



## **Case Study of Value-Added Citrus Products for WA Citrus**

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**West Midlands Group (WMG)**

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## 1 Summary

In recent years, Western Australia's citrus industry has shown sustained growth, reaching a production of 12,326 tons in 2013-14 (Hort-Innovation 2016-17). The variety of oranges most commonly grown are navels, due to their popularity with consumers (WA Citrus.2018).

Of the total citrus production, 3,000 tons was second grade fruit. This fruit has a lower market price or is not sold, destined for animal consumption or discarded all together. This issue formed the focus of this case study: identify potential value-added products for using second and waste grade fruit.

Physical and chemical components of citrus mean the entire fruit can be used in the generation of value-added products for various industries, with the most developed application of citrus being within the food, pharmaceutical and cosmetic industries.

Orange juice is the most consumed citrus value-added product in the world, with Brazil as the largest producer and exporter (FAOSTAT 2018). The valencia variety is the most used for juice production. The characteristics of this variety allow the flavour and sweetness to remain for longer, which does not happen with navels that turn bitter.

However, the juice market is threatened by the dietary trends promoting reduced sugar consumption. Reconstituted juice has been most affected thus far, as it has a higher sugar content than fresh or cold pressed drinks.

Globally, Brazil and the United States are the major orange juice producers. Some juice manufacturers take advantage of the fibre and essential oils generated as waste in the process, using these to further value-add. Both products show an upward trend in their demand and application, mainly in the food industry. Meanwhile, the pharmaceutical industry values the antioxidant and anticancer components of citrus fruits.

There are also success stories in other industries. For example, Orange Fibre uses the waste of a Sicilian juice producer to develop fabric from orange peel. The Italian luxury fashion house, Salvatore Ferragamo, launched a collection using their silky textures. Another development was produced by the Italian paper producer Favini, using citrus cellulose in the production of an exclusive paper line. They also used kiwi, grapes, wheat and coffee.

Globally, large producers of juice, fibre and essential oils have access to large volumes of citrus, as well as tonnes of waste after the juice production. For this reason, value-adding for small Western Australian citrus producers may not be viable or possible due to the sheer size of quantities required.

Harvey Fresh is the only medium size juice producer in WA with sales presence throughout Australia. Their business model is similar to that of major juice producers in the world, producing and processing their own fruit. Therefore, it is the only business that we have identified as able to take the industry to the next level, using the entire fruit to develop by-products such as fibre and essential oils.

In conclusion, the majority of citrus producers are concentrated on the production of citrus fruits for direct consumption. For that reason, they must have a continuous improvement strategy throughout the supply chain. Improving of product quality should mean an improvement in yields and profit.

## 2 Introduction

Citrus is produced worldwide and represents 16 % of total fruit production by volume (Coriolis 2016). There are 140 citrus-producing countries, 70% of which are in the Northern Hemisphere. Brazil, China and the United States (US) have the greatest production (FAOSTAT, 2012). It has been recognised that almost 33% of citrus production is used for processing purposes; however, the majority (77%) is consumed fresh. Juices are the most significant processed citrus product (Kamal & Anwar et al.2011).

Citrus fruit can be used entirely due to their rich source of vitamins, minerals, fibres and bioactive phytochemicals, such as carotenoids, nitrogenous compounds, alkaloids and polyphenolics. The by-products resulting from citrus wastes are an economic and renewable source which can be used in the pharmaceutical, nutraceutical, food and cosmetic industries (Mahato et al. 2018). A few commercial examples for applications of citrus components products include tyres (Yokohama Tyres), papers (Favini), and fabric (Orange Fiber).

Value adding of citrus is a factor that has been an ongoing concern for WA Citrus, which in collaboration with organisations such as Perth NRM, have been studying the potential uses of second grade fruit. They have also been looking at improving the value chain and corresponding market analysis for Western Australian citrus. For these reasons, WA Citrus requested the West Midlands Group, through its Northern Valleys Agribusiness Project, which is founded by Royalty for Regions, to carry out a case study to source information which would answer the following key questions for the specific value-added products of juice, essential oils and fibre:

Q1 What are the markets for value added citrus products?

Q2 What level of investment is required to produce products in WA?

Q3 What volume of fruit is required for the development of viable product lines?

### 2.1 Background

The Citrus Industry is the largest fresh fruit exporter in Australia valued at \$200 million annually (NSWDPI, 2018) and is based on 28,000 hectares, managed by 1,900 growers throughout the country. The Central Burnett (Queensland), Riverland (South Australia), Murray Valley and Riverina (Victoria) are the major production regions (Citrus Australia. 2018).

Western Australia (WA) represents almost 2% of citrus production nationally (Citrus Australia 2018). Navel and Valencia oranges, mandarins and grapefruit are the most common citrus fruits produced in WA's Kununurra, Carnarvon, Moora, Gingin and Harvey production

#### Citrus Grades:

Premium: less than 1cm<sup>2</sup> and fruit size parameter

Composite: a mix of grades premium and greater than 1cm<sup>2</sup> grade fruit.

Second grade: greater than 1cm<sup>2</sup> damage.

Juice grade: greater than 5cm<sup>2</sup> has size for some buyers (oranges, some lemons and grapefruit).

Waste: blue, split, rot.

Source: WA Citrus

regions. Currently, Western Australian citrus producers are expanding with new growing areas and infrastructure are being established for oranges, tangerines, limes and lemons. For example, the recent launch of Moora Citrus Packers which has the capacity to process 20,000 tons of product per year. This has meant an investment of \$7 million into the industry (ABC News, 2017).

Approximately 3,000 tonnes of citrus that do not reach class 1 grade each year and has forced growers to think about alternative solutions for the use of their lower grade citrus fruits (WA Citrus, 2017).

In developing this case study, a diverse range of citrus producers were interviewed. Throughout the interviews these growers gave indications that second grade fruit is still accepted and purchased by consumers. The third class, which is also called juice or value-added grade is used to develop juice or by-products such as essential oils (EO). Most of the juice grade that is not used for value adding purposes and the waste grade are used for livestock feed or dumped.

An Australian study of national vegetable production showed that around 25% of all vegetables produced annually ends up as waste, or AU\$115 million dollars (Rogers. 2013). Food waste in Australia is estimated to cost around AU\$8 billion annually (Ghosh and Fawcett et al. 2016). From a producer's perspective the factors causing products to finish as waste include pest or disease damage, poor produce quality, cosmetic marks, lack of labour to harvest, low prices, regulatory conditions and unfavourable weather (Ghosh and Fawcett et al. 2016).

## 2.1 Value Adding

Although Western Australia has a diverse range of agricultural commodities, there is no prevalent value adding sector compared to Australian food industry that value adds around 6% of products. However, Western Australia has advantages than other states do not, such as its proximity to major economies and markets such as China, Japan, Vietnam and Singapore. In addition, it has market access as a benefit due to international agreements and trade negotiations (Islam & Johnson 2003). For example, the new Trans-Pacific Partnership (TPP-11), which from January 2017 does not include the US, has allowed Australia to increase its exports by filling the supply of products previously offered by the US (The Australian, 2018).

Based on the U.S Department of Agriculture, Rural Business Development, value-added agriculture is defined as:

- A change in the physical; state or form of the product (such as processing oranges to make juice).
- The production of a product in a manner that enhances its value, as demonstrated through a business plan (such as organically produced products).
- The physical segregation of an agricultural commodity or product in a manner that results in the enhancement of the value of that commodity or product (such as an identity preserved marketing system).

Value adding can be generated by a diverse range of actions; however, the most common types are through innovation or coordination (Tilled. 1989). Innovation is focused on improving existing processes, products, services or creating new ones. Frequently, successful value-added businesses focus on very narrow, high-technology, geographically large markets where competition is scarce (Contrain & Barton et al. 2000).

In contrast, coordination focuses on business arrangements between those that produce and market farm products. Horizontal coordination includes combination or consolidation between individuals or companies from the same level of the food chain. Vertical coordination involves various aspects such as contracting, strategic alliances, licensing and single ownership of numerous market stages in diverse levels of the food chain (Peterson & Wysocke. 1997).

Value adding has to potential to provide advantageous impacts for the overall economy of Western Australia, such as increases in the employment rate and potentially higher incomes; however,

engaging in agricultural value-added processing will depend on profitability. Additionally, there are also barriers to consider such as volume (supply and demand), labour and regulations (Islam & Johnson 2003).

From that platform and based on the price difference between processed and unprocessed farming products, it can be inferred that the economy is losing by not processing their products, especially before export (Islam & Johnson 2003).

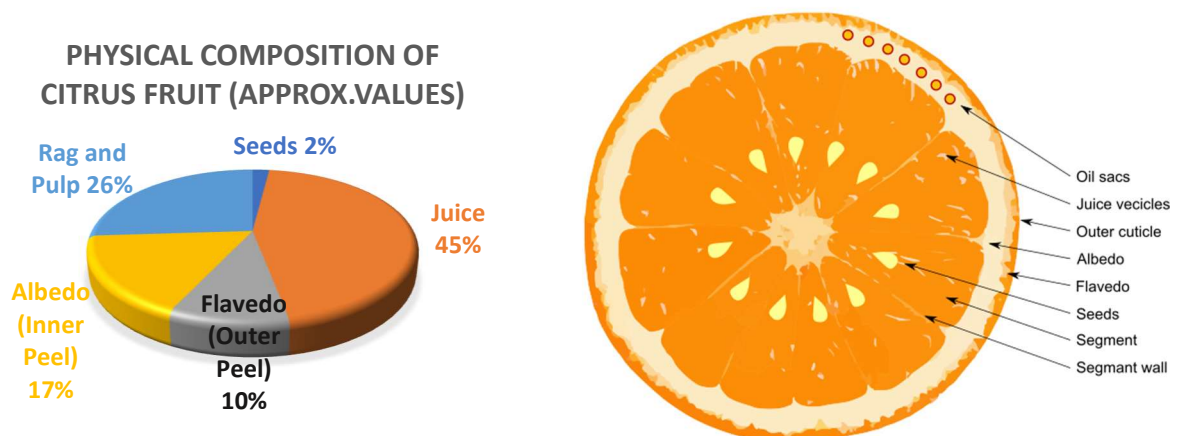
In Western Australia there are a few value adding businesses focused on citrus. Following the global trend, most of them are juice producers. Value adding alternatives to juice have been found to be small or extremely competitive (Peterson & Wysocke. 1997).

## 2.2 Characteristics of Citrus that allow value adding opportunities

The structure of the diverse citrus fruits varies with type, variety, quality, grade of ripeness and climate conditions. Figure 1 represents the physical composition of the most common citrus fruit varieties commercially grown around the globe. Figure 2 denotes the chemical composition of the citrus fruit as well as their micronutrients. Figure 3 shows their internal parts in edible and non-edible categories (Mahato & Sharma et al.2017), where the last category is also known as citrus waste.

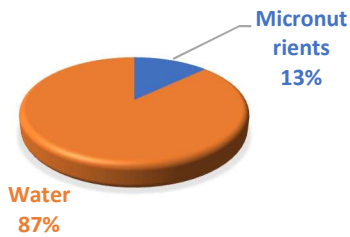
The chemical composition of citrus' non-edible parts (for example seeds, albedo and peel flavedo) contains starch, soluble sugar, fibre; including cellulose, hemicellulose, lignin and pectin, and enormous numbers of flavonoids and vitamins (Figure 1). There are also other compounds that have less significance for potential value adding opportunities that do not pose a risk with processing, such as ash, fat and protein, and many bioactive compounds (Figure 2, Mahato & Sharma et al 2017).

**Fig.1 Anatomy and physical composition of a common citrus fruit (Mahato & Sharma et al.2017)**

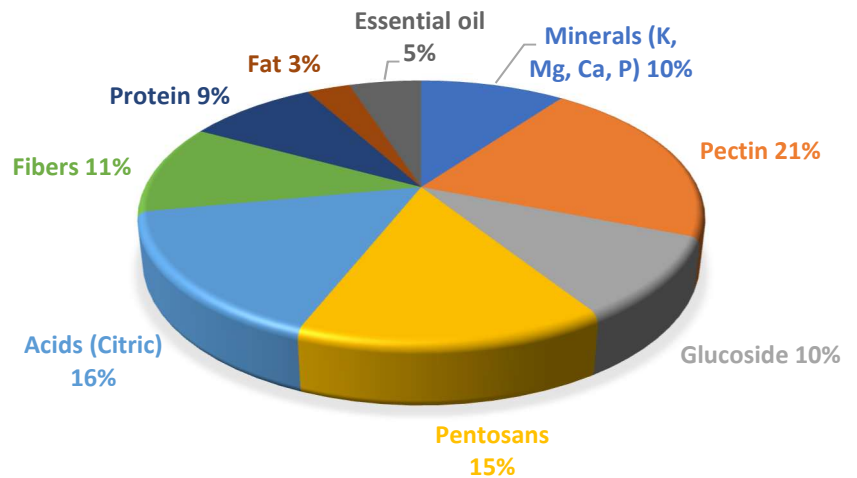


**Fig 2. Chemical composition and micronutrients of the citrus fruits (Mahato & Sharma et al.2017)**

#### CHEMICAL COMPOSITION OF CITRUS JUICE




#### CHEMICAL COMPOSITION OF MICRONUTRIENTS



Citrus fruits can be used in their entirety. They have medical value and are used in the pharmaceutical and cosmetic industries (Abbasi & Ahmad et al 2006). For example, citrus fruits are rich in antioxidants which aids anti-ageing, protects cells and reduces the effects of cholesterol (Citrus Australia 2018). Furthermore, cosmetic companies such as Guerlain, Chanel and Giorgio Armani use citrus notes in their fragrances.



**Fig: 3 Editable, non-editable and waste proportions of citrus fruit (Mahato & Sharma et al.2017)**

<p><b>Citrus edible parts</b></p>  <p>Pulp</p> <p>Juice</p>	<p><b>FLAVEDO</b> (outer coloured part).  <b>Main compounds:</b> flavonoids and essential oils (naringin and limonene), pigments (carotenoids); neoeriocitrin, neohesperidin  <b>Applications:</b> Succade (candied peel), Chin pi (dried peel), honey citron tea, herbal tea, aroma oils, digestives, antiseptics, mouth rinse, soaps.</p>
<p><b>Citrus non-edible parts</b></p>  <p>Segment wall</p> <p>Flavedo &amp; Albedo</p> <p>Pith residue</p> <p>Seeds</p>	<p><b>ALBEDO</b> (white part under the flavedo)  <b>Main compounds:</b> Protein, dietary fibre, pectin, cellulose, neohesperidin.  <b>Applications:</b> Thickening, jellying agent and stabilizers in jams, jellies, marmalades, sweet juices, pectin, pomace, ingredients in pork sausages, beef burger, meat processing and emulsions.</p> <p><b>PITH RESIDUE</b> (remains after juice extraction)  <b>Main compounds:</b> Citric acid, folic acid, amino acid, cellulose  <b>Applications:</b> Ethanol and vinegar production, citrus molasses, clouding agent, pressed juice, dried citrus, pulp pellets, beverage alcohol base.</p> <p><b>SEEDS</b>  <b>Main compounds:</b> Vitamin C, sterol, tocopherol, oleic acid, palmitic acid, linoleic acid, limonin, citric acid, limonoids, trace minerals.  <b>Applications:</b> Seed oil (dietary oil, salad oil), seed flour (food supplement) ointments, medicines, soaps, cosmetics, pesticides, throat gargles, ear drops, nasal drops for sinus infections and cold, antifungal, antibacterial agent, foot creams, preservatives, sterilising and disinfecting operating rooms, nebulizers for controlling respiratory infections.</p>

**Table 1: By products from citrus waste and its uses (Mahato & Sharma et al.2017)**

### 3 Methodology

The format of this study is to investigate the opportunities for value adding of citrus in Western Australia. This involved the review of the value adding opportunities that are available for citrus across the world, as well as interviewing participants in the WA citrus industry. Participants in this study were suggested by WA citrus based on the relevance of their business in the local, national and international citrus markets, and included citrus industry leaders, producers, and entrepreneurs linked to the citrus industry and development of citrus value-added products. The influence of national and international companies was also taken into account to analyse their impact on their citrus market.

The questionnaires used are in Appendix 1 and interviewees are in Appendix 2. Additionally, the search criteria via the internet was citrus; value-added market (International, Australian, and WA), products, by-products, benefits and uses.

During the course of the study, it was found that there are a large number of opportunities for value adding, and so the current study will focus on the value adding opportunities from citrus juice, fibre and essential oils.

## **4 Value adding opportunity: Juice**

### **4.1 Location and scale of production**

Today, one out of three oranges consumed in the world comes from a small area which includes parts of the Brazilian states of São Paulo and Minas Gerais. Half of the orange juice consumed worldwide is produced in Brazil. The second major region is Florida in the US. Both areas have had the focus to produce oranges for juice purposes (Gallas. 2017).

However, at present, neither the Brazilian producers nor other large citrus juice producing countries are having the results obtained historically (Gallas. 2017). Globally, orange juice production for the period of 2017/18 is forecast to be down by 16 % to 1.7 million metric tons as Brazil drops from last year's recovery. Led by the (US) and the European Union (EU), consumption is estimated to reduce. Due to reduced production from Brazil and US, orange juice exports and stocks are likely to fall 8 percent and 9 percent respectively.

In the US there is a fewer amount of processing oranges, caused that juice production would decrease to 97,000 tons to 215,000. Imports are estimated to increase 10 % (330,000 tons), while consumption continues its declining trend.

Brazil's production is expected to drop 16 percent (1.2 million tons) with fewer oranges for processing as orange juice production declines. Exports are reduced in an equivalent way in smaller supplies. As the largest producer, Brazil exports three-quarters of the world's orange juice; while Mexico's production remains the same and their exports slightly changed.

EU production is estimated to decline 12 % for processing oranges due to a smaller area of farming, higher temperatures and lack of rain that results in drought conditions. With relatively flat imports, consumption is lower (USDA. 2018).

### **4.2 Market Trends for Orange Juice**

A recent study released by Grand View Research Inc., during 2017, indicates that the global market for natural juices will be worth \$257 billion by 2025. Some of the key factors for the growing market include the rise in consumption of fruit juices, the introduction of vegetables and fruit mixtures, cold-pressed juices and increasing incomes in developing countries. In addition, the study also indicates that the consumption of non-alcoholic beverages, such as cola drinks, flavoured soft drinks and other beverages sweetened with sugar, is declining globally. These drinks are considered without nutritional value while juices sourced from fruits and vegetables are valued as healthy.

Orange juice consumption is declining internationally and nationally as consumers search for juices with lower amounts of sugar. In the consumption of the reconstituted juice is where a great fall is seen. People are preferring 100% natural products, without sweeteners, over imported reconstituted juices and with added sugar. (Damiani. 2017).

### **4.3 Australian Citrus Juice Market**

For the 2017 production year, the Australian citrus industry estimated that 506,391 tons of citrus were produced. Of that production, 45 percent of that production was used for processing such as juice.

During the last 5 years orange production has increased, especially eating varieties such as Navel. The opposite is happening with Valencia, the most common variety for juicing, due to lower returns (Hort Innovation 2016).

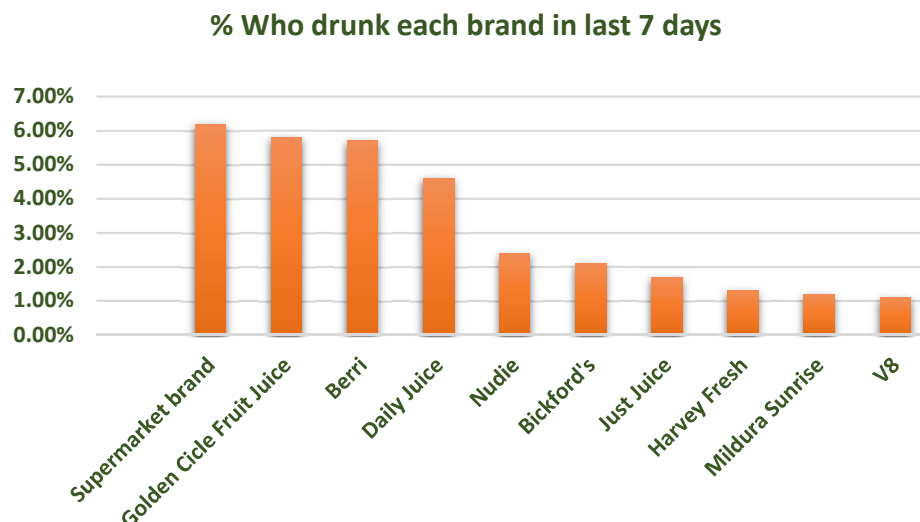
Over the last decade, national orange juice consumption has declined from 49,000 tonnes in 2005/06 to 41,000 tonnes in 2012/2013 and 39,000 tonnes forecasted for 2016/2017. The cause of that fall is driven by a global trend of moving from high sugar beverages, and competition from other drinks such as iced tea and sport beverages (Hort Innovation 2016). However, imported orange juice remains the same from the last 5 years: 32,000 tonnes (USDA 2018).

The volume of Australian orange juice is estimated to be 261.39 ML in 2018, equating to sales of US\$562million from an average per capita consumption of 10.56 L (Statista.2018). In terms of the Internet as a sales channel, the statistics agency declares that it will comprise 0.4% of the total fruit juice purchases by 2021.

Australian fruit juice industry requires 500,000 metric tonnes of citrus annually when the local industry can supply half of the amount of Valencia oranges needed. To cover that shortage, Australia imports Orange Juice Concentrated (OJC) from various countries such as Mexico, Israel, United States and Brazil, country which in 2010 represented 89.6% of the total imported OJC. The South American country has competitive advantages over Australia in OJC production due to lower input cost (i.e. due to lower input as labour and transport) and larger scale growing operations with lower unit production costs (The Senate, 2013).

Based on a Roy Morgan study conducted in Australia from July 2015 to June 2016 the most widely consumed fruit drinks in a week are supermarket brands (6.2%), Golden Circle Fruit Juice (5.8%), Berries (5.7%), Daily Juice (4.6%), Nudie (2.4%), Bickford's (2.1%), Just Juice (1.7%), Harvey Fresh (1.3%), Mildura Sunrise (1.2%), and V8 (1.1%).

**Graph 1 shows the most consumed fruit juices in Australia based on a Roy Morgan study of 2015.**



The same study indicated that men (27.6%) are slightly more likely than women (26.3%) to consume packaged fruit juice, with young people of both genders being more avid customers. Among men between 18-24 years old (34.6%) is the peak of the consumption, with men in the 65+ years range (25.5%) are on the opposite side. For women, the highest drinking group is at 14-17 years old (38.8%) in average consume seven days a week; while 19.9% of women aged 65+ years drink fruit juices.

Supermarkets are the most common place for buying packaged fruit juices. The Roy Morgan study estimates 5.2 million Australians purchase their juices which is a slight decrease from 5.6 million. Conversely, the consumption of juices at 'juice bars' is increasing, with more than 1.8 million Australians often consuming juices there.

#### 4.4 Western Australia Juice Market

The Western Australian citrus industry does not have the scale or structure of low production costs to compete in the global orange juice sector. WA has small-scale fresh juice processors, large, and multinational beverage companies producing fresh juices. Harvey Fresh is the major juice processor that utilises locally produced fresh citrus, processing 20ML yearly which means the 20% of the volume produced in WA (Coriolis 2016).

The commercial and marketing strategy differentiation between big and minor producers begins with their offer. Harvey Fresh produces fresh and concentrate orange juice. In comparison, the smaller factories develop fresh, and cold-pressed juices. Orange juice for example, is sold as a unique flavour or mixed with other fruits and vegetables, with lemons having a similar scenario.

During visits to supermarkets, it was possible to find a mix of fresh citrus juices; however, Harvey Fresh is the only producer from WA present at these points of purchase. The Roy Morgan study also pointed out that Harvey Fresh was the most consumed brand in WA, while Golden Circle and Berri outperform the competition in their respective states of origin, Queensland and South Australia respectively.

Based on interviews, most of the smaller WA brands sell their products directly to restaurants and the catering industry, in community festivals, farmers markets, from their premises or by phone, as well as offering free delivery over certain purchase amounts.

While the small juice factories buy their citrus at Canning Vale Markets or directly from producers, Harvey Fresh (Harvey, WA) uses their own Valencia oranges, as well as purchases from other WA producers to complete their offer. In order to operate all year around, they also import fruit from other states (Harvey Fresh 2017).

Local factories interviewed use in total 4,709 tonnes per year of juice grade fruit, mostly Valencia oranges. WA has a shortage of that variety; therefore, factories commonly import products from the east coast.

#### 4.5 Challenges

**Volume:** In Western Australia, Navel oranges are the dominant variety and taste bitter as a result of the squeezing process. For that reason, Valencia oranges, which are more juicy and sweet, are preferred by juice factories. Harvey Fresh uses their own fruit and buys from other WA producers during the Valencia season, and import from other states to fulfil their operations all year round (Harvey Fresh 2017).

This shortage of Valencia oranges could be exacerbated as WA citrus producers are focused on producing 'eating' varieties such as navels as these are more profitable for domestic and export markets (ABC 2016).

Giving a perspective, in Sicily during 2016 the juice sector used 140,000 tonnes of lemons, 100,000 tonnes of blonde oranges, 100,000 tonnes of blood oranges, 20,000 tonnes of green mandarins and 20,000 tonnes of matured mandarins. In total: 380,000 tonnes of citrus fruit (BBC 2016).

**Keeping quality:** For cold-pressed juice factories, challenges start with maintaining the fruit and the juices at a certain temperature throughout the entire process (US Food & Drug Administration



recommends 5°C). In addition, their shelf life is limited, needing constant restocking at the point of purchase. Another barrier for citrus and cold-pressed juices is the size of fruit to be used, because some machinery is designed for specific sizes of products. Consequently, this further restricts the use of products.

**Sugar levels drop in consumption:** Icy poles made from citrus and orange juices share the same challenge; to conserve their sugar levels within the guidelines established by the sanitary authority. This is especially true when it comes to food consumed by children (Citrus Australia 2018). For that reason, people are preferring juice mixes of fruit and vegetables.

**Cooperation and partnership:** Recently in the WA citrus industry occurred two situations that could affect industry stability and progress. Firstly, the Western Citrus Alliance dissolved, which could sell and even export some of their production. The next season will bear witness to any impacts in terms of quality and marketing as a result. Secondly, the reorganisation of the Fresh Produce Alliance and their partnership.

#### 4.6 Opportunities

**Exports:** Most of the interviewees of this study guaranteed a growth strategy, either by diversifying their business or by working with more sales channels to reach larger scales of production. Although exporting appears to be a big challenge, the Australian brand can be attractive enough for the nearest markets; Singapore, Indonesia and China (Coriolis 2016).

**Technology:** Fresh Produce Alliance based in Manjimup (WA) has a high-pressure processing (Hyperbaric) machinery which process diverse products for the food industry. As a trial, they used navel oranges to produce juice and the bitter taste was not developed.

**By-products:** The Fresh Produce Alliance, in addition to making food for babies and aged care, was taking advantage of the waste of this process to make compost. They were using almost the entirety of the raw material generating a new business.

**Diversification:** When the multinational food producer, Louis Dreyfus Company (LDC), processes citrus fruit to juice, they recover the oils, and all remaining pulp is transformed into rich energy and fibre pellets which are used for animal feed. The essential oils derived from their processes are used in the food and cosmetic industries (LDC 2018). In WA, due to the magnitude of a project such as LDC, Harvey Fresh could be supported by Parmalat to afford and succeed in a project with citrus by-products and to compete with multinational companies which have been working for years in the Australian market.

**Investment:** In a scenario where the product would be manufactured in the Northern Valleys (Chittering, Gingin, Bindoon, Moora and Dandaragan) to cover WA's demand, using citrus exclusively from the area would not be economically viable. The region cannot provide sufficient volumes all year round and there is not enough of a market or demand. Adding up the short life of the products, such as cold-pressed juices, the infrastructure that is required is not extensive in the Northern Valleys region.

For example, the cost of an industrial cold-pressed machine like the Goodnature X1 is AU\$30,000, which can produce 75 -150 litres per hour (using 110 – 219 kg) of cold-pressed juices and cider (Goodnature).

Considering that the demand for fruit and vegetable juices will increase in the short term and the Northern Valleys region produces a vast variety of products, a machine such as the Goodnature Maximiser; which has a capacity to produce 5,000 litres per hour (the size of the fruit is not an issue), would be a business opportunity, not just for a single grower but for a group of growers. This machine

needs a minimum team of 6 people to operate and requires full-time operation. The estimated cost of this high-technology machinery is AU \$1,500,000, although there are other costs involved which are not included in this estimate.

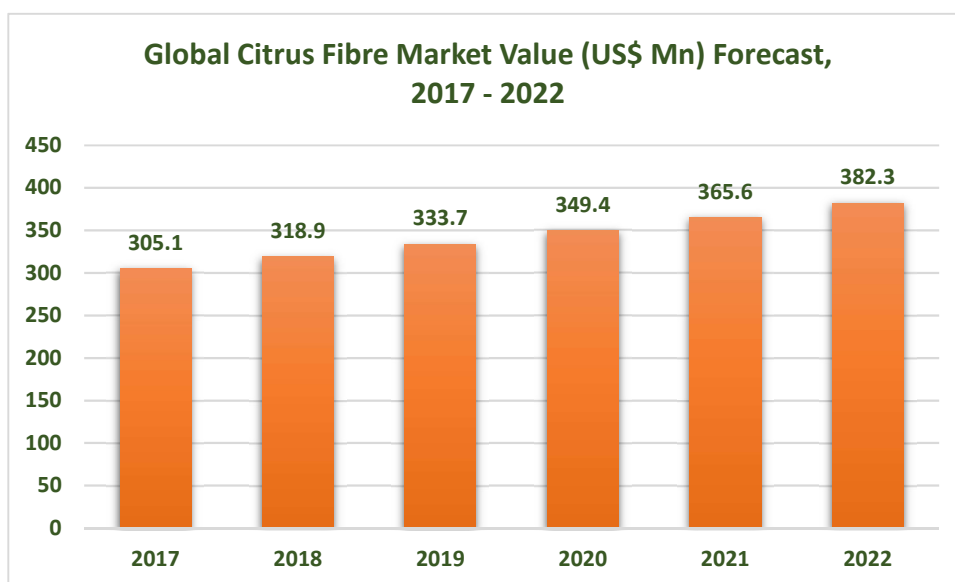
## 5 Value adding opportunity: Citrus Fibre

Citrus peel and pulp are some of the “waste” resulting from citrus juice production. Proportionally, they are 55% to 60% of the fresh fruit weight. This diverse inedible part contains fibre, pectin, cellulose and many bioactive compounds which are used in the pharmaceutical, cosmetic and food industries (Mahato & Sharma 2018).

Recent scientific research has presented citrus fibres as having numerous healthy benefits; for example, preventing and combating diseases especially various digestive disorders and cancer types and it has been also proven that its consumption regulates the metabolism (Mahato & Sharma 2018). Additionally, citrus fibres are derived from non-allergenic sources, which makes them more attractive to the food industry and a significant proportion of the population, as described in a recent report published by Transparency Market Research in 2017.

The same study shows that the global market for citrus fibre has been growing for the last 5 years and it is projected to expand at a compound annual growth rate (CAGR) of 4.6% during the period from 2017 to 2022. Essentially, its growth will be dependent on its use in the food industry.

**Graph 2 presents the global citrus fibre market value forecast value (US\$ Mn) for the period of 2017 to 2022. Source: TMR, 2017**



Market research highlights citrus fibre utilisation in the food industry has enormous potential in the food and drinks market for being a source of vitamin C and boosting the nutritional content of products by adding vitamin B6, potassium, iron, phosphorus, thiamine, riboflavin, niacin and ascorbic acid (TMR 2017). The use of citrus fibre in the food industry will also be supported by the strong determination from consumers demanding natural and healthy products (Mintel.2016).

Currently the food industry uses citrus fibre in many processed foods, as it improves the technical and functional properties, such as; water binder and fat replacer, thickening gums and gelling gums. In addition, fibre's properties can successfully extend the shelf-life of products, as well as provide a neutral flavour, odour and colour. It can also be highly effective in reducing calories and fat levels in food products without compromising the cost, texture or taste of the finished product (TMR 2017).

The stability of the citrus fibres present in different ranges of pH and temperatures makes them highly demanded by the food industry. Furthermore, when it is incorporated, it can improve the texture of the final food products at a lower elaboration cost (TRM 2017).

Consequently, the food industry is the largest market for citrus fibre. It represented US\$196.7 million in 2017 and is expected to reach US\$246.3 million by 2022 with a CAGR of 4.6% during that period. The figures show a growing at US\$9.9 million per year being the greater of any other industry.

**Table 2 show the global citrus fibre market snapshot developed by TMR (2017)**

Segment	Megatrends likely to have high impact				
	Fibre yield	High shelf life	Organic origin	Technology Advancements	Clean labelling
<b>Grade</b>					
Food	X	X	X	X	X
Pharma	X	X	X	X	X
Others	X	X	X	X	X
<b>Function</b>					
Water binder and fat replacer				X	
Thickening gums	X			X	
Gelling gums	X			X	
<b>Application</b>					
Bakery	X	X	X	X	X
Desserts & ice cream	X	X	X	X	X
Sauces & seasonings	X	X	X	X	X
Meat and eggs replacement	X	X	X	X	X
Beverages	X	X	X	X	X
Flavourings & coatings	X	X	X	X	X
Snacks & meals	X	X	X	X	X
Personal Care	X		X	X	X
Pharmaceuticals	X	X	X	X	X
Other applications	X	X	X	X	X

Source: TMR, 2017

## 5.1 Global Citrus Fibre Trends:

Several applications of citrus by-products have been developed in recent years, especially in the food industry. This generates new business opportunities or improvements in production efficiency. For example, Fiberstar created a new variety of citrus fibre, Citri-Fi. This fibre is high in pectin and can be used as a substitute for eggs in baking, such as baking muffins. By using this new fibre avoids the allergenic characteristic of eggs, in addition reduce the total cost of production due to eggs in an expensive item in the bakery business (Food Ingredient First 2018).

The world is moving towards a healthier path, and citrus fibres and gums have been studied as the only stabilisers in beverage creation. For that reason, many companies are using fibres as a natural emulsifier and stabiliser in production of smoothies and drinkable yogurts. In addition, Fiberstar has developed Citri-Fi 125, a natural citrus fibre which can improve the functionality of tomato-based food products through replacement of gums and starches in condiments, sauces, and spreads (Food Ingredient First 2018).

The production of cheese could also find benefits through using insoluble citrus fibres. Incorporating it into cheese processing can help reduce costs and syneresis by decreasing the amount of dry extract or by reducing the use of gums. Additionally, citrus fibre provides the desired level of hot viscosity which is crucial for safety cheese production process avoiding undesirable splashing (TRM 2017).

The citrus fibre is attracting major competitors which are developing patents. The Coca Cola Company currently developing a *“system and method for automatically coring a whole citrus fruit, isolating fibre or whole juice sacs from citrus fruit”*. The Chinese agriculture company, Pingguo Guoyanyuan Agriculture, is also patenting the *“extraction method of citrus fibre from citrus residues”* (TMC 2018).

## 5.2 Most Relevant Global Citrus Fibre Producers

In terms of production volume, Fiberstar (Wisconsin, US) and Herbafood (Brandenburg, Germany) Ceamsa (Porrino, Spain) and Florida Food Products (Florida, US) lead the market.

**Table 3 shows the fibre market leaders and their performances:**

Name	Details	Overall Revenue	Products	Description
<b>Fiberstar, Inc.</b>	Est.1998 Wisconsin, US Employees: 23 (Dec 2016) www.fiberstar.net	US\$ 9.3 million (2016)	Citri-Fi ® 100 Citrus Fibre	Yield improvement, purge reduction, syneresis reduction, phosphate reduction, texture enhancer, moisture enhancement
			Citri-Fi ® 125 Citrus Fibre	
			Citri-Fi ® 200 Citrus Fibre and Guar Gum	Egg reduction, fat/oil reduction, gluten free, moisture retention, strengthen, texture enhance.



			Citri-Fi ® 300 Citrus Fibre and Xanthan Gum	
<b>Herbafood Ingredients GMBH</b>	Est. 1980 Brandenburg, Germany Employees: 33 (Dec 2016) www.herbafood.de	US\$ 5.36 Mn (Dec 2016)	Fruit and vegetables fibres - Herbal Classic, Herbal AQ Plus	HERBACEL ® Classic and HERBACEL ® – AQ® PLUS Obtained from freshly harvested apples (resp. citrus fruits) which are gently dried after extracting the juice (and oils)
			Pectin Products	
			Colouring extracts	
			Sweetening extracts	
<b>Ceamsa (Compañía Española de Algas Marinas S.A)</b>	Est. 1967 Porrino, Spain Employees: 154 (Dec 2014) www.caemsa.com	US\$ 70 Mn (Dec 2014)	Carrageenan	
			Pectin	
			Fibre (Citrus Fibre) - Ceamfibre	The product is a natural fibre ingredient purified from citrus peel with high functional properties for a wide variety of applications
			Locust Bean Gum	
<b>Florida Food Products, Inc</b>	Est. 1954 Florida, US Employees: 41 (Dec 2016) www.floridafood.com	US\$ 12.8 Mn (Dec 2016)	Vegetable & Fruit	
			Texture - FiberGel LC ® and TexDry LC®	The fibre products are the world's first Fibercolloids™ made from fruit and/or vegetable fibre. These products contain “activated” soluble and insoluble fibre that provide desired gelling and thickening to a wide range of textural applications.

### 5.3 Australian Scenario

Australia has no producers of citrus fibre. Multinational companies have offices, representatives or distributors in the main cities, which is the case of Magnum Flavours & Ingredients in Perth, WA. Which distributes for Florida Food Products.

A recent market study conducted by Transparency Market Research (TMR) highlights that the Asia Pacific Excluding Japan region (APEJ), which China and Australia are part of that market, is expected

to dominate the global citrus fibre market in terms of revenues with a CAGR of 5.1% throughout the forecasted period (2017 -2022), evaluated at US\$99 million by 2022.

The analysis made by TMR shows the APEJ region increasing their citrus fibre consumption is driven by a growing consumer base and a rising health awareness. Specifically, younger demographics are demanding healthier juices and beverages. Additionally, the use and demand for citrus flavours in drinks and food is increasing.

TMR forecasts the Australian citrus market will grow from US\$3.7 million in 2017 to US\$4 million in 2022, representing a CAGR of 1.6% for that period. It is also estimated to represent 4.8% of the revenue share of the global citrus fibre market by the end of 2017; however, it is probable to lose 74 basis point (BPS) in its market share by 2022.

Australia is following the same global trend where the food sector is the major market for citrus fibre, which means US\$2.3 million or 63% of the market during 2017. It is expected to reach US\$2.5 million in 2022 or 63.1% of the market. The CAGR forecasted for that quinquennial is 1.6%.

**Table 4 shows the Australia Citrus Fibre Market Size and forecast, 2012 – 2022, as well as revenue (US\$ Mn) comparison by grade**

Year	Food	Pharma	Others
2012	2.1	0.5	0.7
2013	2.2	0.6	0.7
2014	2.2	0.6	0.7
2015	2.2	0.6	0.7
2016	2.3	0.6	0.7
CAGR (2012 - 2016)	1.70%	2.60%	0.50%
2017	2.3	0.6	0.7
2018	2.4	0.6	0.7
2019	2.4	0.7	0.8
2020	2.4	0.7	0.8
2021	2.5	0.7	0.8
2022	2.5	0.7	0.8
CAGR (2017 - 2022)	1.60%	2.30%	1.10%

Source: TMR 2017

“Water Binder and Fat Replacer” is the functional use of citrus fibre with higher market value in the Australian citrus fibre industry, contributing US\$1.5 million and representing 42.2% of the market in 2017, reaching US\$1.7 million in 2022 or 42.6% of the market. The CAGR of the forecasted period is 1.8%.

The citrus fibre market in Australia is projected to increase to US\$0.3 million during the 2017-2022.

Australia's market revenue in the global citrus fibre market is predicted to rise 10% by the end of 2022, compared to 2017. The largest portion is contributed by the bakery sector. This represented US\$0.6 million or 17.6% of the market in 2017, to reach US\$0.8 million in 2022 or 19.3%, which represents a CAGR over the forecast period of 3.5%.

**Table 5 presents the Australia Citrus Fibre Market Value (US\$ Mn) by application 2017 - 2022**

Application	2017	2018	2019	2020	2021	2022	CAGR (2017 - 2022)
Bakery	0.6	0.7	0.7	0.7	0.7	0.8	3.50%
Desserts & ice cream	0.5	0.5	0.5	0.5	0.5	0.5	1.60%
Sauces & seasonings	0.4	0.4	0.4	0.4	0.4	0.4	0.10%
Meat and egg replacement	0.2	0.2	0.2	0.2	0.2	0.2	0.50%
Beverages	0.3	0.4	0.4	0.4	0.4	0.4	1.00%
Flavourings & coatings	0.1	0.1	0.1	0.1	0.1	0.1	0.80%
Snacks & meals	0.2	0.2	0.2	0.2	0.2	0.2	0.10%
Personal care	0.4	0.4	0.4	0.4	0.4	0.4	2.10%
Pharmaceuticals	0.6	0.6	0.6	0.6	0.6	0.7	2.40%
Other applications	0.3	0.3	0.3	0.3	0.3	0.3	0.50%

Source: TMR 2017

## 5.4 Challenges

**Volume:** Magnum Essence imports and distributes two tonnes of citrus fibre annually from Florida Food Products Inc. which is used in WA's local food industry, most of it in the bakery sector. N. Penning, founder of Magnum Essence explained that having factors such as the volume of the local market and its demand of fibre, in addition to the low price of the products, are key points for not investing in a citrus fibre plant (Penning 2017).

Global brands are selling their products to Australia, as Australian producers do not have the volumes to produce and compete with multinational companies. The strategy of the citrus industry bodies for WA and Australia, WA Citrus and Citrus Australia, is to improve and invest in the quality of their first class, not in the juice grade from where the fibre is processed.

**Australian market projection:** In addition, the projections for the citrus fibre market only show a low percentage of growth, making it unattractive for potential investors.

**High level of investment:** In October 2016, Kainos Capital acquired the global leader in fibre, Florida Food Products. The amount has not been disclosed; however, the firm focused on investments in North America with amounts between \$50 million to \$150 million in business with "EBITDA" (Earnings before interest, tax, depreciation and amortization) more than \$20 million (Bloomberg 2018).

## 5.5 Opportunities

**Innovation:** In Sicily, Italy, the citrus industry was searching for an answer about how to use the waste from thousands of tonnes of juiced citrus (about 200,000 tonnes). The challenge was taken by Adriana Santonocito and Erica Arena who founded Orange Fiber, creating the first fabric made by orange cellulose extracted from orange peel and turning it into yarn. The advantage of their process is that the textile can be tinted and mixed with others, such as cotton and polyester (BBC 2017). In its pure form, the material is super light-weight with a soft and silky hand feel and its brightness varies according to production requirements.

During 2017, Orange Fiber launched in collaboration with the Italian fashion house, Salvatore Ferragamo the "Capsule Collection", which shows the expressive potential of citrus fabric.

Their business is partly seasonal because they obtain the waste, for free, from a local juice factory. The cellulose is processed and can be stored for later use. Their team is comprised of 12 people.

At the University of Catania, in Sicily, Italy; there are a group of researchers, led by Professor Salvatore Barbagallo, using orange peel, seeds and part of the pulp not used in juices to produce flour, which can replace half of the fat used in the bakery industry. There were 300 kg produced and distributed as a trial, with the feedback from bakers being positive, saying they have not seen any difference in the taste of their pastries. Additionally, the researchers found new uses for the flour; being soluble it can be added to drinks, providing health benefits.

## 6 Value adding opportunity: Citrus Essential Oils

Citrus essential oils (EO) are obtained from the sacks or oil glands of citrus peel when they are crushed or broken during juice extraction. It is a versatile by-product, used in diverse industries; such as food, cosmetics and cleaning (Sharma & Mahato et al 2016).

There are two extraction methods. Firstly, through cold pressing, where the peel and cuticle are removed mechanically producing a watering emulsion which is centrifuged to recover the essential oil. The second method is distillation, the process which recovers the essences volatile components (Tetrapack 2016). In terms of efficiency, the latter technique has a higher yield than cold press oils (0.21%).

From an economic perspective, the global demand for essential oils are steadily increasing. This trend is indicated by the latest market studies conducted by Transparency Market Research (TMR) and Grand View Research (GVR), both published at the beginning of 2018.

Based on these studies, this international trend is supported by the rise in demand of natural and healthy products, also in the cosmetic and pharmaceutical industries which have reached favourable results in research on treatments and disease prevention. However, the food industry is generally where essential oil usage has increased the most.

Another factor for this rising trend, is income growth in emerging economies with high populations, which are progressively demanding fragrances and flavours produced with essential oils (GVR 2018). The size of the global essential oils market was valued at US\$6.63 billion in 2016, and GVR predicted a CAGR of 9.7% during the period of 2014 to 2024 (GVR 2018).

GVR presented demand for orange essential oil of 52.5 kilotons in 2015, which represents the most significant and fastest growing in their study. That increase is based on a growing demand for orange essential oils in the personal care industry, as well as its use as a cleaning agent. The major component extracted from citrus peel is D-limonene, which is used as a green solvent for the determination of fats and oils soluble (Sharma & Mahato et al 2016). In addition, they are in high demand for their flavours and aromas in food and beverages, and for their uses in therapeutic applications for the geriatric population (GVR 2018).



## 6.1 Citrus Essential Oils World Trade

Table 6 presents the global trade and value of the main citrus oils.

Product	Volume a	Value a	Main Export (share of total export value)	Main importers (share of total import value)
Lemon	13 kt.	US\$320 million	<ul style="list-style-type: none"> <li>– Argentina (35%),</li> <li>– United States (18%),</li> <li>– Italy (11%),</li> <li>– Switzerland (5%),</li> <li>– United Kingdom (4%),</li> <li>– France (3%),</li> <li>– Canada (3%),</li> <li>– Spain (2%)</li> </ul>	<ul style="list-style-type: none"> <li>– United States (30%),</li> <li>– United Kingdom (15%),</li> <li>– China (10%),</li> <li>– Japan (9%),</li> <li>– Switzerland (5%),</li> <li>– France (5%),</li> <li>– Germany (4%),</li> <li>– Ireland (3%),</li> <li>– Canada (3%),</li> <li>– Brazil (2%).</li> </ul>
Orange	50.9 kt.	US\$205 million	<ul style="list-style-type: none"> <li>– Brazil (40%),</li> <li>– United States (21%),</li> <li>– Germany (7%),</li> <li>– United Kingdom (5%),</li> <li>– Italy (4%),</li> <li>– Switzerland (3%),</li> <li>– France (3%),</li> <li>– Belize (2%),</li> <li>– Mexico (2%),</li> <li>– Netherlands (2%)</li> </ul>	<ul style="list-style-type: none"> <li>– United States (22%),</li> <li>– Japan (10%),</li> <li>– Germany (8%),</li> <li>– United Kingdom (7%),</li> <li>– France (6%),</li> <li>– China (5%),</li> <li>– Ireland (5%),</li> <li>– Switzerland (4%),</li> <li>– Canada (3%),</li> <li>– Netherlands (3%).</li> </ul>
Other citrus	8.9 kt.	US\$202 million	<ul style="list-style-type: none"> <li>– Italy (19%),</li> <li>– United States (17%),</li> <li>– Mexico (17%),</li> <li>– Brazil (7%),</li> <li>– United Kingdom (6%),</li> <li>– Germany (5%),</li> <li>– France (4%),</li> <li>– Switzerland (4%),</li> <li>– Peru (3%),</li> <li>– Argentina (2%)</li> </ul>	<ul style="list-style-type: none"> <li>– United States (25%),</li> <li>– France (9%),</li> <li>– United Kingdom (8%),</li> <li>– Japan (7%),</li> <li>– Germany (7%),</li> <li>– Switzerland (5%),</li> <li>– China (3%),</li> <li>– Singapore (3%),</li> <li>– Ireland (3%),</li> <li>– Italy (3%)</li> </ul>

Data source: United Nations Statistics Division (2013)

## 6.2 Global citrus essential oils companies

Many of the multinational essential oils companies have branches in different countries, where they sell and distribute their products, develop and produce new oils under specific standards, and utilise raw material from those locales. Their business strategies are generally based in sustainability, in the

purity of their raw material, which is related to the “new consumer” who ask for healthy and natural products. The models for these companies’ commercial channels are diverse, such as; distributors, franchising, retail, and some have consultants who are part of their direct sell strategy. In general, their brands are present in the Australian market.

**Table 7: Essential oils companies internationally:**

Company name	Website
Young Living Essential Oils (US)	<a href="http://www.youngliving.com">www.youngliving.com</a>
doTerra (US)	<a href="http://www.doterra.com">www.doterra.com</a>
Plant Therapy Essential Oils (US)	<a href="http://www.planttherapy.com">www.planttherapy.com</a>
Mountain Rose Herbs (US)	<a href="http://www.mountainroseherbs.com">www.mountainroseherbs.com</a>
Farotti Essenze (It)	<a href="http://www.farotti.com">www.farotti.com</a>
Moksha Lifestyle (In)	<a href="http://www.mokshalifestyle.com">www.mokshalifestyle.com</a>
Citrus Oleo (US)	<a href="http://www.citrusoleo.com">www.citrusoleo.com</a>
Citrosuco Paulista S.A (Br)	<a href="http://www.citrosuco.com.br">www.citrosuco.com.br</a>
Citromax (Ar – US)	<a href="http://www.citromax.com">www.citromax.com</a>

### 6.3 International Prices of Conventional and Organic Citrus Oils (Caiger 2016)

There is a significant difference in relation to process between conventional citrus essential oils and organic essential citrus oils. Table 8 and 9 how prices collected from different markets by Steve Caiger. The prices are wholesale for quantities of 25kg or more, unless otherwise specified.

**Table 8: Prices of Conventional Citrus Oils (Caiger.2016)**

Product	Origin/Grade	Prices per Kg
Orange (sweet)	Brazil	\$16/Kg, \$30/Kg lots
	Italy (b/orange c/pressed)	\$33/Kg
	Brazil (pera)	\$9/Kg container
Orange (bitter)	Italy (c/pressed)	\$58/Kg
Bergamot oil	Ivory Coast/Italy	\$80/Kg; \$135/Kg 1 Kg lots
Lemon	Italy	\$58/Kg 1 Kg lots
	Italy (c/pressed)	\$35
	Argentina	\$30/Kg container
	Brazil	\$30/Kg
Lime (distilled)	Italy	n/a
	Mexico/Peru	\$35/Kg container; \$62/Kg
Lime (cold pressed)		\$25/Kg
Mandarin (red)	Italy	\$85/Kg
Grapefruit (pink)	Argentina	\$42/Kg; \$50/Kg 1 Kg lots
Grapefruit (white)	France	\$40/Kg

Source: Steve Caiger (2016)

**Table 9: Prices of Organic Citrus Oils (Caiger.2016)**

Product	Origin/Grade	Prices per Kg
Orange (sweet)	Italy	\$36/Kg
Orange (bitter)	Italy (c/pressed)	\$135/Kg
Bergamot	Italy	\$195/Kg
Lemon	Italy (c/pressed)	\$60/Kg
	Italy (c/pressed)	\$71/Kg
	Argentina	\$75
Mandarin (red)	Italy	\$225/Kg
Mandarin (green)	Italy	\$187/Kg
Clementine	Italy	\$120/Kg
Petitgrain (C.aurantium)	Paraguay	\$110/Kg

Source: Steve Caiger (2016)

#### 6.4 Australian Citrus Oils

Although Australia has 28,000 hectares planted with citrus, the citrus essential oil industry is small, especially in comparison to Brazil, Florida, Italy and Argentina. The is due to easy and cheap access to imported oils. Secondly, the small size of citrus juice factories in Australia, which cannot afford the economies of scale given by large centralised operations (McCartney 2003).

The annual volume of citrus oils in Australia is 50 – 60 tonnes. The main oils are made from oranges (Navel and Valencia), lemon, grapefruit and mandarins. The largest production areas in Australia are Mildura in Victoria, and Berri in South Australia. (McCartney 2003).

**Table 10: Australian Imports of Citrus Oils**

Product	Volume (kilos)			Value (US\$)			Unit value (US\$/Kg)		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Lemon	116,151	87,075	161,614	1,830,672	1,601,075	1,877,217	15,76	18,39	11,62
Orange	650,111	364,244	329,638	2,417,389	1,644,356	2,070,562	3,72	4,51	6.28
Other citrus	157,980	350,800	255,536	2,435,780	2,339,648	2,748,102	15.42	6.67	10.75

Based on UNDATA

**Table 11: Australian Exports of Citrus Oils**

Product	Volume (kilos)			Value (US\$)			Unit value (US\$/Kg)		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Lemon	5,579	3,273	16,136	237,377	104,206	287,926	42.54	31.84	17.84
Orange	33,782	22,674	34,256	379,721	277,034	512,814	11.24	12.22	14.98
Other citrus	24,959	10,414	26,732	640,066	226,165	625,026	25.64	21.72	23.39

Based on UNDATA

## 6.5 Australian Main Citrus Oils Producers

Using Australian oranges and lemons, Natural Fractions (Renmark, South Australia), is one of the largest Australian processors of cold pressed citrus oils. Natural Fractions sells between 10,000 and 20,000 litres of essential citrus oils each month in Australia and overseas (John Selga 2017). Natural Fractions produces D-Limonene, Orange Terpenes, Lemon Terpenes and Lime Terpenes. These products can be used in a vast variety of applications, such as in personal care, fragrances, pet care products, air fresheners, emulsifiers, herbicides, laundry products, metal products, paint thinners, and pesticides.

**Table 12 presents four of the main citrus oils producers in Australia:**

Australian producers	Webpage
Essentially Australia	<a href="https://essentiallyaustralia.com.au/?v=322b26af01d5">https://essentiallyaustralia.com.au/?v=322b26af01d5</a>
ABP	<a href="http://www.abp.com.au">www.abp.com.au</a>
Native Oils Australia:	<a href="http://www.nativeoilsaustralia.com.au">www.nativeoilsaustralia.com.au</a>
Perfect Portion:	<a href="http://www.perfectpotion.com.au">www.perfectpotion.com.au</a>

## 6.6 Challenges:

**Competition and market share:** The Australian citrus oils industry is small in comparison to Brazil, the United States, Italy and Argentina (McCartney 2003). Besides, the global industry is highly concentrated. The size and market share of multinational companies make it more difficult for new competitors to enter the industry. Loyalty based on quality is another factor. It may be difficult for customers to change to other brands due to the potential risk of lower quality product. The experts suggest that small producers should target their offer, for example in aromatherapy or confectionary, such as chewing gums (GVR 2018).

**Reduction of resources:** Another challenge for citrus oil producers is the depletion of resources or insufficient volume to produce in larger scales (GVR 2018). In addition, Valencia orange trees have been replaced for eating varieties (Coriolis 2016). Producers, in general, are not focused on producing juicing varieties because the profit is in the premium quality eating fruit.

**Infrastructure:** The production of essential oils requires significant investment, advanced equipment, and strong branding with a unique identity, based on sustainable, pure and healthy concepts.

**Farm product:** As any other farm product, producing EO is labour intensive, exposed to the climate change, pests and diseases (Foxon-Hill 2015).

**Applications:** The health benefits of citrus essential oils have been studied during the last few decades. Currently, they are used for their antibacterial, antifungal, antioxidant, UV protection, anti-obesity and hypocholesterolemia functions (Mahato & Sharma et al 2018).

**Distribution channels:** Most of the major essential oils companies use e-commerce as an important foundation of their commercial strategy, also have direct sales based on representatives.

**Moderate level of investment:** Natural Fractions started their business with an initial investment of US\$50,000. There are diverse technologies for delivering different qualities of essential oils.

In Alibaba (Chinese multinational e-commerce company), an industrial lemon/orange essential oil milling machine producing 500kg/h costs US\$27,000.

## 6.7 Opportunities

**Orange wheels from Japan:** In 2009, the Japanese tiremaker, Yokohama Tires, introduced to the market their dB Super E-Spec which reduces 20% of rolling resistance, consequently increasing performance in fuel efficiency. Their innovative technology uses oil from orange peel replacing 8% of the petroleum used in manufacturing tyres. The result of the orange oil and natural rubber is the Super Nano-Power Rubber compound which is used to make the tyres.

**Juice factories get into Essential Oils (EO):** Major citrus fibre and citrus essential oil global companies started as juice plants; for example, the US' Florida Food Products, and the Brazil's Citrosuco Paulista. Having the waste and using it as a raw material for an in-demand by-product, such as orange oil, could be a good opportunity.

In WA, Harvey Fresh has the potential infrastructure to have an EO plant, and 'Pure and Healthy' in Fremantle is open to developing new products.

## 7 Analysis of the Citrus Value-Added Industry in WA

WA's citrus industry produces 3,000 tonnes of second and third citrus class (WA Citrus), mostly of the Navel orange variety which is not generally used for juicing purposes due to having a bitter taste after squeezing process. Therefore, a significant amount of this fruit is used to feed livestock or is discarded on farms or packing sheds.

The state has small and medium producers of citrus juices and other small citrus value-added producers such as icy poles and restaurant and bars suppliers; in total consuming 4,709 tonnes of citrus, most of that amount in Valencia oranges for their demand in the juice sector. However, fruit producers have replaced their Valencia trees with the Navel variety, since the latter variety has a higher price-value in the market. This situation is not exclusive to WA but occurs throughout the country.

In terms of business management, there are differences between small, medium and large producers. Some of the small producers did not have a defined business plan or projections.

Although most of the interviewees have growth and investment plans, the smallest producers do not want to expand beyond their own area of influence. These growers in particular do not want to make that effort, or rather they do not have the knowledge to do so.

Analysing the global major citrus juice and other citrus by-products companies, revealed some common factors. For example, Florida Food Products started as a juice factory, then they started producing by-products such as fibre and flour from citrus peel. Similarly, the Brazilian company Citrosuco Paulista, started their operations with juices and then added essential oils to their business. Remarkably, both companies started producing juice with citrus from their own orchards. These experiences were not driven by attempting to solve a surplus issue. Based on these experiences, WA's Harvey Fresh could have enormous potential in producing citrus by-products; i.e. citrus fibre, which could encourage Parmalat's own investment in this trend through their subsidiaries like Harvey Fresh.

Innovation could play a key role within the value-added industry for citrus and other products. Examples such as Favini, Citrus Fiber, and Yokohama Tyres, demonstrates the possibilities for



generating new applications for citrus by-products. All these endeavours require capital, investors and research.

The Fresh Produce Alliance (Manjimup, WA) promised to be a great differentiator, and sales opportunity for second-class fruits and vegetables for the WA food industry. Unfortunately, the business ceased operations and its machinery is for sale. Consequently, the closure of The Fresh Produce Alliance could produce distrust for future businesses in the food industry.

In terms of marketing, the presence of juices produced in WA is very low, with only Harvey Fresh having a presence on supermarket shelves in WA and nationally. Other brands offered in WA's supermarkets are from producers in the eastern states.

Although consumers are more informed and demanding healthier products, the generally small volume of the WA and Australian market, was one of the outstanding limitations referred to by interviewees. Certain producers see possibilities in exporting to other states and even abroad. Harvey Fresh for years has had a national presence and has been exporting to Asian markets.

The low national production volume is another factor. For example, Harvey Fresh produces 20ML of orange juice (Coriolis 2016) and Citrusuco Paulista (Brazil), 370 ML (company webpage). Consequently, Australia imports juice and other citrus by-products from countries such as Brazil and the US. This is compounded by production costs, which makes Australia less competitive than countries which can source cheaper labour.

In WA, the Shires of Dandaragan, Gingin and Chittering are collaborating in developing a tourist brand identity for that region. This could be the opportunity to create a processing plant for various local products leveraging their own unique regional identity, where citrus can play a leading role through cold pressed juices and essential oils. The Fresh Produce Alliance was the opportunity for the Sothern Forests area.

In the short term, the general recommendation from experts to WA citrus producers and farmers is to improve the quality and yield coming from their orchards. The return on investments are in the premium quality yields. Last year (2017), the Australian citrus industry experienced a boom and is expecting better conditions for those who have premium and export quality products this year.

## 7.1 Strengths, Weakness, Opportunities and Threats Analysis of the Citrus Value-Added Industry of WA

### Strengths

- Medium and small juice producers: Harvey Fresh, Michael Brothers, Pure n Healthy, Boost.
- Medium and small supplier companies: Citrus WA
- WA Citrus (state citrus industry body)
- Citrus Australia, good linkages with WA

### Weaknesses

- Navel orange bitterness
- Immature industry
- Management skills
- Closure of Fresh Produce Alliance
- Innovation
- Vision & value
- Marketing (distribution and promotion)
- Industry scale is small compared with global competitors
- High degree of capital required for entrants
- Very competitive global industry

### Opportunities

- It is a need
- Variety of uses and applications
- Healthy products trend
- Asian markets
- Australian brand
- “Agripreneurs”
- University

### Threats

- Low domestic population
- Volumes (supply and demand)
- Labour costs
- Expensive investment

## 7.2 Objectives, Strategies and Activities for the Citrus Value-Added Industry of WA

Objectives	Strategies	Activities
Enhance the WA value-added citrus industry	Improving productivity and sales	Organising workshops about business plans, management and export.
	Create a platform for business and discussion between farmers and value-added producers	Organising, a biannual workshop on value-adding and inviting the whole industry to participate. Speakers can be international and national market leaders.
	Improve WA citrus value-added products in supermarkets and food retail	WA Citrus has influence with food retailers, which can be used to advocate for citrus value-added products.

Innovation	Incorporate innovative solutions for the WA citrus industry	Develop a project supported by universities and agricultural start-up incubators to resolve the Navel oranges waste problem.
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## 8 Analysis of the Citrus Industry of WA

To begin this case study, it was necessary to understand what was happening in the citrus industry. For that reason, producers, wholesalers, agronomists, marketers and industry leaders were interviewed, and the project has received constant support from WA Citrus. Market studies, industry materials, and research available on the Internet from different markets and countries were used for this case study.

Analysing the information, it could be deduced that the citrus industry in WA is still maturing, which is also reflected in the value-added sector.

The figures indicate that WA's citrus production is growing in volume, because of new trees and existing trees reaching maturity. However, there is still low production volume and quality, and based on interviews some orange pack outs can be as low as 20% class one.

The major producers of citrus fruits in WA, such as Moora Citrus and AgriFresh, are working with experts and investing to improve their quality because premium grade fruit is where the profit is. Harvey Fresh, which was acquired by the multinational food company Parmalat in 2014, is another major citrus producer in Western Australia. They have an advantage over the rest of the industry: Harvey Fresh automatically consumes their Valencia oranges in the manufacturing of their juices, which are sold throughout the country. The remaining producers are small to medium producers or hobby farms. In some cases, they are retirees who are fulfilling their dream of owning a farm.

The infrastructure used by citrus growers varies from one orchards to another, as well as their ability to manage the business in financial, farm management and marketing areas.

From early 2018, the industry has been affected by several events. Taddei Orchards, which was one of the larger producer in the state, closed their packing facility in Gingin. This situation has caused uncertainty for the producers who used to pack their fruit and vegetables with them. Also, the dissolved of the Western Citrus Alliance and the Fresh Produce Alliance is a wake-up call to how difficult it is for farmers to work collaboratively with others. Unfortunately, the fact that these three businesses ceased their functions will have consequences in the short and medium term for the citrus industry, as well as the horticulture sector in general.

The launch of the Northern Valley Packers (formerly Moora Citrus Packers) packing shed in 2017, and the planned packing shed by Agrifresh, could indicate an improvement in the productivity of the WA citrus industry. Having two large and modern packing facilities north of Perth, possibly creates a new level of competitiveness in the packing space that will most likely benefit the industry in that northern region. Additionally, the volume and seasonality of Moora Citrus' and Agrifresh's products encourages them to work with other producers and product mixes.

There has been experience in exporting to foreign markets with premium class fruit for a decent price, and second-class fruit price returns that are almost enough to cover production costs for the latter class.

Although supermarkets carry out strong campaigns to support local producers, interaction between farmers and the final customer is rare. It is the retailers who have those interactions. It would be interesting to know what the consumer wants in a conversation between all parties, as well as with food retailers in general.

### 8.1 Strengths, Weakness, Opportunities and Threats Analysis of the WA Citrus Industry

#### Strengths

- Large producers: Moora Citrus & AgriFresh, Yambellup Estate, Harvey Fresh, Harvey Citrus
- New packing facility: Northern Valley Packers
- WA Citrus
- Growers working with experts
- Citrus fruits and by-products are healthy
- Citrus by-products with multiple uses

#### Opportunities

- Great export opportunities
- Proximity to airport (Gingin growers)
- Season time (Southern Hemisphere)
- Proximity to Asian markets
- Proximity to Fremantle Harbour
- Road infrastructure
- Buy Local, Buy Western Australian, Slow Food movements
- Eat healthy
- Rising consumption of fruit juices
- Value adding industry
- Working with Citrus Australia and WA Citrus

#### Weaknesses

- Quality (low class 1 pack outs of oranges compared to eastern states growers)
- Low yield
- Poor price returns for class 2 and juice grade.
- Many small growers
- Relationship with supermarkets and wholesalers
- Promotion at the point of purchase
- Relatively new to export
- Management and business
- Value-added citrus producers
- Age of growers
- High content of sugar for healthy campaigns

#### Threats

- Western Citrus Alliance
- Fresh Produce Alliance
- Taddei Orchards Packing
- Governmental and Federal Funds
- High content of sugar

## 8.2 Suggestions of Objectives, Strategies and Activities for the WA Citrus Industry.

Objectives	Strategies	Activities
Quality improvement	Quality study of 10 participants. (Individually funded -not for free) and from other organisations	During the harvesting season hire an expert to supervise quality, distribute the outcome and organise the improvement strategy for the next season.
		Organise a workshop in quality and marketing.
	Work with Citrus Australia (CA)	CA can provide material, technology and expert advice.
	Introducing innovative technologies.	Once a year invite new developments in citrus technologies which help producers to improve yields and quality.
Improve citrus demand in WA	One orange or mandarin or grapefruit a day	Work with scientist and nutritionists explaining the benefits of consuming citrus fruit daily.
		How to manage the sugar levels for total daily food ingestion.
	Marketing campaign for “a glass of orange juice with breakfast”	Based on studies, highlight the benefits for anti-aging, and strengthening immune systems. <ul style="list-style-type: none"> <li>– PR campaign (free press)</li> <li>– Social media campaign</li> <li>– Point of purchase campaign</li> <li>– Fitness campaign</li> </ul>
	Support value added producers	Support them in management (free workshops) collaboration and promotion. Advocate their access to supermarkets.
Enlighten experiences	Organise an export study tour to target markets such as Singapore, China and Japan.	10 growers visiting those countries to understand their demand and how they can provide the quality and standards to meet that demand.
	“Talking with leaders” study tour. Visit the most productive orchards overseas and learn from them	Brazil, Florida, Spain, Mexico, and Argentina could be potential countries to organise a study tour and learning from major producers internationally.



## 9 Limitation of the Study

This study on value-added citrus products had limitations in the collection of academic information because only texts available on the Internet were available for its completion.

On the other hand, some of the producers of citrus by products did not share their results or the quantity of products used in their production for considering these data as strategic.

Finally, except for the market study on citrus fibre, the data from the other market studies were collections of press articles and commercial summaries.

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## **Appendix A**

### **Northern Valleys Agribusiness Project**

#### **Interview**

**Deborah Marten//Fruity Fanatics**

**8.09.2017**

Since Fruity Fanatics began in 2002, the idea was to produce natural, untainted and great tasting products using just 100% pure, fresh, locally grown fruit, and people are really surprised at the quality and delicious flavours of our products explains Deborah

1. Why did you develop a business like Fruity Fanatics?
2. How did you start?
3. What was the most difficult part of your business?
4. How many people worked at your business?
5. What was your marketing campaign?
6. Product: why you decided to go for tubes and iced cups?
7. You promote on your webpage that you have frozen fruit tubes and iced cups, which was or were the most demanded?
8. How did you distribute your products?
9. How did you price them?
10. How did you promote them?
11. If you analyse your business what is its SWOT analysis?
  - Strengths
  - Opportunities
  - Weaknesses
  - Threats
12. What would be a suggestion for a potential value adding business?

### **Northern Valleys Agribusiness Project**

#### **Interview**

**Dustin Michael//Michael Brothers**

**04.10.2017**

13. Why did you develop a business-like Michael Brothers?
14. How did you start?
15. Raw cold press juices and ciders are the products that you have currently. Do you see you developing others?
16. What was the most difficult part of your business?
17. How many people worked at your business?
18. How do you see your business in 5 years more?
19. What is your strategy to grow?
20. What was your marketing campaign?
21. What is the focus of your marketing campaign?
22. How do you distribute your products?
23. How do you price them?
24. How do you promote them?
25. If you analyse your business what is its SWOT analysis?
  - Strengths
  - Opportunities

- Weaknesses
  - Threats
26. What would be a suggestion for a potential value adding business?
  27. You buy from local growers what do you expect from them to buy more, or keep buying from them and not from others?
  28. How much do you spend monthly in citrus, mangoes, apples, etc?

###

## **Northern Valleys Agribusiness Project**

### **Interview**

**Jennie Franceschi//South West Development Commission, Advance Packing and Marketing Services, Fresh Produce Alliance, Avocado Export Company.**

**05.10.2017**

1. Why did you develop a business like Fresh Produce Alliance?
2. How did you start?
3. You are developing juices, baby food and food for age care centres. Do you see you developing others?
4. What was the most difficult part of your business?
5. How many people worked at your business?
6. How do you see your business in 5 years more?
7. What is your strategy to grow?
8. What was your marketing campaign?
9. What is the focus of your marketing campaign?
10. How do you distribute your products?
11. How do you price them?
12. How do you promote them?
13. If you analyse your business what is its SWOT analysis?
14. Strengths
15. Opportunities
16. Weaknesses
17. Threats
18. What would be a suggestion for a potential value adding business?
19. You buy from local growers what do you expect from them to buy more, or keep buying from them and not from others?
20. How much do you spend monthly in avocados, citrus, mangoes, apples, potatoes, etc?

###

## **Northern Valleys Agribusiness Project**

### **Interview**

**Jason Sorgiovanni//Harvey Fresh**

**14.11.2017**



1. How did Harvey Fresh start?
2. When did you start with juices, especially orange juice?
3. What kind of machinery do you have? All fruit and sizes can be used?
4. How many trees do you have and how much juice they produce?
5. How many tons do you need from other growers?
6. Milk, dairy products and fruit juice. Do you see you developing others?
7. Fruit & Vegetable Concentrates
8. Freshly Squeezed / Crushed Juice Products
9. Fresh Milk Products
10. Yoghurt
11. Whipping and Thickened Cream
12. Long Life Fruit Juices
13. Long Life Carrot Juice
14. Long Life Milk products including Lactose Free Milks
15. What was the most difficult part of your business?
16. How many people worked at your business?
17. How do you see your business in 5 years more?
18. What is your strategy to grow?
19. What was your marketing campaign?
20. What is the focus of your marketing campaign?
21. Where do you distribute your products?
22. How do you price them?
23. How do you promote them?
24. If you analyse your business what is its SWOT analysis?
25. Strengths
26. Opportunities
27. Weaknesses
28. Threats
29. What would be a suggestion for a potential value adding business?
30. You buy from local growers what do you expect from them to buy more, or keep buying from them and not from others?

## Appendix B

Name	Company	Product/Activity
Bronwyn Walsh	WA Citrus	Industry Development Manager
Graham McAlpine	Perth NRM	Facilitator – Sustainable Food Production Systems
Brett Heather	Western Citrus Alliance	CEO - Citrus Growers Group
Elizabeth Brennan	Moora Citrus	Citrus grower and Citrus Marketing
Jenny Mercer	WA Farm Direct	Wholesaler
Rod Taddei	Taddei Farm	Citrus producer, packing & marketing
Joseph Ling	AgriFresh	Citrus and packing
Peter Ansell	Gingin Citrus	Organic Citrus grower
Colin and Helen Humphrys		Citrus & mango growers
Andrew Raymer	Fresh Produce Group WA	Citrus Wholesale Marketing
Dustin & Martin Michael	Michael Brothers	Cold press juices & cider
Jennie Franceschi	West and Fresh	Juices, baby food, age care food
Jason Sorgiovanni	Harvey Fresh	Citrus and carrot juices
Nolan Penning	Magnum Flavours & Ingredients	Citrus Fibre
Rene Stapel	Pure and Healthy	Cold press juices
Deborah Marten	Fruit Fanatic	Popsicles
Deanne Dobra	Northern Valleys Popsicles	Popsicles
John Selga	Natural Fractions	Citrus oil distributors
Clinton Wills	Mildura Fruit Juices	Citrus juice and oil producer
Paul Richards	Natural Solutions Orange Power/ Aware Environmental/ Victoria	Orange detergents
Achille Monegato	Favini	R&D
Pablo Liguori	Horticultural Consultant	Citrus expert
Courtney Piesse	Senior Agronomist	Elders
Steve Ferraro & Garth Leary	Woolworths	Supermarket