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The Tomato Value Chain in Australia

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Abstract

Tomato is the main vegetable crop produced in Australia with a production value of \$609.9 million in 2018. The industry is expanding with increasing consumption and production in recent years. The aim of this paper is to examine the performance of the tomato value chain in Australia and identify major constraints, opportunities and future improvements of this business. The study indicates that the increasing trend of tomato crop production in Australia is mostly due to effective information sharing along the chain, the adoption of innovation in production technologies such as glasshouses, and diversification of tomato types. The main constraints of the value chain are the yield uncertainty of field-grown tomatoes, lack of coordination partnerships, asymmetric standards of tomato production specification and shortage of the bush tomato type. Some potential interventions by the main tomato industry actors and supporters are suggested and include setting up industry-wide certifications and regulations, improving the alliance of value chain actors, encouraging the application of protected tomato cropping, managing tomato waste and investigating and engaging in new bush tomato varieties.

Keywords: Australia, tomato, value chain, opportunities

Introduction

The agriculture, fisheries and forestry sector in Australia has achieved dramatic growth during the past 20 years, increasing by 34 per cent in value from around \$49 billion in 1998–99, to approximately \$66 billion in 2017–18 (Jackson, Zammit & Hatfield-Dodds, 2018). The vegetables industry accounts for 6 per cent of this sector and production has grown by a similar amount in the last 20 years (Jackson, Zammit & Hatfield-Dodds, 2018). Tomato is the second most valuable vegetable as measured by production of 484,073 tonnes during 2017–18 (Australian Bureau of Statistics, 2019a), worth \$609.9 million. Domestic consumption of fresh tomato grew noticeably by 6 per cent from 2014 to 2018 (Rural Bank, 2019). It is projected that tomato production will continue to increase to 2022–23, mainly due to the shift in glasshouse technology, higher quality and an increasing number of tomato varieties (Australian Bureau of Statistics, 2019b). The recent growth in tomato production and value shows that there is a huge market potential for tomato products and that there are still opportunities for the value chain to be improved.

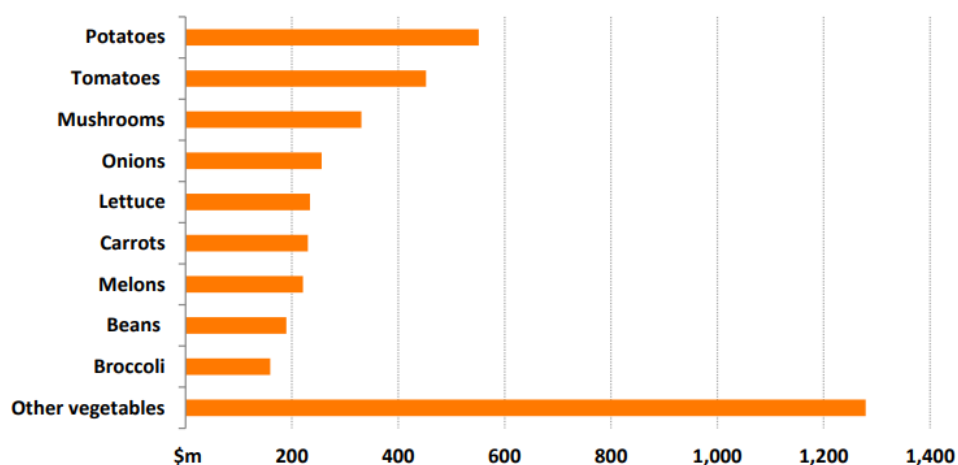
This paper analyses the Australian tomato value chain through detailed mapping of the chain, examining the performance of the chain with the strategic fit and profit drivers, identifying major

constraints and proposing possible interventions to achieve better performance of the whole tomato value chain.

Industry Description

Tomatoes account for the second largest production and the second highest value of all vegetable products grown in Australia (Figure 1). During the year ending June 2018, Australian tomato production was 484,073 tonnes with the value of \$609.9 million (Australian Bureau of Statistics, 2019a; Horticulture Innovation Australia Limited, 2019) (Table 1). Fresh tomatoes are produced Australian wide, mostly in Queensland and Victoria with 57 per cent and 28 per cent respectively, and the main production areas are the Goulburn Valley, the Lockyer Valley, Bundaberg and Bowen (Horticulture Innovation Australia Limited, 2019). Traditionally this crop is grown outdoors, but nowadays both high-tech glasshouses and open-field production systems are widely used in the Australian tomato industry.

Figure 1. Australia vegetable production value 2016-17



Source: Australian Bureau of Statistics (2019a)

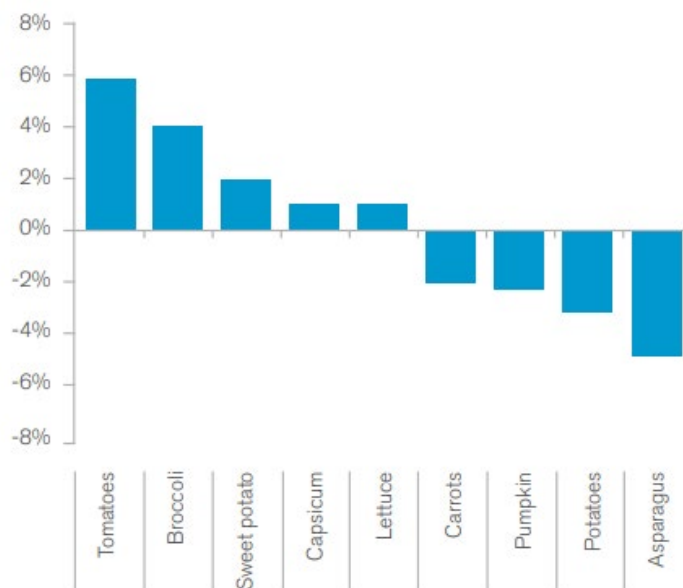
Table 1. Tomato production and value, 2016-2018

Year Ending June	2016		2017		2018	
	Value	Value	% YoY	Value	% YoY	
Production (t)	521,449	426,398	-18%	484,073	+14%	
Production (\$m)	\$ 541.6	\$ 645.2	+19%	\$ 609.9	-5%	
Production area (Ha)	5,430	4,785	-12%	-	-	
Fresh Export Volume (t)	939	530	-44%	804	+52%	
Fresh Export Value (\$m)	\$ 3.0	\$ 2.5	-17%	\$ 3.0	+20%	
Fresh Import Volume (t)	1,386	932	-33%	926	>-1%	
Fresh Import Value (\$m)	\$ 2.9	\$ 2.3	-21%	\$ 1.8	-22%	
Fresh Supply (t)	247,049	242,119	-2%	256,559	+6%	
Fresh Supply Wholesale Value (\$m)	\$ 605.3	\$ 732.5	+21%	\$ 687.7	-6%	
Supply per Capita (kg)	10.25	9.88	-4%	10.29	+4%	

Source: Horticulture Innovation Australia Limited (2019)

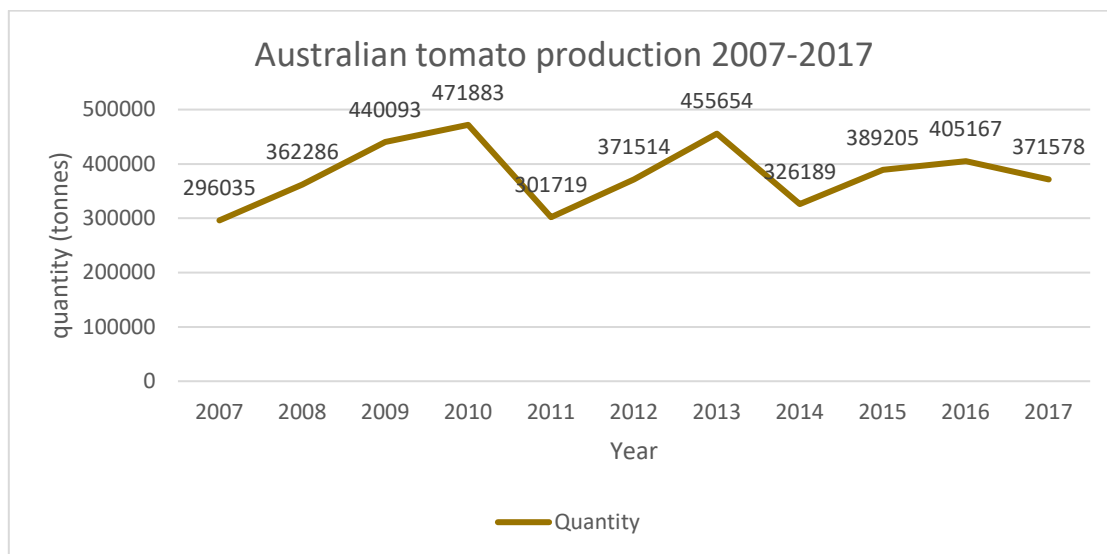
Around 53 per cent of production goes to wholesale distribution and 47 per cent goes to the processing tomato industry (Horticulture Innovation Australia Limited, 2019). The tomato industry mostly serves local consumption in Australia. Australian domestic consumption of fresh tomato is growing compared to other vegetable crops (Figure 2), which increased by 6 per cent between 2014 and 2017. Consumption was 10.25 kg/capita and consumed in 86 per cent of all households during 2016, according to Rural Bank (2018). The increasing purchase of tomatoes is a result of production and technology improvement (Horticulture Innovation Australia Limited, 2019). Figure 3 and Figure 4 present a longer-term view of Australian tomato production and producer price.

Figure 2. Domestic vegetable consumption trend from 2014 in Australia



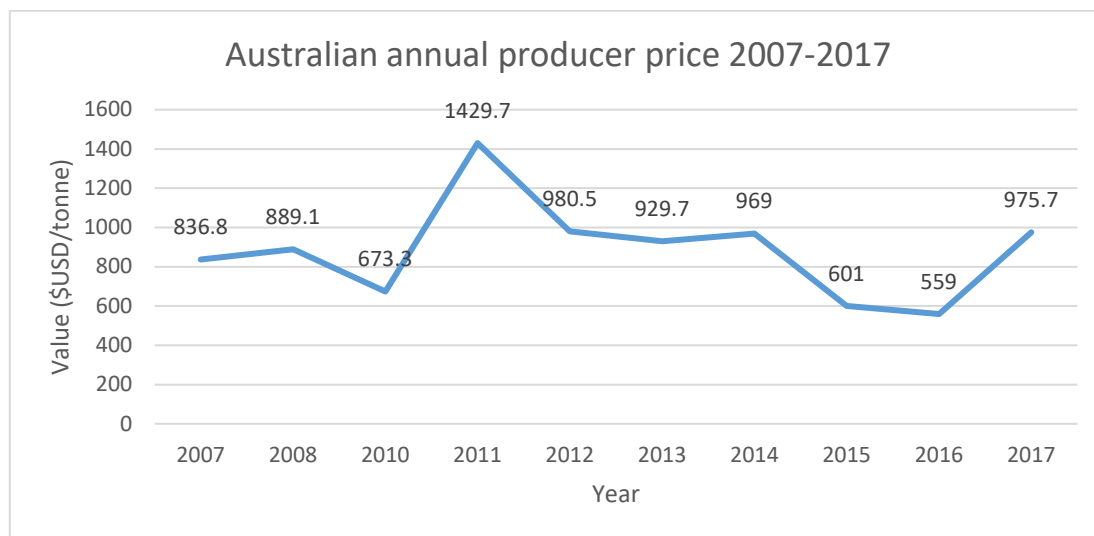
Source: Rural Bank (2018)

Figure 3. Australian tomato production (tonnes), 2007-2017



Source: Food and Agriculture Organization of the United Nations (FAO) (2019a)

Figure 4. Australian annual producer price, 2007-2017



Source: Food and Agriculture Organization of the United Nations (FAO) (2019b)

Australia has become an exporter of tomatoes in recent years. The total export value was \$12.1 million in 2017-18 for a volume of 804 tonnes (Table 2). Australian tomatoes are exported mainly to New Zealand, Singapore, New Caledonia and Papua New Guinea. Small quantities are also imported, approximately similar volumes to exports.

Table 2. Import and export of Australian fresh tomatoes, 2016-2018

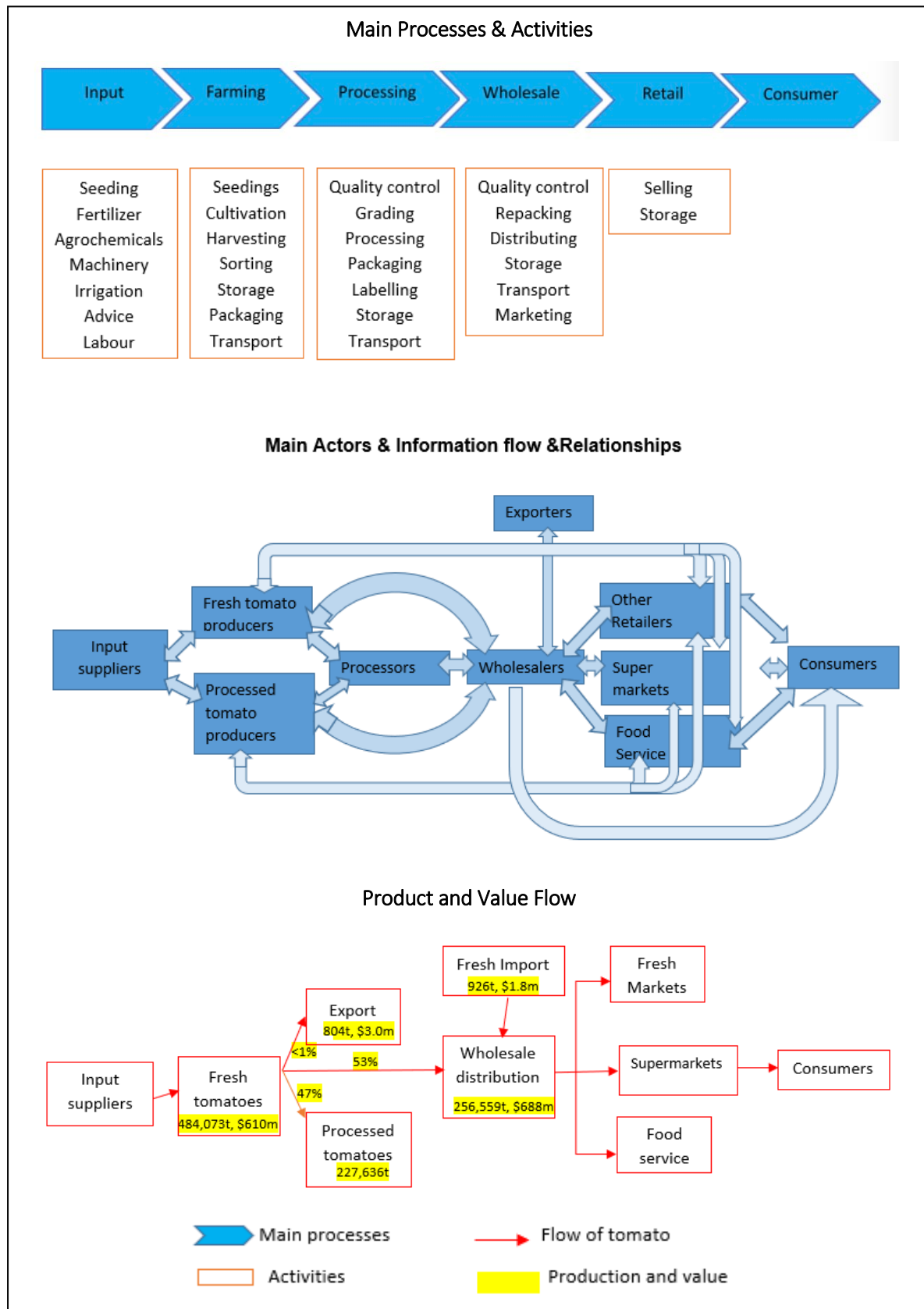
Imports by country (Tonnes)				Exports by country (Tonnes)			
Year Ending June	2016	2017	2018	Year Ending June	2016	2017	2018
New Zealand	1,386	922	926	New Zealand	354	126	239
Turkey	-	10	-	Singapore	154	138	219
TOTAL	1,386	932	926	New Caledonia	67	22	81
				PNG	39	64	58
				Nauru	6	28	47
				Other	318	151	161
				TOTAL	939	530	804

Source: Horticulture Innovation Australia Limited (2019)

Mapping the Tomato Value Chain

In Figure 5 an overview of Australia tomato value chain is presented, including the core processes related to each activity, the main actors, information flow along the chain, relationships, and product and value flow along the chain. The tomato value chain starts with farm inputs, farming, processing, wholesaling, retailing and to final consumers. Mapping the flow of fresh tomato product from agricultural input suppliers to final consumers in a whole chain perspective is a crucial step in better understanding and analysing the Australia tomato business. The activities along the chain create value for the industry. Further actions focussed on different activities in every stage of the chain could improve the efficiency, overall performance, minimize waste and maximise the value of tomatoes.

Figure 5. Australian tomato value chain



Source: Horticulture Innovation Australia Limited (2019)

Main processes/ activities

The main functions of the Australian tomato value chain include input supply, farming, processing, wholesaling, retailing and consuming, and there are a series of associated activities that generate value along the transformation chain as listed in Figure 5. Before tomatoes are cultivated, different inputs are needed, including seed, fertilizer, agrochemicals, machinery, irrigation systems, advice and labour.

Main actors, information flow and their linkage along the chain

The main actors include input suppliers, tomato producers (fresh tomato producers and processed tomato producers), processors, exporters, wholesalers, retailers (supermarkets, food service and other retailers) and final consumers. Examples of the actors are listed in Table 3 (with particular reference to South Australia). Every participant along the chain undertakes different activities and responsibilities. The information flows through the chain from the consumer side. Tomato producers can sell tomatoes to wholesalers, retailers, processors or directly to final consumers. Information is exchanged in every interaction.

There are 378 farms across Australia that are responsible for fresh tomato production (Australian Bureau of Statistics, 2017). In recent years, large-size tomato producers like Sundrop and Costa have adopted an innovated glasshouse production system, transitioning from conventional field-grown to glasshouse produced. It creates a new business model for tomato farming that requires less input but grows in a more sustainable and efficient way. Compared to field production, the controlled production optimises climate conditions, delivers more consistent and high-quality product, and gains 422 per cent efficiency compared to field grown tomatoes (Smith, 2017; Montagu, 2018). At peak production, Costa tomato glasshouses can hold over 1 million plants (Costa Group, 2020). Some of the largest field grown tomato producers have ceased in the past decade due to unfavourable weather conditions and rising cultivation costs, losing competitiveness with the hydroponic tomato growers (Marshall, 2016).

Table 3. Tomato value chain main actors, examples

Input suppliers	Australian Tropical Field Crops Genetic Resource Centre, Numerous seed producers, Numerous agricultural input dealers
Fresh tomato producers	Sundrop, Costa, Victorian Farmers Federation Horticulture Group, Flavorite Tomatoes, Perfection Fresh Australia Pty Ltd
Processed tomato producers	Kagome, Ardmona, Mutti, Annalisa, Macro, La Gina, Leggo's, Masterfoods, Beerenberg
Exporters	Costa, Kagome, ConAgra, Flavorite Hydroponic Tomatoes Pty Ltd
Processors	Ardmona, Rosella, Australian Processing Tomato Research Council Inc.
Wholesalers	South Australian Produce Market, Costco, Charlies Fruit Wholesale, Yarra Valley Farms
Supermarkets	Woolworths, Coles, Aldi, Foodland, Drake supermarket, IGA
Other Retailers	Adelaide Farmers Market, Adelaide Central Market Retailers
Food Service	McDonald's, Subway, Pizza hut

The powerful retailers set the commercial dynamics across the chain. They tend to have very transactional relationships and very short-term contracts with farmers. The short-term transactional relationships with suppliers means there is no real incentive for retailers to work differently. The large

domestic retailers require high volumes and quality standards of tomatoes and only the larger hydroponic tomato producers are able to meet the requirements (Food Magazine, 2020). They tend to develop long-term contracts which have penalties for partial non-delivery. This could drive an oversupply of tomatoes by suppliers to avoid the contract penalties.

Product and value flow of fresh tomato

Of the total production of fresh tomatoes, about 53 per cent directly goes to wholesale distribution (256,599 tonnes, \$688 million) and 47 per cent goes to the processing tomato industry (227,636 tonnes). Less than 1 per cent is exported. The gross margin of tomato is \$527 per tonne (highest among vegetables) with the total cost of \$1,094 per tonne and \$1,621 received price as listed in Figure 5, and below in Table 5 (Australian Bureau of Statistics, 2019c). The value of fresh tomatoes from producer to wholesaler increased from around \$1.26 per kg to \$2.68 per kg, which almost doubled the price (Table 4). Value addition to the export level was 170 per cent at a price of \$3.73 per kg.

Table 4. Value addition in the tomato value chain

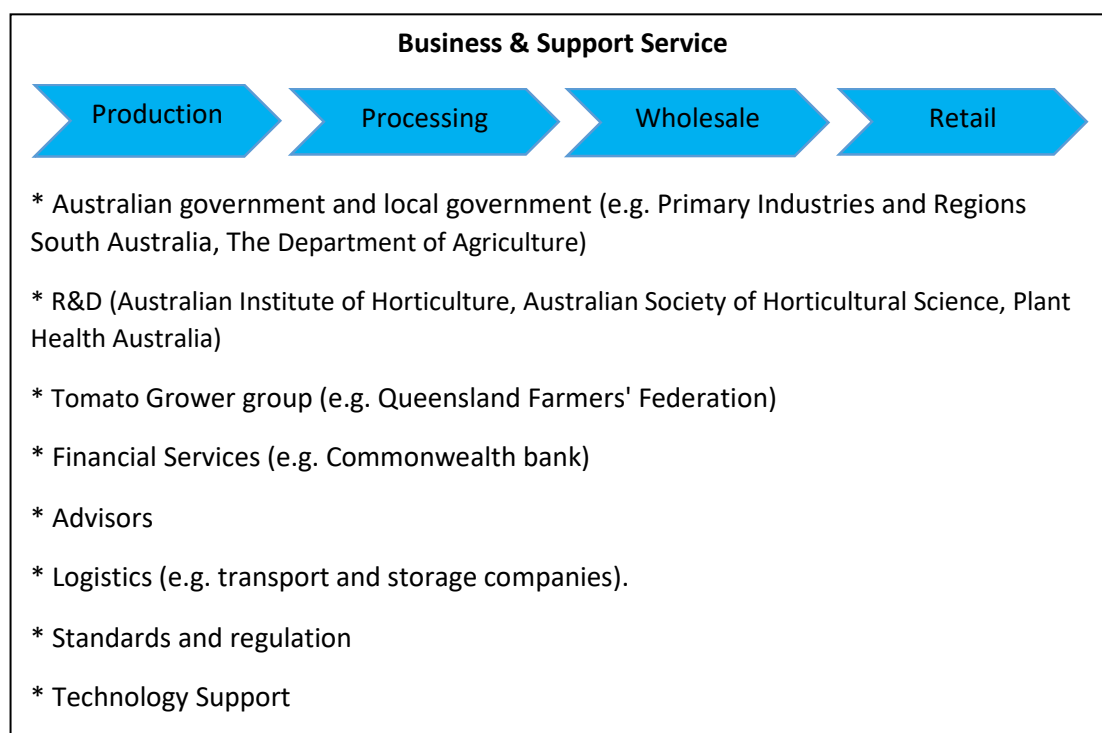
	Product value (\$ per/kg)	Value Added (\$ per/kg)
Fresh tomato producers	1.26	
Wholesalers	2.68	1.42
Exporters	3.73	1.05

Source: Horticulture Innovation Australia Limited (2019)

Major value chain promoters/ supporters

Tomato chain supporters include government and other non-government business to provide support and services along the value chain to promote better performance of the chain and product. The major chain promoters are listed in Figure 6.

Figure 6. Major tomato value chain promoters and supporters



Strategic Fit and the Main Drivers of Profit

Strategic fit

A competitive value chain strategy characterises the relationship to its competitors, fulfils customer needs and achieves higher consumer satisfaction. The Australian tomato value chain is somewhat responsive at a relatively high cost. A large variety of tomato products are delivered in a couple of weeks domestically and exported by airfreight within three days. The tomato value chain participants are aware of consumer needs and face lower supply uncertainty, thus responding effectively. Generally speaking, with the new production systems, the increasing demand for tomatoes is satisfied by sufficient production and varieties of products. This strategic approach defines how the various profit drivers are applied and how the value chain performs.

Logistical drivers - facilities, inventory and transportation

Efficient facilities applied in every stage of the tomato value chain is a key driver in increasing responsiveness, reducing cost and improving product value. Tomatoes have a large range of growing sites across the county and distribution centres are located closely to consumers. Production has shifted to glasshouse facilities in many areas of Australia, driven by the climate variability and labour costs and availability. More tomato varieties are grown in Australia in recent years. Post-harvest tools and storage facilities are crucial in preventing the loss of tomato products and stabilizing supply. Many tomato varieties are bred to increase storage life, for example cluster tomatoes, and cherry and Roma types. Transportation systems throughout the value chain enable the effective distribution of the tomatoes, balancing responsiveness and cost.

Cross functional drivers - information, sourcing and price

Information flowing through the tomato value chain links the value chain participants together, ensuring better coordination and linkages between them. Market and consumer information is gathered by the large retailers and wholesalers. The strong cooperation between the strategic alliance partners reduces cost and generates a positive return.

Australia fresh tomatoes are mostly delivered to the wholesale markets and processing industries, with less than 1 per cent of tomatoes exported. However, there is an increasing potential for tomatoes to be exported in the future due to the safe, diverse and various locations of tomato products. The large food restaurants like McDonalds have built a strong relationship with Australian farmers across the country with 2.8 million kilos of local tomatoes sourced in 2017 (Chung, 2019). Some horizontal integrated tomato producers like Costa own their own logistics service across the value chain to deliver to wholesalers that has largely reduced the transactions cost.

Tomato price is differentiated by various factors throughout the chain. The relatively stable demand and supply result in a relatively stable market price, even though abnormal climate conditions do influence the tomato price. The production methods and range of product varieties increase the value of the product, and a higher price is generated by better product quality. Branding, grading and packaging generate higher tomato prices as well.

Assessing the Performance of this Chain

The performance of the Australian tomato value chain is analysed by four main aspects including efficiency, flexibility, responsiveness and food safety (Aramyan, Oude Lansink, Van der Vorst & Kooten, 2007).

Efficiency

Tomatoes are grown for fresh tomato markets and processed tomato markets, from two production systems, field grown and hydroponically grown. Field grown tomatoes are mainly produced in Queensland and Victoria and supplied during spring and winter season in the southern States, although in some systems they can be harvested all year (Gillard, 2011). Hydroponically grown tomatoes are mainly produced in South Australia.

The gross margin of tomato is \$527 per tonne (the highest among vegetables) with a total cost of \$1,094 per tonne and an average sale price of \$1,621 per tonne, as shown in Table 5. The labour cost is the highest among all the input costs, contributing around 23 per cent of the total cost. It is noticeable that most Australia tomato growers are smallholder farmers and the production cost is significantly higher for them, as listed in Table 6. However, the price received by small scale farmers is also higher which may due to much of their output being premium quality suited to the fresh market. Many of the large-scale producers grow specifically for the processing market. Even so, it is reported that small-scale tomato farmers have negative farm business profit of -\$4200/t (Australian Bureau of Statistics, 2019c).

Table 5. Australian vegetable cost of production (3-year average of 2014–15 to 2016–17)

	Unit	Potatoes	Onions	Carrots	Tomatoes
Administration	\$/t	8	5	5	19
Fuel	\$/t	22	19	16	58
Hired labour	\$/t	39	71	53	256
Contracts	\$/t	13	21	12	150
Electricity	\$/t	10	13	10	24
Packing and freight	\$/t	15	20	13	84
Fertiliser	\$/t	41	34	32	50
Repairs and maintenance	\$/t	31	31	25	70
Seed	\$/t	35	22	21	66
Chemicals	\$/t	19	24	16	41
Water	\$/t	2	2	1	10
Other costs	\$/t	76	90	43	266
Family labour	\$/t	37	19	13	95
Total cost	\$/t	312	353	248	1,094
Unit price received	\$/t	394	499	330	1,621
Margin	\$/t	82	146	81	527
Margin w/ family labour	\$/t	45	127	69	432

Source: Australian Bureau of Statistics (2019c)

Flexibility

The different geological and climatic zones of Australia allow tomatoes to be available for consumers throughout the year (Australian Trade and Investment Commission, 2017). Consumer preferences are affected by the qualities of tomato product, such as colour, flavour and ingredients.

There have been significant new investments in the tomato breeding industry. Tomato seedlings are a major input of the industry and more tomato varieties in the market means consumers have more

choice. The major tomato types grown include Field tomatoes, Large Truss tomatoes, Cherry and Grape tomatoes, and Roma tomatoes, consisting of 42 per cent, 33 per cent, 22 per cent and 3 per cent of total tomato production for the fresh market, respectively (Horticulture Innovation Australia Limited, 2019). Commonly, field tomatoes are cultivated outdoors, Large Truss tomatoes are grown in glasshouses, and Cherry and Grape varieties are grown in both conditions. Figure 7 presents the seasonal availability of these major tomato types.

Table 6. Australian tomato cost of production by scale (3-year average of 2014–15 to 2016–17)

	Unit	Tomatoes	
		2 ha or fewer	More than 2 ha
Administration	\$/t	62	15
Fuel	\$/t	203	43
Hired labour	\$/t	509	231
Contracts	\$/t	118	154
Electricity	\$/t	81	18
Packing and freight	\$/t	96	84
Fertiliser	\$/t	143	41
Repairs and maintenance	\$/t	148	62
Seed	\$/t	183	54
Chemicals	\$/t	75	38
Water	\$/t	43	5
Other costs	\$/t	694	224
Total cost	\$/t	2,354	968
Family labour	\$/t	579	41
Unit price received	\$/t	2,789	1,487
Margin	\$/t	435	519
Margin w/ family labour	\$/t	-145	478

Note: All dollar amounts are in 2017–18 dollars

Source: Australian Bureau of Statistics (2019c)

Figure 7. The seasonal availability of main tomato type in Australia

Type	17/18 Tonnes	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Field	102,575												
Large Truss	89,753												
Cherry/Grape	56,416												
Roma	7,693												
Processing	227,636												
Availability legend			High		Medium		Low						None

Source: Horticulture Innovation Australia Limited (2019)

Responsiveness

Australia fresh tomato wholesalers in central markets play an important part in distributing tomatoes to retailers, supermarkets and other food services. The responsiveness and quality of fresh tomato exports are ensured by picking, sorting, packaging and airflights to Asian markets between 48-60 hours or shipping within 12 to 20 days (Australian Trade and Investment Commission, 2017). The tomatoes mature well and when delivered on time look good on the shelf, generating an appeal to consumers that drives more consumption and at a better price.

The tomato industry achieves good consumer satisfaction that is driven by the retailer knowing consumers' needs. Consumers have different willingness to pay for the varieties and qualities of tomatoes. People would have more choice when they are shopping in the supermarket, for the diverse ways of consuming tomatoes like snacking, cooking and salads.

Information and feedback flow back from consumers, retailers and wholesalers to the tomato producers. The awareness of customer needs in the tomato value chain drives the change in the way tomatoes are produced. This generates more value by producing various types of tomatoes which are grown all year round with the new glasshouse technology. The well-developed tomato categories create profitable margins for tomatoes, valued from \$4 to \$5 per kg up to \$20 to \$25 per kg. The positive information feedback from consumers has contributed to retailers investing more space in supermarkets, and processors/wholesalers being more innovative in packing and presentation. Consumers are willing to pay a higher price for these characteristics.

Food quality

Retailers are concerned about the environment and safe food. They know consumers want to eat food that tastes good and is grown with low chemical inputs. Australian consumers are highly conscious of health value and environmentally safe food products. Since tomatoes are easily spoiled when harvested, many functions through the value chain are aimed to ensure the quality of the final product. Tomatoes are picked by hand at an early stage of ripeness with a small amount of red colour in the plant and then ethylene gas is used to improve ripening. An important post-harvest tool used is dipping the tomato into CaCl₂ for 20 minutes to ensure quality and extend shortage time. Sorting tomatoes is important in keeping the good and consistent tomato characteristic (Arthur, Oduro, & Kumah, 2015). The well-developed glasshouse technology adopts hydroponics growing that contributes to food quality and sustainable production (National Farmers Federation Canberra, n.d.). Wholesalers and large retailers check tomato quality to meet product specifications, such as flavour, colour, smell, weight.

Major Constraints

The retail sales environment and the associated market power

Australia fresh tomato markets are dominated by the larger retailers. The duopoly supermarkets Woolworths and Coles hold the major power among the Australia tomato supply chain, which accounts for over half of the market share at around 344 million (Roy Morgan, 2018). Their market share is growing aggressively at the expense of niche competitors including Aldi, IGA, Foodland and other retail markets. There is insufficient focus on the transaction conditions along the chain, especially in regard to the different types of contracts that apply and the relative balance of power in these transactions.

Asymmetric standards of tomato product specification

According to a study carried by the University of the Sunshine Coast, postharvest loss was found to be between 40.3 per cent and 55.9 per cent of the total harvestable product for two medium sized commercial supply chains. Between 68.6 per cent and 86.7 per cent of undamaged, edible, harvested tomatoes were rejected as out-grades and consequently discarded due to product specifications. Between 71.2 per cent and 84.1 per cent of produced tomatoes were left in the field and not harvested (McKenzie, Singh-Peterson, & Underhill, 2017). A higher level of waste is found in the field-grown tomatoes than those grown in the glasshouse.

Uncertainty of field grown tomato production

Australian tomato production is expanding and is more reliable with the increasing use of glasshouse technology. However, in 2017, favourable weather conditions (mild winter and enough moisture) in the production areas of open field grown tomatoes in NSW and Queensland resulted in an oversupply (Rural Bank, 2019). This oversupply generated high post-harvest losses and lower returns. The tomato market price came under pressure in the spring of 2017. The Queensland tomato market price was down nearly 34 per cent to \$15.24/10kg carton and the Victorian market price dropped dramatically to \$8.02/10kg carton at that time, compared to the same period in 2016 (Rural Bank, 2019).

Ongoing labour shortages

Another challenge for the Australia tomato industry is the lack of seasonal workers available to harvest fresh tomatoes. The industry seasonal harvesting workforce is highly reliant on backpackers and international workers. The agriculture workforce shortage directly contributes to a significant crop loss on the farm worth millions of dollars.

Lack of coordination of partnership

The Australian tomato industry is made up of mostly small-scale family farms. The labour input is among the highest cost in their production activities. With high rejection rates and quality discounts under the private standards, the average price received by the farmers is often very low. Since the use of contracts between small-scale farmers and important retailers/wholesalers is low, buyers will turn to other tomato suppliers when the farmer does not meet their standards. The harvesting cost is often higher than the returns, which again leads to waste the tomatoes and reduce farm income.

Shortage of nutrient-rich bush tomato supply

In recent years there has been a soaring market demand in indigenous food, including bush tomatoes which contain a rich content of minerals and Vitamin C level (AgriFutures Australia, n.d.). This type of tomato requires an arid environment and is only grown in limited locations, mainly in the Northern Territory and South Australia. However, there is a lack of investment in the bush tomato industry (Nadia, 2019) and the farmers cannot meet the increasing demand from consumers and manufacturers. Wild harvest is the main source of bush tomato harvest but the yield is variable and there is a lack for regulatory requirements in production (AgriFutures Australia, n.d.).

Possible Improvements

Building long-term and streamlined relationships

The Australia tomato industry could benefit from moving short-term transactional relationships between major retailers and suppliers to long-term and streamlined relationships and contract arrangements with suppliers.

Setting up product certifications and regulations

Although postharvest handling infrastructure is applied in Australia to reduce the post-harvest loss, the inconsistent and different forms of private tomato standards and market value carried out by chain participants deliberately contributes to a significant amount of tomato loss. Reasonable certification procedures need to be evaluated to ensure proper marketing regimes. This can be achieved by the collaboration of Hort Innovation with supermarkets, other retailers, farmers and consumers to guarantee transparent information of about quality consistency and prices of tomato products. Also, regulations need to be assessed to oversee farmer contracts with large retailers and fresh markets. This together with well-designed pricing strategies would serve well in minimizing post-harvest loss and increasing chain surplus.

Alliance of value chain actors

Tomato industry associations including large and small tomato producers along with other members of the value chain could improve cooperation to respond to market requirements. For example, large-scale tomato enterprises like Costa and Sundrop could be encouraged to assist the workforce skills in smallholders' farms and the effective use of new technology, thus improving overall chain efficiency. Such an alliance of skills/resources would also be useful to address challenges such as product waste and to promote the growth and development of tomato industry.

Greater government intervention on the labour scheme

The Australian government plays a major role in offering incentives to encourage more local workers and students to engage in the seasonal harvesting process. Also, tomato farm workers would be more readily available if government strengthened the Working Holiday Maker program and the Pacific Labour Scheme to get more international workers.

Encouraging the application of protected cropping

Incentives should be evaluated to encourage the application of glasshouse production systems for field tomato growers. Awareness among farmers to adopt innovative cultivation systems is a key driver as well. This would reduce the uncertainty of production and act as protective barriers for quality to remain intact in adverse weather conditions. Moreover, the new system would enhance product diversification, produce a greater yield at generally a lower cost of production which will generate a higher return in the long term.

R&D in recycling tomato waste

Agricultural research centres need to invest in reusing the vine and leaves of green tomatoes to produce useful composting material for other agriculture industries. This will maximize the return of the farm and lead to a more sustainable circular tomato industry and its by-products.

Investing and engaging in bush tomato

The demand for bush tomatoes is in excess of the supply. Investment in the production of this tomato type needs to be assessed. This could be focussed on improving production systems and post-harvest

facilities. The regulatory requirements in production should be addressed by Food Standards Australia New Zealand (FSANZ) to support the national producers in consistent harvesting, reducing the uncertainty and assuring the environmentally friendly and safe food.

Conclusion

This study has focussed on the Australian tomato value chain and its performance. It is shown that the major constraints include market power issues, yield uncertainty of field grown tomatoes, lack of coordination partnership, asymmetric standards of tomato production specification and shortage of bush tomato type. Application of value chain methods could be used to facilitate improved tomato value chain performance through an improvement in product certifications and regulations. Investment in bush tomato R&D would address the shortage of supply of the market and create higher value. Government intervention on the labour scheme could also ease the labour stress of the industry. Furthermore, encouraging the application of protected tomato cropping would generate a higher return in the long term and future solutions in tomato waste could maximize the product flow and return. Most importantly, issues along the chain could be addressed at a large extent by strengthening the cooperation of both the players and supporters.

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