australia and South Africa are the top four supplying countries and regions by average volume in 2010-2014 (Trade Maps), together making up 98.93% of the 2013-2017 average imports. There are also imports from Madagascar, Taiwan and the USA, but with a relatively lower market share. The Hong Kong market prefers lychees with a small seed and red colour as noted by four companies interviewed who handle Australian lychees. Hong Kong importers mainly buy Class 1 fruit in 5 kg trays from Australia. Kwai May Pink and Tai So are the two major

varieties imported into Hong Kong. “Sun Lychees” which is marketed by the United Lychee Marketing Association is the most preferred brand in the Hong Kong market.

5.1.1.4.2 Singapore

Singapore imports mangoes (HS08045020 – Mangoes fresh or dried) from over 40 countries and regions, with major suppliers from the Asia-Pacific region. Thailand, Australia, the Philippines, Malaysia, India and Taiwan are the top six supplying countries, altogether making up 92.59% of the 2013-2017 average imports. Thailand is the dominant mango supplier, accounting for 53.78% of the total supply in Singapore, followed by Malaysia (15.96%). Australia and India comprise 8.31% and 7.06% of the market supply respectively, ranking as the third and fourth largest suppliers. Singapore is a diversified market for Australia mangoes, where several varieties are imported, including R2E2, Calypso, Kent, Keitt and KP. In terms of the grade of fruit, Singapore importers mainly import premium and Class 1 and occasionally Class 2 fruit. Class 1 small fruit, such as size count 11-13 per tray for R2E2, without any blemishes and black spot is most sought-after in the Singapore market, while high-end supermarkets prefer premium larger fruit, such as size counts 7-8 for R2E2. In contrast with Hong Kong, the Singapore market generally does not have specific requirements for fruit colour. According to one wholesaler, only one supermarket in Singapore requires high colour, the other supermarkets are more concerned about the price over colour.

Singapore imports avocado (HS080440 – fresh or dried avocados) from over 30 countries and regions (Trade Map). Australia, New Zealand, USA, Thailand, South Africa and Kenya are the top six sourcing countries, together accounting for 95.91% of the 2013-2017 average imports. Australia and New Zealand are the two largest suppliers, comprising 27.12% and 23.55% of the total supply in Singapore respectively, followed by the USA (19.23%) and Mexico (16.19%). South Africa and Kenya are relatively smaller suppliers, making up 5.65% and 4.16% of the market supply. Singapore’s avocado market is dominated by Hass, although Shepard from Australia is available. Large and small fruit are imported into Singapore, however, the demand is higher for small Australian avocado fruit, with size counts at 28-32. Premium and Class 1 fruit are predominantly imported, however, Class 2 fruit is also imported to cater for some food services. Small premium quality fruit is preferred by grocery chain stores, such as Fair Price and Sheng Siong because of the good value per piece. There are markets for large fruit, such as high-end supermarkets, but they sell slowly, as noted by wholesalers.

Singapore imports lychees (HS08109020 – Lychees fresh) from over 15 countries and regions worldwide, with the top six suppliers including China, Thailand, Taiwan, Malaysia, Australia and the USA contributing to almost 100% of Singapore’s market supply. China is the leading lychee supplier in Singapore, accounting for 79.64% of the five-year average supply. It is followed by Thailand (10.20%). Due to the higher price, Australian lychees are mainly bought in relatively small volumes

by importers, especially around Chinese New Year. There are mainly two varieties available in the market, which are Kwai May Pink and Fay Zee Siu – a green variety.

5.1.1.4.3 China

While imports from neighbouring Asian suppliers have decreased over the past years, China has expanded its imports from counter-seasonable supplying countries, including Australia, Peru and Ecuador. Australian R2E2 is a well-accepted variety in China and is often literally called 'Australian mangoes (Ao mang)'. In recent years, there is also a rising demand for Calypso mangoes, which are called 'Pearl mangoes' by some Chinese wholesalers. The grade most in demand in the Chinese market is premium. As such, Chinese importers dominantly source premium Australian mangoes and often have a strict requirement on the ratio of blush. Australian R2E2 is often regraded into three locally recognized classes based on the blush ratio: premium fruit with over 80% blush, Class 1 with 60-80% and Class 2 with less than 60% blush. In terms of the size, Australian R2E2 mangoes with size counts at 9-11 per 7 kg original box are the most preferred. This is followed by size counts 8 and 12. Mangoes at size count 13 are sometimes imported. Fruit weighed at approximately 500 g is the most preferred by Chinese online retailers and premium supermarkets. Blush and size requirements are strict but can be lowered if there is a limited supply of fruit in the markets.

The Chinese avocado market is dominated by Chile, Mexico and Peru, although New Zealand and Kenya have gained market access into China. Hass is the only avocado variety imported by China. Chinese importers usually prefer to buy medium and small-sized fruit as they want to reduce the unit cost per piece. The preferred avocado tray from Chile and Peru weighs 4 kg with 18-24 fruit and weighs 6 kg with 30-35 fruit from Mexico. In terms of the weight per piece of fruit, the larger fruit is weighed at 166-222 grams from Chile and Peru and 170-200 grams from Mexico. While New Zealand supplies medium and small fruit, larger-sized avocados have been sent to the Chinese markets. For example, New Zealand's AVANZA partnered with Good Farmer, Zespri's agent in China, to supply Chinese customers with large-sized avocados under a new brand for China "Chao Niu Guo" (literally translated as Super Avocado) (Fresh fruit portal, 2018).

Chinese importers import lychees from Vietnam and Thailand. As Vietnam and Thailand have overlapping supply seasonality with China's lychee, China imports mainly to fill the domestic demand gap. With no market access for Australian lychee into China, Chinese wholesalers and importers have very limited knowledge of the Australian lychee industry, not to mention the variety and supplying seasonality. Some interviewees were even surprised to hear that Australia produces lychees. Chinese wholesalers and retailers mainly deal with locally produced lychees. In general, they prefer lychees with a longer shelf life, larger size, smaller seed and red colour.

5.1.1.4.4 Japan

The Japanese market has specific requirements for imported fruit in terms of appearance, taste, fruit size and variety. The appearance is one of the important criteria for food distribution in Japan as Japanese consumers prefer clean and safe products. If there is some damage, the prices drop significantly. Therefore, fruit distributed in Japan needs to be packed carefully for delivery to consumers. The fruit's skin must be free from any scratch, blemish or black marks. The imperfection on the fruit skin indicates that the fruit is damaged and regarded as low quality (Ohta, 2014). The taste of a fruit is generally evaluated by its sweetness and acidity in Japan. Generally speaking, 'sweetness' is regarded as 'delicious', while 'sour' is not (Miyauchi and Perry, 1996). Consumers are focused on brix levels before making a purchase. Fruit with a higher brix (greater than 15 – See Appendix One) is regarded as higher quality and most preferred (Musa, 2010). Mangoes should weigh about 300g-400g per fruit (Musa, 2010). Mango varieties that are available in the Japanese market from the eight supplying countries are shown in Table 50. Irwin mangoes are the most popular fruit from Mexico and the Philippines, while Nam-Dorkmai and Mahachano are the main mango varieties from Thailand. Japanese people are also relatively familiar with the yellowish Filipino mango with its small fruit size and sweet and sour tastes, and also of the Sunset and Apple mangoes from Mexico with red skin, yellow flesh, slightly strong aroma and mildly sweet taste (Panichsakpatana, 2013). Avocado is often called "butter of the forest" in Japan, which means creamy and butter-like tasting avocado is expected from customers. Consistency of the fruit size is important, particularly if they are sold for gift purposes. Since avocados distributed in Japan are mainly from Mexico, avocados weighted at 170g-200g are preferable in Japan. Hass is the most accepted variety in the Japanese markets. Hishishou, the major variety of imported lychees from China, is widely known as a favourite food of Youkihi, a princess of ancient China.

Table 50 Varieties of imported mango distributed in Japan

Country	Variety
Mexico	Haden, Kent, Keitt, Tommy Atkins
Thailand	Nam-Dorkmai, Mahachanok, Nang Klang Wan, ChokAnan, Pin Sane Mun, Rad, Kew-Sawai
India	Alphonso, Kesar, Banganpalli, Langra, Chausa and Malika
Philippine	Carabao, Irwin
Taiwan	Irwin
Australia	Kensington Pride, Keitt, Kent, R2E2, Palmer
Brazil	Haden, Kent, Tommy Atkins
Peru	Kent

Note: Compiled from online public materials: Asiafruit 2008; Asia News Network 2019; Dep. Ag. and Water Resources 2017; Fresh Plaza 2018h; Fresh Plaza 2020b; Jha 2014; Maxwell 2008; Ohta 2014; Panichsakpatana 2013

5.1.1.4.5 South Korea

The South Korea market has requirements for fruit appearance, variety and size. Appearance is a key factor in the South Koreans assessment of fruit quality (New Zealand Embassy Seoul, 2016). A great piece of fruit should be visually appealing and have great flavour (Fresh Plaza, 2019a). Mangoes and avocados are often seen as premium quality fruit, which is available only at high-end grocery stores including those located inside department stores (Suh, 2011). The R2E2 mangoes exported to South Korea generally have a minimum blush ratio. Variety preference for mangoes depends on the supplying countries. For example, Irwin mangoes are the most popular fruit from Taiwan and Korea (Koreaherald, 2010). R2E2 is the only variety imported from Australia. For avocados, Hass is the only variety available on the Korean Market (Source: http://gmarket.co.kr/). Fruit size varies across pieces and varieties. Generally, the South Korean market prefers larger sized mangoes. For example, Irwin mangoes imported from Taiwan weigh around 430 grams (Lim and Kwak, 2017). Australian R2E2 mangoes in South Korea are about 570-800 grams per fruit. Avocados distributed in Korea mostly weigh 170g-220g (Source: shopping.naver.com).

5.1.1.5 Sales regions

In-field studies were not conducted for Japan and South Korea and therefore limited data is available for sales regions for these countries.

5.1.1.5.1 Hong Kong

Hong Kong is a dynamic market and an effective re-export platform of fresh fruit (Lai, 2018). Hong Kong's re-export value of mango, avocado and lychees in 2018 is shown in Table 51. The value for Hong Kong's re-export of mangoes, avocados and lychees represented in thousand Australian Dollars is 5,676, 50,306 and 173 respectively in 2018. China is the dominant destination for mangoes, avocados and lychees re-exported from Hong Kong, with the import portion standing at 80.43%, 98.09% and 55.49% respectively. In addition to China, Macau and Vietnam are also big markets for mangoes re-exported from Hong Kong and Thailand is a big market for lychees re-exported from Hong Kong. Though the number is not available for Australian mangoes, avocados and lychees, the interviews confirmed that Australian mangoes and lychees are re-exported to China, Macau and other countries. The wholesaler interviewed who deals with a notable volume of Australian mangoes stated that they also sell in Guangzhou and Shanghai.

Table 51 Hong Kong's re-export of mango, avocado and lychees in 2018

		Mango	Avocado	Lychees
	Re-export in 1,000 AUD	5,676	50,306	173
Re-export percentage	China	80.43%	98.09%	55.49%
	Thailand			29.48%

	Macau	11.58%	1.91%	
	Vietnam	7.38%		
	Others	0.62%		15.03%

Source: Trade Maps; Note: Mangoes, fresh or dried (08045020); fresh or dried avocados (080440); Lychees fresh (08109010).

5.1.1.5.2 Singapore

Mangoes, avocados and lychees imported into Singapore are dominantly consumed in the local market; however, some fruit is re-exported from Singapore (Table 52) due to its unique location in the centre of several international trade flows (ITA, 2018). Mangoes, avocados and lychees re-exported from Singapore stand at 703 tonnes, 241 tonnes and 46 tonnes respectively, accounting for 4.11%, 4.75% and 2.93% of their total imports. Malaysia is the largest market for mangoes, avocados and lychees re-exported from Singapore, bringing in 79.80%, 70.12% and 63.04% of Singapore's export respectively. Hong Kong, Brunei and Indonesia are the second-largest markets for re-exported mangoes, avocados and lychees respectively, with the import share at 16.5%, 24.07% and 32.61%.

Table 52 Singapore's re-export of mangoes, avocados and lychees in 2018

		Mango	Avocado	Lychee
	Re-export in tonnes	703	241	46
Re-export percentage	Malaysia	79.80%	70.12%	63.04%
	Hong Kong	16.50%	-	-
	New Caledonia	1.14%	-	-
	Brunei	1.00%	24.07%	2.17%
	Cambodia	-	4.98%	-
	Indonesia	0.71%	0.41%	32.61%
	others	0.85%	0.41%	2.17%

Source: Trade Maps; Note: Product: HS 08045020 (Mangoes fresh or dried); HS 08044000 (Avocados Fresh or dried); Lychees fresh (08109010).

5.1.1.5.3 China

Guangzhou, Beijing and Shanghai are the traditionally dominant markets for imported mangoes, avocados and lychees with East Coast cities dominating the consumption of imported fruits. However, sales regions have expanded into surrounding second-tier and third-tier cites as well as some capital cities, such as Wuhan, Chengdu in Central and Western China in recent years, with growing demand from fast-emerging second and third-tier cities in the interior (Hey, 2018). Although the sales in Central and Western China and second-tier and third-tier cities are not comparable with

that in the major cities, there is huge potential for the increased consumption of imported fruits, particularly avocados, because people's requirements for quality of life, especially food, are not lower than those of first-tier cities (Zang, 2018). Figure 34 shows the sales share of Australian mangoes distributed from the Guangzhou Jiangnan market, as estimated by an experienced wholesaler in Guangzhou Jiangnan market. The volume for direct imports of Australian mangoes into China is not considered as there is no data available from the interviewed wholesalers and retailers.

Figure 34 Sales regions of Australian mangoes in China

(Estimated by an experienced wholesaler in the Guangzhou Jiangnan market)

Guangzhou Jiangnan wholesale market is the collection and distribution centre for Australian mangoes, which are sold to these surrounding provinces, including Guangdong, Guangxi, Fujian, Hunan, Hubei, Sichuan and Guizhou, as well as other major wholesaler markets in Shanghai, Beijing and further north and west. The largest market for Australian mangoes is middle and northern China, which accounts for 50% of total sales from the Jiangnan market. This is followed by 30% to

Guangdong province and surrounding regions, which are major mango producing regions. Hainan province, also a major mango producing region in China, accounts for 15% of total sales.

Shanghai Huizhan market accounts for only 5% of the total sales of Australian mangoes from the Guangzhou Jiangnan market. Australian mangoes in the Shanghai Huizhan market are mainly sold to wholesalers and retailers in Shanghai, Zhejiang and Jiangsu, where there are millions of affluent consumers. However, the demand for Australian mangoes is quite small in Shanghai and the surrounding regions. Two Shanghai-based retailers said that the demand for Australian mangoes has not yet developed in Shanghai and sales are quite slow at their retail stores.

Approximately 7.5% of Australian mangoes from the Guangzhou Jiangnan market flow to the Beijing Xinfadi market, where the majority of Australian mangoes are sold to the surrounding regions, such as Shandong, Inner Mongolia, Liaoning, Jilin and Heilong Jiang. Two wholesalers in Beijing Xinfadi Wholesale markets estimated that no more than 30% of mangoes are sold to Beijing markets.

Avocados are very popular in the big cities on the East Coast (Fresh Plaza, 2016c). In the Central and Western parts of China, avocados are still a relatively novel product and have the potential for increased demand. Supafresh, a Shanghai-based import and wholesale company, has opened branches in Guangzhou and Beijing, and also in Wuhan and Chengdu, which are the main cities located in the middle and western part of China. They are very excited about bringing new Australian products into these regions (Fresh Plaza, 2016c).

5.1.1.6 Retail channels

5.1.1.6.1 Hong Kong

The major retailing channels for Australian mangoes, avocados and lychees include traditional supermarkets, high-end supermarkets, fruit hampers and online sales.

Traditional supermarkets, including Wellcome and Parknshop, also have a presence in mainland China. Wellcome and Parknshop are two major grocery chains, which dominate the supermarket category with a nearly 70% market share combined (Li, 2017). Wellcome has more than 280 retailing outlets in Hong Kong, while Parknshop has over 270 outlets with different names and store formats (Li, 2017). Though these big grocery chains have established their direct channels for sourcing mangoes, avocados and lychees, they still purchase products from Hong Kong importers to minimise risks (Lai, 2018). These big grocery chains generally have their own distribution centres equipped with cold storage facilities, from where fruit is distributed to their chain of stores across Hong Kong.

High-end supermarkets target middle and high-end consumers with quality consumable products, including packaged food, fresh food, cosmetics and imported products. City Super, Fusion, Taste and Marks & Spencer are examples of emerging high-end supermarkets in Hong Kong. Fusion and Taste are premium and upscale outlets expanded by Parknshop as consumers continue to seek

high-quality, imported gourmet products (Li, 2017). Compared with traditional supermarkets, their shopping environment is much cleaner with attractive displays. Some high-end supermarkets, such as Yata, have established their own online platforms, in addition to operating brick-and-mortar stores. As premium supermarkets cater for a small group of high-value customers, they often have a small number of stores, for example, City Super has four stores only in Hong Kong, while Yata has seven stores in Hong Kong. In addition, most high-end supermarkets have their own distribution centres and often pre-pack fruit at their own plants.

Fruit hamper stores are premium channels for fruit. Hampers are packed with an array of seasonal imported fruit, which is an ideal gift for any business event and house warming party. Giving fruit baskets in Hong Kong is more popular during holidays, like Lunar New Year or Christmas (Flower delivery review, 2018). People order fruit hampers from Hong Kong florists and gift shops to give as gifts to relatives, colleagues, clients and neighbours (Flower delivery review, 2018).

HKTV Mall is the largest online shopping platform in Hong Kong. Beyond this, there is a limited number of other online platforms, such as *thefreshsupplycompany,* jousun, honestbee and frutodor (Sassyhongkong, 2018). Although E-commerce in Hong Kong is not as developed as in China, due to the mature local direct and retail sales channels (Leung, 2018), many fresh food suppliers have established their own online platforms in addition to operating brick-and-mortar stores. For example, most major supermarkets like Wellcome and ParknShop have established online grocery shopping platforms (Li, 2017). Furthermore, some high-end supermarkets, such as Yata, have developed their online sales platform. It is expected the number of online food stores will continue to rise as both big and small operators look at e-retail as a way to expand their market presence and reduce their exposure to the high commercial real estate prices in Hong Kong (AAFC, 2016). Due to small procurement volumes, pure online retailers mainly source fruit from local wholesalers, or it is supplied by their parent companies. For example, Frutodor is a wholly-owned subsidiary of P&C International Trading Limited (Sassyhongkong, 2018).

5.1.1.6.2 Singapore

The retailing channel for Australian mangoes, avocados and lychees in Singapore mainly includes traditional and high-end supermarkets, wet market, grocery (specialty) stores, Mom-and-Pop stores and e-commerce retailers.

NTUC FairPrice, Dairy Farm International and Sheng Siong Group are the three supermarket chains, which dominate Singapore's grocery retail sector (Kwek, 2018). NTUC FairPrice is the leading player in grocery retailing in Singapore which has opened its upmarket outlet named FairPrice Finest to cater to the changing tastes of Singaporeans (Source: fairprice.com.sg/). With the inclusion of various convenience store, supermarket and hypermarket retailing formats, NTUC FairPrice can cater to both price-conscious and higher-income consumers. However, supermarkets are somehow

divided in the Singapore market. Some supermarkets particularly cater to high-end consumers, while others target more medium income consumers (Fresh Plaza, 2015). Cold Storage and Market Place supermarkets which are operated under Dairy Farm International in Singapore cater to mid-range to high-end consumers, whereas giant hypermarkets and supermarkets, including Sheng Siong, cater to price-sensitive consumers (Export.Gov, 2018).

Wet markets are traditional markets in Singapore, which are not necessarily cheaper, but whose products are perceived as fresher (Fresh Plaza, 2015). Wet markets used to dominate the retailing of fresh fruit and vegetables. However, more consumers prefer to shop for fresh food in supermarkets than in wet markets in recent years due to the longer operating hours and wider product range in supermarkets (Flanders investment & trade, 2016).

Family-owned stores and specialty retail stores which carry premium products targeting the niche and higher-end consumers are fragmented in Singapore compared to supermarket chain stores. With more consumers opting for sustainably sourced, sustainably farmed and non-GMO products, the number of specialty retail stores offering premium and/or organic and natural food products are increasing (Kwek, 2018). It should be noted that there are a number of stores that are Australian-linked such as Little Farms, Farm 'N Pantry and The Fishwives (Export.Gov, 2018).

E-commerce and direct to consumer deliveries of temperature-sensitive products find excellent opportunities in the Singapore market due to the relatively lower overhead and real estate costs of operation and the ability to cater to consumers that do not have time to shop at a retail store (ITA, 2016). RedMart is the largest online grocery retailer in Singapore, which is owned by Alibaba-backed Lazada (Export.Gov, 2018). Honestbee and Amazon's grocery are the two recent entrants which started operations in 2015 and 2017 respectively (Kwek, 2018). With the development of online retailing, supermarkets have also integrated online sales with their in-store sales though establishing online grocery shopping platforms. One retailer indicated that they are excited about the online retailing service due to the savings on expensive rent. Additionally, they are working to expand their sales regions in Singapore.

5.1.1.6.3 China

Retail channels have significantly evolved over recent years in China. Several new retail channels have emerged, including a new retail chain (O2O), premium (high-end) supermarkets, online sales, fruit store chains, fruit factory stores and WeChat sellers.

New retail stores, including Hema Fresh, 7 fresh and Suning have integrated offline and online sales for an exceptional customer experience. These new retail stores cater to middle and high-end customers, with stores mainly opening in the municipality and big capital cities, such as Bejing, Shanghai, Guangzhou, Tianjin, Xi'an and Chengdu.

High-end (Premium) supermarkets target middle and high-end consumers with quality consumable products, including packaged food, fresh food, cosmetics and imported products. Ole, BLT, Super Species, YH Bravo and City Shop are examples of emerging premium supermarkets in China. Compared with traditional supermarkets, their shopping environment is much cleaner and displays more attractive. As premium supermarkets cater to a small group of high-end customers, they cannot aggressively expand store numbers like hypermarkets, community supermarkets, and convenience stores, which means relatively small procurement and sales volumes. The small volumes are because they target small groups of high-end consumers, and often have a limited number of stores in a city. On the other hand, fruit chain stores are more like community convenience stores and can take slightly larger volumes.

Online sales sites, including Yiguo, Fruitday and Benlai, are fighting intensively for market share (and burning through venture capital). There are also open platform sites like Tmall.com and JD.com, which are provided by Alibaba and JD respectively. Online retailers mainly focus their sales regions in big cities, such as Beijing, Shanghai, Guangzhou and Shenzhen and their surrounding regions, given the constraints in fresh fruit delivery. These online retailers have distribution centres in Beijing, Shanghai and Guangzhou (Shenzhen), where the fruit is pre-packed and distributed to their customers. Online retailers often face fierce price competition as consumers can compare prices between several sellers. To compete with other online sellers, they often offer customers discounts or coupons to stimulate their purchase intention. Fruitday sells Australian mangoes on their online platform, but currently, sell no more than 400 trays during Chinese New Year.

Fruit chain stores are developing at a rapid rate and are competing with the old-style family store. The largest, Pagoda, has more than 1,000 franchised stores, while Xianfeng has more than 600 franchised stores. There are other fruit chain stores, such as Benlai Fresh. These fruit chain stores focus on sales volumes as they mainly cater to the middle- and lower-class customers. Their fruit is all re-packed to help reduce wastage. The franchised stores do not have cold storage facilities, though all fruit is distributed from regional delivery centres which have cold storage facilities. Although most fruit is pre-packed, all chain stores have flexible sales in either loose or package format and provide a free cutting service at the store. Figure 35 shows the store display and cutting service provided in a pagoda franchised store. Premium fruit only accounts for a small portion of their sales.

Figure 35 Store display and cutting services in a Pagoda franchised store

Fruit factory stores are selling fruit by the whole box, which distinguishes it from other retail channels. Well Fruit is a typical example in this case. It is based in the Shanghai Huizhan wholesale markets, with 32 stores in Shanghai and 3 stores in Kunshan, Jiangsu province. They are often located in non-downtown locations and have a low mark-up as they sell by the original carton. All their fruit is displayed with the original box and each store is equipped with cold storage facilities as shown in Figure 36. They have not yet sold Australian mangoes, as a whole box of Australian mangoes is too expensive for consumers.

Figure 36 Store display and in-store cold storage facilities

WeChat sellers sell small portions of fruit through their social media (the channel data is unavailable given the difficulty in making an estimation). Although these are currently small sales volumes, it is changing the market dynamic given that there are over 650 million active users on WeChat, which

has developed to be a business platform, as well as a social media tool. Private WeChat sellers often buy fruit from wholesalers and sell via their friend groups. In addition, lots of fruit retailers have launched WeChat selling platforms.

Two new trends in the fruit retail business have emerged in recent years in China. The first is the mergers among different online or offline retailers, which can enable two or more retailers to work together to configure their upstream supply chains. For example, Xianfeng Fruit fully acquired K-Fruit Garden in 2015 (Produce Report, 2015). Another trend is that retailers have worked to integrate online and offline sales. For example, Yiguo Fresh took over all the shares of Lianhua Supermarket held by Yonghui Supermarket in 2016, and Fruitday fully acquired City Shop supermarket in 2017 (Shao and Chen, 2017).

5.1.1.6.4 Japan

The retail channels to consumers in Japan have been traditionally through supermarkets, followed by small independent fresh produce retailers, department stores, and cooperatives. Supermarkets remain the dominant venue and maintain their market share over fresh fruit retailers (Motomura, 2018). Other small channels such as convenience stores and e-commerce have gradually increased their presence over recent years.

Supermarkets in Japan are a major place for consumers to purchase fresh food, including imported fruit, along with the many selections of packaged food or frozen food. The purpose of purchase is for daily use rather than gifts (Fujimoto, 2007).

Convenience stores continue to be a major retail purchasing choice. Due to limited shelf space, convenience stores can only hold a few brands per category. Because of this, product performance is continuously reviewed, and products with little or declining progress are quickly replaced, ensuring the highest turnover possible (Aoki, 2017). Convenience stores sell a diverse range of packaged grocery products including ready-to-eat packs of fresh fruit. (Agriculture and Agri-Food Canada, 2015). Pre-cut produce helps consumers eat fresh fruit with less effort.

Department stores usually import branded products, albeit typically in small quantities. Many of the items are packaged as take-out products due to their proximity to train stations, and the premium nature of the products means they are often used as gifts (Eurofresh Distribution, 2016). The high-quality mangoes are typically sold in high-end department stores or fruit gift shops such as Mitsukoshi, Sembikiya (Deloitte Australia, 2017)

Consumer cooperatives in Japan are well developed. Co-ops not only run the retail business but also provide other everyday living services such as health care and financial services. Co-ops are very close to their end-users. While they operate stores across the country, they also provide weekly home delivery services. Because of this, users of Co-ops are mainly families and elderly people (Aoki, 2017). Fresh fruit is packaged for a single-serving size or family-sized serving.

Although online retailing for food and beverage is currently not a big market in Japan, it is developing rapidly (IBER global, 2016). Many major supermarkets now offer online grocery services in most parts of Japan, including rural areas. Amazon, which is the leading e-commerce site, followed by Rakuten and Yahoo! Shopping, launched its fresh fruit delivery service in Japan in 2017, following the USA and the UK (Asia Fruit, 2017). Thanks to developed logistics, online retailers can shorten delivery time to ensure the freshness of the fruit. Top-ranked products in each online site are mostly expensive fruit that are hard to buy at a supermarket. They are packaged with a fancy box for gift purposes. Imported fruit with some flaws and unattractive colour can also be sold through the online market but at a discounted price. Fruit in a large box (2 or 3kg) is also sold as heavy and bulky items, which are suitable for online shopping.

5.1.1.6.5 South Korea

The retail channels consumers traditionally go through include hypermarkets, supermarkets, department stores, and wholesale retailers. However, due to social and demographic changes, other small channels such as convenience stores and e-commerce have increased their presence in recent years.

Hypermarkets and grocery supermarkets chains are considered as discounted stores and one of the important retail sales channels for food products in South Korea (Mamou, and Lee, 2017). Hypermarkets hold close to 45% of the market share and are the main channel for imported food products (Best Food Importers, 2018). E-Mart, Homeplus and Lotte Mart are the largest chains with an aggregate number of 420 stores nationwide (Mamou, and Lee, 2017). In addition, there are a number of supermarkets, including Nonghyup Hanaro Mart, Homeplus Express and Lotte Super, which offer most items found in the food section at hypermarkets (Location Korea, 2018b).

Costco, E-mart Traders and Vic Market are the three largest warehouse-style bulk retailers in South Korea. E-mart Traders is Shinsegae's response to Costco. It is usually described as the South Korean Costco and sells more local South Korean products at lower prices compared to imported products (Location Korea, 2018a). Wholesaler/retailers carry a wide range of products, including imported fruit, which are cheaper in bulk purchases.

Department stores, which occupy a high-end segment of the South Korean market (Deloitte Australia, 2017), offer a wide range of high-end, premium quality imported food products which are usually hard to find in regular food retail shops, such as supermarkets (Mamou, and Lee, 2017). In Korea, all the largest and most luxurious shopping centres are owned by large conglomerates (Chaebol) such as Hyundai and Lotte (Location Korea, 2018a).The department stores are located nationwide with a focus on big cities like Seoul, Busan, Incheon and Daegu (Mamou, and Lee, 2017). Unlike other kinds of shopping centres or markets, department stores are considered more

expensive (Location Korea, 2018a). The average price of food products in department stores is 10% to 25% higher than supermarkets (Mamou, and Lee, 2017).

The market for fresh fruit is also being fuelled by the domestic restaurant industry by developing new menus using tropical fruit (Lim and Kwak, 2017). For example, companies such as Binggrae use mangoes in the production of desserts (Deloitte Australia, 2017). There is even an establishment named Avocado Cafe in the Mangwon neighbourhood of Seoul that serves a variety of healthy, avocado-packed choices (Korea Herald, 2018). Thanks to South Korea's late venture into avocados, some restaurants, including this cafe, have been more inclined to emulate popular Western culinary creations like avocado quinoa salads, avocado banana smoothies and avocado chicken wraps. South Koreans also seem more responsive to using avocados in traditional cuisines, such as bibimbap (Korea Herald, 2018). Starbucks released the avocado blended frappe seasonal beverage in 2015, which is only available in South Korean locations (Korea Herald, 2018). This reflects the reality that in much of Asia avocados are seen as a sweet treat, often blended with chocolate in shakes and frappes. Due to the wide use of tropical fruit, including mangoes and avocados in restaurants and cafes, the food services have become an important channel for mangoes and avocados, enhancing their popularity among South Korean consumers.

With the rising number of single-person households and an aging population, the convenience store market is growing rapidly and becoming a dominant retail sales channel (Mamou, and Lee, 2017). Convenience stores, like small supermarkets, carry a wide range of products, include fruit and vegetables (Mamou, and Lee, 2017). Storyway, 7-Eleven, Ministop, Emart24, GS25 and CU (formerly known as Family Mart) are the most popular and common convenience stores. As of August 2017, there were 37,539 convenience stores throughout the country compared with 21,221 stores in 2011 (Mamou, and Lee, 2017).

E-commerce retailing is flourishing as many South Koreans live busy lives and focus on their careers. In South Korea, online shopping is also significantly more developed than in other Asian countries and many retailers have a strong online presence (Best Food Importers, 2016). The South Korean Retailer Auction was the first to sell fresh food online in 2014 and since then several e-retailers, including WeMakePrice, Ticket Monster and Gmarket have been established to supply local and imported fruit and vegetables to consumers (Fruitnet, 2017).

5.1.2 Customer insight

Consumers like to purchase their favourite fruit and vegetable in its freshest state all year round regardless of the seasonality of the produce or how long it has to travel to reach the consumers (Bourlakis et al. 2011).

5.1.2.1 Fruit consumption

5.1.2.1.1 Hong Kong

Rising health consciousness among Hong Kong consumers has driven the demand for fresh fruit. Also, with increasingly hectic lifestyles causing younger generations of consumers to place more importance on convenience (Euromonitor, 2014), there is a growing demand for convenience fruit. Moreover, Hong Kong consumers have placed much attention on food safety issues. Because of the increased concern over food safety, organic fresh fruit has witnessed particularly strong growth (Euromonitor, 2014). With new varieties and suppliers always presenting in the market (Lai, 2018), Hong Kong consumers are turning their attention to non-traditional fruits with a growing interest in unfamiliar products (Euromonitor, 2014). The popularity of Cantonese and Japanese food have a large impact on the choice of fresh food among Hong Kong consumers. A wholesaler indicated that Hong Kong consumers have a similar taste for fruit to Chinese consumers, in that they prefer fruit with high brix. The preference for fruit among Hong Kong consumers also varies between age and gender groups, as indicated by a supermarket chain retailer. Their sales history shows that older consumers buy more lychees compared with younger consumers, and young and middle-aged females are the highest consumers of avocados due to its health and nutritional properties.

5.1.2.1.2 Singapore

Price, freshness, quality and service are the four key elements that are valued by Singapore consumers, with the price being the most important. According to a grocery chain store retailer, it is the price, not the variety of the fruit that determines the sales. They say that consumers come to the store and may have in mind they want a mango. However, they may change their minds when they find promotions on other fruit.

The diet of Singapore consumers is quite different from consumers in other countries, as indicated by a grocery chain store retailer. Singapore consumers often use fruit for cakes, smoothies and other fresh fruit ingredients, rather than direct consumption. Because of this, they need to teach people how to cook the fruit rather than eating it fresh. Moreover, people prefer easy-to-bring fruit, like fresh-cut, smaller apples for snacks.

Consumers in Singapore are becoming more aware of health issues and pay more attention to their diet. Linked with the expanding middle class, considerations of health and wellbeing have been increasingly important to Singaporeans. Increasing attention has been given to labels containing information on ingredients, nutritional components and country of origin (Kwek, 2018).

The preference for fruit among Singapore consumers is inherited from residents with a Chinese background, who largely determine the food culture in Singapore (Tortajada and Zhang, 2016). For example, retailers mention, the customer's knowledge of lychee as fruit is from China, with a cold,

red, wet and not brown appearance. However, Australian lychees are sometimes brown with dried skin so that customers think they are spoiled, even though the inside of the fruit is fine.

5.1.2.1.3 China

The number of China's middle and upper-middle-class consumers is continuously expanding. The evolution of the middle class in China means that sophisticated and seasoned shoppers—those able and willing to pay a premium for quality and to consider discretionary goods and not just basic necessities—will soon emerge as the dominant force (Barton et al., 2013). Chinese consumers are becoming more aware of health issues and are paying more attention to their diet. Consumer behaviour towards a greater concern for diet and health results in a willingness to try and pay more for healthy food. For example, avocados are an exotic fruit in China; however, increasing numbers of people are incorporating it into their diets due to the aggressive campaigns promoting the nutritional characteristics and properties of avocados (Fresh Plaza, 2019b).

Chinese consumers are familiar with mangoes and lychees with the availability of a large quantity of locally produced products. In contrast, consumers have limited knowledge about avocados as it is an exotic fruit. Consumer awareness is mainly enhanced through aggressive promotions. Countries such as Chile and Mexico, which arrived earlier on the Chinese market, have already been carrying out awareness campaigns to promote the consumption of avocados (Fresh Plaza, 2019b).

When purchasing fruit, Chinese consumers are generally driven by fruit appearance. For example, consumers love the Australian R2E2 variety particular for its large size and beautiful blush colour. Consumers prefer a smooth appearance when picking avocados. While good appearance is the driving force for purchase, the taste is the key factor for repeat purchases.

5.1.2.1.4 Japan

Fresh fruit is not only an important part of the Japanese diet but more importantly, fruit consumption is associated with its social and cultural practices. For instance, fruit is considered a luxury item and thus plays an important and elaborate part in Japan's extensive gift-giving practices (IBER global, 2016). Japanese consumers are generally not price-sensitive when purchasing fresh fruit and are willing to pay a premium price for fruit (Haghirian and Toussaint, 2011). The word "cheap" is thus not a preferred marketing campaign among grocery retailers. (Agriculture and Agri-Food Canada, 2015). Avocados are especially popular among women as they are rich in vitamin E and minerals that are known to help keep skin smooth and moist and lower blood pressure. Moreover, avocado is gaining popularity due to the variety of recipes being shared on television or social media (Ohta, 2014). As a result, consumers are increasingly eating avocados daily. Although lychee flavoured juices, teas and snacks are relatively popular in Japan, Japanese people are not familiar with eating fresh lychees on a regular basis.

The Japanese are very concerned about the nutritional content of fruit since they are a very health-conscious society. The concern about the safety of imported products has been growing after a series of scandals about Chinese food. In order to ensure the safety and reliability of agricultural products in Japan, the introduction of GAP (Good Agricultural Practice) is being widely applied.

5.1.2.1.5 South Korea

Taste, health and dietary benefits, quality and ease of handling are four criteria indicted by South Korean consumers as to how they select their fruit - Figure 37.

Figure 37 South Korean consumers' preference for fruit
Sourced from Rhee (2015)

Taste is the No.1 basis for fruit selection - indicated by 48% of South Korean consumers. Most South Korean consumers prefer sweet (36%), sweet and sour flavoured (23%) and juicy and fresh (19%) fruit. Therefore, the South Korean preference is for high-quality sweet fruit. In terms of mangoes, they should be sweet, juicy, have a beautiful yellow-orange colour and a smooth texture (Fresh Plaza, 2019a). When a positive eating experience is met, both in terms of how the fruit looks and how it tastes, consumers will return to that fruit (Fresh Plaza, 2019a).

Health benefits, as responded by 23% of South Korean consumers surveyed, has become the second major reason for purchase. South Korean consumers prefer fruit which has a high nutritional value (Rhee, 2015). Avocados provide a good example of how health benefits can create increased demand. Avocados did not take off at first due to the soft texture of the flesh, green hue and rough exterior; however, it is now being praised locally for its nutritional value, such as high vitamin content, benefits for the skin and low cholesterol which is beneficial to diet-conscious South Koreans (Korea Herald, 2018). Therefore, demand has been increasing substantially in recent years.

South Korean consumers also pay attention to fruit quality, though this was only indicated as important by 15% of South Korean consumers. Given that fruit is an important element in the South Korean diet, consumers tend to pay more attention to quality over price (Euromonitor, 2019).

Ease of handling of fruit is preferred by 14% of surveyed consumers. In particular, it is highly valued by younger adults, who place importance on quality and convenience (Rhee, 2015).

5.1.2.2 Country of origin preference

5.1.2.2.1 Hong Kong

Hong Kong's consumers have a wide selection of fruit from neighbouring Asian countries and other countries across the global. Fruits native to the Asia continent accounted for half of all fruit sales in 2012 (Euromonitor, 2014). Fruit imported from the U.S, Australia, New Zealand and Japan, which is renowned as high quality and safe, enjoy a high reputation among Hong Kong consumers. Given that Hong Kong is a quality and trend-driven market, price is not always the most important factor (Lai, 2018), and consumers, particularly affluent consumers, have a preference for fresh produce from the U.S, Australia, New Zealand and Japan, even with higher prices.

5.1.2.2.2 Singapore

Singapore's consumers also have a wide selection of fruit from neighbouring Asian countries and other countries across the globe. Although Singapore has a good percentage of high-income customers willing to spend more on exotic and niche products (Fresh Plaza, 2015), the fresh fruit market is competitive, with extremely price-sensitive consumers (ITA, 2018). One wholesaler indicated that they import mangoes from Australia, India, Pakistan and Thailand and avocado from the USA, Mexico, New Zealand and Australia. Given that Australian avocados are quite expensive and the sales are a bit slow, they often do not buy larger quantities from Australia. While most consumers love cheap fresh produce, some consumers prefer fresh produce from the U.S, New Zealand and Australia as they are considered quality and safe products.

5.1.2.2.3 China

Because of food scandals and polluted air and soils throughout China, Chinese consumers have grown increasingly wary of locally produced food (Fresh Plaza, 2016d). As such, imported fresh produce is highly preferred over locally produced products. Therefore, a growing number of consumers are buying imported fruit and vegetables as they are considered safer and adhere to international safety standards rather than Chinese laws (Weeklytimesnow, 2015). It is reported by Weeklytimesnow (2015), Chinese consumers are paying more than double the price for imported fruit and vegetables to avoid lax food safety standards. Considering the food safety issues in China, affluent Chinese will always choose imported products over local products (Fresh Plaza, 2016d), and the demand for imported food is unlikely to abate anytime soon (asia.nikkei.com, 2016).

5.1.2.2.4 Japan

Many Japanese consumers prefer domestic products given that domestic products are known to be produced to the highest standards of quality and farm practice. Figure 38 shows nearly 60 % of

Japanese people will purchase locally produced fruit even though they are more expensive than imported fruit.

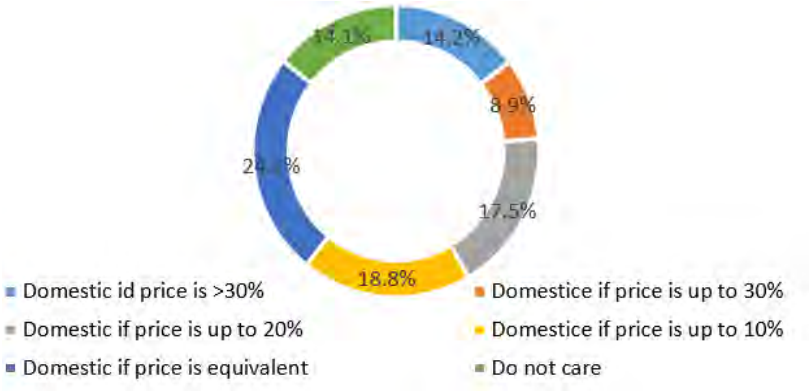

Figure 38 Purchase preference for domestic fruit among Japanese consumers
Sourced from the Ministry of Agriculture, Forestry and Fisheries

5.1.2.2.5 South Korea

Many South Korean consumers prefer domestic fruit over imported fruit. Figure 39 shows 80% of South Korean consumers prefer to purchase locally produced fruit even though domestic fruit is known to be more expensive than imported fruits. Domestic tropical fruit is more expensive than imported tropical fruits as domestic tropical fruit typically require poly-tunnel, or full greenhouses to grow (Lim and Kwak, 2017). For instance, South Korea, like Japan is growing mangoes in greenhouses. The high costs due to high CapEx and OpEx are compensated for by a high purchase price, with margins aided by shorter supply chains. For example, a 3kg boxset of Jeju mangoes is priced at 180,000 won (around USD 157) on lottemart.com. South Korean growers can claim their local mangoes are fresher and have better quality than those from other countries (Jejuweekly, 2017).

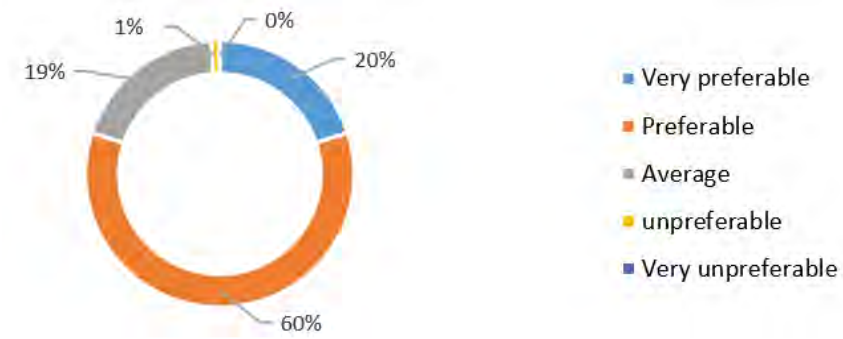

Figure 39 South Korea consumer's preference for domestic fruit in 2016
Source: http://konkuk.dcollection.net/public_resource/pdf/000002208375_20190925163039.pdf.

5.1.2.3 Buying channels

5.1.2.3.1 Hong Kong

Hong Kong consumers are used to buying fresh produce from brick-and-mortar stores given it is incredibly convenient to shop in Hong Kong. For example, most consumers would pick up groceries daily on their way to and from work (Leung, 2018). However, in recent years, there is a trend that more consumers are pre-ordering seasonal fruit online, such as Taiwanese mangoes, and many would use home delivery services provided by online shops (Lai, 2018).

5.1.2.3.2 Singapore

Singapore consumers prefer in-store purchasing of fruit, rather than directly buying online. Because of the perishability of fresh fruit, consumers prefer to go to the store to pick and choose fruit by themselves, as indicated by a chain grocery retailer. The retailer indicated that they have an online store, but it is only a small segment of their business at the moment, making up 1% of their sales. The reason is that very few people buy fruit online.

5.1.2.3.3 China

Older customers generally buy fruit offline for consumption at home and therefore prefer large packages or whole fruits. On the other hand, online customers are usually younger consumers who opt for the convenience of small, delicate packaging (Fresh Plaza, 2019b). As such, there is a difference in requirements from online and offline customers for the packaging of the fruit. In recent years, with the integration of their online and offline fruit retail, consumers in tier 1 cities have a selection in their purchase channels – either buy in-store, buy online for delivery, or even buy in-store for delivery. Differently, consumers in tier 2 and 3 cities mainly rely on community group buyers to purchase imported fruit (Walkthechat.com, 2019).

5.1.2.3.4 Japan

Japanese consumers mainly purchase fruit from supermarkets, which is the leading channel in Japan. Figure 40 shows the changes in retail channels for fruit in Japan from 1999 to 2014. While the department store and online stores remain a small segment in Japan's fruit retail channels, their popularity among consumers has gradually increased over the past years.

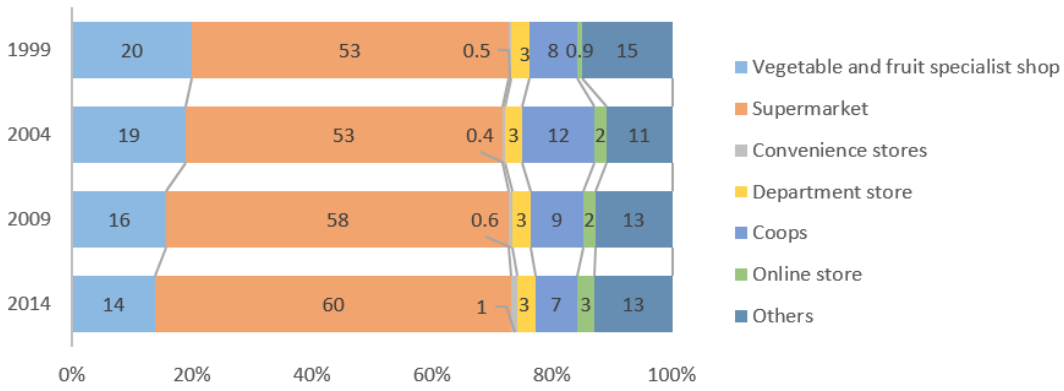

Figure 40 The ratio of retail channels for fruit in Japan
Source: The Ministry of Internal Affairs and Communications

5.1.2.3.5 South Korea

Mangoes and avocados, which were previously regarded as premium fruit, were only available at high-end grocery stores including those located inside department stores (Suh, 2011). However, with increasing imports of mangoes from Taiwan, Thailand and the Philippines, mangoes have become much cheaper and can be seen in large-scale retail stores or small supermarkets (Seoul Taiwan Trade Center, 2014). Consumers generally go to stores and pick their fruit. However, with the online grocery market expanding in South Korea, the demand for delivery services is rising, particularly among young people living alone and childless couples (Fruitnet, 2017).

5.2 Competitive insight – Market competition

5.2.1 Competitor intelligence

5.2.1.1 Market position

There is increased availability of fruit on the markets, as a result of the diversification of the exporting countries and the resulting reduction in the seasonality of supply.

5.2.2.1.1 Competitors in Hong Kong

Mango – The market shares and Cost, Insurance and Freight (CIF) prices of Hong Kong's top 15 mango suppliers on average between 2013 and 2017 are compared in Figure 41. Thailand is the largest mango supplier to Hong Kong, with a market share of over 50%. Thailand's dominance in the Hong Kong market is probably due to its lower CIF Hong Kong price, which is lower than the global average CIF Hong Kong price (1.25 USD/kg). The Philippines is the next largest mango supplier to Hong Kong, at just below 30%, although its CIF Hong Kong price is higher than the global import average. This is followed by Malaysia (6.36%) and Australia (5.75%). Malaysian mangoes are much cheaper, with its Hong Kong landed price lower than the global import average. In contrast, Australian mangoes are quite expensive, with the second-highest landed price (3.52 USD/kg), which is just lower than Cambodian mangoes (4.84 USD/kg). Taiwan and Indonesia are the fifth and sixth largest mango suppliers respectively. While Taiwanese mangoes are more expensive than Indonesia mangoes, Taiwan enjoys a higher market share of 4.38% compared to Indonesia (2.36%). Compared with Australia, other Southern Hemisphere countries, including South Africa and Peru are smaller suppliers in the Hong Kong market. South Africa and Peru ranked 11st and 14th by the five-year average landed price in Hong Kong. While their mangoes are much cheaper than Australian mangoes, their market shares are lower compared with Australia.

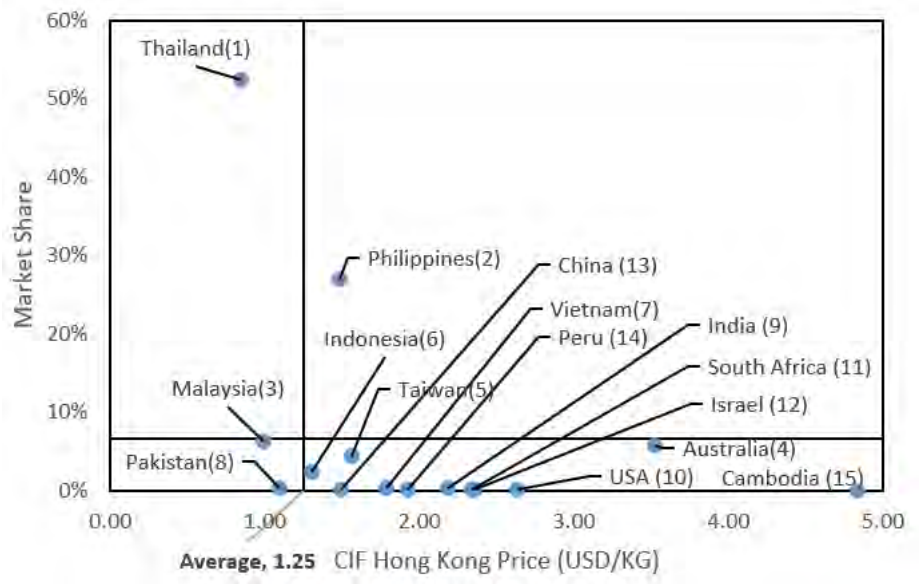

Figure 41 Market share and CIF Hong Kong price of the top 15 mango suppliers in 2013-17

Source: Trade Maps; Mangoes (HS080450); Ranking in the bracket by the average market share

Avocado – The market shares and Cost, Insurance and Freight (CIF) prices of Hong Kong's top 10 avocado suppliers on average between 2013 and 2017 are compared in Figure 42. South American country suppliers, including Chile, Mexico and Peru, are leading players in the Hong Kong market. Chile is the largest avocado supplier to Hong Kong, making up nearly half of the market supply. It is followed by Mexico (25.12%) and Peru (11.78%). Among the three South American country suppliers, Mexico has the highest CIF Hong Kong price, which is greater than the global import average. In contrast, Chile and Peru have lower Hong Kong landed prices, which are below the global import average. The USA and Kenya are the next two big avocado suppliers, with Hong Kong landed prices above the global import average. Although Australia's landed price in Hong Kong (5.21 USD/kg) is the highest among the top 10 avocado suppliers, Australia is the seventh largest avocado supplier to Hong Kong, with a market share of 1.10%.

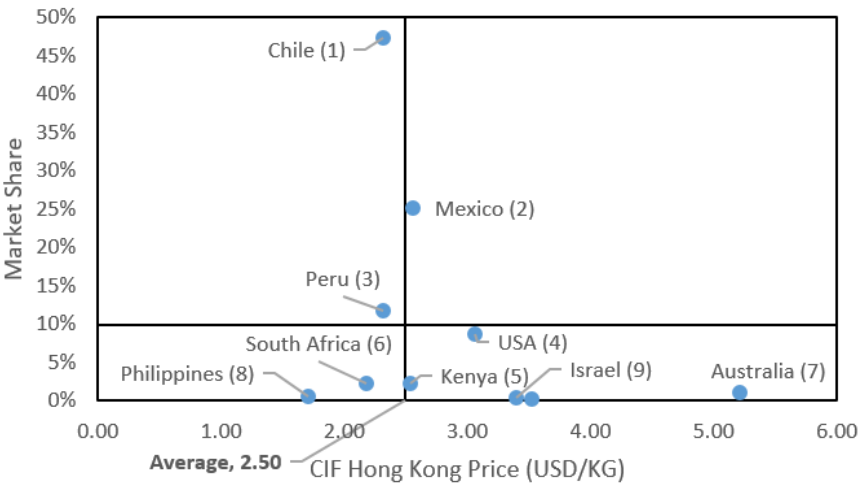

Figure 42 Market share and CIF Hong Kong price of the top 10 avocado suppliers in 2013-17
Source: Trade Maps; Avocado (HS080440); Ranking in the bracket by the average market share

Lychee – The market shares and Cost, Insurance and Freight (CIF) prices of Hong Kong's top 10 lychee suppliers on average between 2010 and 2014 are compared in Figure 43. Neighbouring countries and regions are the major lychee suppliers to Hong Kong. Thailand is the largest lychee supplier to the Hong Kong market, accounting for more than two thirds of Hong Kong's total supply. Vietnam and China are the next two biggest suppliers, with a market share of 14.72% and 9.67% respectively. For the top three suppliers, Hong Kong landed prices are lower than the global import average (0.70 USD/kg), with Thailand's price being close to the global average. Australia's CIF Hong Kong price is the highest (2.53 USD/kg) among the top 10 lychee suppliers; however, Australia is the fifth largest supplier after Taiwan, with a market share of 0.4%. Peru and the USA are the two suppliers with the closest price to Australia, but their market shares are lower than Australia's, at 0.23% and 0.36%.

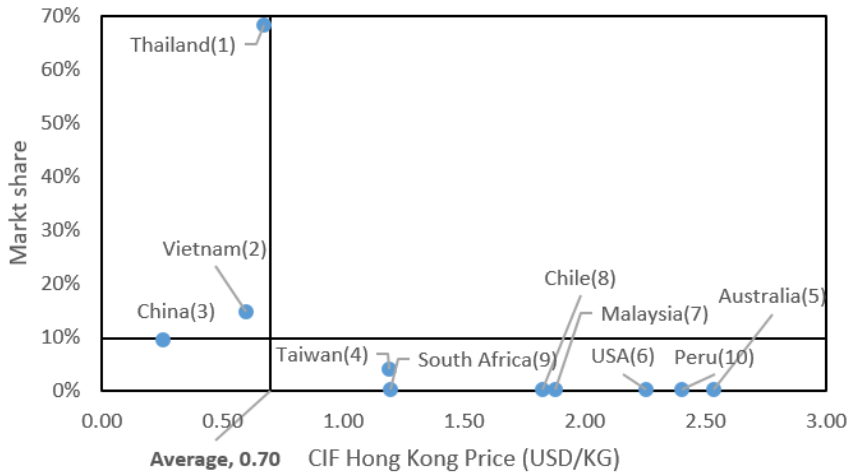

Figure 43 Market share and CIF Hong Kong price of the top 10 lychee suppliers in 2010-14
Source: Trade Maps; lychees (HS081090); Ranking in the bracket by the average market share

5.2.2.1.2 Competitors in Singapore

Mango – The market shares and Cost, Insurance and Freight (CIF) prices of Singapore's top 16 mangoes suppliers on average between 2013 and 2017 are compared in Figure 44. Thailand and Malaysia are the two leading suppliers by market share, at 53.78% and 15.96%; however, their CIF Singapore prices are recorded at only 1.32 and 0.77 USD/kg, which are lower than Singapore's average import price (1.60 USD/KG). Australia is the third largest mango supplier to Singapore by market share (8.31%), although Australia's Hong Kong landed price (2.97 USD/kg) is the third highest after the Philippines (6.59 USD/kg) and Israel (1.63 USD/kg). India is also a supplier with a close market share to Australia. However, India's Singapore landed price is recorded at 1.77

USD/kg. Other supplying countries and regions (Hong Kong, China and Cambodia) have higher Singapore landed prices than the total import average, however, their market shares are lower, with Taiwan having the highest market share (4.51%).

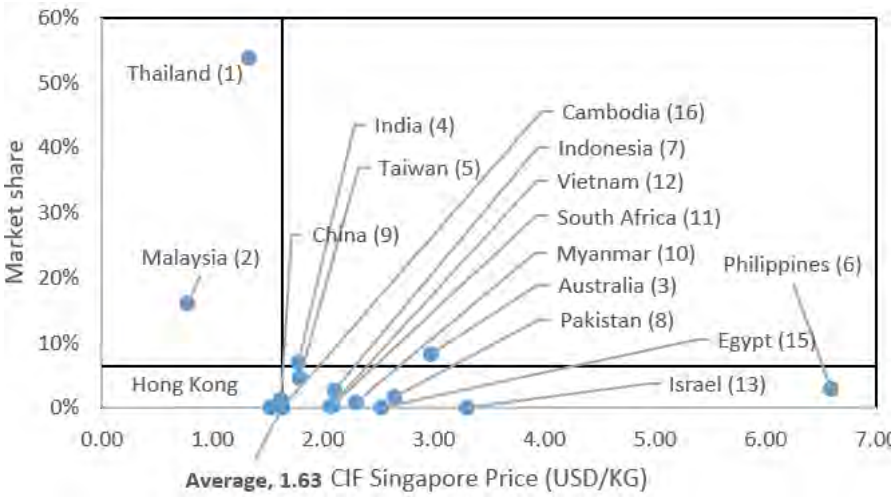

Figure 44 Market share and CIF Singapore price of the top 16 mango suppliers in 2013-17

Source: Trade Maps; Mangoes (HS08045020); Ranking in the bracket by the average market share

Avocado – The market shares and Cost, Insurance and Freight (CIF) prices of Singapore's top 10 avocado suppliers on average between 2013 and 2017 are compared in Figure 45. Australia and the USA are the top two suppliers in the Singapore market, making up 27.12% and 23.55% of the total supply, while their Singapore landed prices (4.13 and 3.90 USD/kg respectively) are only lower than that of Spain and Netherlands. Though imports from the Netherlands and Spain are lower than most supplying countries, their CIF Singapore prices are the top 2 highest, recording at 6.65 USD/kg and 4.71 USD/kg respectively. In contrast, New Zealand and Mexico are the two suppliers with CIF Singapore prices equal to or lower than the total import average, but with higher volumes, which are only lower than Australia and the USA.

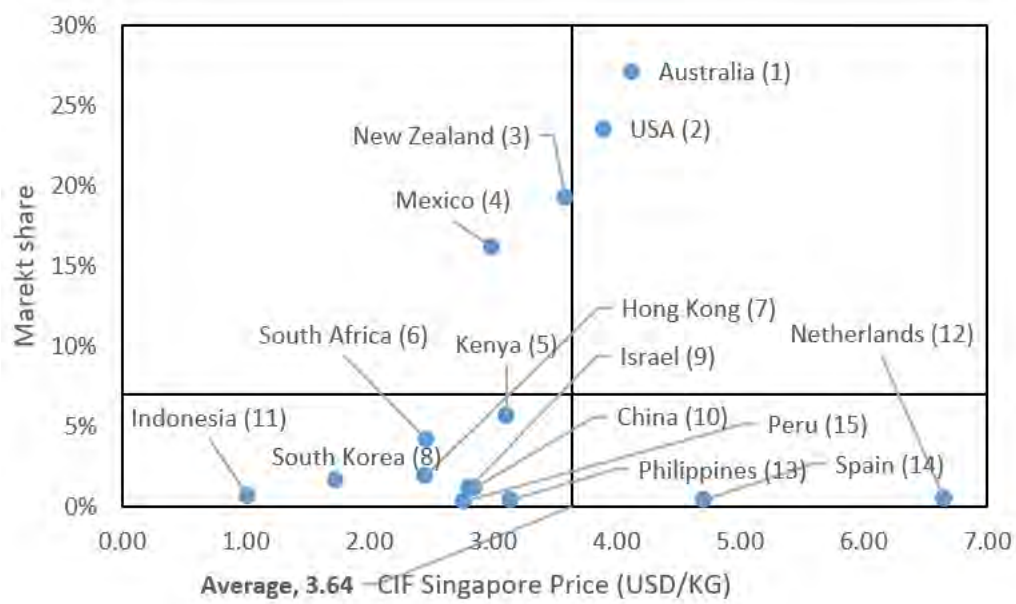

Figure 45 Market share and CIF Singapore price of the top 10 avocado suppliers in 2013-17

Source: Trade Maps; Avocados (HS080440); Ranking in the bracket by the average market share

Lychee – The market shares and Cost, Insurance and Freight (CIF) prices of Singapore's top 10 lychee suppliers on average between 2013 and 2017 are compared in Figure 46. China is the dominant lychee supplier in the Singapore market with the CIF Singapore price at USD 2.22/kg, which is equivalent to Singapore's total import average. In contrast, while Australia has the highest Singapore landed price (USD 9.68/kg), it is the fourth largest supplier. Thailand, Malaysia and Madagascar are the only three suppliers with CIF Singapore prices lower than the total import average; however, Thailand and Malaysia are the second and third biggest suppliers. The rest of the supplying countries have CIF Singapore prices above the total import average. Among them, South Africa and the USA, ranked the sixth and tenth suppliers, having the second and third highest CIF Singapore prices at 8.00 USD/kg and 7.41 USD/kg respectively.

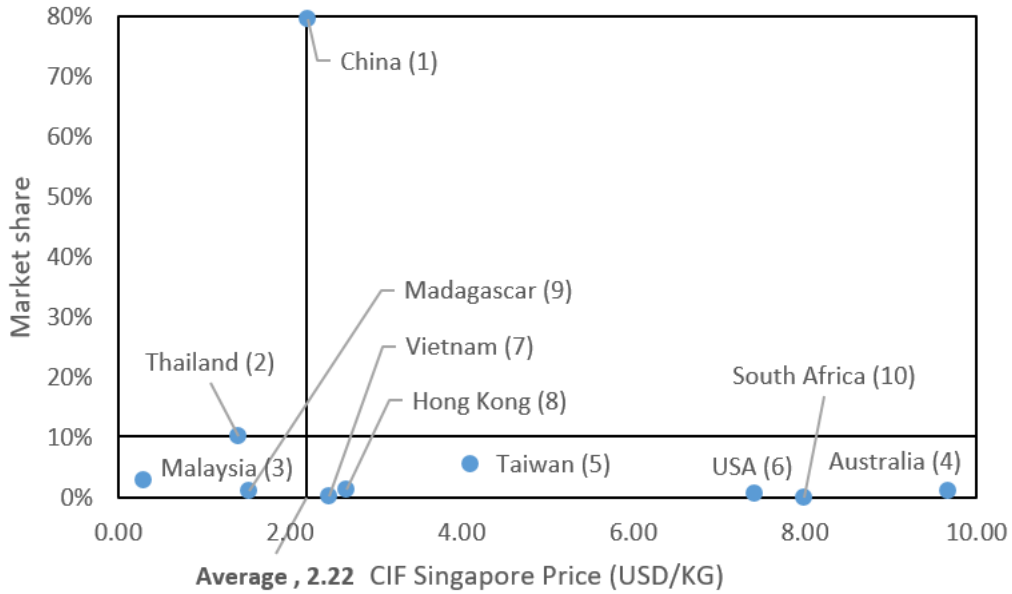

Figure 46 Market share and CIF Singapore price of the top 10 lychee suppliers in 2013-17

Source: Trade Maps; Lychees (HS08109020); Ranking in the bracket by the average market share

5.2.2.1.3 Competitors in China

Mango – The market shares and Cost, Insurance and Freight (CIF) prices of China's top nine mangoes suppliers on average between 2013 and 2017 are compared in Figure 47. Myanmar is the largest mango supplier in the Chinese market, with a market share of 46.73%; however, its CIF China price is the lowest (0.13 USD/kg), far below the total import average (1.92 USD/kg). Taiwan and Thailand are the next two biggest mango suppliers to China, with Thailand having a higher price (3.82 USD/kg) compared to Taiwan (2.02 USD/kg). Australia is the fourth largest mango supplier to China by market share (8.02%), although Australia's China landed price (5.17 USD/kg) is the second highest after the Philippines (8.52 USD/kg) among the top 9 mango suppliers. In addition to Myanmar, Vietnam and Pakistan are the only two suppliers with China landed prices below the total import average; however, their market shares are recorded lower, at 0.53% and 0.12% respectively. In contrast, Peru has a relatively higher market share just after Australia (4.65%); however, its China landed price is higher than the total import average, at 3.42 USD/kg.

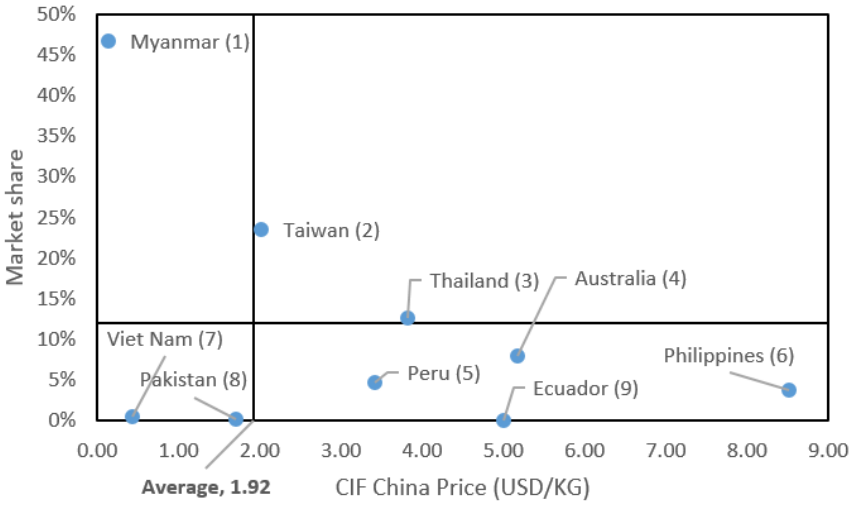

Figure 47 Market share and CIF China price of the top nine mango suppliers in 2013-17

Source: Trade Maps; Mangoes (HS080450); Ranking in the bracket by the average market share

Avocado – The market shares and Cost, Insurance and Freight (CIF) prices of China's top three avocado suppliers on average between 2013 and 2017 are compared in Figure 48. Mexico is the leading avocado supplier to China, accounting for nearly half of China's total supply; however, its CIF China price is 3.05 USD/kg, which is lower than the total import average (3.09 USD/kg). Chile and Peru have lower market shares compared with Mexico; however, their China landed prices are much higher, with Chile and Peru's landed price at 3.09 and 3.20 USD/kg respectively.

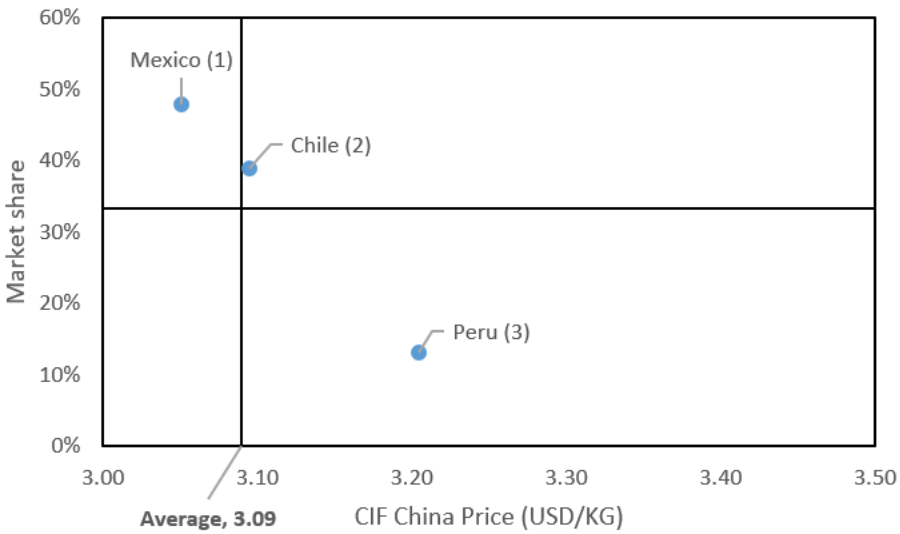

Figure 48 Market share and CIF China price of the top three avocado suppliers in 2013-17

Source: Trade Maps; Avocado (HS080440); Ranking in the bracket by the average market share

Lychee- The market shares and Cost, Insurance and Freight (CIF) prices of China's top two Lychee suppliers on average between 2013 and 2017 are compared in Figure 49. Vietnam is the dominant

lychee supplier to China, with a market share of 91.11%. While Thailand has a relatively lower market share, its CIF China price is much higher at 1.14 USD/kg compared with Vietnam's 0.41 USD/kg.

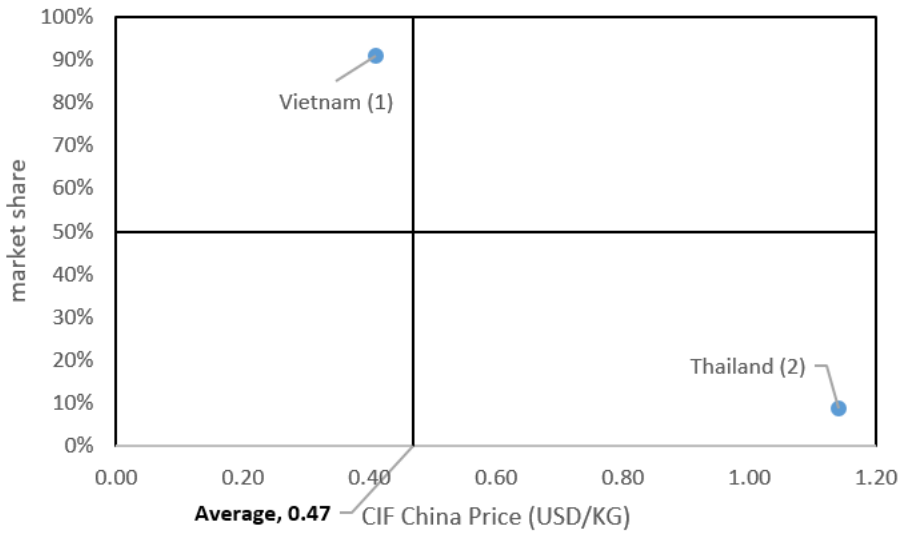

Figure 49 Market share and CIF China price of the top two lychee suppliers in 2013-17

Source: Trade Maps; Lychee (HS); Ranking in the bracket by the average market share

5.2.2.1.4 Competitors in Japan

Mango – The market shares and Cost, Insurance and Freight (CIF) prices of Japan's top 13 mango suppliers on average between 2013 and 2017 are compared in Figure 50. Mexico is the largest mango supplier in the Japanese market, providing just below 50% of the total market supply. Thailand, the Philippines and Taiwan are the next three largest mango suppliers, with market shares at 20.30%, 12.02% and 9.59% respectively. Among the four leading suppliers, Mexico, the market leader in Japan, is the only supplier with a CIF Japan price (3.54 USD/kg) lower than the total import average (3.78 USD/kg). In contrast, Thailand, the Philippines and Taiwan have Japan landed prices higher than the total import average, of which Taiwan has the highest CIF Japan price (8.24 USD/kg), but the lowest market share. Peru and Brazil are the fifth and sixth largest mango suppliers, with Japan landed price above the total import average. Australia is the eighth largest mango supplier after Pakistan, but with the highest, Japan landed price among the top 13 mango suppliers at 8.99 USD/kg. The remaining suppliers have relatively lower market shares, of which Malaysia and Dominica have Japan landed prices below the total import average, while the USA, India and Vietnam have Japan landed prices above the total import average.

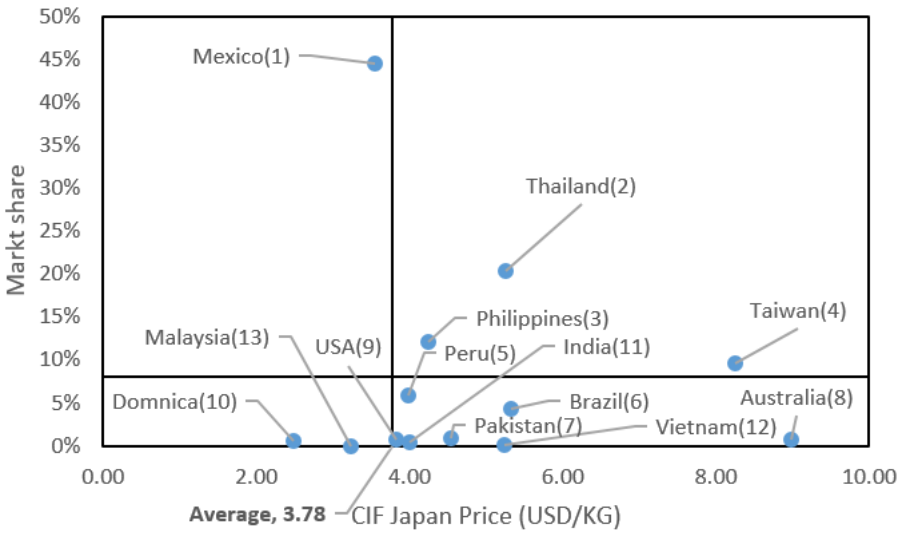

Figure 50 Market share and CIF Japan price of the top 13 mango suppliers in 2013-17

Source: Trade Maps; Mangoes (HS080450); Ranking in the bracket by the average market share (Exchange rate at 1=111 yen)

Avocado – The market shares and Cost, Insurance and Freight (CIF) prices of Japan's top seven avocado suppliers on average between 2013 and 2017 are compared in Figure 51. Mexico is the dominant avocado supplier in the Japanese market, with a market share of 91.18%; however, its CIF Japan price is 2.85 USD/kg, which is just lower than the total import average (2.97 USD/kg). The USA and Peru are the next two largest suppliers, making up 4.32% and 2.48% of the total market imports. Their Japan landed prices are above the total import average, at 3.14 and 3.03 USD/kg. New Zealand and Peru are the fourth and fifth largest suppliers. New Zealand's Japan landed price is above the total import average, at 3.06 USD/kg, while Peru's Japan landed price is below the total import average. Australia and China are minor suppliers in the Japanese market; however, Australia has the highest Japan landed price (5.96 USD/kg) compared with other avocado suppliers. Australia's minor market position could be partially due to only having recent market access into Japan since May 2018.

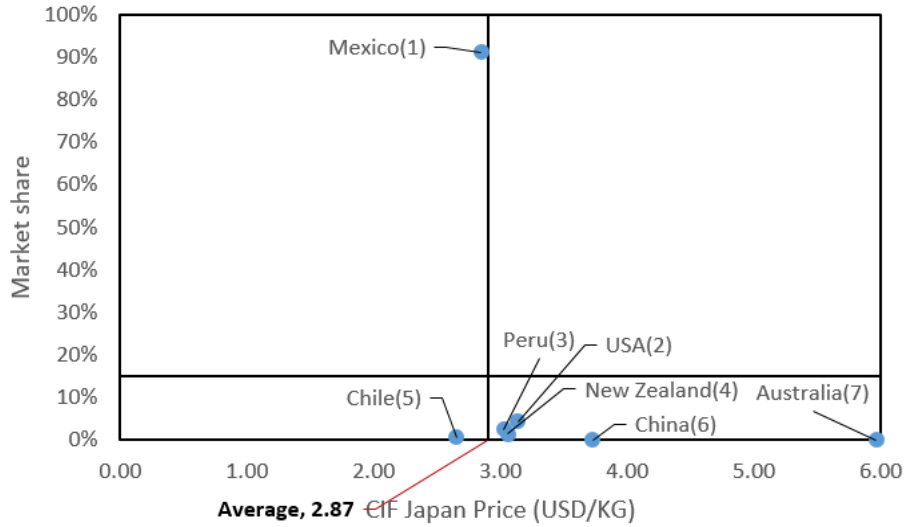

Figure 51 Market share and CIF Japan price of the top 7 avocado suppliers in 2013-17

Source: Trade Maps; Mangoes (HS080450); Ranking in the bracket by the average market share (Exchange rate at 1=111 yen)

Lychee – The market shares and Cost, Insurance and Freight (CIF) prices of Japan's top five lychee suppliers on average between 2013 and 2017 are compared in Figure 52. China is the largest lychee supplier to Japan, with a market share of just below 50%; however, China's CIF Japan price is the lowest (3.78 USD/kg) among the top five suppliers and is lower than the total import average (6.06 USD/kg). Taiwan is the second largest lychee supplier after China, with a market share of 44.14% and a Japan landed price at 8.14 USD/kg. Mexico, which has the CIF Japan price just after Taiwan, is the third largest lychee suppliers, making up 6.71% of total market imports. The USA and New Zealand make up a small portion of the Japanese market; however, their CIF Japan landed prices are the two highest, at 28.96 and 16.89 USD/kg respectively.

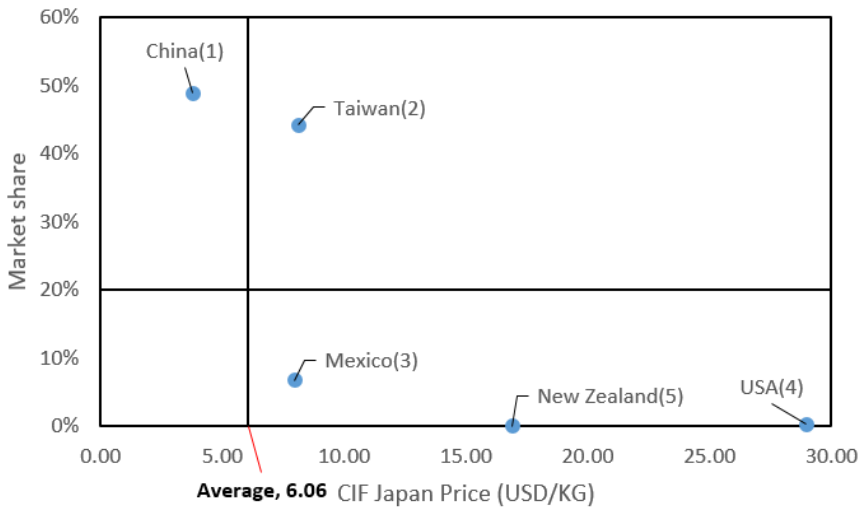

Figure 52 Market share and CIF Japan price of the top five lychee suppliers in 2013-17

Source: Trade Maps; Mangoes (HS080450); Ranking in the bracket by the average market share (Exchange rate at 1=111 yen)

5.2.2.1.5 Competitors in South Korea

Mango - The market shares and cost, insurance and freight (CIF) prices of mangoes from the top 15 mango suppliers to South Korea between 2015 and 2018 are compared in Figure 53. Thailand is the largest mango supplier in the South Korean market, making up over half of the total market imports; however, its CIF South Korea price is just over the total import average at 4.24 USD/kg. Peru and Brazil have much higher market shares compared with Australia, potentially because their mangoes are cheaper than Australia's. Taiwan has higher supply volumes than Australia, even though its mangoes are more expensive. Indian and Pakistani mangoes are cheaper than Australia's; however, their market shares are lower than Australia's. In addition, there are also several other smaller suppliers, including Mexico, Cambodia, the US, China, Canada and the United Kingdom (which don't necessarily grow the fruit) whose landed price in South Korea are higher than Australia. Vietnam and the Philippines are the only two suppliers who supply relatively large volumes and have lower landed prices in South Korea than the average landed price, at 3.31 USD/kg and 2.71 USD/kg each.

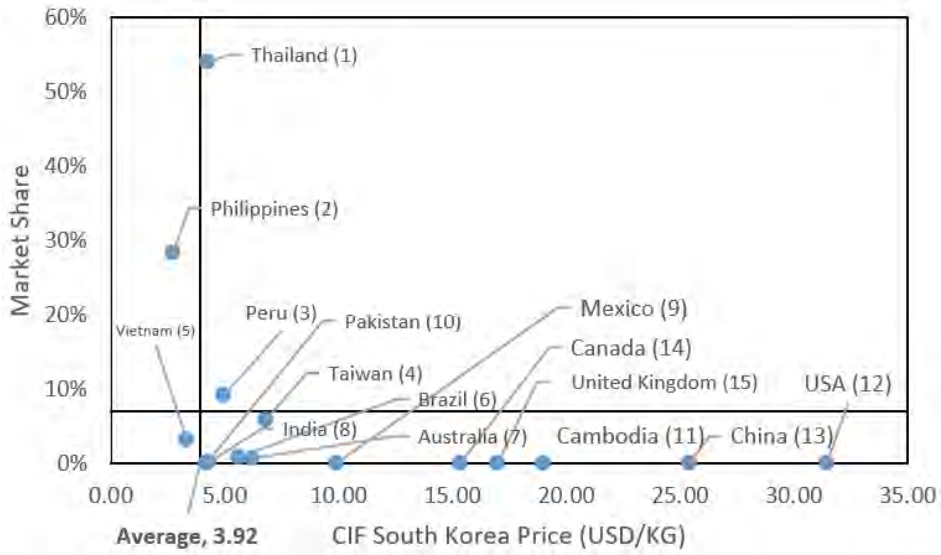

Figure 53 Market share and CIF price of the top 15 mango suppliers in 2015/18

Source: Korea Association of Trade and Industry

Avocado – The market shares and cost, insurance and freight (CIF) prices of mangoes from the top six avocado suppliers to South Korea between 2015 and 2018 are compared in Figure 54. The USA is the largest avocado supplier in the South Korean market, with a market share of 63.25%. Mexico is the second largest avocado supplier after the USA, but with the lowest landed price (3.59 USD/kg)

compared with the USA's 4.66 USD/kg. Although New Zealand's South Korea landed price is higher than the USA's, New Zealand's market share is far lower than the USA's, at 4.71%. Peru, Columbia and Myanmar also supply South Korea, but their market shares are rather small. Columbia and Peru have the two highest CIF South Korea prices compared with other suppliers, at 16.5 and 8.53 USD/kg, while Myanmar has a relatively lower landed price, but the third highest, at 5.00 USD/kg.

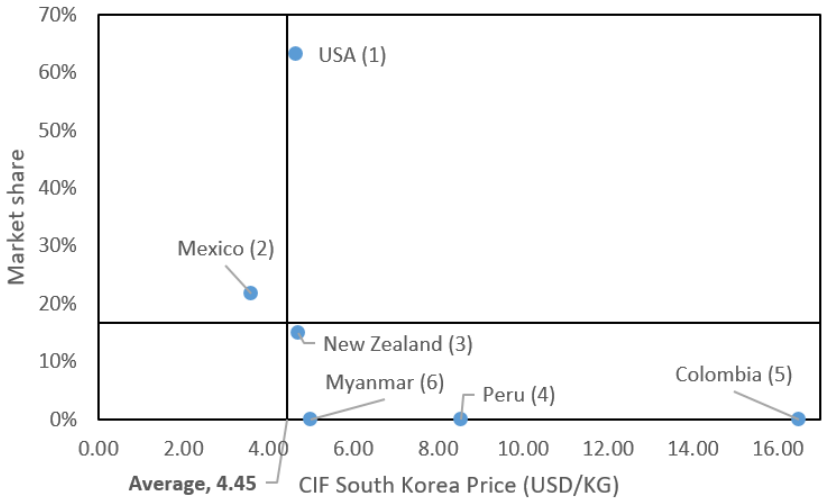

Figure 54 Market share and CIF price of the top 6 avocado suppliers in 2015/18

Source: Korea Association of Trade and Industry

According to trade statistics for South Korea, there is no data available for lychee supply into South Korea.

5.2.1.2 Market strategy

5.2.1.2.1 Market strategies in Hong Kong

Major supplying countries often launch market campaigns in the Hong Kong market. According to Lai (2018), major fruit exporting countries have launched promotional programs in recent years across different media platforms and have successfully established an image and gained the consumers' confidence (Lai, 2018). With the use of quality fruit in fresh desserts and even food service industries, some supplying countries also launched specific promotions, where hotel chefs incorporated high-value fruit into menus, such as desserts using berries, mangoes, and durians. In 2016, ATO Hong Kong facilitated a promotion at a five-star hotel featuring U.S berries used in desserts and cocktails. These types of special menus often attract media attention as diners and bloggers love to share pictures of beautifully presented dishes on social media (Lai, 2018).

5.2.1.2.2 Market strategies in Singapore

Thailand dominates the fruit market in Singapore thanks to quality produce and the government's support with subsidies on the freight costs (Oakeshott and Akem, 2011). With regards to in-market support, the Australian government and suppliers generally do not provide Singapore importers with

any support, indicated by a Singapore wholesaler. On the other hand, authorities from other countries sometimes provide some support, such as subsidies to promote their fruit. Furthermore, one retailer indicated that some exporters from Taiwan, South Korea and China do offer them in-market support, such as working with them on marketing and helping them to promote new products.

5.2.1.2.3 Market strategies in China

Market strategies include special launch events, social media, brand promotion and other avenues to increase awareness of the imported product for both retailers and consumers. South American countries make full use of massive market strategies in the Chinese market to enhance the recognition of their fruit. For example, when Ecuador's first mangoes were exported to China by air to Shanghai, a special ceremony was launched at the Huizhan Market on the 24th October 2016. The event was co-organized by the Ecuador Export and Investment Promotion Agency (PRO ECUADOR), the Ecuadorian exporter Picaler Ecuadorian Mangoes, the mango importer Henro (Shanghai) International Trading Co., Ltd. and the distributor Yuhua Fruit (Produce report, 2016). Ecuador also commenced e-commerce sales for better promotion. Yiguo Fresh held a special press conference to announce that Ecuadorian mangoes officially entered the field of e-commerce sales on 15th November 2016. Ecuadorian mangoes were mainly sold through online shopping platforms such as Yiguo Fresh and Tmall, where relevant promotional activities were launched to achieve better publicity and improve awareness among Chinese consumers (China fruit portal, 2016). Camposol, one of Peru’s largest supplier of mangoes, teamed up with a leading importer Dole to offer Chinese consumers “Peruvian Flame Mangoes” for Springtime Festivities (FreshPlaza, 2018f). They brought Kent mangoes, under the Peruvian Flame Mango branding, to the Shanghai market in 2018.

New Zealand companies also launched market campaigns to promote its fruit. For example, after New Zealand gained official approval for exporting of avocados into China in February 2018, Darling Group and Just Avocados worked with Win-Chain Supply Chain Marketing Limited, the global sourcing centre for e-commerce giant Alibaba, to bring New Zealand’s premium avocado into Chinese markets (Fresh fruit portal, 2018). AVANZA also partnered with Good Farmer, which is Zespri’s agent in China, to supply Chinese customers with large-sized avocados under a new brand for China “Chao Niu Guo” (literally translated as Super Avocado) (Fresh fruit portal, 2018).

In addition to market campaign activities, South American countries, such as Mexico, Chile and New Zealand pay great attention to consumer analysis and market investment in the Chinese market. They have China-based marketing and research groups to analyse Chinese consumers preferences and buying behaviours so that they understand the Chinese markets very well, as indicated by a Chinese importer. The importer further pointed out that South American countries are quite successful because they have taken the time and put in the investment to know their market and

target their fruit accordingly. This includes national approaches to create market opportunities by launching appropriately targeted promotion strategies to capture consumers attention.

5.2.1.2.4 Market strategies in Japan

Major supplying countries launched market promotion activities and campaigns to raise the awareness of their fruit and even differentiate their fruit from other competitors. For example, the U.S. cooperators and trade associations have been working actively to differentiate U.S. fruits from those from other countries by advocating the safety and high-quality of U.S. fruit (Motomura, 2018). According to Motomura (2018), ATO Japan supports these efforts and is available to assist in exploring new opportunities for U.S. fruits in the Japanese market.

5.2.1.2.5 Market strategies in Korea

Market development is also deployed by supplying countries in the South Korean market. For example, AVANZA, a partnership between New Zealand's largest avocado producer - AVOCO and New Zealand's two biggest avocado exporters, Southern Produce and Primor Produce, has been working to educate South Korean consumers on the health benefits of New Zealand avocados and promote the new AVANZA brand (Bopbusinessnews, 2018). AVANZA-led promotional activities include not only educating consumers on the health benefits of avocados but teaching importers and distributors how to correctly handle and store the fruit. As of 2017, the promotional activity included an ongoing association with Maeil Dairies, one of the largest beverage companies in South Korea. The partnership enabled AVANZA to participate in Maeil's soy milk and avocado smoothie promotions, including social media campaigns. AVANZA's market investment also included recipe ideas and supermarket demonstrations, which are seen by marketers as an effective way to reach first-time consumers.

5.2.2 Product intelligence

5.2.2.1 Supply seasonality

5.2.2.1.1 Hong Kong's supply seasonality

The supply of mangoes (HS080450) in the Hong Kong market is year-round. Figure 55 shows Hong Kong's monthly average mango imports in 2016-2017 and supply seasonality by country and region. The supply of mangoes from China, the Philippines, Taiwan, Thailand and Indonesia are available throughout the year in Hong Kong. Brazilian mangoes are available almost year-round (December excluded), although it is a small player in the Hong Kong market. Malaysian mangoes are available for 10 months, excluding June and July, while supply volume is relatively small. Australian mangoes have a relatively longer supply window at eight months. Though Australia's supply commences from August and ends in April, the peak season for Australian mangoes is from November to January in Hong Kong, when Australian mangoes make up 30% of the total market supply. In contrast, South

Africa, Peru and Kenya have shorter supply windows of only a couple of months; however, their supply windows overlap with Australia's.

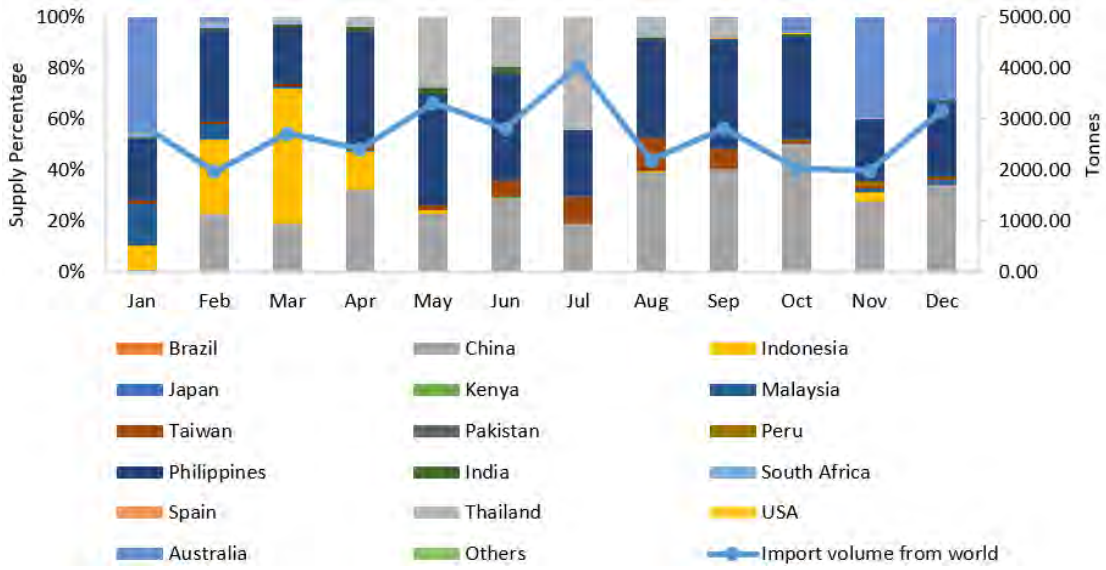

Figure 55 Hong Kong's mango import seasonality by country (2016-17 average)
Source: Trade Maps; Mangoes (HS080450);

The availability of imported avocados (HS080440) is year-round in Hong Kong, with imports peaking at 745 tonnes in June before decreasing to 332 tonnes in December. Figure 56 shows Hong Kong's monthly average avocado imports in 2016-2017 and supply seasonality by country and region. Australian avocados face competition from Mexican avocados throughout the year as Mexico and Australia are the only two suppliers who supply avocado year-around to Hong Kong markets. In contrast to Mexico, Australian avocados have a relatively small market share in Hong Kong, with the highest monthly market share in September at 9.68%. Kenyan avocados can be available in the Hong Kong market for 11 months of the year (January excluded), with peak supply between March and July. Avocados from the Netherlands can also be available for 11 months (September excluded), but with a small supply. The emergence of the Netherlands points to the impact of both protected cropping and the traditional role the Netherlands plays as a re-exporter. This will be a major consideration in emerging global competition. Avocados from Chile and the USA have much longer supply windows, with Chile not supplying mid-year and the USA mainly supplying between March and July. In contrast, supply windows of avocados from Peru and South Africa are concentrated between April and August. Avocados from other small suppliers, including New Zealand, Colombia and Ecuador are occasionally supplied throughout the year.

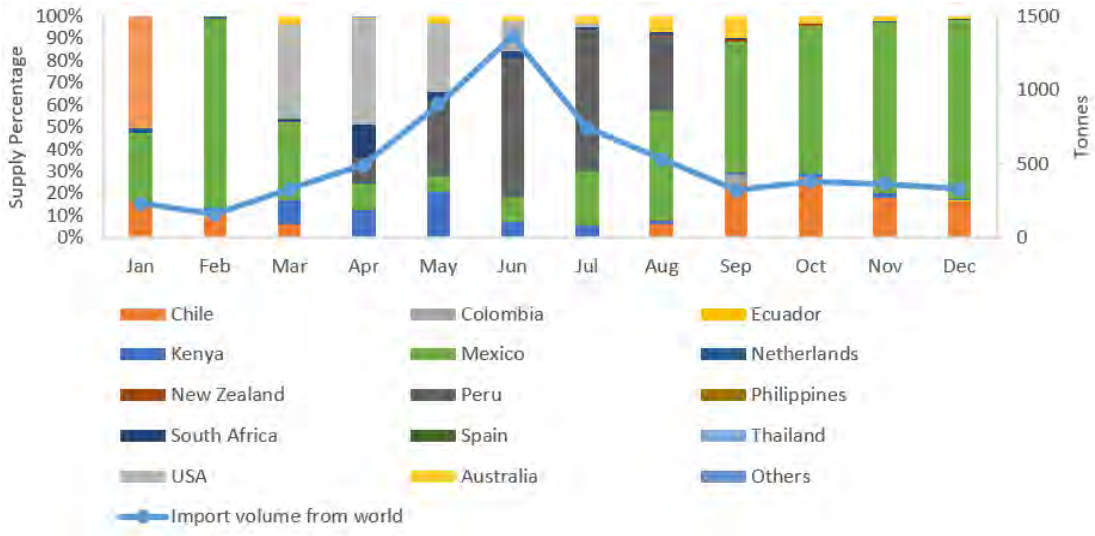

Figure 56 Hong Kong's avocado import seasonality by country (2016-17 average)
Source: Trade Maps; Avocado (HS080440).

The supply seasonality of imported fresh lychees by country in Hong Kong is officially unavailable. If a broader category of lychees (HS 081090) is considered, the data shows that Australia can supply lychees year-round in Hong Kong, which contradicts with Australia's supply window. Because of this, the data collected from the field study in Hong Kong and published information were combined for seasonality analysis. One retailer indicated that lychees available in the Hong Kong market are from Thailand, Taiwan, China and South Africa. Thailand's supply window lasts from March to June, while China and Taiwan's supply windows sit between May and July and between June and July respectively. Australia is therefore counter-seasonal to the three largest lychee suppliers to Hong Kong. As a result, Australia has a supply advantage in the Hong Kong market during Chinese New Year when the northern Hemisphere is "off-season" (Houser, 2018). However, Australia may face competition with South Africa and other Southern Hemisphere countries, such as Madagascar and Réunion, due to the overlayed supply windows (Noller, 2015).

5.2.2.1.2 Singapore's supply seasonality

The supply of imported mangoes (HS08045020 – Mangoes fresh) in Singapore is year-round. Figure 57 shows the changes in world imports by volume and supply seasonality per country. During the period of 2016-17, the highest import volume (2,138.5 tonnes) occurred in May, while the lowest import volume (652 tonnes) occurred in October. Generally, mango supply in the Singapore market tends to increase from January to May and decreases from June to October.

Mangoes from the two largest mango suppliers, which are Thailand and Malaysia, are available throughout the year in Singapore. Mangoes from India, Indonesia and the Philippines are supplied almost year-round in Singapore. Though Australian mangoes are supplied in the market from

September to April only, the peak supply from Australia is between November and January when Thailand and Malaysia are the two major competitors.

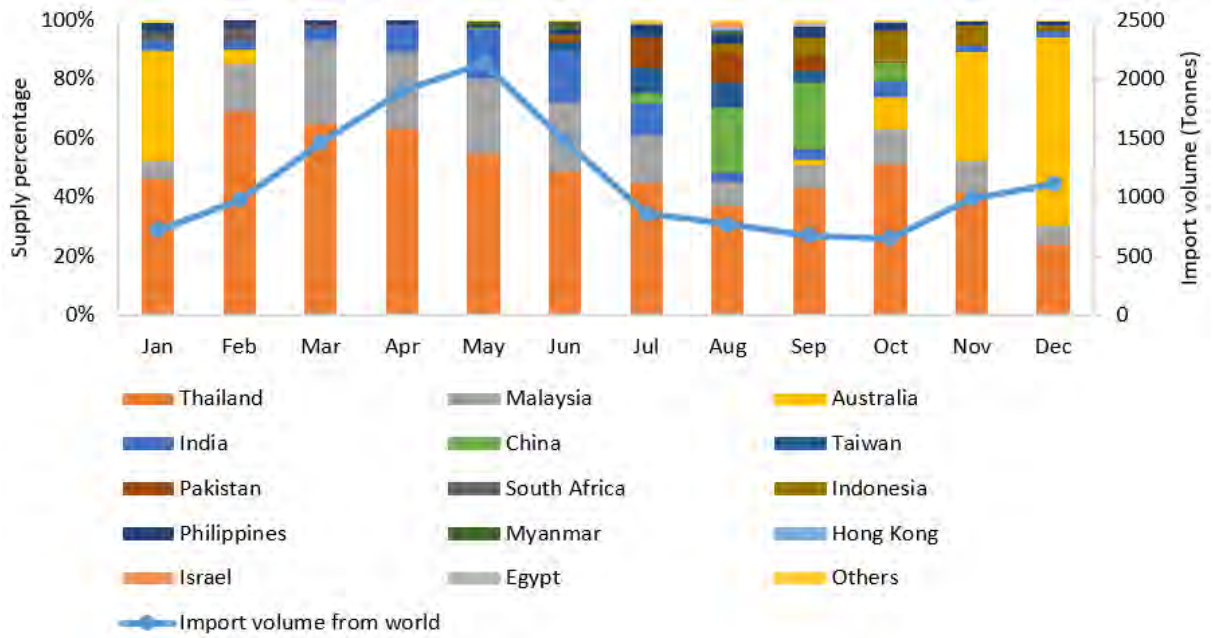

Figure 57 Singapore's mango import seasonality by country (2016-17 average)

Source: Trade Maps; Product: HS08045020 (mangoes fresh or dried);

There is a year-round supply of avocados (HS080440 – fresh or dried avocados) in the Singapore market. Figure 58 shows the changes in imports from the world and supply seasonality by supplying country. Singapore's import volume is relatively flat and fluctuates around 350 tonnes for each month, albeit with the highest supply in November (434.5 tonnes) and the lowest supply in February (247.5 tonnes).

Avocados from Mexico, the USA, Kenya and Australia are available year-round in the Singapore market. This points to a consistent competition among these supplying countries. During the period of 2016-17, avocados from Mexico and the USA had an average monthly market share of 28.61% and 24.79% respectively, which is higher than Australia's (19.06%). Though Australian avocados are available year-round in Singapore, the peak supply is between May and August, when the USA avocados have a relatively larger supply. New Zealand ships more avocados from September to February than Australia; however, its market supply is not available from March to June.

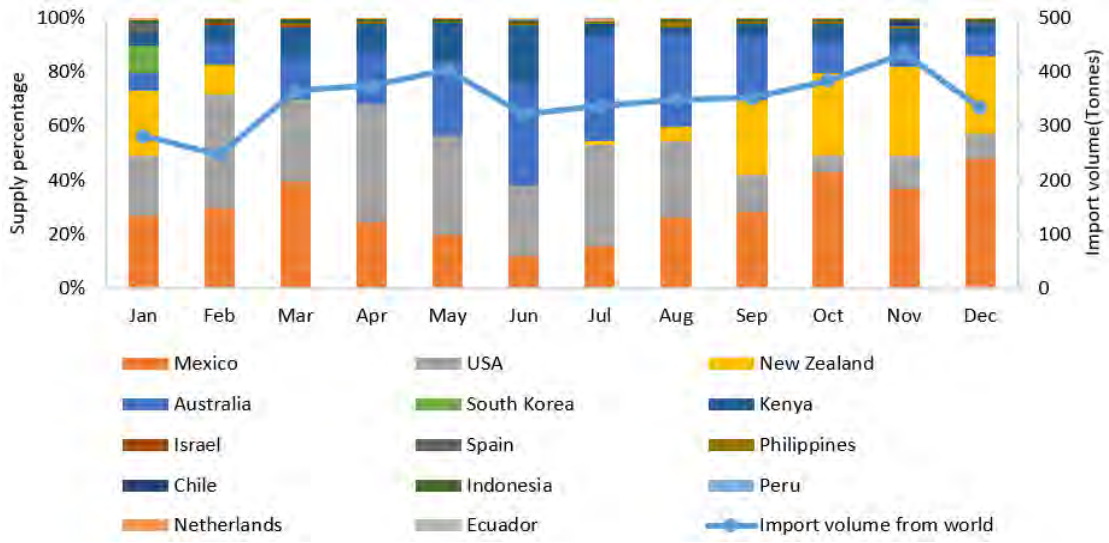

Figure 58 Singapore's avocado import seasonality by country (2016-17 average)

Source: Trade Maps; Product: HS080440 (fresh or dried avocados);

Lychees (HS08109020 – Lychees fresh) are only available in some months throughout the year in the Singapore market. Figure 59 shows the changes in imports from the world and supply seasonality by the supplying country. The highest supply happens between May and June when Chinese lychees are in season. Chinese lychees dominate Singapore's lychee market from May to August, when lychees from Malaysia and Taiwan are also available. Due to the counter-seasonal production with China, Australian lychees dominate the Singapore market from November to February and face competition from Madagascar, which can supply the Singapore market in December.

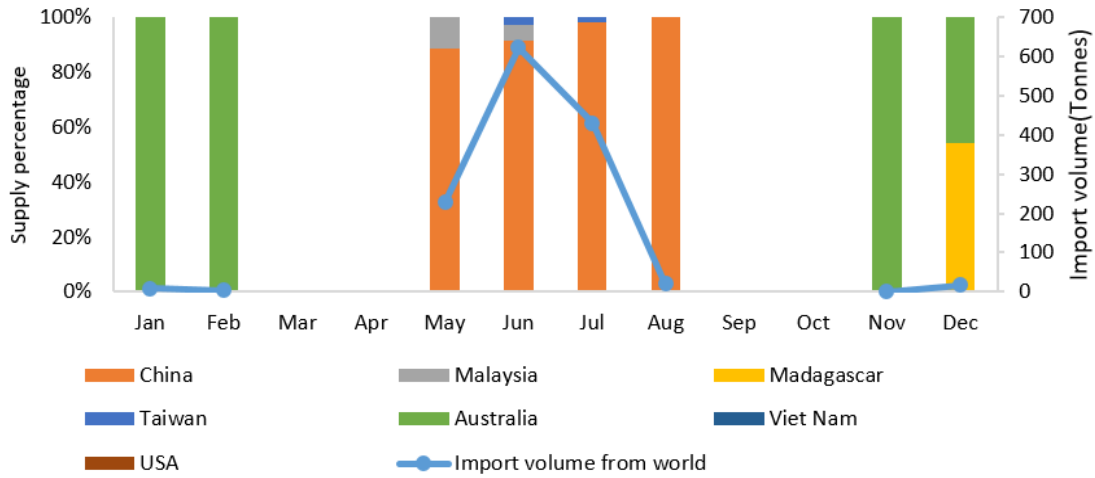

Figure 59 Singapore's lychee import seasonality by country (2016-17 average)

Source: Trade Maps; Product: HS08109020 (Lychees fresh);

5.2.2.1.3 China's supply seasonality

China has a year-round mango (fresh or dried) import program so that imported mangoes are available throughout the year (Figure 60). Mangoes from Thailand and Philippines are available year-round in the Chinese market, while mangoes from other countries are available for just a few months. Australian mangoes are supplied from October to January to China when mangoes from Thailand, Philippines, Ecuador and Peru are also available. As a result, Australian mangoes face competition with these supplying countries. Peru is the major competitor for Australia in China as more mangoes from Peru are imported into China than from Australia.

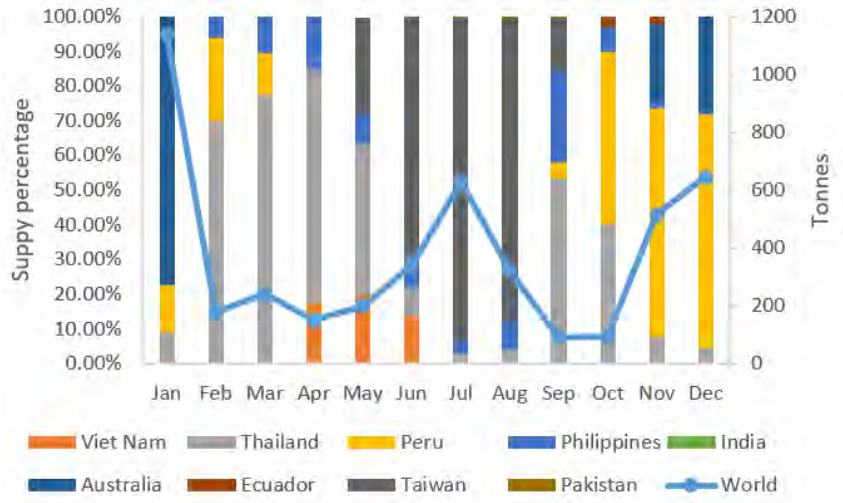

Figure 60 China's mango import seasonality by country (2016-17 average)

Source: Trade Map; Product Code HS 08045020 (Mangoes, fresh or dried)

Imported avocados are supplied year-round in China. Avocados from Mexico and Chile are available all year (Figure 61). Mexican avocados have a peak supply around April, while Chile's peak supply is around October. Peruvian avocados are available in China from March to October. The peak supply of Peruvian avocados is around July when Mexico and Chile are in low supply. New Zealand is the fourth country approved to export to China in late 2018. Its supplying seasonality data is not yet available.

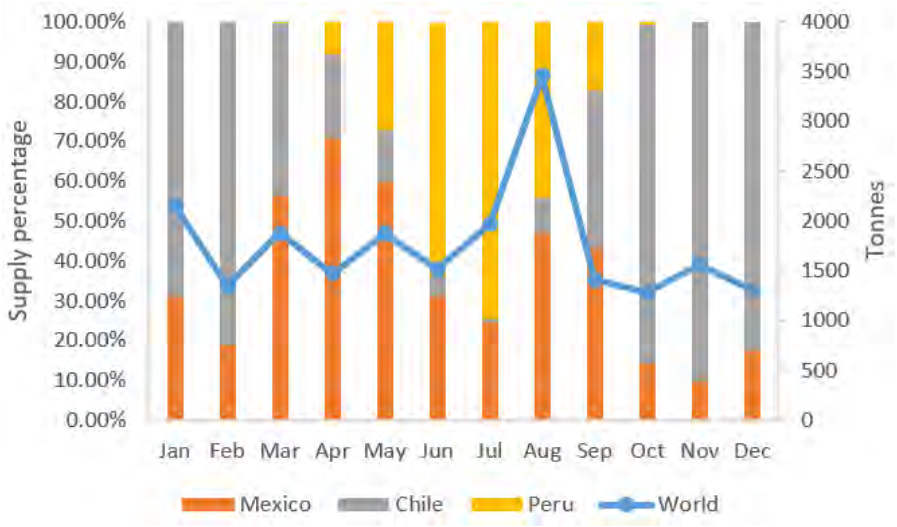

Figure 61 China's avocado import seasonality by country (2016-17 average)

Source: Trade Map; Product Code HS 080440 (Fresh or dried avocados)

China has a short lychee import seasonality as it imports from Thailand and Vietnam only (Figure 62). The supply of Thailand lychees in China starts from April to June and also December, while Vietnam's supply is from May to August. Thailand and Vietnam do not compete with each other in April, July, August and December; however, they have to compete with local production in May to August.

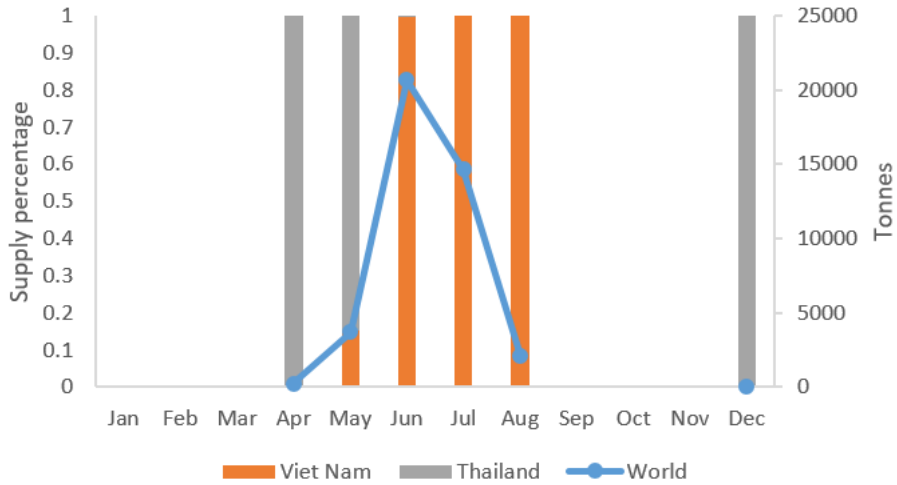

Figure 62 China's lychee import seasonality by country (2016-17 average)

Source: Trade Map; Product Code HS 08109010 (Lychee, fresh)

5.2.2.1.4 Japan's supply seasonality

The supply of imported mangoes in Japan is available throughout the year, although imports mostly occur between April and July (Table 53). There is a year-round supply of mangoes from Thailand in the Japanese market. Mangoes from Mexico and the Philippines have a relatively longer supply window (8 months). Australia, Brazil and Peru have shorter supply windows, however, they have

counter-season production with Japan. As such, they can supply the market when local production is out of season and the volumes from major suppliers (i.e. Mexico and Thailand) are low.

Table 53 Mango's monthly import volume and seasonality in 2018

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mexico		4	39	374	843	727	926	400	129			
Thailand	72	95	214	535	543	199	51	29	58	48	50	74
Philippines	5	3	8	119	162	39	5	1				
Taiwan					4	288	331					
Australia	3	10									3	14
Brazil	8	14	7						39	73	88	24
Peru	126	211	259	64								47
Mexico		4	39	374	843	727	926	400	129			

Source: Trade Statistics of Japan (Tonne)

Mexican avocados are available year-round in Japan. The supply window from Peru and the USA is much longer compared to New Zealand, supplying the market from May to October and from March to August respectively. New Zealand's avocados are available in Japan between October and December only when the supply from Peru and the USA is low (Table 54). Australian avocados were recently approved for exporting into Japan in May 2018, with the first shipment landing in December.

Table 54 Avocado's monthly import volume and seasonality in 2018

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mexico	5,043	5,367	6,341	5,836	5,601	5,123	5,216	4,761	4,551	5,290	6,488	5,833
Peru					52	631	1,635	1,439	873	532		
USA			123	449	1,327	671	250	31				
New Zealand										170	243	90
Australia												1

Source: Trade Statistics of Japan (tonne).

Japan imports lychees for only a few months in a year. The supply of lychee imported from Taiwan and China mainly occurs from May and July, when it is the producing season in China and Taiwan. The supply window of Chinese and Taiwan lychees in Japan is shown in Table 55.

Table 55 Lychee's monthly import volume, seasonality and variety in 2018

	Variety	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Taiwan	Gyokukahou Kokuyou					48	105	1					
China	Hishishou					34	76	11					

Source: Trade Statistics of Japan (tonne).

5.2.2.1.5 South Korea's supply seasonality

The supply of imported mangoes in South Korea is available year-round, although the import supply occurs mostly between January and June (Figure 63). Mangoes from Thailand, the Philippines and Vietnam are available year-round in South Korea. The supply from Thailand is most stable throughout the year and has the highest monthly average market supply (52.65%), whereas the supply from the Philippines (17.63%) and Vietnam (5.15%) is more seasonal. Mangoes from Peru, Brazil and Mexico have wide supply windows (more than 6 months). Unlike Mexican mangoes which have a scattered supply throughout the year, Brazilian and Peruvian mangoes are mainly available from July to December and from November to June respectively. Taiwanese and Indian mangoes have short and overlapping supply. Taiwanese mangoes have the highest market supply in July (45.28%), when Thailand mangoes are in the lowest supply. Australian mangoes are mainly available in the South Korean market in November and December when the supply from Thailand, the Philippines, Vietnam and Brazil is available.

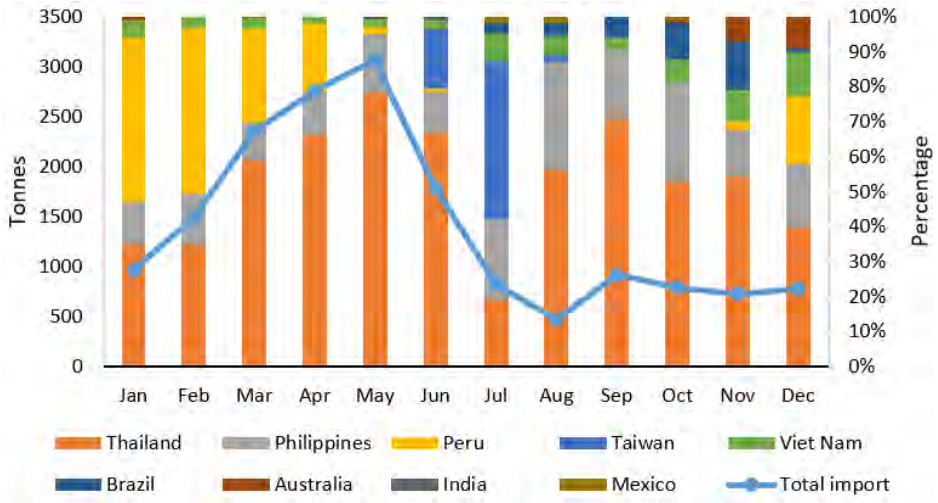

Figure 63 Monthly mango import volume and supply seasonality in 2018

Source: Korea Association of Trade and Industry (HS code: 0804502000)

The supply of avocado's to the South Korean market is year-round thanks to imports from several countries, including predominantly Mexico, the USA and New Zealand (Figure 64). While the supply of avocados in South Korea is available throughout the year, the import supply

occurs mainly between February and July, when the American avocados dominate the market supply with more than 80% of the market share. Mexican avocados are mainly supplied from August to March. New Zealand's avocados are in low supply from July and January, although its market share is relatively higher between September and November when USA supplies are low.

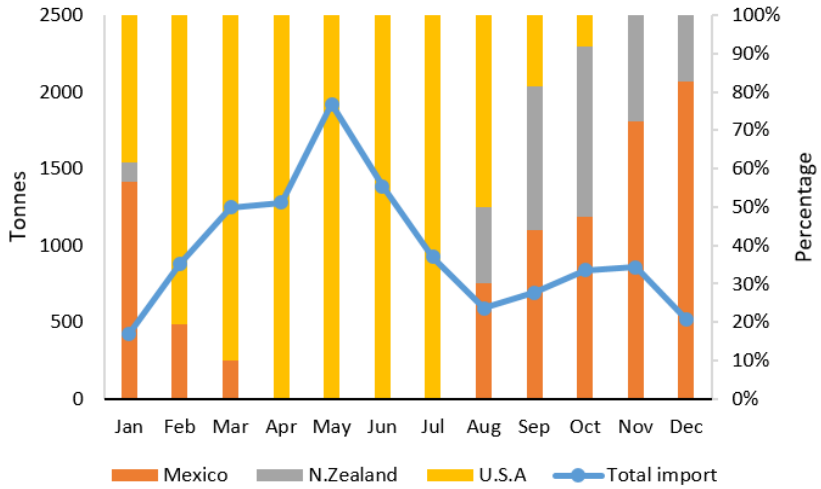

Figure 64 Monthly avocado import volume and supply seasonality in 2018

Source: Korea Association of Trade and Industry (HS code: 0804400000)

According to the trade statistics for South Korea, no data for lychee supply seasonality is available in Korea.

5.2.2.2 Sales prices

5.2.2.2.1 Hong Kong

Mango – Australian mangoes (R2E2) are thought to be good quality as indicated by interviewees. Meanwhile, they indicated that mangoes from Taiwan, Thailand, Japan and India are also viewed as good quality. Figure 65 shows the origin of production, variety and retailing price of some mangoes sold on 4th May 2019 in the Yau Ma Tei wholesale market. Though many mangoes are not given an indicated origin of production, mangoes from Japan, Taiwan, Philippines, Australia, Thailand, Cambodia and Columbia are sold in the market. The most expensive mango is the Miyazaki mango from Japan, which is sold at $33.33 (exchange rate for the Australian Dollar and Hong Kong Dollar is set at 5.4; hereafter). There are also Miyazaki mangoes from Columbia, which is sold at $15.82 – cheaper than the Japanese Miyazaki mango, but more expensive than other mangoes. Australian R2E2 is sold at $12.93 per piece or $15.82 per three prices, which makes it the third most expensive mango. Taiwan's Irwin mangoes are cheaper than Australian R2E2 mangoes, sold at $12.96-$14.81 per two pieces, with a higher price for selective mangoes. In contrast, mangoes from Thailand, the Philippines and Cambodia are much cheaper and often sold at $9.26 per four pieces. Nam Dok Mai

and Crown are the two major varieties from Thailand, while Carabao is the main variety from the Philippines. In addition, organic mangoes are sold in the market, but without indicating the origin of production and variety.

Figure 65 A snapshot of mango sold in the Yau Ma Tei wholesale market

Grocery chain stores, including Wellcome and Parknship and high-end supermarkets, sell mangoes either by piece or by weight (Pound). Generally, mangoes in high-end supermarkets are more expensive than in grocery chain stores. Meanwhile, the price in grocery stores is higher than that in the Yau Ma Tei market. For example, Thailand's Nam Dok Mai is sold at $8.33 per piece in City Super and Taiwan Irwin mango is sold at $13.50 per piece, while the large green mangoes from Vietnam are sold at $4.43 per piece in Parknshop. Grocery chain stores and high-end supermarkets mainly have mangoes from the same supplying countries and with the same variety. However, they tend to differentiate between their competitors through the country of origin and variety and a rare variety is often very expensive. For example, Indian mangoes and Taiwan Heixiang Mango are only sold in City super, where Taiwan's Heixiang Mango is sold at $20.70 per piece.

Avocado – Australian avocados are thought to be the best by interviewees in terms of the percentage of dry matter and appearance, compared with avocados from other major supplying countries. Figure 66 shows the origin of production, variety and the retailing price of avocados from Australia, Chile and Philippines sold on 4 May 2019 in the Yau Ma Tei wholesale market. Australian avocados are sold at $9.26 for two pieces of large fruit and four pieces of a medium-sized fruit. Chile

medium-sized avocados are sold at the same price as Australia's medium-sized fruit. In contrast, Philippines avocados are much cheaper and sold at $7.41 per five to six pieces.

Figure 66 A snapshot of avocado sold in the Yau Ma Tei wholesale market

Though the origin of production of avocados is not given in some grocery chain stores and high-end supermarkets, avocados from the USA, Mexico and Spain were sold. Australian large avocados are common in grocery stores and high-end supermarkets, where they are sold by pieces, while avocados from Mexico and Chile are sold either by pieces or in pre-packed net bags. A net bag of re-packed avocados with five pieces are often sold at $6.09 in Parknshop and their premium outlets, including Taste and Fusion. There is a large gap in the sales price between Australian large avocados and Mexican medium-sized avocados within a store. For example, Australian large avocados (labelled as XL Avocado (Australia) are sold at approximately $6.65 per piece in Taste, while Mexican avocados are sold at $4.37 per three pieces. Also, organic avocados from the USA and Spain were sold in City Super and Fusion respectively. In City Super, one piece of organic avocado from the USA was sold at $5.93, which is cheaper than the Australian large avocado ($6.48), while one piece of Mexican avocado was sold at $3.70.

Lychee – Australian lychees were not available during the field study in Hong Kong. However, some lychees from China were sold in the Yau Ma Tei wholesale market (Figure 67). Chinese lychees are often sold in bunches with leaves as shown in Figure 67. The retail price for the variety 'Bai Tang Ying' ranges from $5.56 to $7.04 per pound. In contrast, Australian lychees are mainly sold in re-packed punnets weighing 500g in grocery chain stores and high-end supermarkets.

Figure 67 A snapshot of lychees sold in the Yau Ma Tei wholesale market

5.2.2.2.2 Singapore

Mango retail - R2E2 from Australia is a benchmark mango preferred by the consumer in Singapore (Oakeshott and Akem, 2011). Premium prices were often based around the R2E2 Australian variety which features a good blush and large size (Oakeshott and Akem, 2011). Australian R2E2 were not sold in the Singapore retail outlets during the field study in late April 2019; however, Thailand R2E2 mangoes were available in the market. Figure 68 shows the retail prices of some Thailand mangoes in Singapore. The retail price of one piece of Thailand R2E2 mango was recorded at 4.39 AUD (exchange rate: 1SGD=1.1 AUD) in a chain supermarket, which is higher than other Thailand mangoes. For example, the retail price for one piece of rainbow mangoes and honey mangoes is $2.04 and $1.87 AUD respectively. The retail price is much higher in a premium supermarket. Even so, one piece of premium quality Thailand honey mangoes is sold at $4.35 AUD, which is slightly below the price of a Thailand R2E2 mango in a chain supermarket.

Figure 68 Mango retail prices in Singapore

Avocado retail - Australian avocados were not sold in retail stores in Singapore; however, avocados from the USA and Mexico were available in the market (Figure 69). The retail price of one piece of avocado from The USA and/or Mexico in chain supermarkets ranged from $1.82 to $2.42 AUD. Premium supermarkets generally sell large-sized avocados – XL, which are much more expensive compared with avocados in chain supermarkets. The special offer for three pieces of XL avocados was $8.75 AUD, with each piece of avocado at $2.92 AUD.

No lychee sales were recorded in the Singapore market when the field study was conducted on 24th - 29th April 2019.

Figure 69 Avocado retail prices in Singapore

5.2.2.2.3 China

Mango wholesale - mangoes imported from Thailand, Vietnam, the Philippines and Taiwan have experienced reduced sales prices in recent years in China. This is not only because they have to compete with cheaper local mangoes with overlapping supply windows, but also because China has introduced popular varieties, for example, Green Mango and R2E2, and have improved existing varieties, that contribute to improved quality and taste. However, mangoes from Peru, Ecuador and Australia often have strong sales due to their counter-seasonable supply.

Most Chinese importers would regrade and re-pack Australian mangoes upon arrival. They re-grade the mangoes based on the blush level – generally Premium at above 80% blush, first class at 60-80% blush and second class at above 30% blush. After re-grading, they re-pack the fruits with different branded boxes to show the different grades, before selling in the wholesale markets.

Australian mangoes are generally sold from October to February in the wholesale market in China, with larger volumes in November and December. Figure 70 compares the changes in wholesale price for Australian premium and first class mangoes in China. The wholesale price for premium and first class mangoes is initially at $80-$96 per tray in October and comes down to $60-$80 per tray with increased volumes, before plunging to $40-$70 per tray in December and returning to $60-$80 per tray. Second grade mangoes are sold about $10-$16 lower than first grade fruits.

Figure 70 The lowest and highest wholesale price for Australian mango in China

Mango retail - Imported mangoes are often sold by the piece or in gift packs in offline retailing stores. They are also sold in the form of a gift pack, simple pack, bag pack and or case pack in online retailing. In addition, mangoes are often sold with other fruits as a bundle. Mangoes are often pre-packed for value-adding. The retailing price for Australian mangoes is shown in Figure 71.

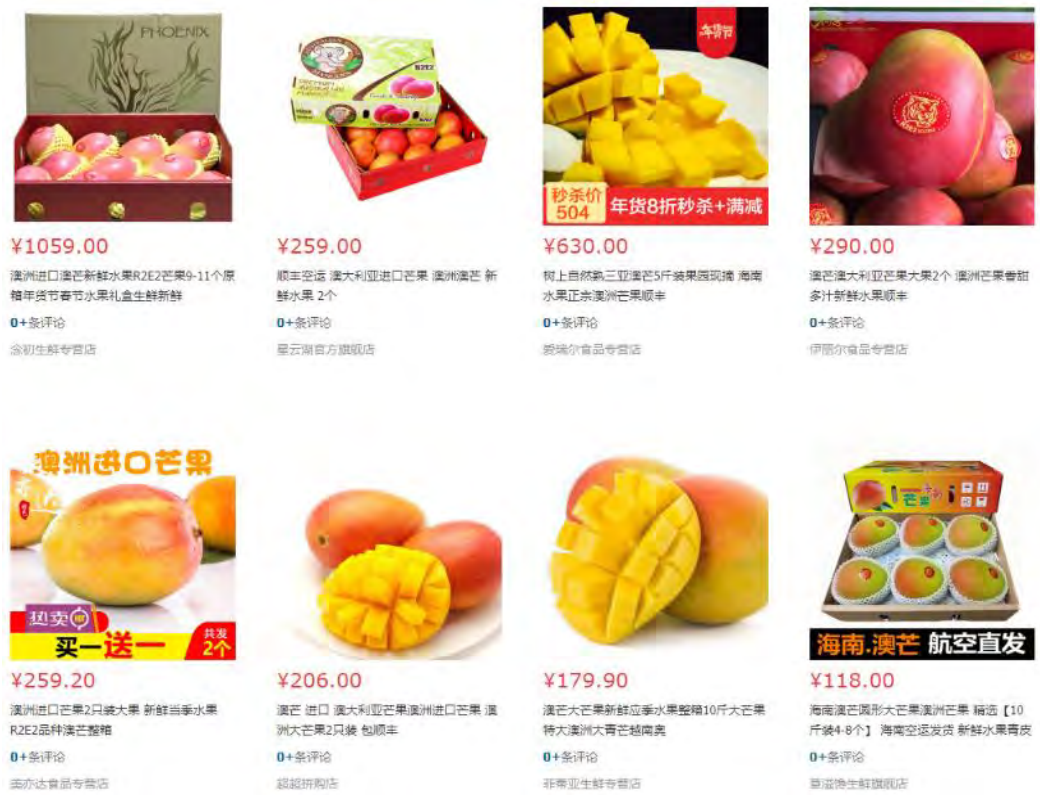

Figure 71 Online retailing price for Australian mango in JD. COM

On JD. COM, Australian mangoes (R2E2) are sold as either an original gift tray (Figure 13 - top left 1) or two pieces (top right 1 and 3). Figure 13 shows the sales price posted by different online sellers.

The price may vary greatly from one seller to another. The prices shown in Figure 13 can be used as a reference. The retailing price (delivery included) for a 7 kg tray with size counts 9-11 is $211.80, while the price for two pieces (about 1.2 kg per piece) is about $51.8-$58 or $43-$48 per kilo. Generally, instore and online retailing prices are often fixed, but sometimes with a price drop or discount for promotions. R2E2 grown in Hainan and Vietnam are also sold on JD. Com, but the price is relatively much lower than for Australian R2E2. The retailing price for Hainan Grown R2E2 (Bottom right 1) is $2.36 per kilo, while the price for Vietnam R2E2 (Bottom right 2) is $3.60 per kilo.

Avocado wholesale - The wholesale price of avocado from Mexico, Chile and Peru have shown a downstream trend compared with previous years. In 2017, the wholesale price for Peru's avocado fluctuates between $16-20 and $30-34 per 4kg tray, while the wholesale price for Mexico's avocado varies from $32-$34 to $56-$60 per 6kg tray. The highest prices only last for a short time if compared across three years. The lowest wholesale price occurred in 2018. In particular, Chile's avocado hit the lowest price in October and November at $10 per 4kg tray, which lasted for about three to four weeks. Although its prices recovered, they only reached $20-$24 per kg. Mexico's avocado also saw reduced prices, although its taste and appearance are more attractive to customers. It has been a reality that avocado is not considered a luxury fruit any more as the prices have fallen much lower than in previous years. The price reduction is mainly because more countries have gained market access to China and larger volumes are imported in recent years.

Avocado retail – Imported avocado are often sold by the piece or in gift pack in offline retailing stores, while they are sold in the form of a gift pack, simple pack, bag pack and or case pack in online retailing. As opposed to mango sales, consumers can choose either 2, 4, 6 or 12 pieces. In addition, avocados are also sold with other fruits as a bundle. Figure 72 shows the sales price posted by three online sellers - JD director sales, Dole and Chunzhen Fresh. The retailing price varies from $1 to $2.08 per piece based on their appearance and size. Generally larger fruits are more expensive than smaller fruits. For example, the cheapest selection is $5.98 per six pieces with each piece weighing 100-130 grams, while the expensive selection is $10.4 per six pieces with each piece weighing 200-240 grams.

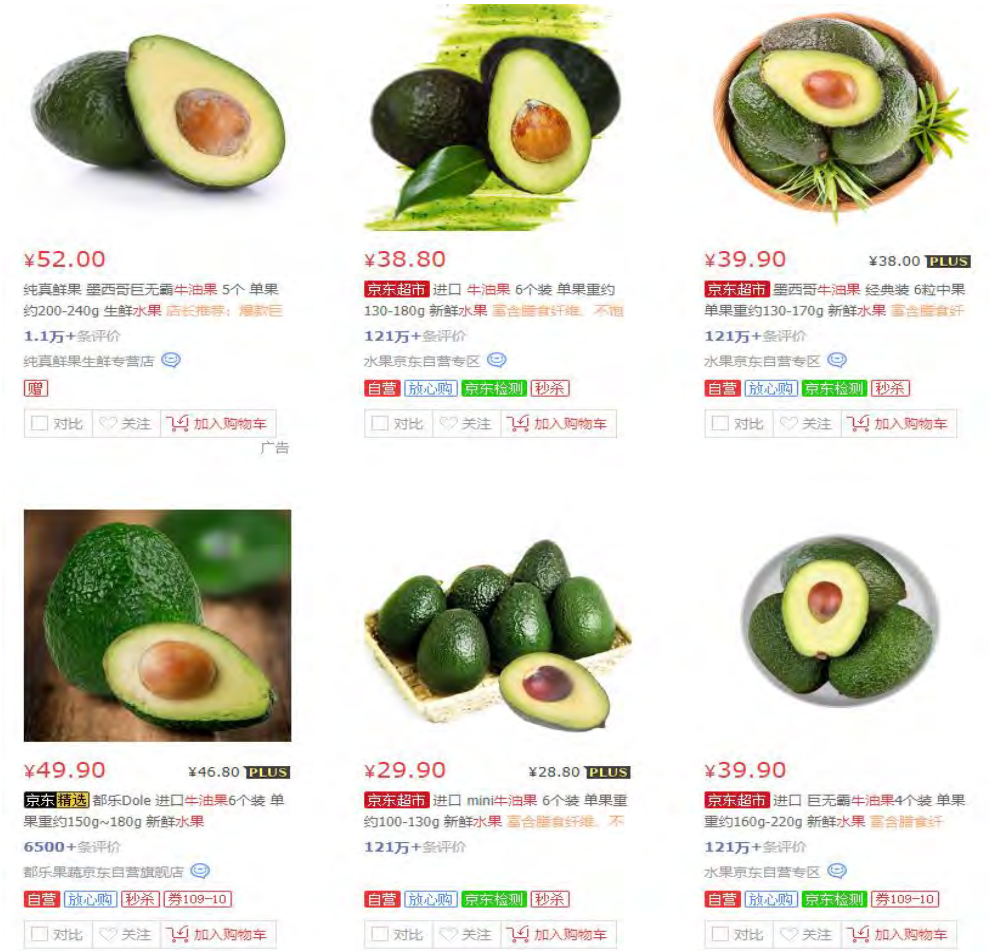

Figure 72 Online retailing price for imported avocado in JD. COM

Lychee wholesale - The sales of Thai lychees often starts in April or May in wholesale markets in China. Its sales price is commonly low at about $20 per 5kg tray, although it may increase to $30 per 5kg tray. In contrast, there is a small volume of Vietnam lychees sold in the wholesale markets.

Lychee retail - Fresh lychees are also sold in the form of a gift pack, simple pack, bag pack and or case pack in online retailing. In addition, lychees are also sold with other fruits as a bundle. There are frozen lychees available to cater for different customer's needs. Currently, lychees are not available in Chinese markets as it is out of season. Lychee is not an expensive fruit in China compared to Australia. Lychee retailing prices peaked in 2017, with average prices at $4.4 per kg (Tina, 2018b).

5.2.2.2.4 Japan

Mango wholesale – The wholesale price of imported mangoes on average has decreased from 2015 to 2018. Mangoes from all the major supplying countries (Mexico excluded) have experienced decreasing wholesale prices, as shown in Figure 73.

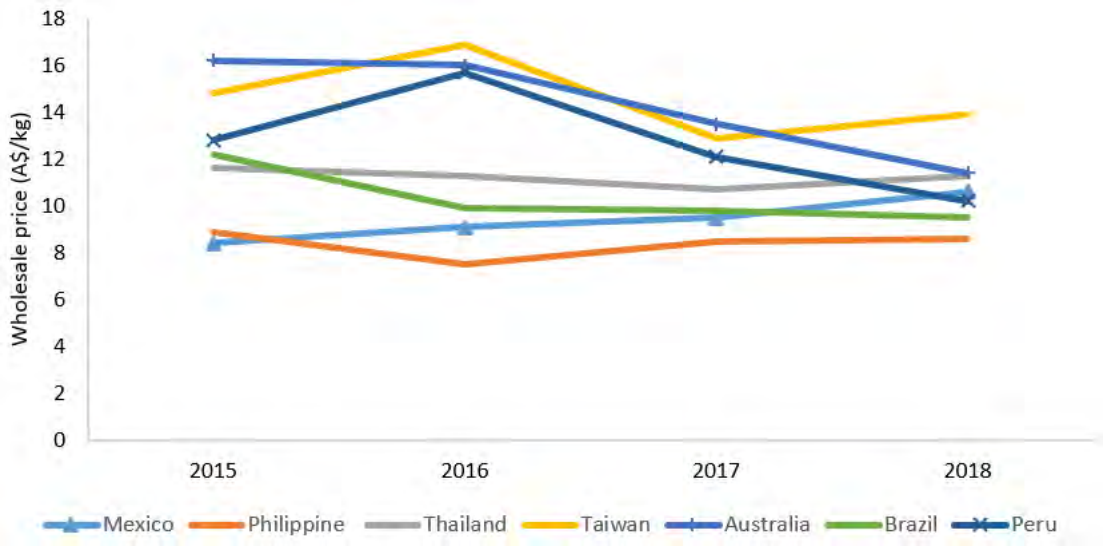

Figure 73 Wholesale price of mango by country from 2015 to 2018

Source: the Tokyo Wholesale Market (Exchange rate at A$1=75.8 yen)

Australian mangoes had the highest wholesale price in 2015, but show the most significant price reduction, decreasing from $16.2/kg in 2015 to $11.4/kg in 2018. Taiwanese mangoes were the second most expensive, after Australian mangoes in 2015; however, they have become the most expensive mangoes in 2018, at $13.9/kg. Wholesale prices for mangoes from Peru, Brazil and Thailand all averaged around $12/kg in 2015 However, their wholesale prices generally have decreased over the years. Brazilian mangoes, in particular, had a significant price reduction, dropping from $12.2/kg to $9.5/kg. In contrast, Mexican mangoes have seen an increase in the wholesale price, from $8.4/kg in 2015 to $10.6/kg in 2018. Because of the changes in the wholesale price over the past four years, the price gap among major supplying countries became smaller in 2018 when compared to 2015.

Locally produced mangoes are generally more expensive than imported mangoes. Mangoes produced in Japan are valued as a premium mango due to their unique production and strict quality control. For example, farmers control the quality by placing a small net under each mango, so that it will not drop after it is ripened. Mangoes cultivated in Miyazaki prefecture are widely known for their high quality with a rich sweetness and scrumptious aroma. As a result, the wholesale price for Miyazaki mango is normally from $50 to $90 per kg, but values at over $5,000/kg have been recorded (Japan today, 2017). Moreover, mangoes are produced even in Hokkaido, which is located in the northern part of Japan. The wholesale price for the Hokkaido mango harvested in winter is also high, from $55 to $85 (Fresh Plaza, 2016e).

Mango retail - Imported mangoes are usually sold either by piece or by bag pack in traditional retailing channels, such as supermarkets and independent small fruit shops. Mangoes in the

supermarket are normally displayed on the shelf with protective packages. In contrast, department stores mainly sell mangoes in a gift pack for gift purposes. Product details and instructions are also attached to the packaging, including storage advice and nutrients, which add value. The packaging is mostly designed for the small size of a typical Japanese family. Japanese people consume mango by neatly cutting its fresh into dice shapes, so advertisements are often displayed as shown in Figure 74-(8).

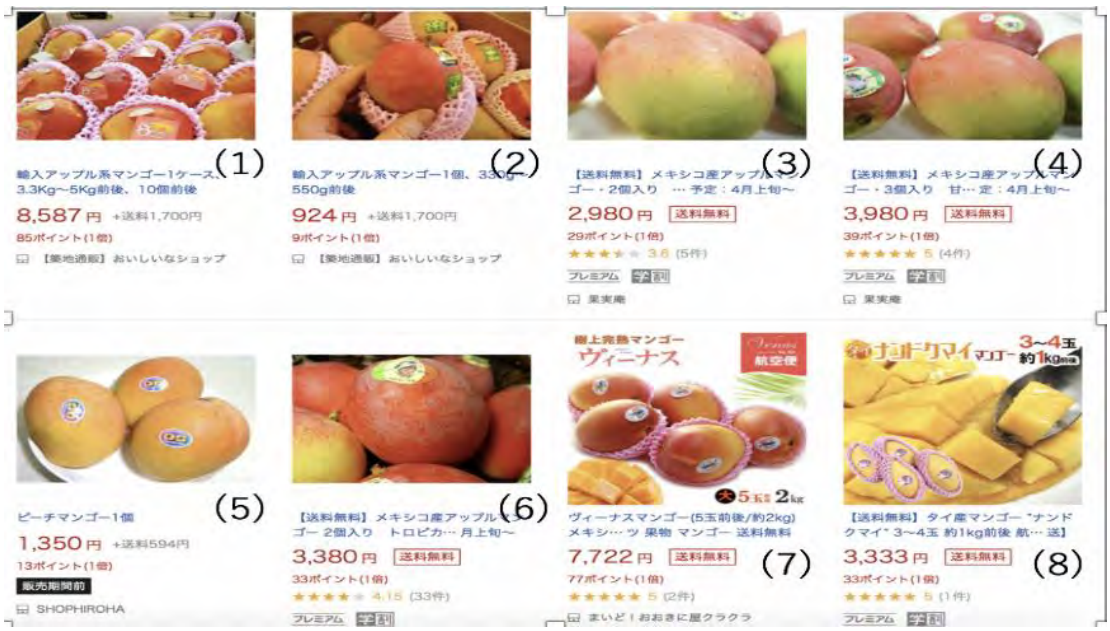

Figure 74 Online retailing price for imported mangoes in Rakuten.com (6th May 2019)

Figure 74 shows the sales price posted by different online sellers on the Rakuten.com site. The price may vary from one seller to another. The retailing price for two pieces (about 0.6kg-1kg) from Mexico is about $37-$45 (Figure 74-(3), (6)), while the price for a 2kg tray with size counts five is $101 (Figure 74-(7)) and for 3.3-5kg tray with size counts ten is $115 (Figure 74-(1)). Thailand mangoes are also sold on this site. The retailing price for Nam DorcMai is $45/kg (Figure 74-(8)). Kensington Pride from Australia is sold at $17/piece (Figure 74-(5)). Some retailers sell imported mangoes online without indicating the origin of production. They instead only mention the type of mango by colour or appearance. For example, apple mango refers to Haden, Kent or Tommy Atkins from Mexico and Brazil as their skin is reddish, giving an apple-like appearance. Peach mango refers to Kensington Pride from Australia as its skin is peach coloured. Yellow mango refers to Carabao from the Philippines. Mango varieties sold by retailers are generally those that can be found in the wholesale market (Figure 74-(1), (2)).

Generally, the retail price for locally produced mango is much higher than the imported. Since imported mangoes have diminished quality due to the vapour heat treatment, domestic producers differentiate their produce from the imported produce and emphasise their high quality in

advertisements. Figure 75 shows two domestic premium brands. One premium mango, called Taiyo no Tamago (Egg of the sun), is sold at $65 per two pieces (Figure 75-(2)). According to the Miyazaki Agricultural Economic Federation, mangoes sold under the brand ‘Taiyo no Tamago’ must meet strict criteria: weigh at least 350g each, possess a high sugar content and have more than 50% of their skin covered in a bright red hue. Its main supply season is between mid-May and mid-June. Another premium mango from Hokkaido, branded as “Sun in the snow” is sold at $220 for two pieces (Figure 75-(1)). The mangoes grown in Hokkaido have slightly higher sugar levels than those produced in other regions due to the island's particular climate (Fresh Plaza, 2016e). The reason for its highest price is mainly because they are produced in the greenhouse, surrounded by snow. (Fresh Plaza, 2016e).

Figure 75 Online retailing price for Domestic premium mangoes (6th May 2019)

Organic mangoes produced in Japan are sold with a JAS certificated seal at $129 for a 4kg box (Figure 76-(1)). Some imported mangoes are sold as an organic mango product in the form of canned mango or dry mango. Figure 76-(2) shows dried mango processed from Nam-Dorkmai in Thailand and is sold at $38 per 500g.

Figure 76 Online retailing price for organic mangoes 6th May 2019)

Avocado wholesale - The wholesale price of imported avocados slightly decreased from 2015 to 2018. Changes in the wholesale price of avocados from four major supplying countries are shown in Figure 77. Avocados from Mexico which is the largest avocado supplier in the Japanese market had a stable wholesale price from 2015 to 2018, at around $6/kg. In contrast, wholesale prices for avocados from other supplying counties, including Peru, the USA and New Zealand, fluctuated over the same period. American avocados experienced the most significant fluctuation in the wholesale price, ranging from $4.7 to $7.5/kg. Although New Zealand's avocado recorded the lowest wholesale price ($4.6/kg) in 2016, most of their wholesale prices stood at over $6/kg. The wholesale price of Peru's avocados also fluctuated; however, there is generally an upward trend, with the wholesale price up from $3.8/kg in 2015 to $5/kg in 2018.

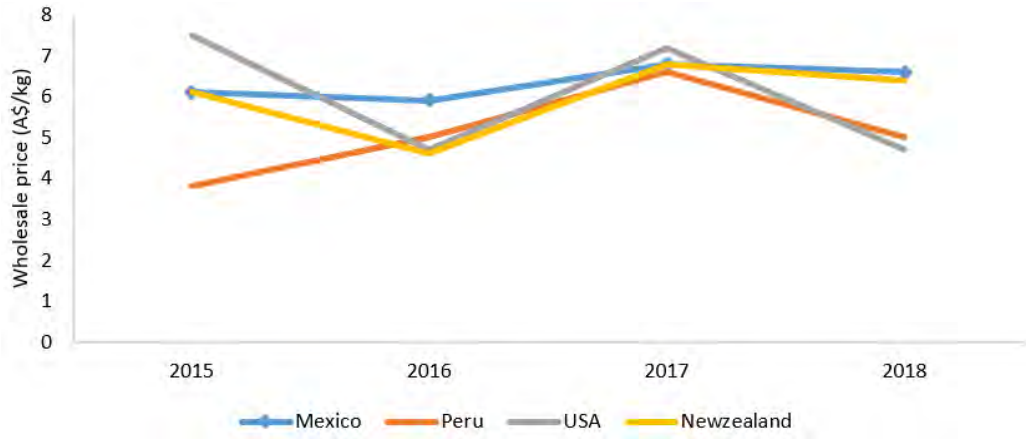

Figure 77 Wholesale price of avocado by country from 2015 to 2018
Source: the Tokyo Wholesale Market (exchange rate at A$1=75.8 yen)

Locally produced fresh produce tends to be more expensive than imported produce in Japan, and there is no exception with avocados. The average price of avocados from Okinawa and Ehime was $11/kg and $17/kg respectively.

Avocado retail – Imported avocados are normally sold by the piece or in a pack in traditional retailing stores. Avocados are carefully wrapped with foam bags and sold at a supermarket (Ohta, 2014). As opposed to mangoes for gift purposes, avocados are rarely seen in gift packs, but some high-end fruit shops offer avocados in a gift pack attached with cooking instruction and storage information (Fujimoto, 2007). Some retailers started to sell avocados based on the maturity of the fruit. They highlight the level of ripeness on their advertisements so that customers get informed that the fruit will be ready for consumption within the next 2-3 days. Frozen avocados sliced into small sizes for meals are also available via online shopping (Figure 78-(3)).

Figure 78 Online retailing price for imported avocado in Rakuten.com (Dated on 6th May 2019)

Figure 78 shows the sales prices posted by retailers in Rakuten.com. The retailing price for avocados from Mexico varies from $2 to $4 per piece based on their size and appearance (Figure 78-(2), (4), (7)). Whereas, the retailing price for avocado from the USA is much cheaper, at $1 per piece (Figure 78-(5)). Hass is the only variety sold in the online platform. Local avocados are rarely seen in the market due to low production. However, some farmers have built online sites to accept orders from aspirational customers.

Lychee wholesale – The transaction period for imported lychees in the wholesale market is very short, from May to June. The wholesale price of lychee is not officially available due to small volumes.

Lychee retail - since imported lychees are mostly frozen, they are sold in the form of bag packs at a supermarket. Fresh lychees are mainly imported from Taiwan and China. Gyokukahou and Kokuyou are two major lychee varieties imported from Taiwan. Gyokukahou is sold online at about $45 per 1kg (Figure 79-(1)), whereas Kokuyou is sold at $65 per 3kg (Figure 79-(6)). Hishishyo, a major variety imported from China, is sold at about $35, $65 and $85 per 1kg, 2kg and 3kg respectively (Figure 79-(2), (3), (5)). Some retailers sell Taiwan lychees via pre-order – lychees are imported after receiving the customers' order (Figure 79-(1)). Locally produced lychees are also considered a premium fruit due to the small production in Japan. Japanese lychees are sold for just one month only, from mid-June to July. The price for Japanese lychee varies based on its appearance and quality, ranging from $79 to $250 per 1kg (Figure 79-(4) and (8)).

Figure 79 Online retailing price for lychees in Rakuten.com (Dated on 6th May 2019)

5.2.2.2.5 South Korea

Retail prices for mangoes, avocados and lychees were retrieved from shopping.naver.com. NAVER Co., Ltd., founded in 1999, is South Korea's largest web search engine, as well as a global ICT brand that provides services including LINE messenger, currently with over 200 million users from around the world (source: https://www.navercorp.com/en/naver/company). The varieties available and sales price are constrained to the search which was conducted in October 2019.

Mango retail - Imported mangoes are typically sold for consumption as whole fruit in retail channels (Deloitte Australia, 2017). South Korean people consume mango by neatly cutting its flesh into dice shapes, so mangoes are often advertised online with diced cutting. According to the search in October 2019, locally grown mangoes from Jeju and mangoes imported from Thailand, the Philippines and Brazil were all available in the shopping.naver.com. A snapshot of some imported mangoes posted for sale in the shopping.naver.com is shown in Figure 80.

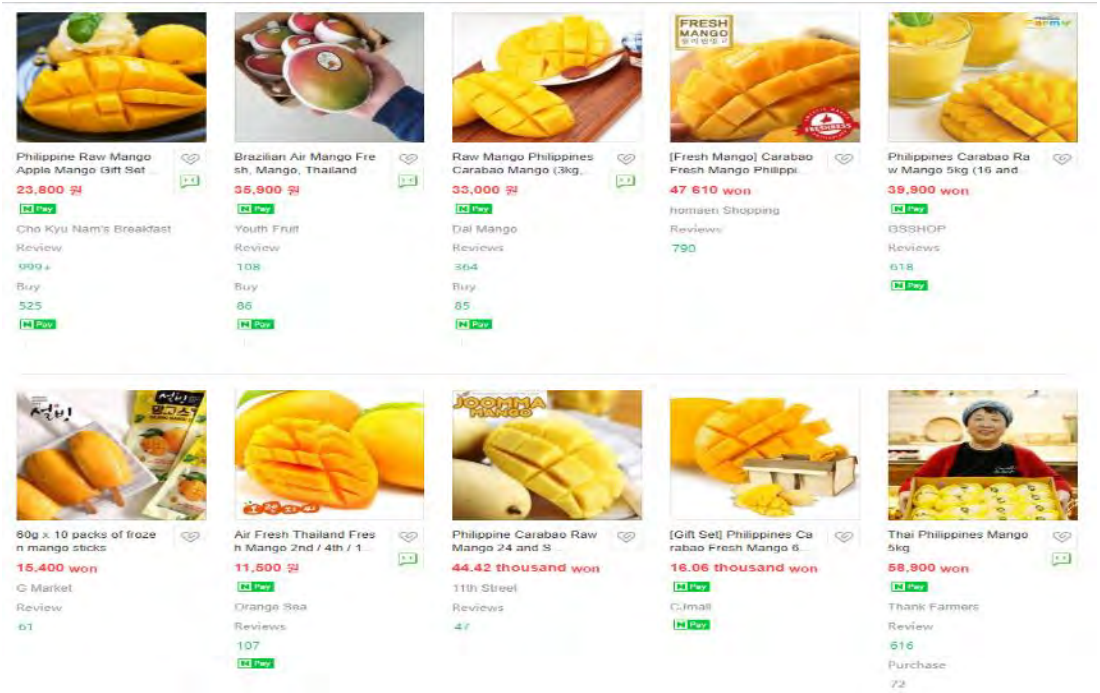

Figure 80 Imported mangoes posted in shopping.naver.com (10th October 2019)

Imported fresh mangoes are sold either by weight or by piece in South Korea's shopping.naver.com. Table 56 shows mango prices from some sellers. Many sellers indicate the name of mango traders in South Korea, and some sellers indicate the supplier of the mangoes as shown in Table 56. When the imported mangoes are sold by weight, sellers normally indicate the number of mangoes, as larger size mangoes are much more expensive. For example, 5kg of Thailand mangoes for size 20 are marked at $70, while mangoes with the same weight for size 12-14 are marked at $74. This points to a preference for larger fruit. Mangoes are also sold in gift packs at a price premium compared with common packaging.

Table 56 Retail prices for some imported mangoes in *shopping.naver.com*

Origin of country	Variety	Brand	Supplier	Name of trader	Weight	Number of fruit	Pack type	Sales price
Philippines	Carabao			Doori Golden Trading	1.25kg			$20
					2.5kg			$40
					5kg			$60
Thailand				Le Bon International	5kg	18		$61
					5kg	14		$67
				Sooil Commerce	5kg	20		$70
					5kg	12-14		$74
			Pieske International		≥500g	1		$7

Brazil		Apple mango		Turtle Farming	4kg	6-7		$63
					4kg	<7	gift pack	$69
					2kg			$37

Note: Retail prices were retrieved from 10th to 24th October 2019; Exchange rate at A$1=807.10 Won

Avocado retail - Avocados imported from Mexico and New Zealand were available in the shopping.naver.com when the search was conducted. A snapshot of some posted avocados for sale in the shopping.naver.com is shown in Figure 81. To demonstrate the good quality of fruit, avocados are often advertised online cut in half.

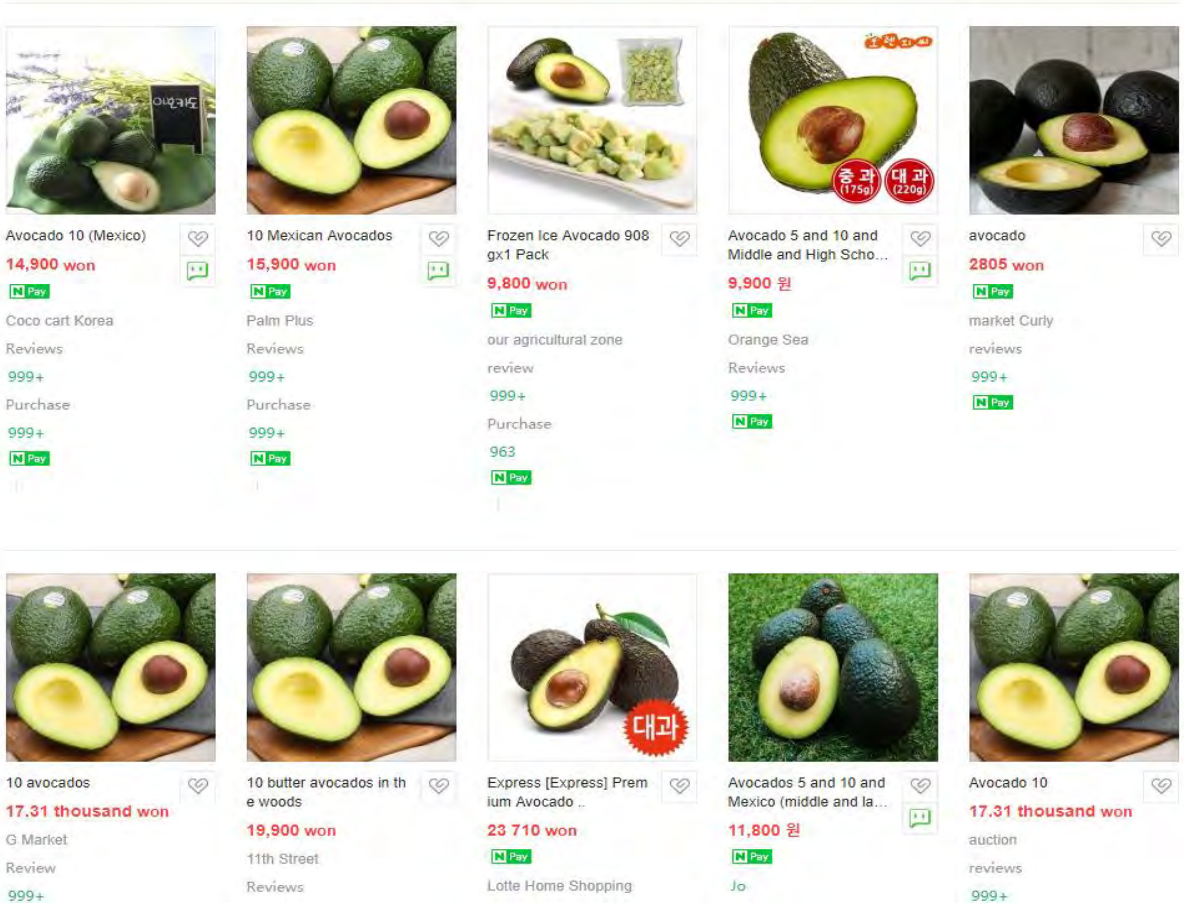

Figure 81 Imported avocados posted in shopping.naver.com (10th October 2019)

Only Hass avocados are sold in the South Korean market. A piece of fruit weighs between 170 to 220g. Avocados posted in the shopping.naver.com are sold either by piece or by the box as shown in Table 57. The retail price for a 170g piece of avocado is marked at $2.50-$3. The large fruit is a little bit cheaper. For example, a piece of avocado weighing 220g is marked at $2.90-$3.50. It should be also noted that New Zealand's avocados are slightly cheaper compared with Mexican avocados. Some sellers indicate the name of fruit traders in South Korea as shown in Table 57. Although some

sellers indicate the origin of country, it seems that it may not be an important factor in attracting consumers given that some just give a broader indication, such as avocados from the US/ New Zealand/ Mexico.

Table 57 Retail prices for some imported avocados in shopping.naver.com

Origin of country	Variety	Name of trader	Weight	Number of fruit	Sales price
Mexico	Hass	Mission Produce	170g	10	$30
			220g	10	$35
New Zealand		Jinwon Trading	170g	15	$38
			220g	12	$43
Mixed – the US/Mexio/NZ			170g	1	$3
			220g	1	$3.5

Note: Retail prices were retrieved from 10th to 24th October 2019; Exchange rate at A$1=807.10 Won

Lychee retail - Fresh lychees were not available in shopping.naver.com when the search was conducted. However, frozen lychees are imported from China and Vietnam. A snapshot of frozen lychees sold in shopping.naver.com is shown in Figure 82. When selling imported lychees, some online retailers indicate the country of origin, such as picture two in Figure 82, which shows they are imported from Vietnam. While others just give a rough indication - picture one shows frozen lychees from China or Vietnam. The sale price varies among different online sales. Picture one shows that 1kg of frozen lychees imported from China/Vietnam are marked at $4.71. Whereas, picture two shows that 1kg for frozen lychee from Vietnam is marked at $11.03.

Figure 82 Online retailing price for imported lychee in shopping.naver.com (10th October 2019)
(Exchange rate of A$1=807.10 Won)

5.3 Market opportunities and challenges

5.3.1 Market opportunities

5.3.1.1 Hong Kong

Hong Kong importers and retailers are open to new varieties as Hong Kong is an unregulated market and also a re-export platform. Thus, new varieties can be tested in the Hong Kong market.

Hong Kong's economy is predicted to bounce back over the next five years as a result of it strong business environment, increasing foreign investment, resilient domestic demand and population growth as a result of increased immigration from mainland China (Euromonitor, 2014). These factors are contributing to not only a general increase in demand for imported food but also consumers trading up to more value-added products. Stimulated by government healthy living campaigns, fresh food consumption will continue to grow (Euromonitor, 2014). Since 2011, Hong Kong has been promoting a "2 Plus 3 a day" diet campaign aiming to raise the public's awareness on consuming a minimum of two portions of fruits and three portions of vegetables daily (Cheung et al., 2016). Driven by growing consumer health consciousness and increased availability in restaurants and retail, fruit and vegetables are the most consumed fresh foods in Hong Kong (Euromonitor, 2014).

Speciality fruit shops, which sell premium fruit and offer services such as cut fruit and freshly squeezed juices, have emerged as a new fruit channel. They differentiate themselves by setting up a clean and neat shopping environment and providing shoppers with information about origins, taste notes, and nutrition facts (Lai, 2018). This has created a new market opportunity for premium fruit.

5.3.1.2 Singapore

Singapore's total food spending is expected to grow through 2023 and reach nearly $9 billion (USD) by 2020 (PMA, 2019). In the face of rising obesity rates, government initiatives and consumer choices to eat healthier has created a demand for healthy processed foods and fresh products in Singapore (PMA, 2019). This creates opportunities for exporting fresh fruit into Singapore. Singaporean customers have a strong demand for fresh produce, and even busy professionals who cannot visit the markets frequently will buy fresh produce and freeze it themselves to consume later (PMA, 2019).

The food service industry is another important market segment for fresh food exporters, given that Singapore is considered a transportation and tourism hub (Flanders investment & trade, 2016). According to Singapore's Department of Statistics, there are approximately 7,260 Food and Beverage establishments in Singapore, including restaurants, cafes, snack bars, food courts, fast food restaurants, food caterers, etc (Export.Gov, 2018).

5.3.1.3 China

Australian fruit has higher recognition and acceptance among Chinese consumers. For example, Australian mangoes (R2E2) are well-liked in the Chinese market. The quality of mangoes from Peru and Ecuador cannot compete with Australia's quality. The acceptance of avocados, which is a new fruit in the Chinese market has been increasing with the market campaigns launched by South American countries. Despite this, the average consumption is still very low and there is substantial room to increase market demand and size. Lychees are a well-recognised fruit in China as it is a

native fruit. The high recognition and acceptance of mangoes, avocados and lychees provide a big market opportunity in the Chinese market.

An increasing number of consumers have shifted their consumption to more healthy and nutrient-rich foods. Meanwhile, consumers have a higher requirement for food safety and prefer ready-to-eat foods. Furthermore, many young consumers would like to eat exotic and new food products, which are thought to be safe and healthy. In addition to the demand generated from major cities, due to changing urban patterns, increasing demand for quality foods is also occurring from third and fouth-tier cities. As such, there will be an expanding export market in the Chinese market.

Premium channels look for high quality and/or new food products or new varieties to differentiate their competitiveness. For example, City shop only sells Mexican avocados at the moment as their quality is superior to avocados from Chile and Peru. The rise of premium channels will create the opportunity for the increased demand for quality and premium fresh fruit.

5.3.1.4 Japan

Japan has steadily increased import volumes in order to secure sufficient supply to meet the country's demand due to decreasing competitiveness in the domestic farm sector, global climate change, natural disasters and the opening up of the import market (ATC, 2006). In 2017, total imports of fresh fruit to Japan were valued at US$ 2.14 billion, accounting for one third of fresh fruit demands in the Japanese market (Motomura, 2018).

While mango imports into Japan have decreased over the past years, mangoes are a well recognised fruit in Japan. Avocados are not a typical food in Japan. However, after its introduction, import volume has significantly increased in line with the global trend toward health and nutrition and the appeal of exotic products (Motomura, 2018). It is now no longer uncommon to find them in supermarkets or even in some local restaurants. With the demand for avocado continuing to grow in the Japanese market, there is a market opportunity for Australian avocados, which gained market access into Japan in 2018. Fresh lychees are not usually consumed in Japan. However, there is a niche market given that Japan imports lychees from China and Vietnam.

5.3.1.5 South Korea

Mango consumption in the South Korean market has been increasing exponentially over the last five years. Australian mangoes hold a significant place in the South Korean market as South Korean consumers love the R2E2 variety for its large size and beautiful blush colour. Australian mangoes have gained market access to South Korea.

The South Korean avocado market continues to grow, with ample market opportunity for Australian avocados if market access is approved. The success of New Zealand avocados in the South Korea market could shed light on Australia's market development strategies. Lychees are a rare fruit in South Korea due to the unavailability of local production. However, there are niche

markets for lychees as South Korea imports lychees from China and Vietnam, with frozen lychees available in online markets.

Food service outlets could be a prosperous market due to the wide use of tropical fruit, including mangoes and avocados in restaurants and cafes. The market for fresh fruit is also being fuelled by the domestic restaurant industry developing new menus by using tropical fruit (Lim and Kwak, 2017). For example, companies such as Binggrae use mangoes in the production of desserts (Deloitte Australia, 2017). There is even an establishment named “Avocado Cafe" in the Mangwon neighbourhood of Seoul that serves a variety of healthy, avocado-packed choices (Korea Herald, 2018). Thanks to South Korea’s late venture into avocados, some restaurants, including this cafe, have been more inclined to emulate popular western culinary creations like avocado quinoa salads, avocado banana smoothies and avocado chicken wraps. South Koreans also seem more responsive to using avocados in traditional cuisines, such as bibimbap (Korea Herald, 2018). In 2015 Starbucks released an avocado blended frappe as a seasonal beverage, which is only available in South Korean locations (Korea Herald, 2018). Due to the wide use of tropical fruit, including mangoes and avocados in restaurants and cafes, the food services have become an important channel for mangoes and avocados, enhancing their popularity among South Korean consumers.

5.3.2 Market challenges

5.3.2.1 Hong Kong

Hong Kong is a relatively small market due to land constraints. While Hong Kong’s population is continuing to increase as a result of the immigration of Chinese citizens, the market volume for fresh fruit is still small. While there are increasing high-end consumers in Hong Kong, price competition is intensifying. Australian fruit is less competitive in the market compared to direct competition from China, South Africa and South American countries. These countries have also raised the standard of taste and quality that are attractive to buyers (Lai, 2018).

5.3.2.2 Singapore

By 2030, Singapore officials expect the population to be 6.1 million. While Singapore’s population will continue to grow, it remains a small market compared to its regional peers (PMA, 2019). Because of this, the market demand is relatively small compared with other major neighbouring countries.

Singapore’s food retail sector is facing a challenging environment: tough operating conditions, subdued consumer demand and a strong Singapore dollar. Consumer confidence in Singapore is dropping and demand is constrained as a result. Retail sales growth in Singapore was weak over 2018 and it is expected to continue in 2019 (PMA, 2019).

5.3.2.3 China

Fierce competition is a big challenge in the Chinese mango and avocado market due to mangoes and avocados being available throughout the year in China. Competition from new supplying

countries would be another market challenge as the Chinese government is working to approve market access to other countries. For example, as of 29th November 2019, China has approved imports of Hass avocados from the Philippines, which will join Mexico, Chile, Peru, New Zealand and Kenya in the Chinese market. Additionally, competition from locally produced products will be a challenge in the coming years. For example, China's mango production has increased in both volume and quality in recent years due to expanding plantations, improved breeds and the introduction of popular varieties from other countries and regions, including Taiwan, Thailand, Vietnam and Australia. Locally produced avocados may be a challenge for imported avocados. While China has a limited supply of local avocados at the moment, many companies and farmers have started to produce seedlings and grow avocado due to the strong market demand and promising returns.

Higher and stricter quality requirements on fruit is a signifiant challenge in China. Importers and retailers often have higher more selective requirements when they source fruit from overseas suppliers. For example, Chinese importers have a high requirement on the blush ratio of Australian mangoes. Since only a small portion of mangoes meet Chinese importers' blush ratio requirements, Australian mango suppliers can have difficulty in ensuring all mangoes meet the stringent requirements. This has greatly reduced Australian suppliers confidence in exporting to China.

The grey channel is a challenge for direct exports of fruit into China. It is estimated by industry representatives in Australia and China that more than 90% of Australian mangoes sold in Chinese markets go into China via Hong Kong – the grey channel, rather than by direct imports. Several importers have increased their exports to Hong Kong, from where the fruit is distributed through mainland China, which may pose a challenge for direct imports into China. In addition to the grey channel, brand copying (fruit fraud) and misleading information and promotions from retailers remains a challenge for premium fruit in the Chinese market.

Changing consumer behaviours and shifts in diet and health would be another potential challenge for sweet fruit. A Chinese retailer indicated that consumers are becoming more health conscious and have concerns about the sugar content of the food. This is a trend that leads many consumers to choose less sweet fruit as they are perceived to have lower sugar levels.

5.3.2.4 Japan

The contraction of the fresh fruit market in Japan is considered to be caused by several factors. First, the Japanese population is declining. It recorded a decline for the first time in 2005 and has been gradually decreasing since 2010 due to its low birth rate. The Japanese food market, in general, is in a downward trend with the lower population and the fresh fruit market is no exception.

Secondly, when fresh fruit consumption is examined in detail, it is found that fresh fruit consumption per household in Japan is decreasing as well, with the exception of Kiwifruit and Banana (Fruitnet,

2018). Rising costs for fruit have been identified as a key factor in the decline in fruit consumption (Fruitnet, 2018). The chart below shows that fresh fruit purchase per person has continuously declined over the years (Motomura, 2018). It is reported that if the current rate of decrease is maintained, fruit consumption in Japan will reach the lowest levels in five decades (Fruitnet, 2018). Australian mangoes account for less than 1% of the total imported mangoes in Japan. Australia's exports to Japan by volume has decreased in recent years. The reduction could be because the Japanese fresh fruit sector is highly competitive with other countries, making some inroads to the market difficult (Motomura, 2018). Australian mangoes are more expensive than other imported mangoes and have overlapping supply windows with Brazil and Peru, which together result in lower supply compared with other major supplying countries. Mexico maintains its strong position in Japan's imported mango market, comprising 45% of market share. Mexico, Brazil and Peru supply the same mango varieties, which are popular and familiar for Japanese people, whereas the varieties from Australia are not well known among Japanese consumers.

5.3.2.5 South Korea

The South Korean mango market is currently dominated by two year-round suppliers - Thailand and the Philippines. While Australia ranks seventh in the South Korean mango market in terms of average volume from 2015 to 2018, Australian mangoes accounted for less than 1% of total mango imports in South Korea. Compared with major suppliers, Australian mangoes have a very short supply window, mainly supplying in November and December, when there is fierce competition from Thailand, the Philippines, Vietnam and Brazil. Mangoes are regarded as a high-grade fruit in the South Korean markets, where there is an increasing demand for premium mangoes. Considering that bananas were a high-grade imported fruit in the past, but have become a cheaper and more popular fruit in South Korea (Seoul Taiwan Trade Center, 2014), if demand continues to increase, mangoes are highly likely to follow the same trend and become commoditised with a large volume supply (Seoul Taiwan Trade Center, 2014).

Section 6 Supply chain intelligence

6.1 Strategic insight

6.1.1 Strategic orientation

Strategic orientation is a means used by companies to manage and carry out activities in business to maintain and improve business performance (Hakala, 2010).

6.1.1.1 Upstream supply chain strategies

6.1.1.1.1 Shortened supply chains

The need for visibility into and across the supply chain so as to deliver greater profit is the driving force for a shortened supply chain strategy. Mango and avocados growers pursue this strategy across northern Australia. One NT-based mango grower exporter indicated that they prefer a short supply chain because they grow, pack and export and gain control of their supply chain. They further added that merchant exporters who buy fruit at the wholesale market for the export market affect the grower's brand. As such their short supply chain strategy can ensure control quality along the chain and protect their brands. Another QLD-based mango grower believed that when exporting through a middleman, they do not have enough information on the fruit's progress to the market; yet the middleman would come back to ask for a discount when there is a problem with the fruit. Improved financial returns are another incentive for a short supply chain, as one QLD-based avocado grower indicated; they keep 5-10% of profit if they do not export through a middleman. However, growers also need to know that shortening supply chain has its risks as they do not understand the market. .

6.1.1.1.2 Collaborative supply chain

A collaborative supply chain strategy has been followed by mango and avocados growers in northern Australia. The driving force for a collaborative supply chain strategy is to improve competitive advantage in the market by a united brand and consistent quality. Collaborative marketing companies and some exporters interviewed indicated that they provide necessary packing and grading guidelines to their growers and even provide united packing boxes. A united brand is widely used by collaborative marketing companies, such as Sun Fresh and Martin Walker Marketing, in domestic and international markets. In view of the value of a single brand, some exporters have worked with mango and avocado growers to use a united brand for domestic and international sales. Additionally, to strengthen their collaboration with growers, some exporters provide growers with the necessary assistance in gaining market access to protocol markets. For example, one WA-based avocado exporter indicated that they help growers to be eligible for the Japanese market.

Another form of a collaborative supply chain is the establishment of partnerships with their importers. One mango grower exporter indicated that they have built strong partnerships with their international customers, who receive the shipments and ripe mangoes, prepare the orders and distribute to the

retail channels. The collaborative relationship can ensure bidirectional information flow which supports a rapid response to customer needs through short, clear communication channels.

6.1.1.1.3 Supply chain integration

Vertical and horizontal supply chain integration strategies have been adopted by some interviewed companies. One QLD-based exporter indicated that they are fully integrated, covering growing, packing and marketing and direct exporting to wholesalers and retailers and even have a sales team in China. The exporter added they have bought several mango farms since 2018. Another QLD-based exporter expressed their interest in buying mango and avocados farms to ensure consistent supply. In addition to vertical supply chain integration, horizontal supply chain integration has emerged to enhance export capability. One example is that of Southern Forests Food Council (SFFC), which are leading from the front with their new “Genuinely Western Australia” export initiative for premium WA produce, having partnered with an experienced distributor Mercer Mooney to develop opportunities for consolidated supply (Fresh Plaza, 2018e). Another example includes fourteen of Australia’s leading fresh produce companies who have joined together to create the Australian Fresh Produce Alliance (AFPA), who provide a prominent and respected voice on major issues involving the production, supply and sustainability of fresh produce for Australian consumers as well as export markets (Jones, 2019).

6.1.1.1.4 Value chain strategy

Creating and delivering value to customers is the key to a successful product. However, capturing the value that has been created and delivered has proven a difficult task for many horticultural growers. Having more control and visibility of the entire value chain, and understanding where the value lies provides the possibility of profitability and growth. As such a value chain strategy has been incorporated into supply chain operations by some companies in northern Australia. For example, one mango grower exporter indicated that they are operating their process on a principle of value chain management that ensures a better understanding of consumers. This drives up their domestic sales and export marketing. The grower-exporter mentioned that consumer insights are a very important element for business success. They seek to understand what consumers value most, and then deliver the right products to their consumers through the whole chain effectively and efficiently. This is where value delivery and value capture come together to build stronger business models.

6.1.1.2 Downstream supply chain strategy

In-field studies were not conducted for Japan and South Korea and therefore limited data is available for the downstream supply chain strategy for these two countries.

6.1.1.2.1 Hong Kong

None of the Hong Kong companies interviewed have overseas farms and nor do they display an interest in acquiring an overseas farm and vertically integrating. They indicated that they would rather

focus on their existing fruit wholesaling and/or retailing businesses, instead of buying and operating an overseas orchard. Potential challenges in running a farm with an overseas partner as pointed out by the interviewees include: whether you trust your partners to handle all the farming; or whether you have the expertise to run the farm once your partners leave the business. One interviewee pointed out “We have heard of lots of accidents where the Chinese investors got ripped off in the overseas farm acquisition not only in Australia, everywhere in the world”. These failures reduce investors motivation for upstream supply chain integration.

All the five interviewees however intended to maintain long-time partnerships with their suppliers. However, they mentioned that it is not easy to find an ideal partner who shares the same supply chain strategy. Among the five interviewees, only one wholesaler has already built a strong partnership with one of their mango suppliers in the Philippines, who provides all the supply chain details, supply chain visibility and provenance, including the date of picking and packing to his Hong Kong wholesaler. This includes sending his local employees to assist with proper ripening in Hong Kong. While this can affect supply costs, it indicates a strong long-term collaborative strategy that can support a premium if the cost is borne by the consumer rather than the supplier.

Irrespective of sourcing strategies, both Hong Kong wholesalers and retailers have strict requirements on fruit quality when sourcing mangoes, avocados and lychees. None of the companies interviewed buy second grade fruit. For purposes of supply chain visibility, including quality assurance from the origin, they prefer to work with exporters who have farms or have strong relationships with growers. This is an important consideration in the way Australia’s growers seek to build their supply chains.

Hong Kong’s first-tier wholesalers are also importers and even act as import agents for some retailing stores. They source fruit from across the globe to supply different market segments. Two wholesalers interviewed confirmed this and indicated that they need to trust their suppliers to assist with quality control and assurance since it is very challenging to monitor fruit quality when working with several suppliers in different supplying countries. To simplify their sourcing operations, they tend to work with a small number of large-scale suppliers who have sizable supply capacity. However, they have to work with several suppliers in some cases where suppliers have limited capacity. For example, one wholesaler pointed out “We work with six to seven agents in Australia for mangoes and only one agent for lychees”. The two wholesalers also indicated that they often set a supply program with their suppliers for the whole season to show their sustainable procurement capability, which can help them build a long-term relationship with their suppliers. In terms of import packaging, they often take the boxes widely used by suppliers. However, it should be noted that Hong Kong wholesalers who distribute Australian mangoes into China often ask their Australian suppliers to use generic boxes without any branding information.

As Hong Kong retailers generally source fruit from different suppliers, it enables them to compare prices and make the cheapest selection based on product quality. This can also assist them to source mangoes and avocados for year-round supply. However, their procurement of lychees only occurs in a short period through the year due to short supply windows, pointing to opportunities for some Australian producers.

Retailers tend to buy from overseas exporters for cost savings; however, their procurement volume is often smaller than wholesalers, which makes it uneconomical for them to directly import mangoes and avocados. As a result, in addition to direct import in some cases, they choose to either work with importers or buy from the wholesale market. Three retailers pointed out “We have a portion of direct imports, but we also either work with first-tier wholesalers who act as our import agents or procure from the wholesale markets where we can compare quality and price to make favourable procurements”. Furthermore, all the retailers indicated a difference in their procurement of mangoes and avocados, which is avocados require ripening services, while mangoes are naturally ripened during the sale. Given the ripening needs for avocados, Hong Kong retailers generally request their avocado suppliers, including overseas suppliers or local wholesalers to assist with ripening. One retailer particularly pointed out “our avocados are mainly sourced from importers who can provide us ripening services”. In addition, high-end retailers indicated that they want to procure new varieties or differentiated products to distinguish from their competitors. For example, City Super sources Heixiang mangoes from Taiwan, which is rare to see in Hong Kong as well as organic avocados from American suppliers.

6.1.1.2.2 Singapore

Local companies interviewed in Singapore, including wholesalers and retailers, do not have overseas farms and do not have a current interest in farm acquisition in a foreign country. In contrast, the two multinationals either have farms in their parent countries or are planning to acquire farms in producing countries. Singapore local wholesalers indicated that they prefer not to take on the risk of either acquiring a farm or making direct investments in farms. Because of a lack of farming knowledge, they prefer to concentrate on their core trading business. Though they have no interest in making direct investments in Australian farms, they instead would like to build long term partnerships with farmers. One interviewed wholesaler indicated that they signed a contract with farms in Australia for Rockmelon. However, they have not yet developed partnerships with Australian mango, avocado and lychee growers. Their small import volume for mangoes, avocados and lychees from Australia is a key constraint for partnership - as indicated by three local companies.

Singapore wholesalers tend to directly import mangoes, avocados and lychee from producing countries that they are familiar with, to serve their customers from different channels. While retailers work to obtain products from different supplying countries via direct import and/or through local

importers/distributors to realise year-round supply as much as possible. Some wholesalers have established their buying offices in major supplying countries to facilitate their direct sourcing. One wholesaler indicated that they have buying offices in South America, Australia and Korea. Wholesalers generally work with either growers, traders or brand owners for direct sourcing. Some wholesalers may also appoint consolidators in specific countries, including Australia to consolidate products they ordered in smaller volumes from different suppliers for a one-off shipment. One wholesaler pointed out that they source Australian mangoes from growers and traders but buy Calypso from a brand owner – Perfection Fresh who owns the rights to the "Calypso" brand. This provides additional revenue streams through royalty payments based usually as a percentage of the sale price. In terms of the number of suppliers, they prefer to work with a small number of suppliers for fruit in supplying countries.

As opposed to the sourcing strategies implemented by wholesalers, retailers generally have another business to look after their sourcing and dispatching. For example, one retailer indicated that they have two business entities – one is their supermarkets and the other is a marketing company, which handles sourcing on behalf of their supermarkets and looks after the logistics and dispatch to their stores. Even though some retailers are heavily involved in the direct sourcing, they often leave a purchasing gap for local procurement given that they sometimes can acquire produce for lower prices in the local market. One retailer mentioned that they generally source about 90% of their mangoes directly and leave the rest to procurement from the wholesale market. When sourcing from local suppliers, the shelf life should be three to five days after they receive them. In terms of direct sourcing, retailers also indicated that they prefer to work with a small number of suppliers for fruit in supplying countries.

Wholesalers generally do not require ripening services for mangoes in direct sourcing as they are often naturally ripened during sales. In contrast, retailers often request their overseas suppliers to assist with mango ripening. One retailer indicated that all their directly imported mangoes are usually ripened at the source. They further added that mangoes maybe 50% ripened when they buy from Australia. Additionally, retailers need reliable and consistent suppliers who do not send any sub-standard fruit given the cost to deal with the problem is very high. Since avocados are sensitive fruit to handle and need proper ripening for good sale prices, retailers prefer to buy from local importers, rather than source directly from overseas suppliers. Fresh Mart has established a first mover advantage in the avocado category, although some companies are trying to develop expertise in avocados. Given that Fresh Mart is the dominant avocado supplier in Singapore, they can ask different retailers for quantity and order together, provide proper ripening and storage as well as assist with product awareness.

6.1.1.2.3 China

All the companies interviewed, including importers/wholesalers and retailers, are cautious about orchard acquisition in a foreign country. They express concern that it is too risky to operate an overseas farm. They would rather specialise in fruit wholesaling and/or retailing that they have the expertise in. Some interviewees said that it is very difficult to manage farms in another country as they are not familiar with overseas farm operations. One Shanghai-based interviewee particularly mentioned a case of an overseas farm acquisition made by the Joyvio group, which is the sole strategic investment platform for food and agribusiness of Legend Holdings. He said Joyvio found they had bought an empty farm as all experienced staff and key resources were gone when they took control of the farm. While most Chinese local companies are not positive about overseas farm acquisitions, many overseas Chinese have stepped into the agri-food industry by making agricultural investments, and directly buying farms with a view to substantiate exports into China. Some interviewees mentioned several Chinese Australians have invested in seafood farms, cattle stations and fruit orchards in Australia and sell fresh Australian foods to China. They said that some Chinese-Australian businesspeople work with Chinese wholesalers, while others are aggressively involved in the retail outlets.

Chinese importers and wholesalers expressed their willingness to develop a long-term relationship with their overseas suppliers for continuous and consistent supply. However, given that fruit trade is mainly dominated by opportunistic spot transactions, it is not an easy task to find a quality supplier to work with over a long time. According to three Chinese importers, with regard to sourcing from Australia, they hope that the Australian suppliers can offer assistance when the market performance is weak in China and can send smaller volumes of fruit or postpone delivery when there is abundant fruit available in the markets.

Chinese retailers generally have high requirements on fruit quality and prefer suppliers with self-operated orchards and packaging plants for direct imports. This sourcing strategy will help them to more clearly inform suppliers of its standards and requirements for imported fruit so as to strictly control quality (Produce Report, 2015). Most retailers want to directly source fruit from Australian suppliers, preferably trading companies with farms or with close relationships with farms. However, due to their small procurement volumes, they choose to either procure from the wholesale markets or work with several wholesalers so that they can buy quality products at a lower price. Either way, quality is the most important element. One Shanghai-based retailer pointed out: “since we cater for middle and high-end customers, we do not want to put poor-quality fruit into our channels. We would stop buying and selling if we cannot find good quality fruit in the wholesale market”. As for the sourcing strategy of imported fruit, Chinese retailers generally adopt the direct sourcing strategy for “hard fruit” that they can sell in large volumes, and indirect sourcing strategy for “soft fruit” that they

can sell in small volumes. Pagoda is one company which has deployed this direct sourcing strategy in their imports of Chilean cherries, blueberries, South African grapes, American oranges, Mexican avocados, etc., indicated that all fruits should meet Pagoda's high, self-imposed standards which include strict control of levels of brix (sugar content), acidity, freshness, crispness, tenderness, fragrance, and general food safety (Produce Report, 2015).

6.1.2 Governance structure

6.1.2.1 Upstream supply chain structure

6.1.2.1.1 Mango export supply chain

Asia is a major market for mangoes produced in northern Australia. Exports are to open markets, such as Hong Kong and Singapore, and protocol markets, such as China and South Korea.

The mango export supply chain evolved in northern Australia is depicted in Figure 83. Northern Australia's mangoes are exported to Asian markets through several modes. The exporters in Australia, including brand owners (growers), grower exporters, marketers/agents and exporter traders, who ship mangoes either to importer consolidators or directly to importers.

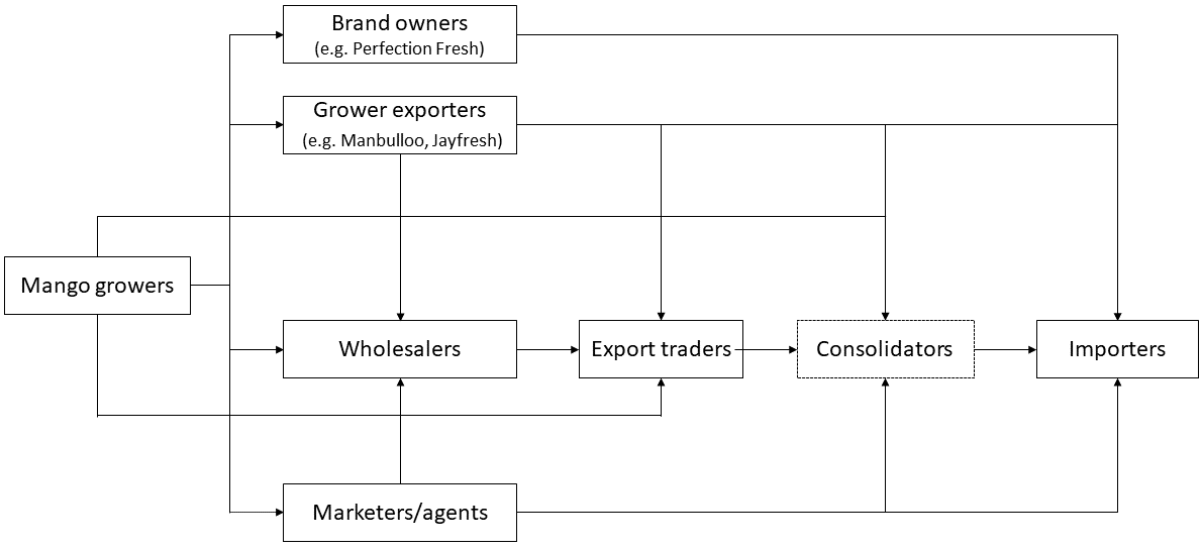

Figure 83 Northern Australia's mango export supply chain mapping

6.1.2.1.2 Avocado export supply chain

Avocados from northern Australia primarily exported to open markets in Asia, such as Hong Kong and Singapore. Japan is a newly developed protocol market in Asia. The country, released a new protocol agreement for exporting Hass avocados to Japan in May 2018 which stipulated that avocados must only originate from officially recognised areas free from QLD fruit fly which includes WA, Riverland (South Australia) and Tasmania. This means that WA is the only state in northern Australia that has official market access to Japan (DAWE, 2018).

The avocado export supply chain evolved in QLD and WA is depicted in Figure 84. Several supply chain modes are used in exporting northern Australia's avocados where grower exporters, marketing companies (either grow-owned or private) and export traders are involved with export businesses either directly with importers or with importer consolidators in Australia.

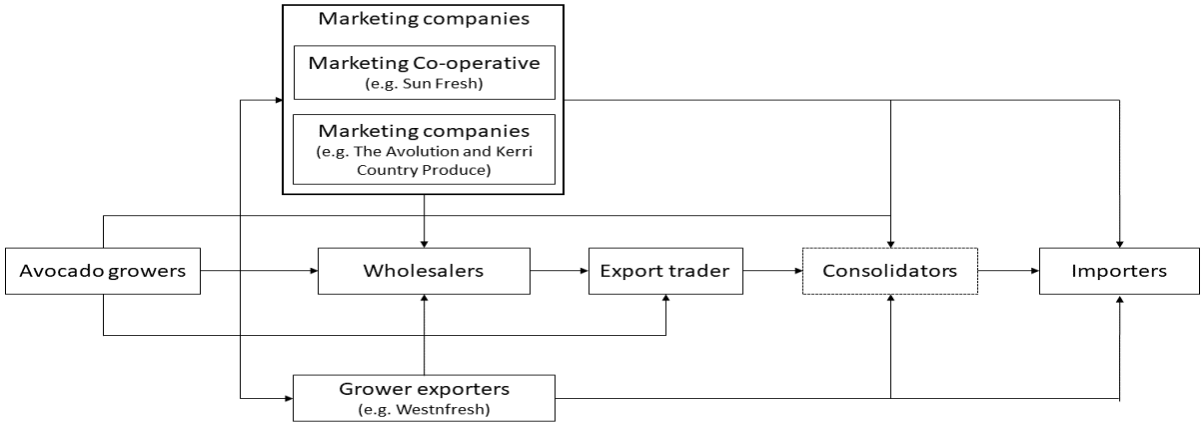

Figure 84 Northern Australia's avocado export supply chain mapping

6.1.2.1.3 Lychee export supply chain

The Australian lychee industry currently exports to several countries, but only has a foothold in the quarantine free Asian countries, including Singapore, Malaysia and Hong Kong. Quarantine protocols make it difficult to have access to most other markets, including China, Japan, Taiwan, Korea, Thailand and Vietnam.

The lychee export supply chain evolved in north QLD is depicted in Figure 85. The lychee industry has already established at least two effective export business models, with one being a grower-owned, collaborative marketing group and the other being driven by one of the industry fresh fruit marketers under their own brand (HIA, 2018d). Growers can handle marketing individually or join one of the lychee marketing groups (Menzel, 2002). The majority of exports are quality-controlled fruit from two marketing groups – United Lychee Marketing Association and Top Crop. There are also opportunistic exports from Sydney, Brisbane and Melbourne markets, where exporters buy off the market floor and ship only to open or phyto markets, but generally not to treatment markets except NZ (ALGA, 2018).

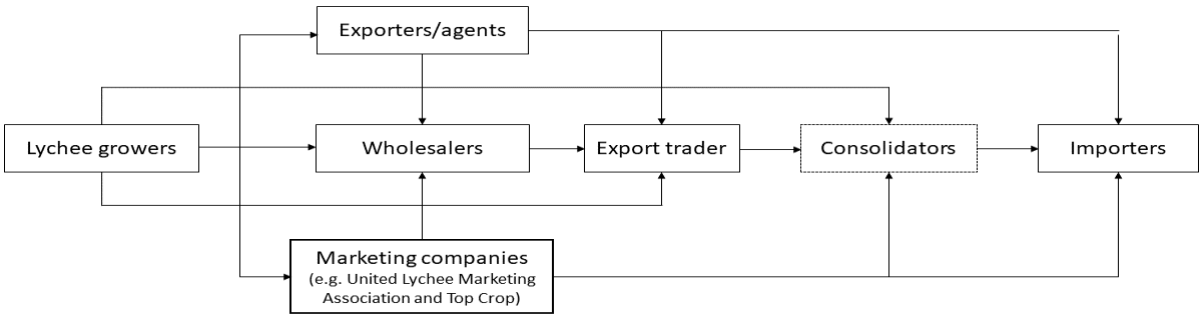

Figure 85 Northern Australia's lychee export supply chain mapping

6.1.2.2 Downstream supply chain structure

6.1.2.2.1 Hong Kong

Given the limited size of Hong Kong in terms of both population and geography, importers may also play the role of wholesaler/distributor, while retailers may also import products directly from suppliers, bypassing the need for intermediaries (Austrade, 2019). Figure 86 shows the mapped distribution channels for mangoes, avocados and lychees in Hong Kong and for re-exporting from Hong Kong importers. Though retailers directly source from overseas suppliers, Hong Kong importers still play an important role in fruit distribution and often act as a wholesaler and a distributor, who distribute fruit to supermarkets, foodservice outlets, second-tier wholesalers and fruit hampers. Though retailers choose to buy fruit direct from Australian suppliers, they still purchase part of their products from Hong Kong importers to minimise risks (Lai, 2018). As opposed to the supply chain structure for mangoes and avocados, direct import of avocados by retailers makes up a small portion given retailers need ripening services. As a result, avocados are mainly moved from exporters to retailers via Hong Kong local importers and wholesalers who can provide ripening services.

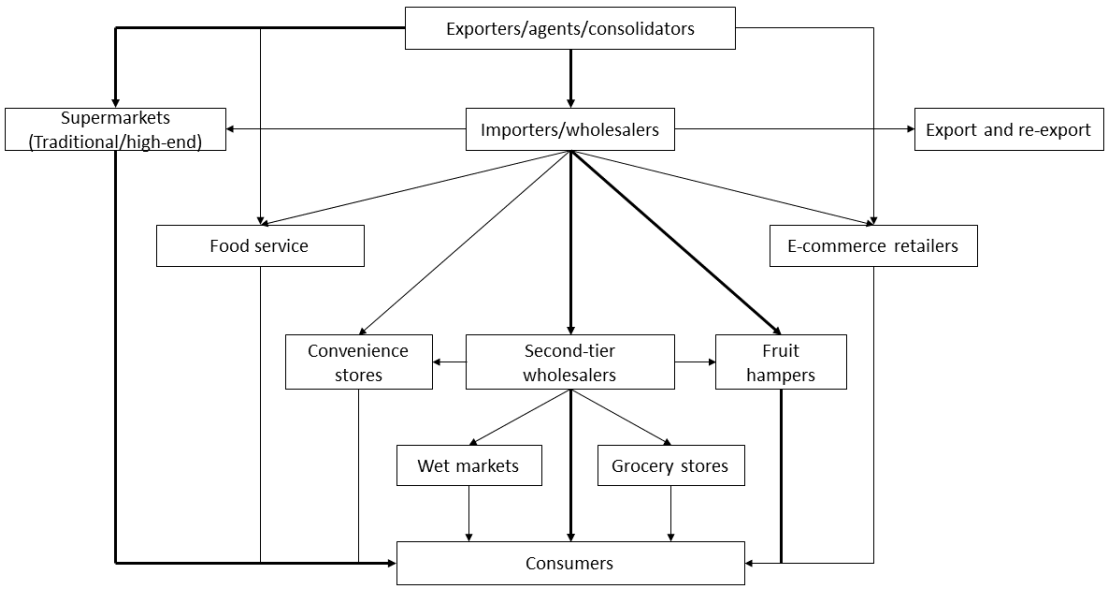

Figure 86 Supply chain structure for mangoes, avocados and lychees in Hong Kong

6.1.2.2.2 Singapore

Fresh fruit is brought into Singapore by larger wholesalers, supermarkets, food services and e-commerce retailers. Given that supermarkets may nominate their local agents for importing fresh fruit, importers may also act as import agents for some supermarkets. Most imported fresh fruit is sold for fresh consumption and a small proportion of imported fresh fruit and vegetables is used for domestic food manufacturing (Flanders investment and trade, 2016). Figure 87 shows the supply

chain structure for fresh fruit into Singapore starting from either overseas growers, exporters or consolidators.

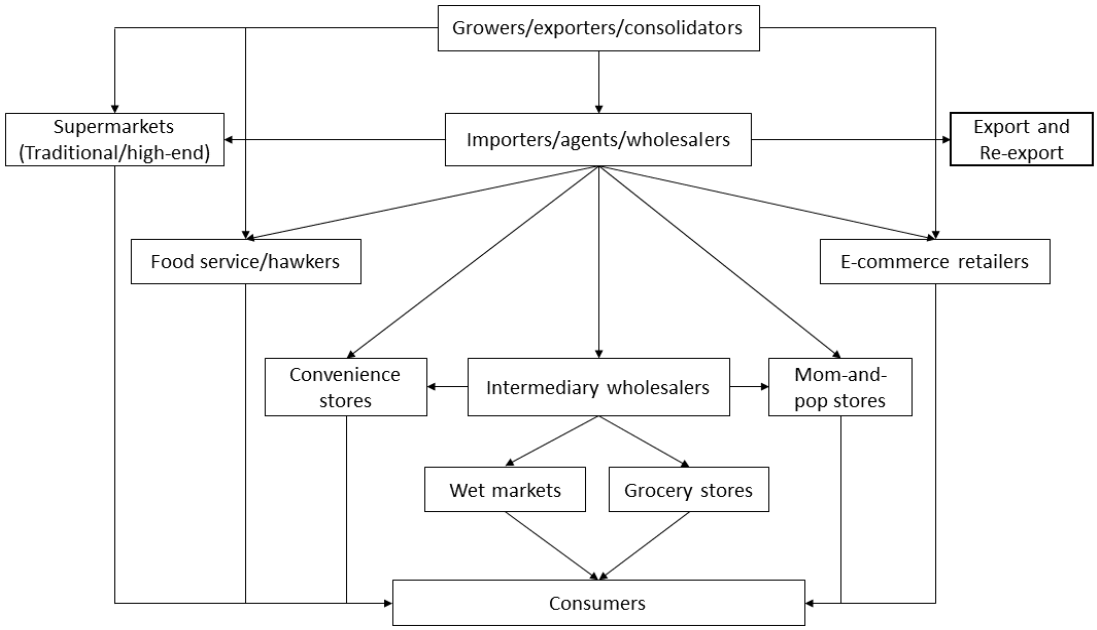

Figure 87 Supply chain structure for fresh fruit in Singapore

The main supermarket chains, including NTUC FairPrice, Dairy Farm International and Sheng Siong Group, obtain fresh fruit via the direct import or through local importers/distributors (Export.Gov, 2018). Importers and wholesalers within and/or outside the Pasir Panjang wholesale centre import direct and serve different businesses in Singapore, including supermarkets, food services, intermediary wholesalers and e-commerce retailers. The larger wholesalers who may also act as distributors usually have their own facilities to handle fresh fruit and have the capabilities for re-packing and distribution to their customers (ITA, 2018). In addition to supplying domestic markets, some importers and wholesalers also involve the export business, with fruit re-exported to surrounding countries and regions, including Malaysia, Hong Kong, Brunei and Indonesia. Intermediary wholesalers also play an important role in fruit distribution in the Singapore market. They buy fruit from larger importers and wholesalers and distribute to the wet markets, small grocery and mom-and-pop stores (ITA, 2018). Foodservice companies, like hotels and restaurant groups, may import products themselves, but mostly depend on local distributors for supplies due to small volumes (Export.Gov, 2018).

6.1.2.2.3 China

Figure 88 shows the supply (cold chain) structure for Australian mangoes in China, including emerging retailing channels. The dominant distribution channel for Australian mangoes in the Chinese markets is marked with the thick arrow lines. The emerging retailers in China mainly source Australian mangoes from local importers and wholesalers, rather than direct sourcing from Australia.

There is a cold chain break in the existing supply chain structure as indicated with the red arrow lines. This is a consequence of the under-developed cold chain facilities in China. On the other hand, there could be a low risk of cold chain breakdown if retailers work with importers/agents and directly transport imported fruit to the distribution centres as marked with a green arrow line. However, this channel has not yet been significantly developed due to small procurement volumes from retailers.

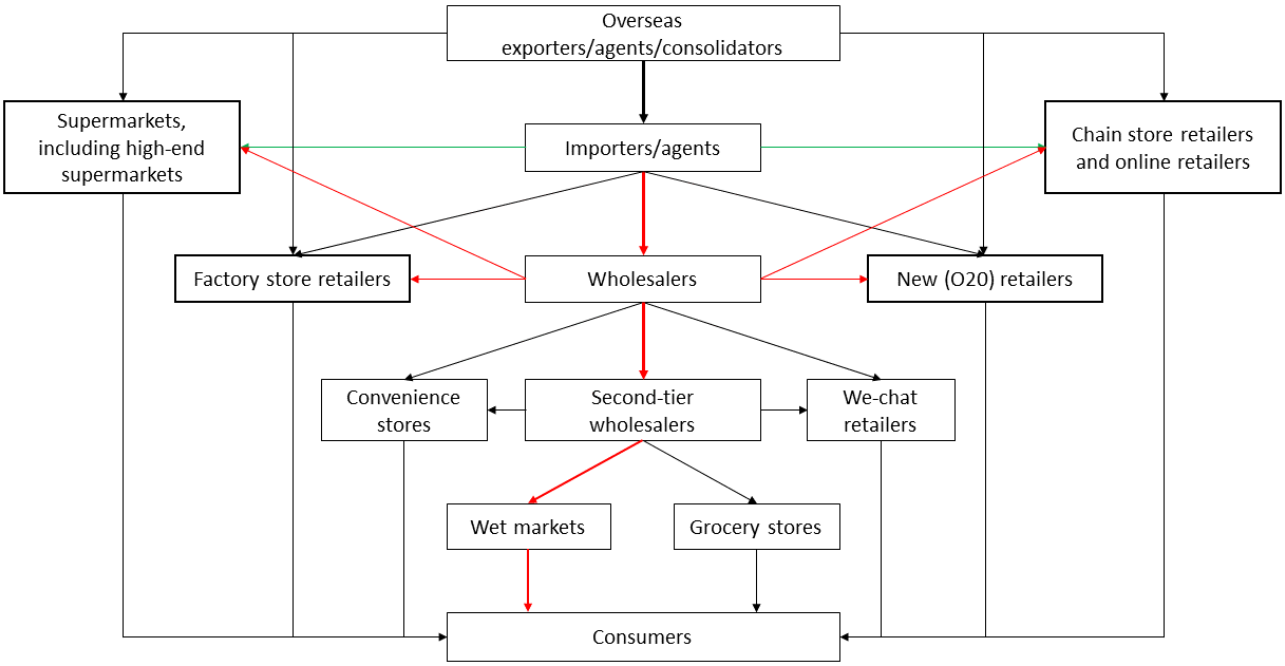

Figure 88 Supply chain structure for Australian mangoes in China

6.1.2.2.4 Japan

The distribution channel for imported fresh fruit in Japan involves importers, wholesale markets, and retailers, as shown in Figure 89. The wholesale market is part of the fundamental infrastructure of Japan's system of food distribution, which is supervised by the MAFF or local authorities. There are 53 central wholesale markets for fruit in Japan. Prices are determined by auction, reflecting the day's supply and demand and is believed to ensure fair pricing (Tokyo metropolitan central wholesale market, 2019).

Imported fruits are mainly transacted in Tokyo, Osaka, and Nagoya wholesale markets as these are the three largest markets, have high demand and are located near ports. Wholesale markets account for 60% of total fruit products, or over 90% if domestic products are included. Wholesale markets are maintaining their importance as a major pathway for the food distribution system in Japan. However, the volume and value of trade through the wholesale markets has decreased due to the increase of direct transactions from trading firms and importers to retailers. The shortened supply chain makes it more feasible to provide consumers with fresh fruit and to sell imported fruit at an affordable price (Izumi 2014). Trading firms and importers play a role in controlling the quality of

imported fruit and providing ripening services for mangoes and avocados. They have ripening and cooling rooms in their facilities. Avocados are received unripe from ports and are ripened to the level requested by each retailer before delivery.

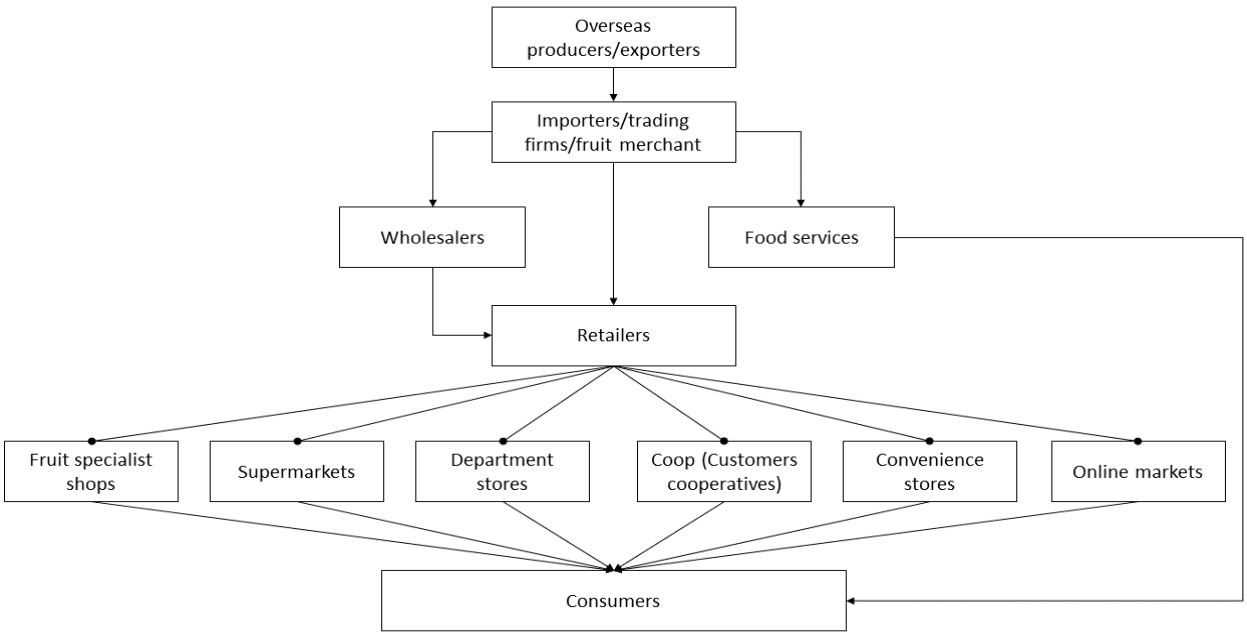

Figure 89 Supply chain structure for imported fresh fruit

6.1.2.2.5 South Korea

The distribution channel for imported fresh fruit in South Korea involves sales through a network of trading agents, importers and distributors (Deloitte Australia, 2017) as shown in Figure 60.

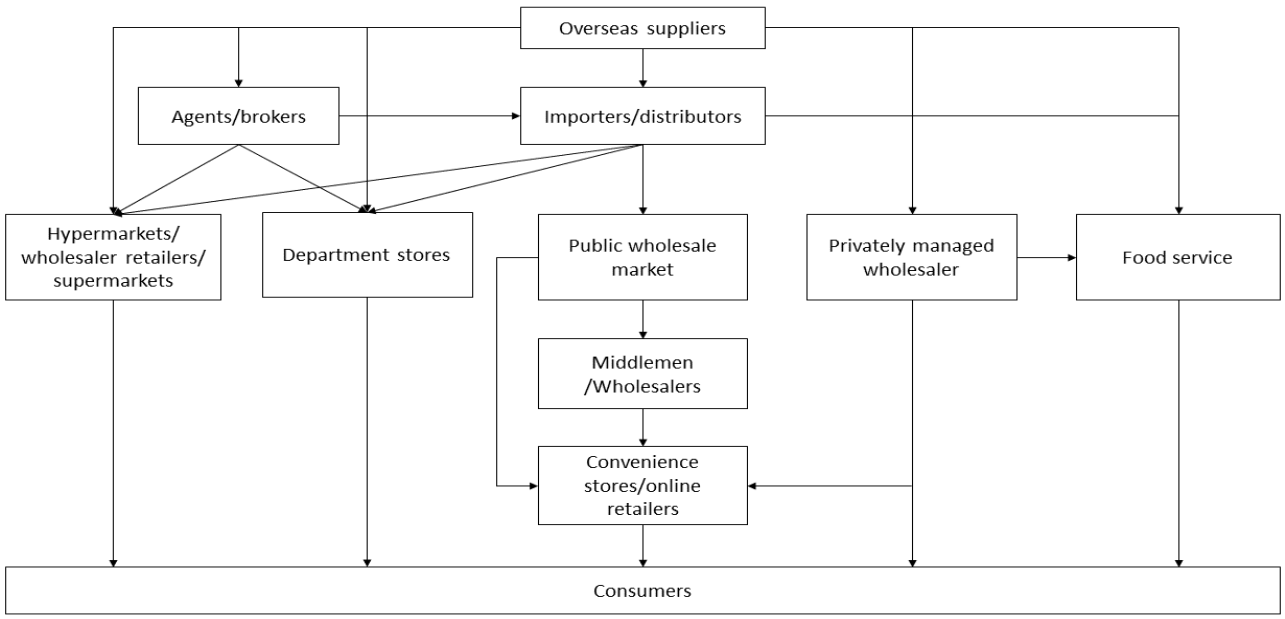

Figure 90 Supply chain structure for imported fresh fruit

The Garak-dong Agricultural Market is the oldest and largest public wholesale market in South Korea for marine and agricultural products. This is where Seoul Fruit and Vegetables, Hankook Fruit and Vegetables, Nonghyup, Seoul Gunhae, Seobu Fruit and Gangseo Fruit are top distributors (Fresh Plaza, 2012). Jin won is a wholesale distributor of fresh fruit and vegetables and was responsible for Australia's first shipment of mangoes in 2010 (Deloitte Australia, 2017). The majority of fresh produce is sold through the retail sector including the traditional market (Suh, 2011). South Korean importers of mangoes supply mainly to hypermarkets, supermarkets, department stores and foodservice companies (Deloitte Australia, 2017). While there is an increasing trend for these big retailers to source direct from foreign suppliers, South Korean retailers still rely on specialized importers and distributors for imported fresh fruit (Best Food Importers, 2016).

6.2 Operational insight

6.2.1 Operational process

6.2.1.1 Upstream supply chain operational process

6.2.1.1.1 Port of export

QLD, NT and WA have a number of ports for exporting local products to international markets. However, between 2016 to 2018 a majority of QLD and NT mangoes and QLD lychees, were exported from the ports of Brisbane and Sydney. Mangoes and avocados produced in WA are exported mainly from Perth due to geographical proximity. Although no official data is available for lychee exports, lychees are mostly exported from Brisbane, which is closer to the production region and therefore preferred by Asian customers. Table 58 ranks the export ports for mangoes and avocados by percentage as calculated from the 2016 to 2018 data.

Table 58 Ports for the exports of mango and avocado in 2016-18

Port of export		Australia	QLD	NT	WA
Mango export via	Brisbane	61.05%	75.51%	27.20%	3.10%
	Sydney	25.41%	13.01%	65.92%	13.53%
	Cairns	6.89%	8.80%	0	0
	Melbourne	4.44%	0.92%	4.44%	0
	Perth	0.64%	0.07%	0.30%	78.55%
	Darwin	0.02%	0	0.15%	0
Avocado export via	Brisbane	44.51%	69.65%	NA	1.35%
	Sydney	21.65%	17.89%	NA	0.72%
	Perth	16.66%	0.46%	NA	97.84%
	Melbourne	10.58%	2.16%	NA	0
	Cairns	0.04%	0.07%	NA	0

Source: calculated with World Trade Atlas data supplied by Hort Innovation Australia

Given the Northern Australia Infrastructure Facility (NAIF) has approved finance for a $300 million expansion of airport facilities, including storage and energy infrastructure in Darwin, Tennant Creek and Alice Springs (MDIIS, 2018), the export capacity from these airports could be expanded. Mango exports from Darwin by air to Asian markets will be further increased as direct flights from Darwin to Shenzhen in China have started in May 2018 and a freight and cold storage facility will be built in the Darwin Airport in 2019 (Brann, 2018b).

6.2.1.1.2 Mode of transport

Most mango, avocado and lychee produced in northern Australia are shipped by air to international markets. However, export companies are starting to trial sea freight shipments of mangoes to international markets given it's a lower-cost transport system (QCMD, 2010b), which could help expand their exports by lowering their freight costs. The first sea freight shipments were exported to Japan and mainland China in controlled atmosphere sea containers during the 2009/10 season (Campbell, 2012). According to Campbell (2012), sea freight could provide savings of $5.00 per carton when compared to air freight. It would also enable better temperature control during transport and more consistent fruit quality on arrival in destination markets. The first export of Australian mangoes to South Korea occurred during the 2010-11 season (QCMD, 2010b). In late 2017, Manbulloo mangoes shipped 3,250 cartons of mangoes directly from their Giru packing shed in north QLD to South Korea via the Port of Townsville aboard refrigerated container vessels. The direct sea shipment of mango from Townsville means less physical handling of mangoes and shorter supply chain. Perfection Fresh is trialling sea freight of Calypso mangoes into China with a project funded by the CRCNA (https://www.crcna.com.au/research/projects/sustainable-export-supply-chains-calypso-mango-china).

6.2.1.1.3 Operational constraints

Supply chain constraints that affect the cost, timelines, quality, efficiency and presentation either separately or in combination have been identified. The frequency of supply chain constraints reported by 24 interviewees are shown in Figure 91.

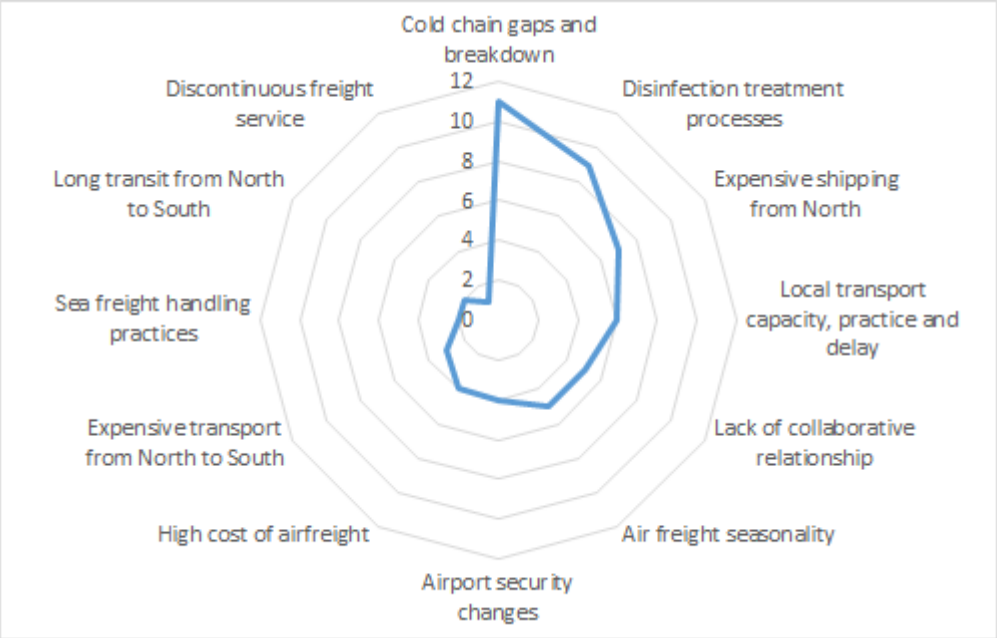

Figure 91 Frequency of supply chain constraints reported by 24 interviewees

Source: In-field interview data collation, as per table 2.

Constraints on export supply chains are raised by 24 out of 29 (82.76%) interviewees across mango, avocado and lychee industries operating within the CRCNA's definition of northern Australia. Figure 92 shows the relationship between supply chain constraints and 24 companies interviewed.

Among the identified 12 constraints in export supply chains, cold chain gaps and breakdown in either domestic transit or international shipping is ranked as being the highest concern, as indicated by 11 interviewees. Given that the respondents come from mango, avocado and lychee industries, this constraint appears across all three export supply chains. Disinfection treatment processes are the next concern, indicated by eight interviewees from the mango industry and one from the avocado industry (nine interviewees in total). The disinfection treatment required for mangoes exported to protocol markets, such as China and Korea and Japan, is Vapour Heat Treatment, which could damage fruit and bring in extra costs. It also leads to the increased lead time of supply chains as this treatment process takes six to eight hours and involves re-packing after treatment. As noted by one interviewee, it could take up to three days to complete the treatment when counting the dates when the fruit is brought in and re-packed. The treatment for avocado exported to Japan is pallet segregation packing, which means that a small number of trays can be shipped in an AKE or PMC. This treatment makes the cost of exports higher to Japan.

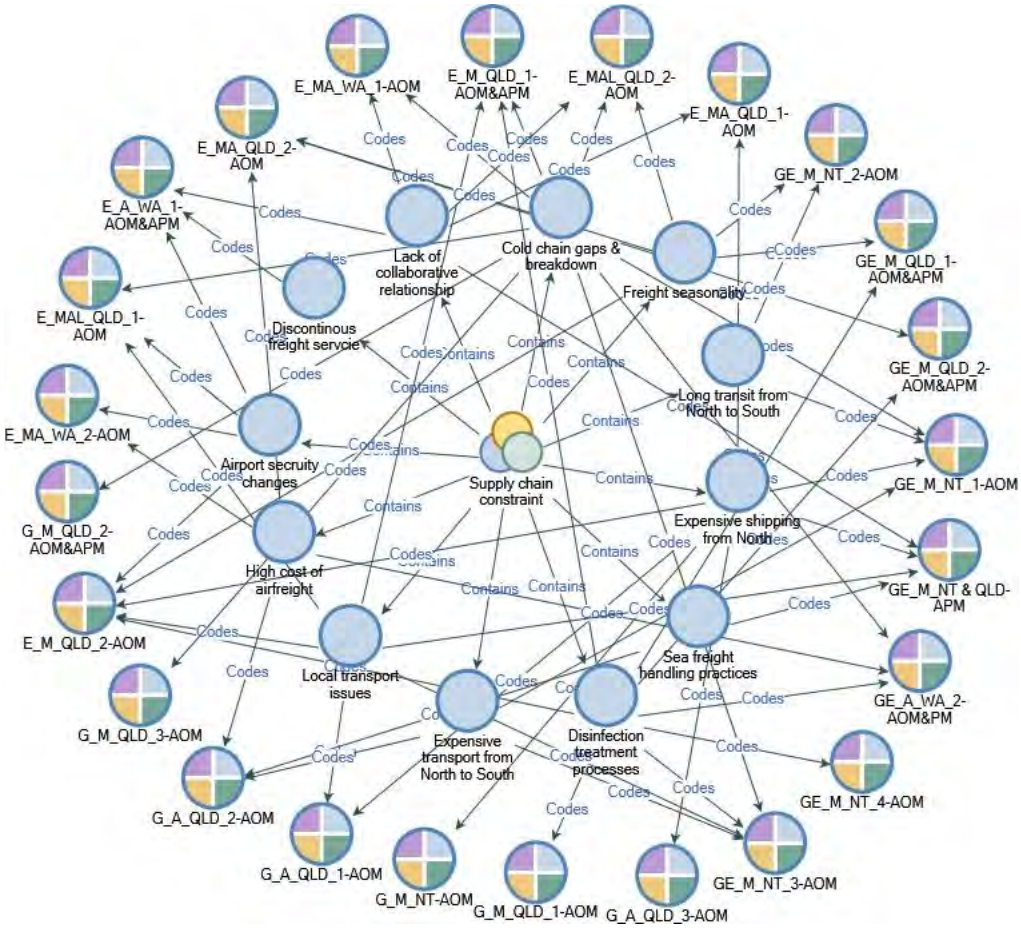

Figure 92 Relationship between supply chain constraints and companies interviewed

Source: In-field interview data collation, as per table 2.

Local transport capacity, logistics operational practice and delay, as indicated by six interviewees, is the third-highest constraint. This constraint is applied to the supply chains of mango, avocado and lychee. Local transport delays were indicated by four interviewees compared with local transport capacity and practice, which was indicated by one interviewee each. Similarly, lack of collaborative relationships across the chain and freight seasonality are indicated by five interviewees each. These two constraints are indicated by merchant exporters and grower exporters. As indicated, a lack of collaborative relationships not only happens in their relationship with upstream growers but also in their relationship with international customers. Given that mangoes, avocados and lychees are mainly air freighted from Brisbane and Sydney, air freight seasonality refers to the seasonal unavailability of air freight space in these two airports, particularly in the Christmas season. This constraint not only gives rise to delivery delays but also leads to increased airfreight costs.

With current export supply chains stretching from NT and far north QLD to Brisbane, Sydney and Melbourne, expensive transport and long transit times from north to south were raised by one grower and two grower exporters interviewed. The mainstream supply chain mode increases supply chain

costs as well as leads to a longer supply chain lead time. Although some interviewees expressed their interest and even attempted to ship directly from Darwin and Cairns, the reality is that direct shipping from the north is more expensive compared with shipping from Brisbane, as indicated by three interviewees. Costs may be reduced as Cairns International Airport aims to expand high value food exports (Advance Cairns, CRCNA et al., 2020). The high cost of airfreight in Brisbane and Perth was also raised by four interviewees from WA and QLD. While interviewees indicated that air freight services run smoothly in Brisbane and Sydney, discontinuous airfreight services in Perth was raised by one interviewee from WA. Besides, airport security changes refer to the screening process effected on 1st April 2019. Four interviewees from WA and Brisbane indicated that the airport security changes can lead to extra costs.

Sea freight can be an alternative solution as shipping by sea is usually cheaper than by air. However, extension of the supply chain lead time by sea freight handling practices were raised in interviews with one interviewee indicating that they have to send their fruit to Brisbane, where double handling is required due to pallet size differences. Mangoes shipped from the port of Townsville are required to be delivered in the containers to the port one to two days before the vessel arrives (James, M 2020, pers. comm. 5 June).

6.2.1.2 Downstream supply chain operational process

6.2.1.2.1 Entry channel

In field studies were not conducted for South Korea and therefore limited data is available for entry channels for this country.

Entry channel into Hong Kong - Fruit into Hong Kong is organised almost entirely through two wholesale markets: the Western wholesale food market and the Yau Ma Tei wholesale fruit market (Martin and Chan, 2014). The Yau Ma Tei wholesale fruit market used to centralise the distribution of all imported fruit, and today still handles a significant portion (Lai, 2018). The market handles more than 70% of total fruit products in the Hong Kong market (Lee, 2009) and continues to command the lion's share of Hong Kong's fruit wholesale business (Martin and Chan, 2014). According to an importer and wholesaler, Australian mangoes, avocados and lychees are mainly transported from the port of arrival to the Yau Ma Tei wholesale fruit market. A small portion of the fruit goes directly to some retailers distribution centres upon arrival in the cases for direct import by retailers. Most importers, including wholesalers and retailers, use a third-party transport company to assist with fruit pick-up and distribution; however, some importers have a fleet transport team. One wholesaler indicated that they have a team of 12 people for their fleet transport.

Entry channel into Singapore – Pasir Panjang wholesale centre is Singapore's main wholesale market and distribution point for imported fruit and vegetables (Valluvar, 2017). It is estimated that about 40% of all fruit and vegetable imports in the country pass through the centre, while the

remaining 60%is handled by independent retailers and other importers, some of whom have their own facilities (Valluvar, 2017). Three local importers were interviewed – one in the Pasir Panjang wholesale centre, while the other two have cold storage facilities outside the centre. Therefore, the percentage of Australian mangoes, avocados and lychees that enter the wholesale centre and other independent importers cannot be identified. However, it can be confirmed that Australian mangoes, avocados and lychees are air freighted to Changi airport, from where they are transported with refrigerated trucks to the importers located in the wholesale centre or other importers who have their own facilities in other parts of Singapore.

Entry channel into China – Imported fruit into China are predominantly shipped by air and mainly enter China via the major ports, such as Shanghai, Beijing and Guangzhou, from where they are sold in the local markets or to other parts of China. For example, Good Farmer – a fruit importer - mainly uses the ports of Shanghai, Guangzhou, Tianjin and Dalian (Fresh Plaza, 2017b). Similarly, direct imports of Australian mangoes are mainly to major markets, including Shanghai, Beijing and Guangzhou. Although the export of Australian mangoes via the direct channel into China is increasing, it is estimated by some industry practitioners more than 90% of these Australian mangoes enter the Guangzhou Jiangnan Wholesale market via the Hong Kong grey channel. Once in China, they are then distributed to other regions, including wholesale markets in Shanghai and Beijing. Two wholesalers in Guangzhou Jiangnan wholesale market indicated that only some wholesalers in the Jiangnan market know how to handle the grey channel, while the wholesalers in Shanghai and Beijing do not know how it works. This statement is validated by wholesalers in Shanghai Huizhan markets who said they buy Australian mangoes from Jiangnan-based wholesalers as they don't know how to handle the imports via the grey channel.

Entry- channel into Japan - The main ports of entry for mangoes, avocados and lychees are shown in Figure 93. Mangoes and lychees are typically airfreighted to Japan due to their limited shelf life. The key airports for receiving mangoes are Narita and Haneda airport near Tokyo, while the key airports for receiving lychees are Narita airport, Haneda airport and Tokyo Port. In contrast, avocados are mostly imported into Japan by ship, with Tokyo, Yokohama and Kobe being the major ports of entry. Though sea freight is used by some other countries for shipping mangoes and avocados into Japan, Australian mangoes and avocados are all air-freighted to Japan, where Narita airport is the only receiving port.

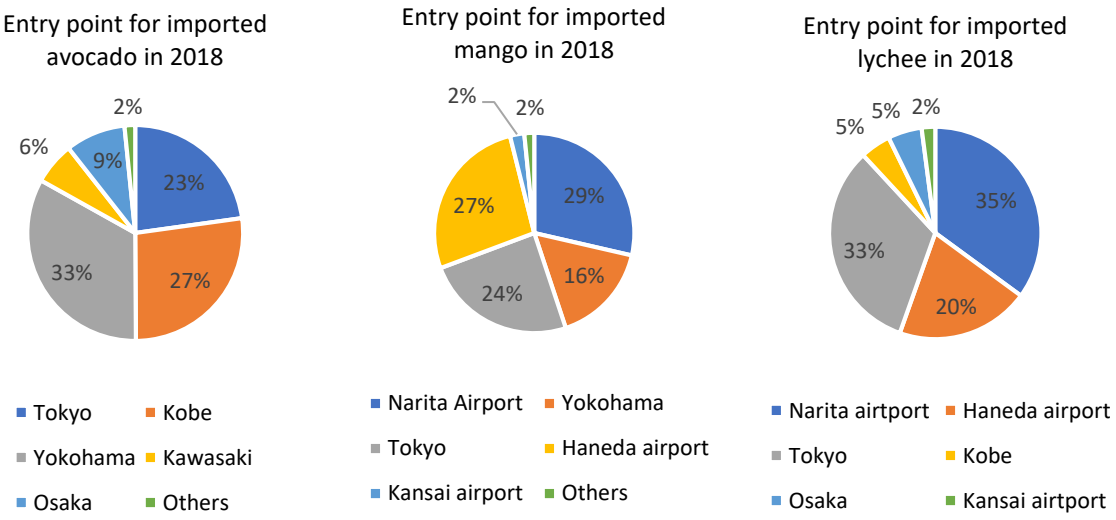

Figure 93 Entry points for imported mango, avocado and lychee in 2018
Sourced from Trade Statistics of Japan

6.2.1.2.2 Fruit storage

In-field studies were not conducted for Japan and South Korea and therefore limited data is available for fruit storage for these countries.

Fruit storage in Hong Kong - Most Kong Hong importers and wholesalers do not have cold storage warehouses due to high rents in Hong Kong. One importer and wholesaler pointed out “It is just simply unaffordable for us as it would cost us billions of dollars to have a proper warehouse”. For the wholesalers who do not have a cold storage warehouse, they leave the container to refrigerate their fruit. This practice is typical for most Hong Kong importers. However, some importers and wholesalers, such as Good Views, have built storage facilities and even a ripening facility to ensure all fruit is conditioned to meet client requirements and remain fresh, thereby enabling them to differentiate their product from their competitors (Fructidor, 2017). In contrast, most big retailers, including the three retailers interviewed, have central distribution centres which are equipped with cold storage facilities. Their fruit which is directly imported or procured via import agents or from the wholesale markets is transported to their distribution centres for cold storage.

Fruit storage in Singapore - Singapore has a highly developed and sophisticated cold chain distribution system (ITA, 2016). All three local companies interviewed have cold storage facilities and even one importer/wholesaler has adequate ripening facilities. Wholesalers generally use third party transport with refrigerated trucks to pick up the fruit upon arrival and transport to their cool rooms, which are situated in either the Pasir Panjang wholesale centre or other regions. Similarly, retailers have forwarders to pick up fruit from the port on arrival with cold trucks and place the product in their distribution centre for cold storage. Some wholesalers who also act as distributors have their

fleet transport team for distribution to their customers. Retailers generally have their own distribution centres equipped with cold storage facilities. One retailer said that they have one major distribution centre for fruit storage and dispatch given the small size of the Singapore market.

Fruit storage in China - Most Chinese importers and wholesalers in the three major wholesale markets do not have cold storage warehouses. While some do have cold storage facilities, their storage facilities are not well constructed and often have limited capacity. Since they can retain the containers for a couple of days after receiving the fruit, they often leave the fruit in the containers for temporary storage. The customs broker interviewed in Shanghai indicated that they have 200 truck racks available to be used by their customers to stack the containers. A truck rack provided by a Shanghai-based customs broker is shown in Figure 94.

Figure 94 A container stacked on a truck rack provided by a Shanghai-based customs broker

In contrast, some online retailers, such as Benlai and Fruit Day and chain store retailers, such as Pogoda and Xianfeng have developed regional distribution centres which are equipped with cold storage facilities. As a result, they can store fruit that is directly imported in their distribution centres upon arrival. However, there is a cold chain break for the fruit that they buy from wholesale markets as they pick the fruit from the market and then transport to their distribution centres.

Currently, imported fruit is mainly sold at room temperature in the major import wholesale markets. In the winter season, there could be a small impact on the fruit quality due to low room temperatures. However, in the summer season, fruit quality is negatively affected by the temperature variation between temperature-controlled containers and room temperature. It is reported that avocados often arrive in a container at below 4 °C and sold outdoors at temperatures over 30°C in summer. The

considerable temperature variation leads to quality degradation, such as bruising and black spots (Fresh Plaza 2017b). Because of this, importers and wholesalers try to move the fruit as quickly as possible. It should be noted that as the Australian mangoes in Chinese markets are sold in the winter season when temperature-induced damage is less of an issue.

6.2.1.2.3 Distribution channels

Fruit distribution channels in Hong Kong - Hong Kong importers, including wholesalers/agents and retailers, bring fruit to a wholesale market, dominantly the Yau Ma Tei market, for distribution or re-export (Lai, 2018). In the Hong Kong market, Australian mangoes, avocados and lychees that are imported by importers and wholesalers are mainly distributed to retailers and fruit hampers as well as secondary wholesalers who are also involved in retailing businesses in the Yau Ma Tei wholesale market. One wholesaler indicated that they sell Australian mangoes and lychees to supermarkets, including Wellcome and also fruit retailers in China, such as Pagoda.

Fruit distribution channels in Singapore - Pasir Panjang wholesale centre is Singapore's main wholesale market and distribution point for imported fruit and vegetables (Valluvar, 2017). It is estimated that about 40%of all fruit and vegetable imports in the country pass through the centre, while the remaining 60% is handled by independent retailers and other importers, some of whom have their own facilities (Valluvar, 2017). Australian mangoes, avocados and lychees imported into Singapore by importers and wholesalers are distributed to secondary wholesalers (wet market), food services, supermarkets and e-commerce. The distribution channel varies for Australian Hass and Shepard avocados in Singapore. Hass avocados are mainly sold to supermarkets and sometimes to food services, while Shepard avocados are mainly distributed to the wet market, where there is a demand for the Shepard variety from specific consumers.

Fruit distribution channels in China – There are four major imported fruit distribution centres which serve the Chinese markets (Figure 95). Imported mangoes, avocados and lychee mainly come to Guangzhou, Shanghai and Beijing, and sold at wholesale markets, local supermarkets and to second wholesalers in surrounding provinces and markets. Each distribution centre serves a geographic area. For example, Beijing Xinfadi market serves the surrounding markets, including wholesale markets and supermarkets in Liaoning, Jilin, and Heilongjiang, as well as Hebei, Shandong, and Inner Mongolia (Fresh Plaza, 2018g). While Shanghai Huizhan markets serve wholesale markets and supermarkets in Jiangsu, Zhejiang and Anhui and Guangzhou Jiangnan market serves these surrounding regions, including Guangdong, Guangxi, Fujian, Hunan, Hubei, Sichuan and Guizhou.

Figure 95 Major imported fruit distribution Centers
Sourced from Roberts and Wandschneider (2015)

Fruit distribution channels in Japan – Imported fruit is mainly transacted in Tokyo, Osaka, and Nagoya wholesale markets as these are the three largest markets, have high demand and are located near ports. Wholesale markets account for 60% of total fruit products. This is over 90% if domestic products are included. Wholesale markets are maintaining their importance as a major pathway for the food distribution system in Japan. However, the volume and value of trade through the wholesales market has decreased due to the increase of direct transactions from trading firms and importers to retailers. The shortened supply chain makes it more feasible to provide consumers with fresh fruit and to sell imported fruit at an affordable price (Izumi 2014). Trading firms and importers play a role in controlling the quality of imported fruit and providing ripening services for mangoes and avocados. They have ripening and cooling rooms in their facilities. Avocados received unripe from ports are ripened to the level requested by each retailer before delivery.

Fruit distribution channels in South Korea - The Garak-dong agricultural market is the oldest and largest public wholesale market in South Korea for marine and agricultural products, where Seoul Fruit and Vegetables, Hankook Fruit and Vegetables, Nonghyup, Seoul Gunhae, Seobu Fruit and Gangseo Fruit are top distributors (Fresh Plaza, 2012). Jin won is a wholesale distributor of fresh fruit and vegetables and was responsible for Australia's first shipment of mangoes in 2010 (Deloitte Australia, 2017). The majority of fresh produce is sold through the retail sector including traditional markets (Suh, 2011). South Korean importers of mangoes supply mainly to hypermarkets, supermarkets, department stores and foodservice companies (Deloitte Australia, 2017).

6.2.2 Operational innovation

6.2.2.1 Upstream supply chain innovation

6.2.2.1.1 Digital supply chain traceability

New digital technologies have been deployed in the avocado supply chain to track and see where products go and monitor the temperature. One avocado exporter indicated that their deployment of WiFi-enabled data loggers to track and monitor the export supply chain helped them to address the issues that were not detected using a traditional data loggers. With the WiFi-enabled data loggers, they can easily download and trace the whole process, whilst in a 3G network.

6.2.2.1.2 Real-time communication capability

New digital data systems have been developed by some companies in northern Australia as a means of facilitating real-time communication between growers and exporters. One example includes an interview with an exporter who has developed an innovative fresh produce software which allows real-time communication between growers, suppliers, pack houses, market agents, and buyers. The exporter indicated that with the digital data system, their mango growers can monitior their fruit closely by being able to instantly access the fruit quality reports, which are compiled before and after the VHT. This software has enhanced transparency in the supply chain and enabled greater tracking, monitoring and quality control of mangoes as they move from the grower to the market.

6.2.2.1.3 Sea freight trialling

Most of the mango, avocado and lychee consignments are shipped to international markets by air, given the high cost of air freight. Some exporters have investigated sea freight as a viable alternative. For example, Manbulloo Ltd planned a sea freight shipment as a trial to assess the performance of this lower-cost transport system (Austrade, 2017). Another exporter – Perfection Fresh – is also working to trial sea freight of Calypso mangoes into the Chinese market.

6.2.2.1.4 Product-related service

Product-related value-adding services are another kind of innovation generated in the upstream supply chain to better serve international customers. One QLD-based mango grower exporter indicated that they support their customers with the conditioning of the mangoes. The grower exporter added that when they ship mangoes to their Asian customers, they tell their customers what the condition is like for each shipment and advise their customers how to treat and ripen these mangoes to get the most benefits. One WA-based avocado exporter also indicated that they provide the same kind of service to their customers. They presented a case study and explained how they guided their customers in Singapore and Malaysia on how to properly ripen avocados.

6.2.2.2 Downstream supply chain innovation

6.2.2.2.1 Value adding products

Value-adding with Australian mangoes – Chinese importers often regrade the Australian mangoes into three locally recognised classes based on the blush ratio: premium fruit with over 80% blush, Class 1 with 60-80% and Class 2 with less than 60% blush. After Australian mangoes are regraded, they are packed with Chinese local brands, such as Big Tiger, Sun Phoenix and Gogofruits. Figure 96 shows two local brands sold in the Shangahai Huizhan wholesale market.

Figure 96 Australian mangoes displayed with local brands in a wholesale market

Value-adding with avocados- Chinese importers and retailers have introduced value-added options, such as ripe-and-ready-to-eat, along with the expansion of fresh-cut and frozen fruit. This has contributed to making it more convenient for consumers to enjoy avocados. Ripeness indicators are being printed onto avocado packaging, which helps consumers accurately identify fruits ready for immediate consumption. Shanghai Supafresh avocados are sold in assortments of three respective groups of ripeness – 30%, 60%, and 90% (Golnazarian, 2017). Figure 97 shows the avocado packed in three ripeness stages. Currently, consumers can choose the “ready to eat” or mixed ripe avocados via JD.com. In addition, there are frozen avocados available online to cater to different customers needs.

Figure 97 Avocado assorted into three groups of ripeness in China

6.2.2.2.2 Procurement mode innovation

Chinese retailers have worked to expand their capacity for direct sourcing from international suppliers, rather than simply relying on importers and wholesalers. Some retailers have expanded their businesses to absorb large-scale direct procurement. For example, Benlai, a Beijing-based retailer has established a new business under the umbrella of Benlai, which directly sources fruit for its e-commerce platform and supplies other retailers and grocery stores as well. Some retailers have merged to expand their procurement capacity. For example, Xianfeng Fruit fully acquired K-Fruit Garden in 2015 (Produce Report, 2015). Expanding the number of chain stores is another example of how to improve direct procurement capacity. For example, Pogoda and Xianfeng have been expanding their store numbers so that they can have a large procurement quantity.

6.2.2.2.3 Sales channel innovation

Many Chinese importers and retailers have worked to expand and innovate their sales channels in the competitive Chinese market. For example, Supafresh – an import and wholesale company – is expanding its retail business and foodservice. It has sales channels through E-commerce, TV shopping and physical stores in the centre of Shanghai. The company's foodservice supplies hotels and restaurants with ready-to-eat fresh produce (Fresh Plaza, 2016c). Pagoda continues to expand the distribution of its stores throughout cities in China to provide optimum coverage. Although this expansion is still focused on first- and second-tier cities, to further intensify their current distribution network, they have accelerated their vertical penetration of markets in third- and fourth-tier cities where there are growing demands for quality fresh food (Fresh Plaza, 2019b).

The integration of online and offline sales have occurred at wholesale and retail levels. For example, Good Farmer – an importer and wholesaler, sells imported products both online and offline to large scale markets, such as the Jiangnan market in Guangzhou, the Huizhan market in Shanghai and the Xinfadi market in Beijing (Fresh Plaza, 2017b). Many retailers have worked to integrate online and offline sales for a better shopping service. For example, Yiguo fresh took over all the shares of Lianhua Supermarket held by Yonghui Supermarket in 2016 and Fruitday fully acquired city shop supermarket in 2017 (Shao and Chen, 2017). Another recent channel innovation is the inclusion of community group buyers, with community buying groups developing in recent years, as indicated by a Shanghai-based retailer.

6.2.2.2.4 Strategic collaboration

Chinese wholesalers and retailers have worked to build strategic relationships. The importers and retailers generally enter a partnership with retailers and act as their import agent and distributors. For example, Good Farmer has built stable, long term relationships with large scale retailers, such as Vanguard, Walmart, Carrefour, Jingdong and Tianmall, and e-commerce platforms, such as Fruit Day and Benlai.com (Fresh Plaza, 2017b).

6.3 Performance benchmarking

6.3.1 Upstream supply chain performance

6.3.1.1 Supply chain cost and lead time from producing regions to main markets

Table 59 offers a summary of alternative transport costs and lead times facing northern Australia's horticultural producers.

The additional complexity of Australia's export supply chain results in transport costs being a larger component of the total cost of production in the agriculture sector than it is for many international competitors. Therefore, supply chain efficiency in the agricultural supply chain – and particularly cost minimisation – is a critical element of the overall global competitiveness for Australia's agricultural sector.

Table 59 Transport time and lead time from northern Australia to key capital markets

Production region	Place of despatch	Destination	Transport time	Transport cost ($/pallet)
NT	Katherine	Sydney	3-5 days	$354
		Melbourne	3 days	$261
		Brisbane	3 days	$267
		Perth	5 days	$502
		Adelaide	2 days	$195
		Darwin	0.5 day	$85
	Darwin	Sydney	3 days	$440
		Melbourne	4-5 days	$440
		Brisbane	5 days	$630
		Perth	5 days	$650
		Adelaide	3 days	$400
WA	Carnarvon	Perth	2 days	N/A
	Kununurra	Perth	4 days	$156
North QLD	Mareeba/ Dimbulah/ Cairns	Sydney	3 days	$272
		Melbourne	4 days	$280
		Brisbane	1 day	$195
		Adelaide	5 days	$358
	Atherton	Brisbane	1 day	$180
		Cairns	2 hours	$15-16
	Bowen/ Burdekin	Sydney	2 days	$300
		Melbourne	3 days	$360
		Brisbane	14 hours	$228
		Adelaide	4 days	-

Source: In-field interview data collation, as per table 2.

Note: Trays per pallet – 120 | R2E2, 136 | KP, 128 | Keit and others; 170 | Avocados and 168 | lychees.

6.3.1.2 Lead time and freight costs of export supply chain into Asia

Table 60 provides a snapshot of freight cost and the transit time from some Australian ports to targeted Asian markets.

Table 60 Freight cost and lead time from Australia to targeted Asian markets

		Airfreight		Sea freight	
	Destination	AKE	PMC	40 ft	Lead time

Place of despatch		Loading	Airfreight	Loading	Airfreight		
Brisbane – QLD	Singapore		$1,105	$325	$3,100	$3,500	
	Hong Kong		$1,285	$325	$2,850		
	Shanghai	$520	$1,782	$1100	$3,921		
	Tokyo		$1,950		$3,850		
	Seoul		$1,758		$4,552		
Townsville – QLD	HK/Shenzhen	-	-	-	-		28 days
	Busan	-	-	-	-		29 days
Perth – WA	Singapore		$1,350		$2,700		
	Hong Kong		$1,485		$2,935		
	Tokyo		$2,500		$3,500		
Darwin – NT	Singapore						
	Hong Kong						30 days

Source: In-field interview data collation, as per table 2.

Note: (1) AKE – 1500 KG Max; PMC – 4500 KG Max.

A recent Advance Cairns and CRCNA report [Export 2030 – delivering fresh food fast: The opportunity to double high value food exports from Far North Queensland] examined the air freight cost components for horticultural crops exported from Cairns International Airport. Cairns International Airport exports to a number of priority markets in Asia, including China, Hong Kong, Indonesia, Japan and Singapore. It found the average FOB air freight price per kg over the the last decade from Cairns International airport was $4.88 per kg for avocados/mangoes and $7.87 per kg for other fresh fruit.

6.3.2 Downstream supply chain performance

6.3.2.1 Strategic performance

6.3.2.1.1 Hong Kong

Some Hong Kong importers have established supply chain partnerships with their overseas suppliers. For example, one of the interviewees has built a partnership with one of their Philippines mango suppliers and directly invested in their overseas business partners. Gyaldar Limited invested in the Myanmar avocado industry (Fresh Plaza, 2018b). However, no such kind of partnership between Hong Kong importers and Australian exporters, or direct investment from Hong Kong importers, has been identified based on the information gathered from the field study and secondary sources.

6.3.2.1.2 Singapore

Singapore importers source mangoes, avocados from several countries. One wholesaler indicated that they import mangoes from Australia, India, Pakistan and Thailand and avocados from the USA, Mexico, New Zealand and Australia. While they buy avocados from Australia, they do not buy large volumes from Australia due to the higher procurement price. Another wholesaler mentioned that they buy avocados from the USA, Mexico, Kenya and Australia. Singapore importers import lychees from a few countries, such as China and Vietnam. Two wholesalers indicated that they only import a small volume, while the retailer said that they only import from China. Singapore retailers generally import mangoes and lychees directly, albeit with some procurements from local wholesalers. However, as avocados are a sensitive fruit that require a ripening service, they mainly source from Fresh Mart, which specializes in the import, export and distribution of premium quality fresh fruits and vegetables. Though Singapore importers prefer to work directly with growers, they mainly rely on Australian exporters/traders for supplying mangoes, avocados and lychees. One wholesaler indicated that other supplying countries, including Thailand and Malaysia, mostly have a direct supplier for mangoes. However, given that many orchards do not directly export, there are not many direct suppliers in Australia. As such, they mainly source Australian mangoes from exporters/traders, most of whom are located in the wholesale markets in Sydney, Melbourne and Brisbane. In contrast, the mango supply chain from Thailand is very rigourous as there are a few large exporters who work with lots of growers to supply the fruit.

Singapore importers generally work with one to two suppliers for sourcing mangoes, avocados and lychees. For example, one wholesaler indicated they only buy Australian avocados from two suppliers and they only use one supplier for lychees. Another wholesaler also indicated they only work with Avolution for Australian avocados and Sun lychee for Australian lychees. Retailers also adhere to a few supplier strategies. For example, one retailer indicated that they usually have one supplier in every country that they work with. However, when sourcing Australian mangoes, they usually have to work with two or thress more suppliers. This is because they want to obtain a competitive price by comparing suppliers due to the fluctuating price in procuring Australian mangoes during seasons. One wholesaler who imports directly from Australian growers indicated that they have to work with more than two mango suppliers in Australia given that mangoes suppliers (growers) are located in different regions.

Singapore importers do not trade with consignment unless their supplier has sales problems and asks them to do so. They generally buy the fruit and pay later. One wholesaler indicated that they usually pay their Australian exporters between 14 to 30 days after receiving the fruit. They follow a similar payment method for all suppliers across the world. This is the same case for local sourcing, retailers also make the payment from 14 to 30 days after receiving the fruit.

6.3.2.1.3 China

Chinese importers often work with either exporters or grower exporters when sourcing mangoes and avocados from South American countries. It is the same case for sourcing mangoes from Australia. In the early stage, Chinese importers would provide a supply program, which turns into relationship-based transactions over time. In terms of the trade mode, it depends on their negotiation and business relationships. A Guangzhou-based importer and wholesaler said that some suppliers work with consignment or minimum guarantee payment, some with a percentage of upfront payment, but for the majority, payment is made after receiving the fruit.

It could be a different story when the Chinese importer's source mangoes from Vietnam and Thailand. Although working with exporters or grower exporters for direct sourcing is a common practice, several importers go to the farms and buy all the fruit before the harvest. They then pay a packer to pack based on their requirements or directly rent a packhouse to pack by themselves. The two wholesalers interviewed in the Beijing Xinfadi market follow this rule. They said sourcing like this can help them control the entire process to reduce cost and ensure quality consistency.

6.3.2.2 Operational performance

6.3.2.1.1 Hong Kong

The comparison of supply chain lead time from origin to destination is shown in Table 61. The obvious advantage for Australia's fruit export to Hong Kong is the shorter transport time by air compared with the USA, South Africa and South American countries. However, Australia's advantage in transit time to Hong Kong by sea has not been evident in recent years given the optimisation of shipping from South America to Hong Kong.

Table 61 Comparison of supply chain lead time from origin to Hong Kong

Departing country	Port of departure	Mode of transport	Shipping time
Australia	Brisbane	Sea	22 days
	Brisbane	Air	1 day
Mexico		Sea	21 days
		Air	3-4 days
Chile	Valparaíso	Sea	22 days
		Air	3-4 days
USA		Air	2-4 days
Philippines	Manila	Sea	3-4 days
South Africa		Sea	25 days
Kenya		Sea	22-28 days

Source: In-field interview data collation, as per table 3.

One wholesaler mentioned that ocean freight is far cheaper than air freight and thefore the return to the growers is very good when shipping mangoes from Australia to Hong Kong. But the risks associated with shipping mangoes by sea are much higher and you cannot guarantee the quality. An importer pointed out that almost 99% of Hong Kong importers do not want to ship mangoes by sea.

6.3.2.1.2 Singapore

Singapore importers accept different modes of transport for shipping mangoes, avocados and lychees from supplying countries. The comparison of supply chain lead time from major supplying countries to Singapore is shown in Table 62.

Table 62 Comparison of supply chain lead time from origin to Singapore

Departing country	Port of departure	Mode of transport	Shipping time (days)	Sea freight cost (AUD) (40ft Container)
Australia	Brisbane	Air	Same day	
	Sydney	Sea	Approx.20	1,470-1,620
USA		Air	2-3	
	Los Angeles	Sea	Approx.30	1593-1756
Mexico		Air	2-3	
		Sea	30+	
New Zealand	Auckland	Sea	30+	2648-2929
Taiwan		Sea	7	
Thailand		Road	2-3	
Philippines	Manila	Sea	Approx.12	760-840

Source: In-field interview data collation, as per table 3 and secondary data (https://moverdb.com/shipping-to-singapore/).

Note: exchange rate (1USD=1.42 AUD; 1 NZD=0.95 AUD; 1 PHD=0.028 AUD).

Mangoes from Thailand are shipped by truck, which takes about two to three to days to Singapore, while mangoes from Taiwan are shipped by sea, which takes about seven days. Avocados from Mexico, the USA and New Zealand are mostly shipped by sea. Although sea freight is much cheaper, one wholesaler indicated that the quality is sometimes not stable upon arrival due to the lengthy trip by sea. Australia has a cost advantage over New Zealand when shipping by sea; however, Singapore importers import Australian avocados mostly with airfreight, given that the air freight cost is acceptable. More importantly, as indicated by one wholesaler, fruit can arrive on the same day by air, which can ensure the maximal freshness consumers demand. On the other hand, it could take about 20 days by sea from Australia to Singapore.

6.3.2.1.3 China

The obvious advantage for exporting Australia's fruit to China is the shorter transport time compared with the USA, South Africa and South American countries. The comparison of supply chain lead time from origin to destination is shown in Table 63.

Table 63 Comparison of supply chain lead time from origin to destination

Departing region/country	Mode of transport	Port of arrival	Shipping time	Road transport from Guangzhou to Shanghai	Road transport from Guangzhou to Beijing
South America	Sea	Shenzhen	20-30 days	1 day	1.5 days
	Air	Guangzhou	3-5 days		
Australia	Sea	Shenzhen	12-15 days		
	Air	Guangzhou	1 day		

Source: In-field interview data collation from Chinese interviewees, as per table 3.

Sea freight is the most used mode of transport for transporting avocado from South America to China as it is cheaper compared with air freight. A Guangzhou-based wholesaler said that air freight is about four to five times more expensive than sea freight. But the issue with sea freight is that it often takes 20-30 days to get to China and the quality is not predictable upon arrival. Airfreight is often used for mangoes and sometimes for avocados as it is much faster and usually takes about three to five days with the inclusion of waiting and transit time (Tina, 2018c). Given the risk of a cold chain break in transit and waiting in traditional air freight, some importers, such as Yiguo, have tried air charter to import Mexico's avocados. The air charter only takes 25 hours from Mexico to China, which can ensure fast and reliable delivery. In contrast, the transit time from Australian exporters to Chinese importers is much shorter, at one day by air and at 12-15 days by sea.

Road transport is the most used mode of transport when importing mangoes from Thailand and Vietnam. Normally, the fruit is transported to the land port (Pingxiang Port) in Guangxi and then transported to Guangzhou, Shanghai and Beijing. A Beijing-based wholesaler said that it takes one week to reach Beijing.

Given the overlapping supply windows with local mangoes in Guangdong and surrounding regions, mangoes produced in Thailand and Vietnam are not competitive any more in the Jiangnan market as a result of the improved production and quality of local mangoes.

Table 64 compares supply chain cost and sales price for mangoes by country of origin. Peru and Ecuador have a much higher shipping cost in terms of air freighting mangoes to China. The cost of air freight from Peru and Ecuador is at least $4.30 per kg compared with $1.58 kg per kg from Australia. Because of the higher cost of air freight, Peru and Ecuador have to target premium market channels through quality and taste, rather than competing on price (Produce report, 2016). A high-end retailer said that their procurement price for Peruvian mangoes from local importers and

wholesalers are sometimes higher than Australia's. As a result, the retailing price for air-freighted mangoes from Peru and Ecuador are quite similar to that of Australia's at the high-end retailer's end. To further improve their competitiveness, Peru and Ecuador have trialled sea shipment to reduce their freight costs. The first sea shipment of Peruvian mangoes landed in Shanghai in February 2017 (Fresh Plaza, 2017a) and Ecuador will send their first sea shipment during the 2019/2020 Season (Produce report, 2019).

Table 64 Breakdown of supply chain cost and sales price for mangoes

Country	Variety	Tray weight (kg)	Airfreight cost ($/kg)	CIF Guangzhou via direct import ($/Tray)
Australia	R2E2	7kg	1.58	60-84
Peru	Kent	6kg	4.3+	NA
Ecuador	Kent	6kg	4.3+	NA

Source: In-field interview data collation from Chinese interviewees, as per table 3.

Table 65 compares supply chain cost and sales prices for avocados by country of origin. The cost of sea freight from the three South American countries to China is approximately similar, at $0.29 per kg in 2018. New Zealand secured the approval for direct imports of avocado into China. As the volumes imported at this stage is low, New Zealand exporters are using air freight, with the shipping cost around $2.59 per kg from New Zealand to Shanghai.

Table 65 Breakdown of supply chain cost and sales price for avocados

Country	Variety	Tray weight (kg)	Mode of transport	Freight cost ($/kg)	CIF Shanghai ($/Tray)
Mexico	Hass	6kg	Sea	0.29	$32 +
Peru	Hass	4kg	Sea	0.29	18
Chile	Hass	4kg	Sea	0.29	18
New Zealand	Hass	5.5kg	Air	2.59	NA

Source: In-field interview data collation from Chinese interviewees, as per table 3.

The wholesale price for avocados from South America has shown a downward trend in China in recent years. In August 2017, the wholesale price for Peru's avocado in Shanghai fluctuated between $16-$20 and $30-$34 per 4kg tray, while the wholesale price for Mexico's avocado varied from $32-$34 to $56-$60 per 6kg tray (Fresh Plaza, 2017b). A Guangzhou-based importer and wholesaler said that the lowest wholesale price for avocados occurred in 2018 when Chile's avocados hit $10 per 4kg tray in October and November and this price lasted for about three to four weeks. Although their prices rebounded in the following months, they only reached $20-$24 per tray. Mexico's avocados also saw price reductions, although Chinese customers prefer them to Chile and Peru's avocados in terms of taste and appearance. The price reduction is mainly because of larger volumes flooding in with more countries gaining market access to China. As indicated by one retailer, avocado

is not considered a luxury fruit any more as the retail price ($2 per piece) is much lower than in previous years. New Zealand is supplying Chinese markets with large sized fruit to differentiate their fruit from other key suppliers (Fresh fruit portal, 2018). As shown in JD.com one piece of New Zealand avocado weighed over 330g and was sold at around $6 per piece.

Section 7 Main findings and recommendations

7.1 Industry Collaboration Framework (ICF)

Value creation and delivery in export supply chains require efforts from value chain stakeholders, including growers, exporters, logistics providers, importers and retailers, and industry development stakeholders, including government agricultural departments, industry peak bodies, exporter associations and Austrade. Based on the main findings from the project, an industry collaboration framework has been developed (Figure 98).

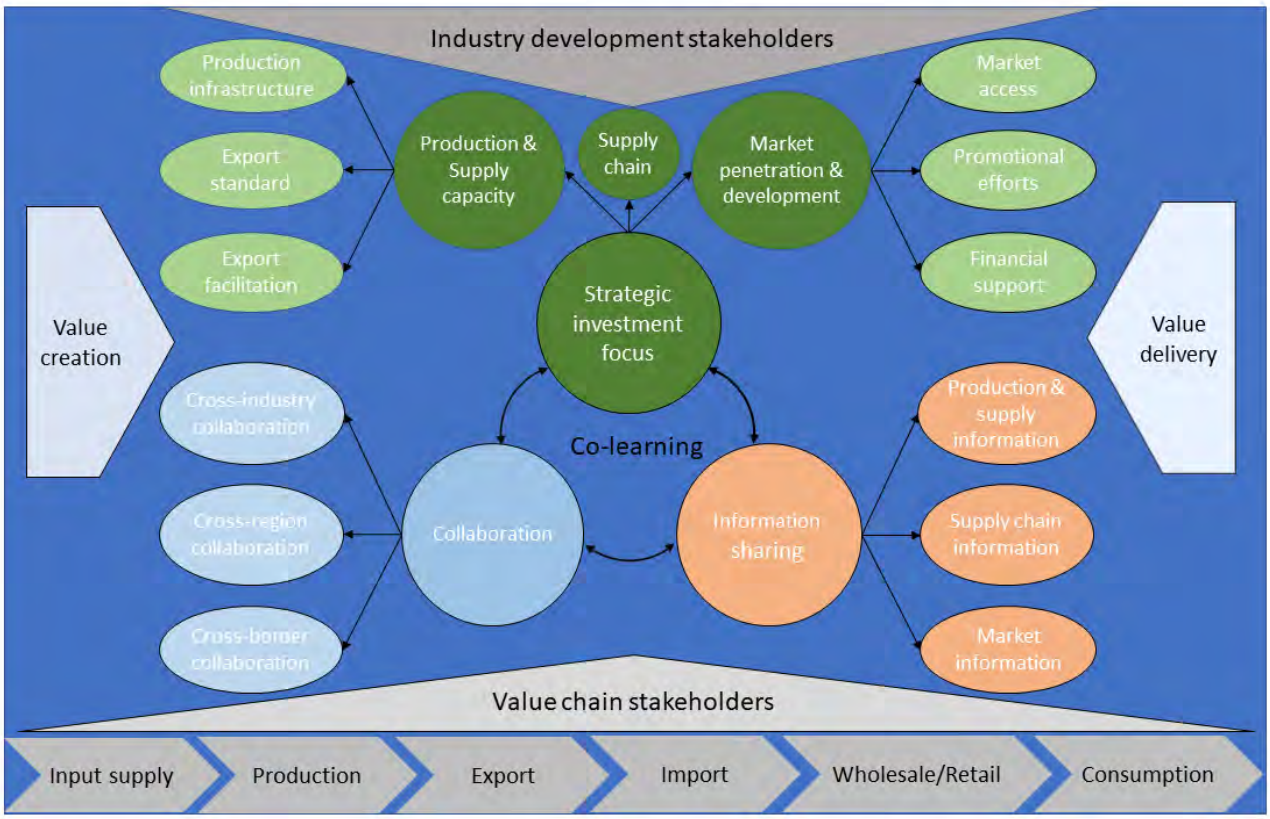

Figure 98 Industry collaboration framework

- A **strategic investment focus** on production and supply chain capacity, supply chain, market penetration and/or development is formulated from information sharing, which determines the priorities for collaboration
- **Collaboration** with industry and supply chain actors, in the forms of cross-industry, cross-region, and cross-border, will address shared problems with an industry, regional or national focus for value creation and delivery

- **Information sharing** on production and supply, supply chain and market, which informs the areas for collaboration and strategic investment focus

7.2 Evidence-based strategies for export expansion

7.2.1 Industry-based export strategy

7.2.1.1 Address production constraints

Northern Australia is a major producing region for mangoes, avocados and lychees. However, there are several explicit or implicit factors constraining productivity. First, mangoes, avocados and lychees are subject to a range of diseases before and after harvest (Dunmall, 2011), therefore, plant health and fruit quality are two major concerns across the three industries. Second, according to grower interviews, there are several constraints impacting the production of mangoes, avocados and lychees in northern Australia. Of the 12 identified major contraints, climate/weather variability and skilled labour shortages were two common impediments shared across these industries. To enhance the productivity and quality of mangoes, avocados and lychees in northern Australia, innovations in production, which include those which have emanated from the phases of pre-harvest, harvest and post-harvest, are needed from both industry and farm levels to address these constraining factors.

7.2.1.2 Re-develop export strategy

Total plantings of mangoes, avocados and lychees in northern Australia has been on the rise over the past years. It is projected that total production will greatly increase with more new trees bearing fruit in the coming years. The increasing production, coupled with relatively small domestic market volume, presses for export market development. The three industries have identified one of the key strategies for export growth is through developing existing markets and penetrating into new export markets (de Vos, 2010; Allen, 2008; Noller; 2015). However, due to strong performance in domestic sales and higher risks associated with the export business, most growers lack financial incentives for direct exports and mainly rely on a middleman for exports. Statistics show that Australia's mango, avocado and lychee industries are currently heavily focused on the Australian domestic market (HIA, 2018), with fresh exports to international markets accounting for 11.58%, 3.51% and 16.99% respectively in 2016-17. To further expand export growth, an export risk management mechanism could be developed to minimise/mitigate export risks and develop a mechanism to ensure the distribution of added value for each step in the export chain. In addition, with the group buying model evolving in the Asian market, China in particular, a regional export hub would be a solution to directly connect international customers.

7.2.1.3 Penetrate protocol markets

Export markets have increased in the past few years with the establishment of free trade agreements. However, mangoes, avocados and lychees are mainly exported to open markets, which

are free of import regulations and do not require any specific treatments by the grower or exporter (AMIA, 2017). Australian mangoes have been approved to be sold in many protocol markets, including China, Japan and South Korea, while avocados and lychees have not yet been approved for these protocol markets, except NZ and USA (note: Hass avocados from specific regions have been approved for exporting into Japan). Given that protocol markets are often regarded as high-margin markets, once industry bodies have made formal requests for market access, governments can support the negotiations for more protocol markets for avocados and lychees.

7.2.1.4 Support protocol market access with supplementary policies and infrastructure

Although Australian mango growers can be registered for exports to China, Japan and South Korea, via strict market protocol – as indicated by growers interviewed – it is still a challenge to access these markets. This signifies that in addition to gaining access to new markets, industry representative bodies, supported by RDCs and the government can develop relevant policies to support producers to be capable of exporting to Asian protocol markets. VHT facility accessibility is another challenge. The three VHT facilities available are in QLD (one in Giru and two in Brisbane). With no VHT facility currently available in NT (NT) and WA (WA). Mangoes produced in these regions must be transported in refrigerated trucks to QLD for treatment before exporting to protocol markets. This increases the costs and further hinders the export capacity from NT and WA. A small VHT facility has begun to be built in Darwin and is due for completion in September/ October 2020. Once completed, it may create increased export capacity from the NT as mangoes can to be sent direct to export markets in a timely manner and in a better condition.

7.2.1.5 Implement export standardisation by developing market-specific grades

Australian mango and avocado industries are not export-oriented in terms of export standardisation, as these two industries do not have an industry-guided export grading standard. Fresh mangoes are generally graded into two classes: Class 1 and Class 2, following the Australian mango industry grading guide. However, mango growers and packers often pack and sell their mangoes into four classes – Premium, Class 1, Class 2 and composite. The fresh avocados are generally graded into Premium, Class 1 and Class 2, which are differentiated mainly by external appearance. These grading classes are developed to cater for domestic demand, without explicitly considering the need of international markets. The Australian lychee grading guide completed in 2018 clearly defines the specifications for first grade, premium and export fruits. However, a market-specific grade has not yet been developed for fruit into second-grade cartons. As such, industry-led export grades should be based on specific market requirements to avoid misunderstanding in or disputes over quality specifications and requirements.

7.2.1.6 Facilate direct exports from northen Australia

Australia ranks poorly in global comparisons of productivity of freight and logistics (iMove, 2019). This is at least in part driven by inefficient supply chains that require far more transport modes and carriers and further distance than would seem optimal. The small proportion of mangoes and avocados produced in QLD and shipped out of Cairns, means the supply chain stretches from north QLD to Brisbane, Sydney, and Melbourne, before international shipment. Similar to mangoes produced in the NT, only 0.15% are directly shipped from Darwin. The long supply chain for north Australia's horticultural products not only leads to increased logistics costs, but also results in more handling, increasing the risk of reduced fruit quality upon arrival at their international destination. This is problematic when the price of Australian horticultural products is generally at the higher end. Limited freight capability and poor export facilities in the north are two constraints for direct exports from Cairns and Darwin, as indicated by the interviewed growers and exporters. To shorten the supply chain into Asia and facilitate exports from the production regions, freight capacity and export facilities should be considered for upgrade in the north.

7.2.1.7 Emphasise premium product positioning

Australia is a small supplier in the global mango, avocado and lychee markets, with mango and avocado production making up around 1% of global production each and lychee production accounting for only 0.1% of world production. As such, Australia does not have the production capacity to be a supplier of quantity (with exceptions, such as some temperate fruit and nut industries). While Australia is a small supplier, Australia's mangoes, avocados and lychees are more expensive than most major supplying countries. Considering Australia's production capacity and higher export price, the main opportunity for northern Australian horticulture is to export premium, quality fresh fruit. Australia has positioned itself as a premium fruit supplier in Hong Kong (Lai, 2018). To further build strong awareness and acceptance of premium Australian fruit, Australia should consider launching promotional and sales campaigns to attract consumer attention and improving the industry supply chain capability, ensuring the delivery of consistent quality.

7.2.1.8 Establish region-oriented export strategies

QLD generally produces more mangoes than the NT and WA. Burdekin/Bowen is the most productive region; However, NT and WA have increasing yields, which has overtaken QLD's yield in 2016-17. The majority of Australian mangoes exported are from QLD, accounting for around 80% of national exports. However, mangoes from the NT and WA generally have better performance in both export and domestic markets compared with QLD's mangoes. Given the wholesale price of mangoes from the NT and WA is often higher than the export price, exports are unattractive for mango growers from the NT and WA. Australian avocado exports are mainly from QLD and WA, making up around 60% and 30% of national exports from 2014-15 to 2015-16. QLD's avocados have a better

performance in exports than in domestic wholesale. In contrast, WA's avocados have higher prices in domestic markets than in exports.

7.2.2 Market-oriented strategy

7.2.2.1 Hong Kong

Hong Kong is a well-developed export destination for Australian mangoes and lychees. Australian avocados have not yet had a strong market presence, compared with Australian mangoes and lychees, however, their import volumes into Hong Kong have increased over recent years. Australian mangoes and lychees do not face much competition in the Hong Kong market given their counter-seasonal production. On the other hand, Australian avocados have to compete with major supplying countries that have cost advantages. Therefore, education on the differences and benefits of Australian avocados is important to inform consumers as to why Australian avocados are worth their money.

Hong Kong consumers are turning their attention to non-traditional fruits as their interest in unfamiliar products grows (Euromonitor, 2014). This creates market segments for Australia which has positioned itself as a premium fruit supplier in Hong Kong (Lai, 2018). With the increasing import of Australian mangoes, avocados and lychees into Hong Kong, Australia needs to stay competitive by differentiating its fruit from competitors and expanding its market share by offering innovative products and superior quality. Since new varieties and suppliers are always entering the market, Australia should be knowledgeable about the market dynamics and benchmark market performance of other global suppliers. This will enable growers in northern Australia to better position themselves in the market and to learn from other successful cases.

E-commerce has emerged in Hong Kong with most major supermarkets like Wellcome and ParknShop having established online grocery shopping platforms. There is also a trend that more consumers are pre-ordering seasonal fruit online, such as Taiwanese mangoes, and many would use home delivery services provided by online shops (Lai, 2018). Australian suppliers should seek out opportunites in the emerging online sales channels.

7.2.2.2 Singapore

Australian mangoes, avocados and lychees are well-established in the Singapore market. As a leading supplier in the Singapore market, Australia needs to maintain market competitiveness and expand market share by offering innovative products, maintaining quality superiority, and educating the market on the benefits of Australian fruit over competitors. In addition conducting consumer research to understand the dynamic changes of consumer preference and then working to meet consumers evolving needs would benefit Australia.

Singapore is a diversified market for five Australian mango varieties, including R2E2, Calypso, Kent, Keitt and KP, in different grades and sizes. Singapore consumers have also diversified demand for

avocado and consequently this provides a good opportunity to test the market with new varieties. Hass and Shepard are the two major varieties of avocado preferred by Singapore importers. Hass is the dominant variety mainly sold to supermarkets, while Shepard would be mainly sold in the wet markets. This implies that there are segment markets for Australian avocados and therefore it is essential to conduct market segmentation analysis. Singapore customers knowledge of lychee as a fruit stems from China, and consequently customers prefer a cold, red, wet and nonbrown appearance. It is therefore, important for Australia to educate consumers on the differentiation of the appearance of Australian lychees which are good quality, despite sometimes turning brown with dried skin.

Although price (the most important), freshness, quality and service are the four key factors that determine sales, there are emerging niche markets for fresh quality fruit. Because Australian mangoes, avocados and lychees are more expensive, freshness and quality become important factors.

7.2.2.3 China

China has reduced mango imports from global markets over recent years, but imports from Australia have expanded. The increase in demand is largely due to Australia's advantage of counter-seasonable production with China and the increasing market acceptance of Australian mangoes in China. Australian mangoes were approved for direct entry into China as early as 2004 (DAFF, 2005); however, the grey channel via Hong Kong is still the dominant channel for Australian mangoes(Fresh Plaza, 2016b). The competition between direct imports and the grey channel is of particular concern as the grey channel could play down direct imports. In addition, brand copying (fruit fraud), misleading information and promotions from retailers remains a challenge. The deployment of blockchain systems for food traceability may be a viable solution.

China has an increasing demand for avocados in recent years with consumers being familiar with the exotic fruit. Despite this, the average consumption is still very low and there is substantial room to increase market demand and size. Although the promotion of avocado has made good progress in first-tier cities in the past few years, many consumers still do not fully understand the nutritional value and consumption choices for avocado and are unable to achieve the right ripeness at home to get the taste they want (Fresh Plaza, 2017b). However, the avocado market in China can continue to increase if demand is generated from consumers in second and third-tier cities. There would be market opportunites for Australian avocados if market access is approved. However, Australian avocados would face high competition from existing suppliers who have a cost advantage.

China is home to the lychee and is the world's largest producing country, followed by India, Vietnam, Taiwan and Thailand (Jahiel et al., 2014). The strong demand for lychees, coupled with Australia's counter-seasonal production to China would bring big export opportunities if Australian lychees are

approved for market access. As Chinese wholesalers and importers have very limited knowledge of the Australian lychee industry, not to mention the variety and supply seasonality, substantial effort should be made to increase market awareness.

Retail channels have significantly evolved over recent years in China. As such, several new retail channels have emerged, including a new retail chain (O2O), premium (high-end) supermarkets, online sales, fruit store chains, fruit factory stores and WeChat sellers. Australia should be alert to these dynamic market changes that could open opportunities for northern Australia's fruit in the Chinese market.

7.2.2.4 Japan

Australia is a small supplier in the Japanese mango market, and Australian mangoes are not well known among Japanese consumers. In this regard, Australia could consider educating Japanese customers about how Australian mangoes differentiate from other imported mangoes. It would also be beneficial for Australian growers and exporters to increase understanding of Japanese consumer's preferences and optimise packaging or marketing for further value-adding. It should be noted that Japanese consumers prefer domestic fruit over imported fruit. Therefore, it is essential to consider locally grown mangoes that would pose potential challenges to Australia's market strategy. However, Australia could benefit from learning more about the production practices in Japan, as Japanese farmers have spent considerable time and energy in improving their products based on taste, appearance and the development of a production method to supply out of season produce.

The Japanese avocado market continues to grow, and therefore there is a market opportunity for Australian avocados since gaining market access into Japan in May 2018. However, entry into Japan means that Australia has to compete with established suppliers, including Mexico, Peru, the USA and New Zealand. Australia does not have counter-seasonable advantages in supplying avocados and has faced continuous competition with Mexico. However, Australia may have a competitive advantage over Peru and the USA which do not supply year-round. As New Zealand avocados are cheaper than Australia's, there could be competition with New Zealand. It would be beneficial for Australian growers to identify areas where they can increase the appeal of their products to customers, thereby differentiating Australian products from other competitors.

Increasing market awareness for Australian lychees would create market demand; however, market access would be an issue. The major suppliers, such as China and Taiwan, have a geographical advantage as they can supply the market with a short delivery time and respond to customer demand quickly. In contrast, Australia is distant from Japan and must establish a distribution system to deliver fresh lychees in a responsive time given the short shelf life of lychees.

7.2.2.5 South Korea

Mangoes are regarded as high-grade fruit in the South Korean market, where there is an increasing demand for premium mangoes.To increase the market share of Australian mangoes in the South Korean market, Australian suppliers are suggested to work directly with South Korean importers to extend supply windows and educate customers to recognise and accept Australian mangoes as a premium fruit. More importantly, identifying areas where Australia can sell its innovative aspects to customers, thereby differentiating Australian mangoes from other competitors could be beneficial. Apple mango is the most popular mango in South Korea and local apple mangoes are more expensive compared with imported ones. It could be valuable for Australia to benchmark Australian mangoes against the apple mangoes in terms of taste and weight. This could indicate suitable directions for developing quality mangoes to cater for discerning South Korean consumers.

The South Korean avocado market continues to grow, with ample market opportunity for Australian avocados if market access is approved. Currently, the South Korean avocado market is dominated by Mexico, the USA and New Zealand, which together supply the market throughout the year. The potential entry of Australian avocados would mean that Australia has to compete with established suppliers, and new entrants, such as Peru. Although Australia would directly compete with New Zealand in the South Korean avocado market, Australia can learn from the successful case of AVANZA, which made substantial investments to improve the recognition of New Zealand avocados. Their success could shed light on Australia's market development and investment strategies.

Lychees are rare fruit in South Korea due to the unavailability of local production. However, there are niche markets for lychees as South Korea imports lychees from China and Vietnam. Once Australian lychees gain market access, increasing market awareness for Australian lychees could supply the market when lychees from China and Vietnam are out of season. Additionally, since frozen lychees are available in the market, there could an opportunity to supply frozen lychees.

Foodservice outlets could be a prosperous market for Australian mangoes, avocados and lychees due to the wide use of tropical fruit, including mangoes and avocados, in restaurants and cafes.

7.2.3 Supply chain positioning strategy

7.2.3.1 Configure supply chain for product integrity

Asian wholesalers and retailers have strict requirements on the quality of imported mangoes, avocados and lychees no matter sourcing from either Australian suppliers or local importers. The quality of mangoes, avocados and lychees delivered to final consumers in the destination Asian markets from northern Australia depends on how supply chain integrity is ensured both upstream and downstream of the supply chain. Asian importers generally do not have much control over the upstream supply chain that starts from producers in Northern Australia to the port of export. To ensure that they can source quality fruit, importers would like to work with exporters who have farms

or have strong relationships with growers. In addition, some importers have established their buying offices in major supplying countries to facilitate direct sourcing of quality fruit. These sourcing strategies provide an indication to Australian suppliers on how to configure their supply chains to supply Asian importers with the assurance of product integrity.

7.2.3.2 Transform existing operations to serve direct sourcing customers

Australian mangoes, avocados and lychees are mainly imported into the wholesale markets where Asian wholesalers distribute fruit to different channels. While Asian retailers still rely on the traditional supply chain to source fruit, newly emerging retailers are prone to implement a direct sourcing strategy to shorten their supply chains, thereby having more control over cost saving and fruit quality. However, they are discouraged by a minimum order quantity. As these retailers would like to deal with premium Australian fruit, existing supply chain operarations need to be transformed and upgraded with demand aggregation capability so as to supply those retailers who have a direct sourcing strategy. Directly supplying retailers could help Australian suppliers to hear the voice of the consumer.

7.2.3.3 Build collaborative supply chains for better customer service

While importers in the targeted Asian markets show no interest in farm acquisition in Australia, they intended to establish long-term partnerships. Through the partnership or close supply chain relationships, importers indicated they want their suppliers to share timely and correct information about supply chain details, including the date of picking and packing. This kind of supply chain information supports importers to make right decision-making in planning their sales and reducing waste and losses. However, it was mentioned by the importers interviewed that it is not easy to find an ideal partner in Australia who shares the same supply chain strategy. Although some innovative Australian suppliers have initiated to collaborate with their customers by providing them with more information, largely Australian suppliers to date, particularly the spot market-based exporters, have not established such collaborations. To ensure sustainable exports, this requires Australian suppliers develop collaborative relationships with supply chain actors that can help ensure quality and consistent products are delivered to end-consumers.

7.2.3.4 Incorporate value chain strategy in supply chains

Australian mangoes, avocados and lychees are perceived to be premium compared with products from other competitors. However, they are mainly exported as commodity products with the value adding in the market. To increase market competitiveness, it is important for Australian suppliers to understand what consumers value most, and then work closely with their downstream customers to deliver the value adding products to their consumers through the whole chain.

7.2.3.5 De-risk the export supply chain

Supply chain constraints affect the efficiency in delivering consistent and quality mangoes, avocado and lychees into the Asian markets. According to 24 companies interviewed, including growers, exporter growers and exporters, there are several constraints impacting the operations of shipping mangoes, avocados and lychees from northern Australia into the targeted Asian markets. Of these 12 identifed major contraints, cold chain gaps and breakdown, disinfection treatment processes and expensive shipping from northern Australia are the four leading common constraints shared across these industries, across northern Australia. Cold chain gaps and breakdown is the major reason for quality inconsistency and therefore cold chain integrity should be assessed throughout the supply chain. Disinfection treatment processes are a main concern for mango growers and exporters in relation to the VHT. Since the interviewees indicated that the VHT process could damage fruit and bring in extra costs, this requires a comprehensive assessment of the VHT processes and adaptive guidelines provided to growers and exporters. Expensive shipping from northern Australia refers to the high cost of shipping fruit from Cairns and Darwin. This constraint could be resolved by increasing air freight infrastructure in the Cairns and Darwin airports.

7.2.3.6 Implement end-to-end digital supply chains for value adding

Current mango, avocado and lychee supply chains into Asian markets are fragmented with actors at different tiers of the supply chain. A major barrier for growers is the length of their supply chain and their position in that supply chain, both of which are preventing them from knowing where their products are sold and getting clear market signals directly from consumers. A digital inclusion in the supply chain would provide more visibility to growers and more importantly to enable them to hear the voice of the consumer. Some exporting companies, in particular one from the avocado industry and one from the mango industry, have initiated enabling the tracking of the supply chain and implementing digital solutions for real-time communication between supply chain actors. Digital solutions would bring more benefits to growers if adopted.

7.3 Conclusion and future research directions

The purpose of this research has been twofold, to:

1. Support an expansion in exports of horticultural products from northern Australia (North QLD, NT and WA) to high margin Asian markets through supply (value) chain innovations.
2. Propose a co-learning mechanism for export development by evaluating exports from the three horticultural industries (one newer industry – lychees and two established industries – mangoes and avocados) in northern Australia and by benchmarking potential competitors.

The project has conducted both desktop research and field studies to gain deep insights across regional and international perspectives. Specifically, 29 field interviews with growers and exporters who are involved in the mango, avocado and lychee industries within the boundary of northern

Australia were conducted and supported by secondary data gathered from industry partners and other sources. In addition to the secondary data analysis, more than 30 companies, including importers and retailers, were interviewed in Singapore, Hong Kong and China during two-rounds of field studies. While field studies were not conducted in South Korea and Japan, in-depth desktop research was conducted to capture market insight from Japan and South Korea.

These analyses identified the key elements that drive export growth and constraints in export development from both a regional and industrial perspective. Market opportunities, supply chain strategies, current and potential competition and successful models deployed by competitors were also investigated using primary and secondary data gathered from targeted markets.

One of the key findings is that the voice of the consumer in the Asian markets analysed is not being heard by most growers. A small number of highly successful growers and exporters have built a presence in specific cities and regions in China and have built very strong international market strategies over many years. However, the vast majority of smaller growers do not have the resources and are not integrated into a supply chain and therefore do not have the awareness or understanding of consumer needs and behaviour in key Asian regional and city markets.

One solution that could be implemented is to walk the supply chain, where growers would observe each of the stages of post-harvest logistics, distribution, marketing, wholesale and retail including talking directly to consumers. This is costly and difficult to achieve, and also is a one-off experience for growers, and therefore difficult for the experience to be embedded in their practices. What has been proposed is a stronger long-term solution, supported and enabled by technology.

1. Digitally transform and strengthen existing supply chain governance and collaboration arrangements across these three industries with respect to northern Australia (or nationally) with strong industry and key partner leadership to ensure delivery of the best research and technology for success in the market.

2. Suggest the development of an Export Development Decision Support System (EDDSS) which would allow a large number of industry stakeholders from the producing regions and international markets to extensively interact while collecting data on activities, actions and outcomes for the export-import process. The upstream voice of both growers and exporters and the downstream voices of importers and consumers in international markets would become a key element of holistic export development strategies. Specifically, the development of an upstream participatory decision support system to aid in the decision-

making capability of growers and exporters, improving export development and regional export strategies. The development of a downstream participatory decision support system with the involvement of importers and retailers will increase the capacity to promote product benefits to target markets. The system would aim to increase international market access and market development through improved margins.

3. Within the suggested EDDSS, establishment of a digital export and knowledge hub that the blockchain technology and systems could feed into, that systematically builds the high-quality information base needed for growers to make better judgements about their product, markets and also where and how to innovate. What is proposed is a program of work over a number of years that builds direct real-time data on products out of northern Australia, including following and sustaining provenance through to the consumer. This includes a direct communication chanel from the consumer to the grower. This not only improves knowledge but enhances branding and control of the supply chain that is currently fragmented for most growers. Building on the knowledge acquired from this research, a phased approach could be implemented to enable rigorous, quantitative capture of essential data, that can be used for strategic decision making by both individual growers and entire industries.

4. New product development utilising emerging genetic technologies is increasingly key to remaining competitive in the horticultural market. Researchers led by growers who are engaged in breeding and development of new plant varieties and implement innovative propagation technologies can quickly bring new varieties to the market and develop products that will find a high value market due to their attractiveness to consumers. To achieve this, a cross-border collaborative research and development framework could be established to increase collaboration between those in industry, research and consumer market settings to improve the planning around R&D priorities.

Horticultural growers could possibly benefit from reviewing successful modern practices and technologies implemented by other industries. This shared approached to learning gives the growers confidence as the technology has already been proven and implemented in other industries and provides a reduced level of risk.

A major barrier for growers is the length of their supply chain and their position in that supply chain, both of which are preventing growers from getting clear market signals directly from consumers. The solutions proposed are directed at increased effective supply chain communication, particularly

where the supply chain is shortened, through using supportive blockchain technology. Successful innovations in this industry (genetics, growing practices and postharvest) can occur through addressing and applying consumer preferences as seen in other industries across northern Australia. Based on the findings, future research priorities are proposed at both industry and value chain levels.

7.3.1 The Export Development Decision Support System (EDDSS)

To overcome barriers identified to export development, follow-on initiatives focussed on designing and implementing a participatory decision support system for export development have been suggested. The Export Development Decision Support System (EDDSS) would allow a large number of industry stakeholders from the producing regions and international markets to extensively interact while collecting data on activities, actions and outcomes for the export-import process. The upstream voice of both growers and exporters and the downstream voices of importers and consumers in international markets will become a key element of export development strategies.

An upstream participatory decision support system for export development and industry or regional export strategies

The upstream participatory decision support systems would:

- Capture and communicate the voice of growers and exporters as a means of increasing interest and commitment to exports;
- Put growers and exporters export development needs at the centre of the northern Australia export development initiative;
- Rapidly diagnose and constantly monitor the risks and constraints that exporters face in their export involvement and
- Facilitate more responsive necessary financial and industry support and mitigation strategies for sustainable export development.

QLD and NT have announced the development of freight and export hubs to facilitate export growth from northern Australia. The aim of developing these hubs is to allow fresh produce to be shipped directly from the producing regions, gaining produce to market quicker by bypassing the regular routes via Sydney, Brisbane and Melbourne. The locations of freight and export hubs are presented in Figure 99. To ensure the success and effectiveness of these export facilities, the voice of growers and exporters should be focal.

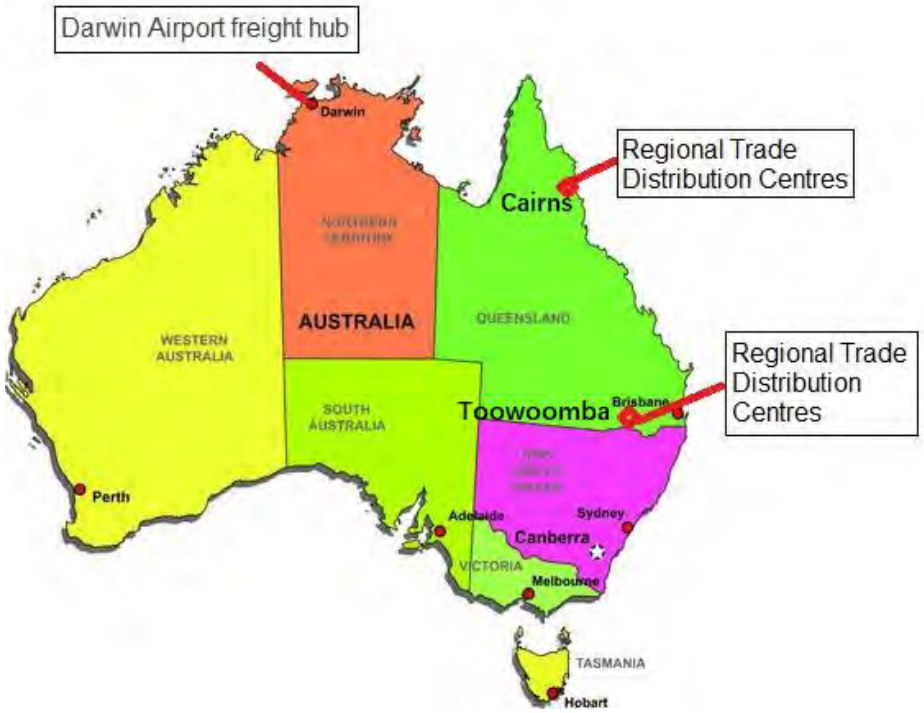

Figure 99 Freight and export hubs for export facilitation

Source: http://www.fruitnet.com/asiafruit/article/180117/export-hub-for-far-north-queensland

A downstream participatory decision support system for international market access and development strategies

The downstream participatory decision support system would:

- Capture and communicate the voice of consumers and importers, their preferences and commitment to buying and consuming northern Australian fruit;
- Place consumers and importers needs at the centre of international market access and development strategies;
- Understand the challenges and risks that importers face in dealing with Australian fruit in their markets and sales channels and
- Identify customers needs, and address these through education and awareness programs, marketing and communication strategies and coordinated product and process innovation.

The dynamics of the market needs to be further explored for developing in-market strategies. Taking the Chinese market as an example, the market can be classified into different hierarchies. Figure 100 shows that the Chinese market can be classified by geographical regions, city tiers and city clusters. The evolution of these hierarchies must be actively tracked for responsive product delivery. This requires a better understanding of the realities of the market structure, and the capacity to drill down beyond a regional level when formulating market development strategies.

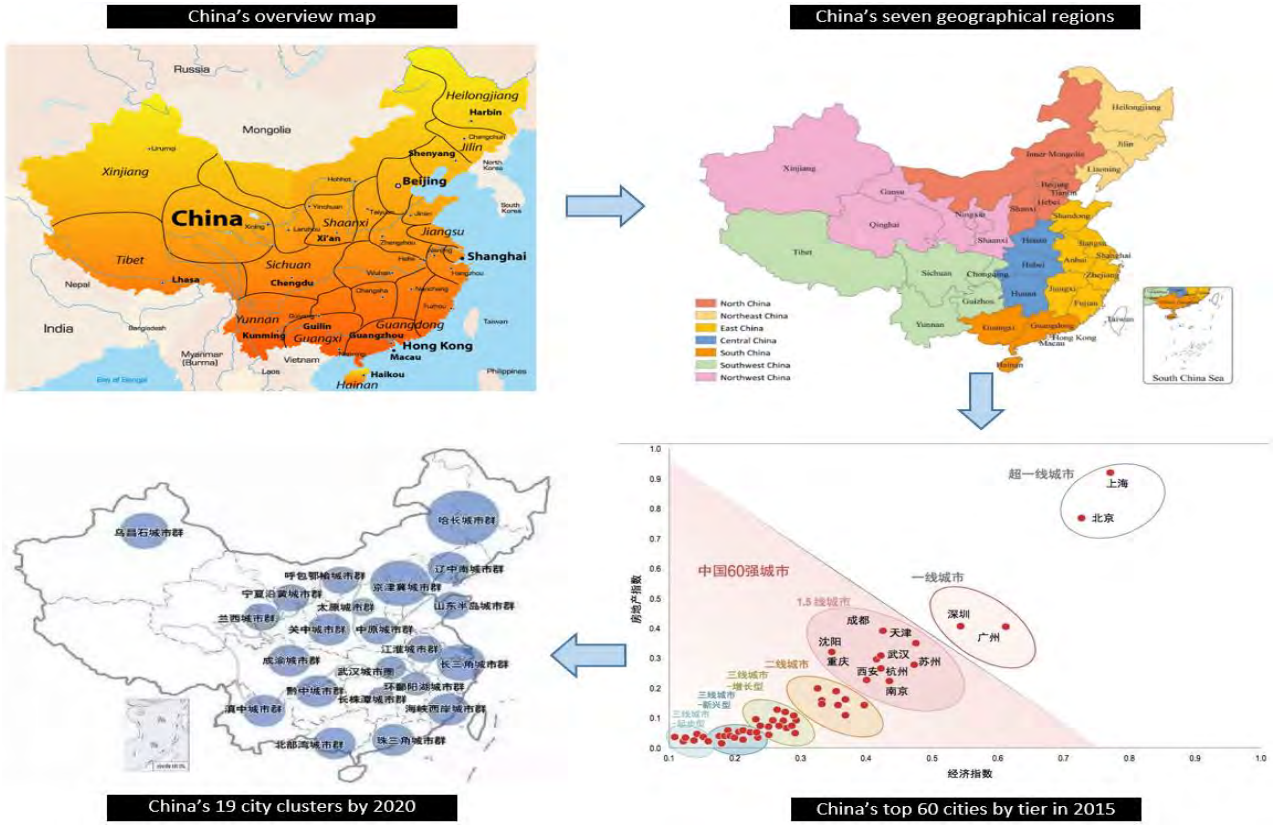

Figure 100 Market segmentation based on China's market hierarchy

Source:https://www.researchgate.net/publication/322362241_Trends_in_geographical_disparities_for_cervical_cancer_mortality_in_China_from_1973_to_2013_A_subnational_spatio-temporal_study/figures?lo=1, https://new.qq.com/omn/20191101/20191101A02SCA00.html and http://www.crcbi.cn/index.php/news/show/aid/239.html.

7.3.2 Operationalising the EDDSS

The EDDSS which also links to Hort Innovation strategy would assist with the formulation of market-oriented strategies, which can contribute to expanding exports of horticultural products from northern Australia. The EDDSS's purpose is to provide all growers and exporters with the most current intelligence on the markets that they currently export into and those that they plan to export into as they shift their strategies across countries and regions within countries, the ultimate data is streaming data. Five key areas where data needs to be constructed, integrated, analysed and disseminated:

1. International markets drilled down to individual cities and including demographic data, consumer behaviour and buying patterns;
2. Competitive intelligence on new developments including both market and production innovations among all current and emerging competitors into the key markets;

3. Daily data on volumes and prices for domestic markets, so that growers can see trends over seasons and daily trends where they're dealing with the spot market so that they can balance their export strategies;
4. Product innovation surveillance across international competitors and growers, government departments, agencies, and individuals nationally so that growers can ensure they keep pace with technological changes, varietal changes, market demands, and also establish collaborations among the more innovative growers to seek new market niches and
5. A digital export and knowledge hub could be coordinated across industry sectors, as many growers span multiple industries.

Currently the EDDSS is in the first phase of development. Export development constraints and barriers were analysed with data collected manually through interviews and field studies and supplemented by secondary data analysis. This initial analytical approach is essential but static and descriptive. This lays the foundation for the next phase, where manually collected data gradually transitions towards full reliance on direct streaming primary data across large populations and large numbers of variables. This involves systematically capturing the benefits of big data and passing these directly to participants in the high value supply chain form northern Australia to targeted Asian city tiers and city clusters. When the EDDSS reaches this third phase, data will be collected in a fully automated manner through real-time streaming. All participants will have constant access to the online platform that presents the data in a visualised format to overcome language and cultural barriers. In contrast, with previously utilised methods, the analysis will be dynamic, inferential, and over time (when sufficient data is captured) will be predictive to facilitate strategic planning and actions for all supply chain participants.

7.3.3 How the EDDSS feeds into industry development and value chain innovation

7.3.3.1 Industry actions supported by the EDDSS

Launch market campaign strategy based on market knowledge.

A nationwide fresh fruit association or coordination body supported by existing fruit associations could launch promotion and sales campaigns, similar to the "Super Fruit Bowl" campaign conducted by Chilean Fresh Fruit Association (Fresh Plaza 2020; Karst 2019), to attract consumer attention and build strong awareness and acceptance of premium Australian fruit.

Taste Australia led by Horticulture Innovation is working to promote Australian products and could be an excellent channel to help achieve this. Australian Horticultural Exporters and Importers Association or Australian Fresh Produce Alliance could also potentially assume this role.

Consumer awareness and demand for Australian fruit can be enhanced through digital advertisements and social media. Content appearing in social media could drive consumers to learn more about Australian fruit.

- Use mechanisms to open communication and build transparency for all industry segments along the supply chain, giving retailers and wholesalers the support they need to drive sales as well as import directly;
- In addition to accessing research reports, Australian suppliers could have opportunities to meet potential Asian importers and retailers in person or online as well as have a better understanding of consumption patterns and consumer behaviour in the target markets via observational assessments and
- Establish opportunities for vicarious learning where larger grower-exporters provide access to their in-country and export teams to new and prospective exporters and industry bodies.

Develop export standards through a joint collaboration with import countries

- There is a need to **access the extensive data**, information and knowledge available for growers to understand market requirements;
- Industry-led market-oriented **export grades** are required to avoid misunderstanding in or disputes over quality specifications and requirements;
- Australian suppliers should be educated to follow market-focused export grading guidelines, which can be manifested as measurable indicators for blush, rot, taste, shelf life, transportability and cold chain and VHT impacts and
- Using these standards coupled with market intelligence, provide growers with more extensive feedback on quality.

Upgrade industry supply chains with evidence-based knowledge

Improve supply chain transparency nationally at industry-level to expand direct exports while sustaining brand protection

- More transparent supply chains work to distinguish fruit using official channels from those falling into unofficial channels;
- Linking traceability with quality consistency would improve the sales and competitiveness of Australian mangoes, avocados and lychees and
- Consumer awareness in the target markets needs to be raised for distinguishing Australian produced mangoes from the same variety (i.e., R2E2) produced in Vietnam, Thailand and China, as online retailers can provide misleading information when they sell Australian mangoes, confusing consumers and affecting the reputation of Australia's product.

Build a strong evidence base to help optimise supply chain efficiency and effectiveness

- Conduct end-to-end supply chain data collection, collation, analysis and dissemination to support and provide appropriate education to importers and retailers, in the case of mangoes, ensuring shelf life is more controllable and predictable after VHT treatment;
- Conduct supply chain monitoring in Asian markets to assess shelf life given that secondary wholesalers and retailers tend to ask for a longer shelf life and
- Provide VHT evidence to educate the importers about the other contributing factors to quality inconsistency and give instructions on how to properly handle the fruit to ensure longer shelf life. This is necessary in both wholesale markets and retail outlets

Enhancing infrastructural productivity by building a a regional export hub that takes advantage of the big data era

- Provide weekly (and overtime streaming) crop and sales data and reports for informed decision making based on the most current, reliable data along entire supply chains;
- Produce a global innovation database to measure and monitor incremental and disruptive innovations domestically and globally so growers are able to respond quickly to international competitor breakthroughs;
- Conduct strategic analyses of markets and competitors to assist Australian growers, exporters and industry stakeholders decision making and
- Achieve market agility for Asian markets by providing current and eventually streaming consumer buying behaviours and preferences as well as channel evolution, and then launch optimal strategies that keep pace with changing behaviours – across demographic segments.

7.3.3.2 Value Chain Innovation

Drive production and supply innovation

- Support greater access to and uptake of varietal innovation and development that reflects buying patterns in premium channels in Asia, which look for both quality and differentiation and
- Form collaborative marketing companies to coordinate growers from different areas for export development. The dual aims are to ensure a larger volume of supply and extending the supply window across the entire year.

Strive for chain-wide supply chain innovation at horizontal and vertical levels

Horizontal and vertical collaboration:

- collaborate with suppliers to ensure supply of larger volumes across longer supply windows;

- collaborate with upstream growers to mitigate quality risk and ensure the best quality consistency from the beginning;
- develop relationships with importers and provide necessary support including risk and profit-sharing with importers to progress from transactional to strategic trust-based relationships (Figure 102) and
- Integrate retailers into the channels

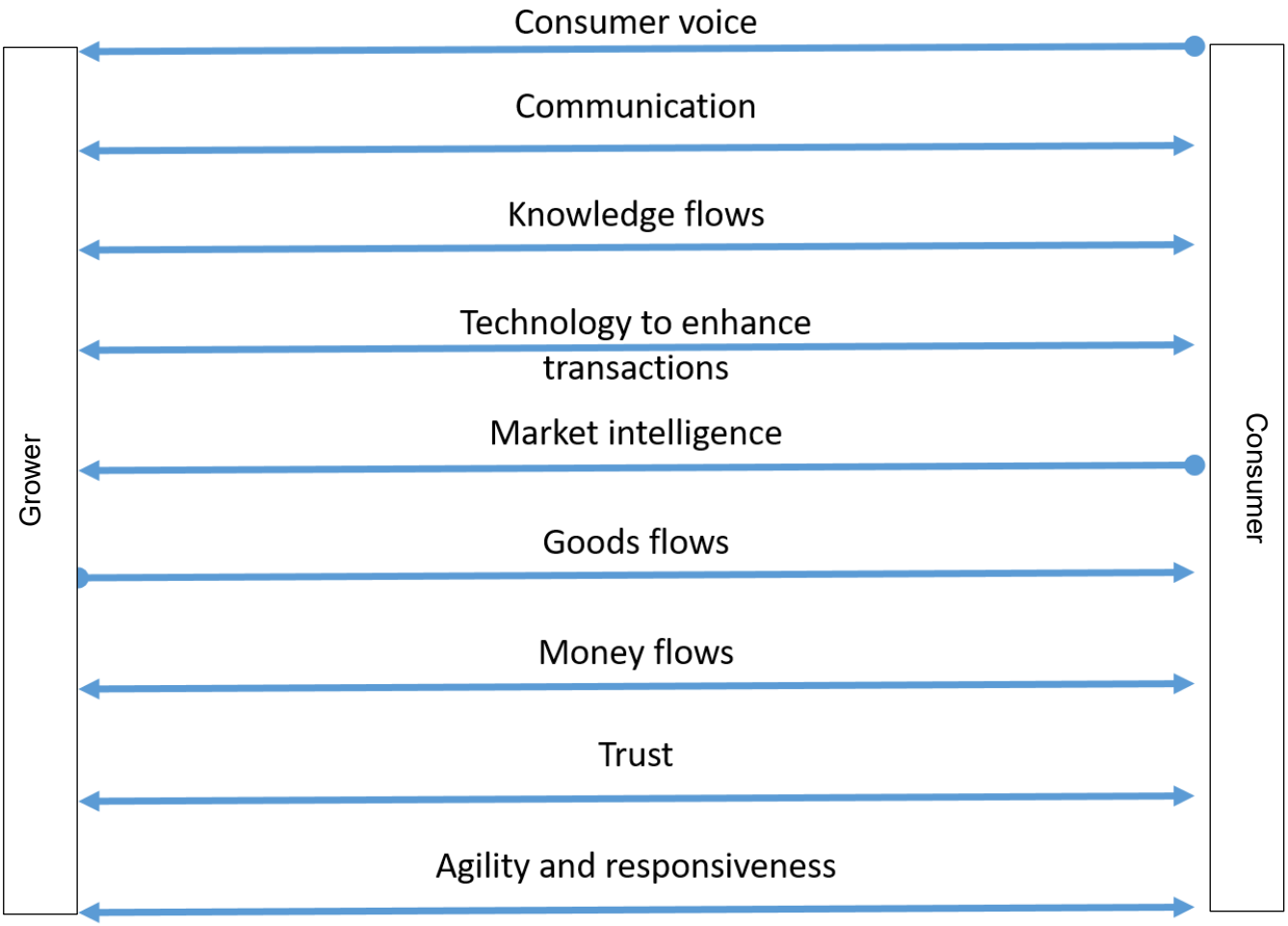

Figure 101 Foundations for progressing beyond transactional relationships

Each of these goals will be supported by:

- Cultural linkages – to improve cultural awareness – practices, processes and protocols with supply chain governance;
- Good supply chain practice to provide accurate supply chain details across production and harvest, through to retail markets. This can support Asian wholesalers and particularly retailers to make optimal decisions on how to handle and sell the fruit;
- Consolidate the supply chain by entering relationships with large and reliable regional distributors/wholesalers in the market or even nominate national/regional sales agents

to move fruit and offer assistance for chain-wide quality control. This will help avoid oversupply in a region and unnecessary competition for markets and

- Develop a rational expectation of the market based on evidence to create realism about retail sales volume and price, quality expectations and differentiation strategies.

Boost sales and marketing innovation:

- Bolster international sales teams and support these teams in their delivery of market intelligence across all exporting growers and exporters in northern Australia - allowing them to be closer to customers and build deeper market knowledge. The market is the people, so to understand the market is to understand the people – transactional non-relationships need to be overcome. All business is about relationships;
- Work with importers to supply customised packages attached to educational and promotional materials.
- Segment market demand, and work with existing and potential importers to open market channels and identify customers for Class 2 fruit, not only Class 1 fruit, which would drive the demand for Australian mangoes – while also managing branding and reputational capital implications and
- Build and promote collaborative brands rather than a generic Australian Brand and work to raise brand awareness among consumers.

Transform the value chain with digital technologies:

- Adopt new technology to digitalise export value chains, thereby unlocking the value of real-time information about logistics, supply chains consumer behaviour, tastes and needs, quality and efficiency;
- Provide digital inclusion solutions to capture the voice of the customers dynamically, so as to ensure currency of market intelligence;
- Develop the digital traceability capability that other competitor countries already have in place and are using to build a brand through supply chain visibility – this will deliver through the added value that comes with knowledge of provenance and traceability and
- Create a common digital language to facilitate communication and information sharing along the value chain and across languages – preferably based where possible on visualisation rather than text.

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Appendices

Appendix One- Brix Chart for Fruit and Vegetables

BRIX CHART

Brix : The ability of sap to bend (refract) Sun Light.
Crops with higher Brix will produce more alcohol from fermented sugars
and be more resistant to insects, thus resulting in decreased insecticide usage.

FRUIT	EXCELLENT	GOOD	AVERAGE	POOR
Apples	18	14	10	6
Apples Sweet	22	18	14	10
Apricot	20	16	12	6
Avocados	10	8	6	4
Bananas	14	12	10	8
Bilberry	15	12	8	6
Blackberry	12	8	6	4
Blueberry	20	16	14	10
Cantaloupe	16	14	12	8
Carrots	18	12	6	4
Cantaloupe	16	14	12	8
Casaba	14	12	10	8
Cherries	16	14	8	6
Celery	12	10	6	4
Cherry - tart	16	14	8	6
Cherry-sweet	25	20	16	10
Coconut	14	12	10	8
Elderberry	9	7	5	4
Gooseberry	11	9	7	5
Grapefruit	18	14	10	6
Grape Reg.	20	16	12	8
Grapes-Sweet	26	20	16	12
Honeydew	14	12	10	8
Kiwifruit	18	14	12	8
Kumquat	12	10	6	4
Lemon	12	8	6	4
Lime	12	10	6	4
Mango	16	10	6	4

	EXCELLENT	GOOD	AVERAGE	POOR
Nectarine	20	16	12	6
Orange	20	16	10	6
Papaya	22	18	10	6
Passion	18	12	9	6
Peach	18	14	10	6
Pear	14	12	10	6
Pineapple	22	20	14	12
Plum	20	16	12	6
Raisons	80	75	70	60
Raspberry	14	12	8	6
Red Current	14	12	8	6
Strawberry	16	14	10	6
Watermelon	16	14	12	8

Grasses /Herbs/Other				
Alfalfa	22	16	8	4
Grains	18	14	10	6
Sorghum	30	22	10	6
Field Peas	12	10	6	4
Roses	15	13	10	6
Parsley	12	8	6	4
Basil	12	8	6	4
Dill	12	10	6	4
Garlic-Cured	40	36	32	28
Sunflower	12	8	6	4
Thyme	12	8	6	4
Rosemary	12	8	6	4
Mustardd	12	8	6	4

Source: http://www.stevewestin.com/brix-chart.html