

**Economic and Broader Contribution of the
Australian Dairy Processing Industry**

Australian Dairy Products Federation

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Contents

Glossary	i
Executive summary	ii
Australia's dairy processing industry	ii
Economic and employment contribution	ii
Contribution to the dairy supply chain	iv
Environmental and sustainability contributions	v
Regional business contributions	v
1 Background	1
1.1 Defining the dairy processing industry and its activities	1
1.2 Spatial distribution of the Australian dairy processing industry	2
1.3 The dairy processing market and industry structure	3
2 Methodology overview	5
2.1 Contribution analysis using Input-Output Modelling	5
2.2 Analysis of other dairy processing contributions	6
3 Economic and employment contribution of Australia's dairy processing industry	8
3.1 Contribution to gross domestic product	8
3.2 Employment contribution	10
4 Beyond the economic contribution	14
4.1 Supply chain contribution	14
4.2 Environmental and sustainability contributions	21
4.3 Contributions to regional Australia business environment	25
5 Conclusion	31
Endnotes	36

Charts

Chart 1.1 : Dairy processing milk utilisation and share of milk and products production, 2019-20	4
Chart 3.1 : Dairy processing FTE employment by state, 2020-21	11
Chart 3.2 : Estimated proportion of FTE employees employed in regional areas, 2020-21	12
Chart 4.1 : Dairy product consumption, average per person and share of total food intake, 5-year average to 2018	18
Chart 4.2 : Estimated Australian cheese supply and use, 2020	19
Chart 4.3 : Value of dairy product exports by category, 2019-20	20
Chart 4.4 : Share of dairy product export volume by state of origin, 2019-20	21
Chart 4.5 : Dairy processing energy intensity and milk powder share of dairy product production volumes	22
Chart 4.6 : Emissions and energy intensity of Australia's dairy processing industry	23
Chart 4.7 : Australia's dairy processing industry water use and wastewater generation (Gigalitres)	24
Chart 4.8 : Processor capital investment and share of food manufacturing total	26
Chart 4.9 : Expected change in capital employed and investment 2019-20 to 2021-22, number of processors	27
Chart 4.10 : Dairy processing R&D expenditure, million dollars	28
Chart 4.11 : Female FTE employees in dairy processing proportion of FTE workforce, 2020-21	29
Chart 4.12 : Skills distribution of selected industries and sectors in regional Australia	30

Tables

Table i : Economic contribution of the Australian dairy processing industry, 2019-20	iii
Table ii : Indirect employment contribution and industry value-added for the Australian dairy processing industry, 2019-20	iii
Table 1.1 : Dairy processing ANZSIC classes	1
Table 1.2 : Selected characteristics of Australia's dairy regions, 2019-20	3
Table 2.1 : Definitions of economic contribution estimates	6
Table 3.1 : Economic contribution of the Australian dairy industry, 2019-20	8
Table 3.2 : Indirect contribution of the Australian dairy processing industry, 2019-20	9
Table 3.3 : Employment contribution of the Australian dairy processing industry, 2019-20	10
Table 3.4 : Indirect employment contribution of the Australian dairy processing industry, 2019-20	10
Table 3.5 : Estimated direct dairy processing FTE employment in selected NRM regions and region share (%) of state total, 2020-21	13
Table 4.1 : Gross value of milk production by State and NRM region, \$m, and milk's share of gross value of agricultural production, 2019-20	15
Table 4.2 : Australian per capita dairy product consumption	17
Table A.1 : Definitions of economic contribution estimates	32

Figures

Figure 1.1 : Dairy processing and other businesses in the dairy supply chain	2
Figure 1.2 : Australian dairy processing locations and summary statistics	2
Figure 2.1 : Stylised representation of direct and indirect dairy processing activities	5
Figure 4.1 : Stylised dairy freight task map and transport costs	17
Figure A.1 : Definitions of economic contribution estimates	33

Glossary

Acronym	Full name
ABARES	Australian Bureau of Agricultural and Resource Economics Sciences
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ADPF	Australian Dairy Products Federation
ANZSIC	Australian and New Zealand Standard Industrial Classification
AUD	Australian dollar
CO ₂ e	Carbon dioxide equivalent
COVID-19	Coronavirus disease (2019)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Corporate social responsibility
EBITDA	Earnings before interest, tax, depreciation, and amortisation
FAO	Food and Agricultural Organization of the United Nations
FSANZ	Food Standards Australia New Zealand
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GJ	Gigajoule
GOS	Gross operating surplus
L	Litre
L/L	Litre of water per Litre of milk
ML	Megalitre
MWh	Megawatt hour
NRM	Natural Resource Management
NSW	New South Wales
PJ	Petajoules
PV	Photovoltaic
R&D	Research and development
SMP	Skim Milk Powder
TAFE	Australian Technical and Further Education
TJ	Terajoule
UHT	Ultra-High Temperature
UK	United Kingdom
US	United States
WMP	Whole Milk Powder

Executive summary

Deloitte Access Economics has been engaged by the Australian Dairy Products Federation (ADPF) to estimate the economic and broader contribution of the dairy processing industry in Australia. The ADPF is the national peak policy body representing commercial, post farm-gate members of the Australian dairy industry (including processors), traders and marketers of Australian dairy products. Members of the ADPF process more than 90% of Australian milk volumes and provide dairy products for both domestic and export markets.ⁱ

The ADPF works to protect and promote dairy for the future success of dairy processors, providing advice and public advocacy to government and the community, on the economic, social and health benefits of dairy.

This report outlines the dairy processing industry's footprint in Australia, including in regional areas.

Australia's dairy processing industry

The Australian dairy processing industry consists of a diverse range of businesses that produce a variety of dairy based products. Processors sit centrally in the dairy supply chain, sourcing raw milk from dairy farmers to supply domestic and overseas consumers through retail and food service value chains.

A range of manufacturing techniques are used during processing to convert raw milk into dairy products, including standardisation, pasteurisation and homogenisation. In addition to these primary manufacturing activities, processors are typically responsible for the transportation of raw milk (to the processing facility) and dairy products (to end markets) and are involved in warehousing and storage.

In 2019-20, Australia's **dairy processing industry received 8.8 billion litres of raw milk** from dairy farms,^{vii} **generating \$15.7 billion in revenue.**ⁱⁱ Dairy processing increases the value of the raw milk it receives through manufacturing (which requires capital expenditure, use of other ingredients and energy), and its other supply chain activities such as transport, marketing and storage.^{iii,iv} Reflecting costs incurred by industry and consumer demand met by processors, products produced by **Australian dairy processors were valued in 2019-20 at 3.3 times the cost of raw milk paid by processors.**

Drinking milk (32% of dairy processing milk utilisation) and cheese (39%) are the primary products manufactured by dairy processing,^v but the industry is characterised by diverse product and supply chains that are continually evolving to meet consumer demand.

Economic and employment contribution

The dairy processing industry in 2019-20 is estimated to have **contributed a total of \$12.4 billion to Australian Gross Domestic Product** (GDP; Table i). Of this, **\$3.1 billion is direct value-added** within dairy processing itself, with a **further \$9.3 billion in indirect contributions** elsewhere in the Australian economy. This means that, **for every dollar of value-added in dairy processing, the industry supports \$3.0 of value-added elsewhere in the economy.** This 'multiplier' is similar to that observed for the Meat and Meat Product Manufacturing, where every dollar of value-added supports \$2.9 elsewhere.

The dairy processing industry also **contributes a total of 70,158 Full Time Equivalent (FTE) jobs to Australian employment. Of these, 29% are direct employees within dairy processing, totalling 20,394 FTEs. Direct dairy processing employment is estimated to have fallen to 17,851 FTEs in 2020-21.**¹

¹ Inter-year changes in dairy processing estimates reported by the ABS are highly variable.

Table i: Economic contribution of the Australian dairy processing industry, 2019-20

	Value-added	Employment
	\$m	FTE jobs
Direct contribution	3,135.0	20,394
Indirect contribution	9,308.2	49,764
Total	12,443.2	70,158

Source: Deloitte Access Economics

The dairy processing industry also supports a **further 49,764 FTE employees in other parts of the Australian economy** (Table ii). This means that, **for every job in dairy processing, the industry supports 2.4 positions indirectly**. This large 'multiplier' lies between other important agricultural processing industries such as the Grain Mill and Cereal Product Manufacturing sector (3.1 positions) and the Meat and Meat product Manufacturing sector (1.1 positions), and reflects the industry's reliance on intermediate inputs (mainly milk from dairy farming) that also have strong labour needs.

Table ii: Indirect employment contribution and industry value-added for the Australian dairy processing industry, 2019-20

	Employment contribution		Industry value-added	
	FTE positions	% of indirect total	\$m	% of indirect total
Dairy cattle ²	16,431	33.0%	2,621	28.2%
Professional, Scientific and Technical Services	4,822	9.7%	821	8.8%
Road Transport	4,562	9.2%	572	6.1%
Wholesale Trade	2,977	6.0%	566	6.1%
Finance	859	1.7%	455	4.9%
Non-Residential Property Operators and Real Estate Services	830	1.7%	363	3.9%
Other Agriculture	2,488	5.0%	454	4.9%
Employment, Travel Agency and Other Administrative Services	1,011	2.0%	325	3.5%
Auxiliary Finance and Insurance Services	940	1.9%	274	2.9%
Transport Support services and storage	868	1.7%	230	2.5%
All other industries	13,975	29.4%	2,628	28.7%
Total	49,764	100%	9,308	100%

Note: Rows may not add to totals due to rounding.

Source: Deloitte Access Economics.

Dairy processing activity is concentrated around the dairy farming regions in south-east Australia principally in regional areas. Processors are typically located at an average distance of between 150 and 200 kilometres (km) from dairy farms. This is demonstrated through the distribution of employment with **56.5% of industry direct employment located in regional Australia**. This regional share is considerably **higher than the averages for other food processing (42%) and the broader manufacturing sector as a whole (31%)**.

² Also includes Sheep, Grains and Beef farming.

Dairy processing's regional footprint is particularly high in Tasmania, where 95.9% of all employees are in regional areas. New South Wales (61.6%), Victoria (55.5%) and Queensland (51.6%) each have more than half of their dairy processing workforce located in regional areas. While significant portions of South Australian (32.4%) and Western Australian (26.9%) employment are also regionally based.

Some states have a large proportion of the dairy processing workforce located in one regional area. For example, the Queensland National Resource Management (NRM) region of South East accounts for 79.0% of state's dairy processing employment and Cradle Coast accounts for 76.9% in Tasmania. Other states, like Victoria and NSW, have their workforce dispersed over several regions.

Contribution to the dairy supply chain

The dairy processing industry does not operate in isolation, rather it works closely with farmers, transport and other supply chain participants to meet the needs of Australian and overseas dairy consumers. These relationships have key contributions over and above those captured by their contribution to the economy and employment.

In 2019-20, Australian **dairy farmers received an estimated \$4.8 billion from dairy processors for the production of raw milk.**^{vi} There were an estimated 5,055 dairy farms in Australia with raw milk production totalling around 8.8 billion litres.^{v,vii} For these businesses payments for milk production are the main source of income, accounting for 85% of annual receipts on average.^{viii}

Despite a 4.3% fall in national milk production in the decade to 2019-20, prices paid to farmers rose by 6.1% to \$6.99 per kilogram of milk solids (in 2019-20 dollars).^{ix} Milk is the main cost incurred by dairy processors, although there are a range of other expenses that underpin the industry's manufacturing and other activities. In light of the significant costs incurred by processors, long-term profits have remained modest with annual profit margins averaging between 3 and 5% in the decade to 2019-20.^{xxviii,xxx}

Transport is also an integral part of the dairy supply chain with processors typically involved in both collection from farm and distribution after processing. Based on CSIRO modelling,^x Australia's dairy processing supply chain supported an **estimated 5.1 million vehicle trips in 2020-21 and 12,888 unique origin-destination paths. During this period, the cost of dairy supply chain freight transport is estimated at around \$890 million.** Most of the associated transport costs (78.4%) result from trips occurring after the point of processing.

According to Dairy Australia, Australians consumed around 319 litres of dairy products in 2019-20.^{3,ix} Milk is the primary dairy product supplied to Australian consumers (on a weight basis) with 97 litres of milk consumed per person across the country on average in 2019-20.^{xi} This in part reflects Australia's high coffee intake alongside a diverse array of dairy products that is supported by relatively high incomes. In per person terms, Australians are among the largest consumers of dairy products in the world. Compared to other developed countries, Australia sits alongside the United States (226 kg) as outliers compared to the European Union (187 kg), New Zealand (137 kg) and Canada (154 kg).

While Australians are large consumers of dairy products, substantially more is produced in Australia than is consumed by the domestic market. **Around 29% of production is exported, with the value of trade totalling \$3.4 billion in 2019-20. Dairy now accounts for around 7.0% of all agricultural exports.** This is higher than the average of 6.2% in the last 10-years and comes mostly from Victorian processors via the port of Melbourne.^{xii, xiii}

Australia also imports a range of dairy products, with trade totalling **\$1.7 billion in 2019-20.** Most dairy imports (90% by value) are cheese and consist of lower value processed and block cheeses from New Zealand and the United States, as well as higher value specialty cheeses, (e.g. Gouda, parmesan and brie) from Europe.^{xxv} Dairy imports are mainly used to complement

³ In milk equivalent terms.

Australian production with overseas cheeses accounting for 31% of Australian consumption in 2020 equivalent to around two-thirds of the volume exported from Australia that year.^{xxv}

Environmental and sustainability contributions

Reflecting the shifting demands of consumers, the dairy processing sector is continually looking to improve its environmental and sustainability footprint. Key impacts in this area include energy consumption, greenhouse gas emissions, water consumption and waste generation.

Compared to other manufacturing industries in Australia, dairy processing is relatively less energy intensive per unit of value of production. In 2019-20 for example, the industry used 926.7 Gigajoules (GJ) of energy per million dollars in revenue, which is around a third of the average for manufacturing as a whole (2,656.4 GJ/\$m in revenue).^{ii,xiv,xv} **Energy intensity has been falling in recent years, with 2019-20 levels around 24.5% below the average of the 3-years prior.**^{xv} This decrease has been driven by a shift away from energy-intensive products (particularly powder) and efforts by processors to integrate renewables and other energy saving innovations into manufacturing sites.

Of the industry's greenhouse gas emissions, 90% are a direct result of energy consumption and the national grid's reliance on non-renewable sources.^{xvi} As such, recent reductions in energy intensity have also contributed towards a lower emission intensity. **Total dairy processing emissions have fallen 23.5% from a recent peak in 2016-17, around twice as fast as the national total (down 11.1%).**^{xv} In 2019-20 the dairy processing industry was estimated to account for just 0.2% of Australia's emissions.^{xv}

In 2019-20 the industry is estimated to have used 16.4 gegalitres of water.^{xv} As a share of dairy supply chain water use, processing accounts for only a small share of the total.^{xvi} Water use fell 5.8% from that in 2018-19 but has trended up in prior years, as the industry's focus has shifted to higher value products that also require more water inputs (such as cheese and yoghurt).^{xv}

Most solid waste generation by dairy processors involves packaging materials and general corporate waste. **Dairy processing waste generation fell 3% in 2019-20 to around 14,900 tonnes.**^{xv} Processors account for a relatively large share of food waste generation (36% of the estimated total)^{xvii} but generate significantly less waste than the average for the manufacturing sector (relative to value-added). Based on the dairy industry's sustainability survey,^{xvi} **dairy processing generated around 70 tonnes of waste per million dollars in value-added between 2016-17 and 2018-19, significantly below the manufacturing sector average of 115 tonnes.**^{xviii}

Regional business contributions

The decentralised footprint of dairy processing means the industry makes important contributions in regional Australia. This includes jobs and value-added, but also other elements that support regional businesses including investment, skills and training, achieving social responsibility goals, and promoting health and safety.

One of the main contributions dairy processing makes in this space is through ongoing investment in capital, which supports future innovation and growth in the industry's value chain. Dairy processing requires significant capital to support specialised activities, handle logistics capabilities and manage branding and marketing activities. A survey of processors **indicates capital expenditure for the industry averaged around \$383 million annually between 2017-18 and 2019-20.**^{xix} As a share of total food manufacturing capital investment, **dairy processing accounted for an average of 15%.**^{xx}

Further, nearly \$6.1 billion in capital was employed across the dairy processing industry in 2019-20.^{xix} This, plus ongoing capital investment will drive the industry's economic contribution in the near future.

Innovation is a core aspect of dairy processing and is a fundamental pillar that supports competitiveness in domestic and export markets. Between 2017-18 and 2019-20 dairy processors **invested around \$36 million in research and development.**^{xix} As a share of food

manufacturing more broadly, dairy processing accounted for 3.2% of research and development, similar to the industry's share of revenue.^{xx}

Women comprise a small share of the dairy processing industry's workforce. In 2020-21, 5,906 FTE positions were held by females, accounting for 33% of the total. However, compared to other industries, dairy processing performs well across many measures of gender equality in the workplace. In 2020, for example, the full-time gender wage gap in the industry was 13% (compared to 20% across all industries) and the wage gap for managers was 8% (compared to 23% across all industries).^{xxi}

The dairy processing industry also plays an important role in regional development by offering employment opportunities across a range of both higher and lower skilled jobs. **Nearly a quarter (23%) of the dairy processing sector's workforce was categorised as being in the two highest skilled categories of jobs.**⁴ While over half of dairy processing jobs in regional areas fall into the two lowest skilled categories of jobs, only 15% of the dairy processing workforce is categorised as least skilled. This compares to more than a third of all food manufacturing employees and 19% for the manufacturing sector as a whole. These roles provide important opportunities for people in regional areas who typically have access to fewer employment opportunities than their metropolitan counterparts.^{xxii,xxiii}

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⁴ The Australian and New Zealand Standard Classification of Occupations Skill levels is a classification of all occupations by required skill. The five skill levels are defined in terms of formal education and training, previous experience and on-the-job training.

1 Background

Australia's dairy processing industry is concentrated in regional areas and generated \$15.7 billion in revenue in 2019-20 from a diverse product mix.

Deloitte Access Economics has been engaged by the Australian Dairy Products Federation (ADPF) to estimate the economic and broader contribution of the dairy processing industry in Australia. The ADPF represents post farm-gate members of the Australian dairy industry, including processors, traders and marketers of Australian dairy products. Members of the ADPF process more than 90% of Australian milk volumes and provide dairy products for both domestic and export markets.ⁱ

This report outlines the dairy processing industry's footprint in Australia, including in regional areas.

1.1 Defining the dairy processing industry and its activities

The Australian dairy processing industry consists of a diverse range of businesses that produce a variety of dairy based products including drinking milk, cheese, adult and infant milk powders, yoghurt, butter and whey powder. The dairy processing industry forms part of a broader food processing industry (ANZSIC classes 1111 to 1199) and manufacturing sector (ANZSIC division C) and is defined here to include the three Australian and New Zealand Standard Industrial Classification (ANZSIC)^{xxiv} classes described in Table 1.1.

Table 1.1: Dairy processing ANZSIC classes

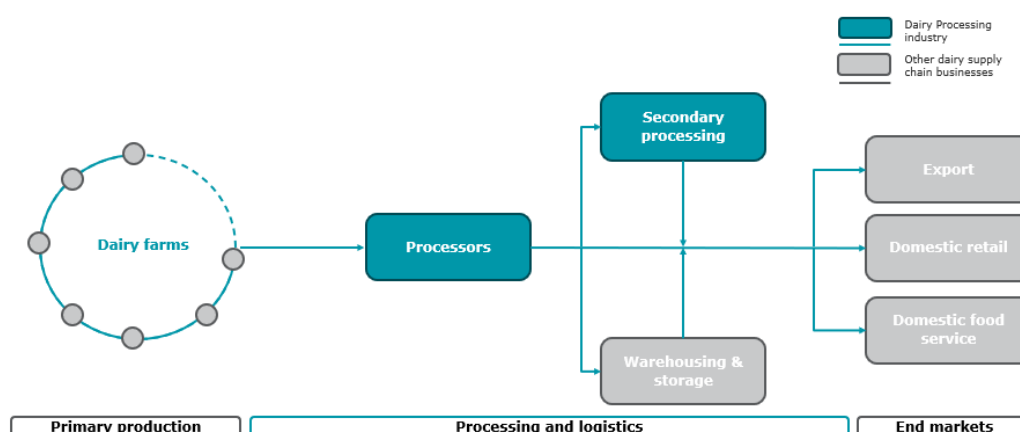
ANZSIC class	Primary activities
1133 - Cheese and Other Dairy Product Manufacturing	Manufacturing rennetted or cultured dairy such as cheese or yoghurt, or in manufacturing other dairy products such as butter, milk powder and condensed or evaporated milk.
1132 - Ice Cream Manufacturing.	Manufacturing ice cream or frozen confectionery.
1133 - Cheese and Other Dairy Product Manufacturing	Manufacturing rennetted or cultured dairy such as cheese or yoghurt, or in manufacturing other dairy products such as butter, milk powder and condensed or evaporated milk.

Source: ABS^{xxiv}

Processors sit centrally in the dairy supply chain, sourcing raw milk from dairy farmers and supplying domestic and overseas consumers through retail and food service value chains (Figure 1.1). During processing, a range of manufacturing techniques are used to convert raw milk into dairy products, including standardisation, pasteurisation and homogenisation.

In addition to their manufacturing role, processors are typically responsible for the transportation of raw milk (to the processing facility) and dairy products (to end markets) and are involved in warehousing and storage.

Figure 1.1: Dairy processing and other businesses in the dairy supply chain



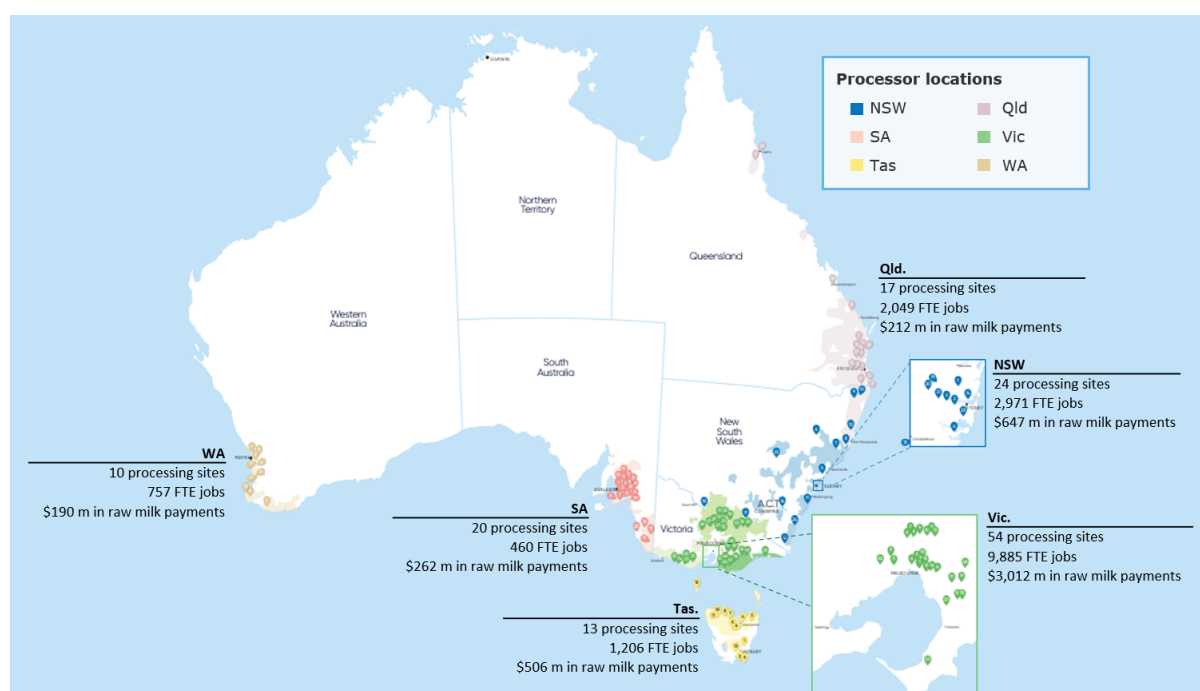
Source: Adapted from Productivity Commission^{xxv}

1.2 Spatial distribution of the Australian dairy processing industry

Most dairy processing takes place in close proximity to dairy farming regions, in order to minimise costs and risks in transporting highly perishable raw milk. In Australia, dairy farming primarily occurs in high rainfall areas close to the coast, with inland farms typically featuring irrigated systems. Processors are typically located at an average distance of between 150 and 200 km from dairy farms, but can be up to 600 km away.^{xxvi}

Region-specific characteristics, including climate and production profiles, dictate the end markets targeted by processors in each region. The Southern region (which includes Eastern Victoria, Murray, Western Victoria, South Australia and Tasmania regions) mostly manufactures products for export (primarily cheese and milk powders) in addition to some products for domestic markets. The Northern and Western Australia regions mostly produce fresh drinking milk and export only a small proportion of total output.^{xxvi}

Figure 1.2: Australian dairy processing locations and summary statistics



Note: Processing locations as at 2019; employment figures refer to 2020-21 average and raw milk payments refer to 2019-20.

Source: Dairy Australia^{xxvii}; Deloitte Access Economics estimates based on ABS employment data^{xxi}; ABS^{vi}

Table 1.2: Selected characteristics of Australia's dairy regions, 2019-20

	Dairy farms		Milk Production		Value of milk production	
	no.	Share of total	ML	Share of total	\$m	Share of total
Gippsland	1,202	24%	2,027	23%	1,086	23%
Murray	1,167	23%	1,776	20%	955	20%
New South Wales	354	7%	787	9%	488	10%
South Australia	206	4%	488	6%	262	5%
Subtropical	444	9%	444	5%	302	6%
Tasmania	391	8%	950	11%	506	11%
Western Australia	135	3%	364	4%	190	4%
Western Victoria	1,156	23%	1,940	22%	1,040	22%
Australia	5,055	100%	8,776	100%	4,829	100%

Note: Subtropical region includes the northern New South Wales and Queensland dairy regions, Murray refers to northern Victoria and southern New South Wales (spanning the Murray river).

Source: Dairy Australia^{xxxi}

1.3 The dairy processing market and industry structure

In 2019-20, Australia's **dairy processing industry received 8.8 billion litres of raw milk** from dairy farms, **generating \$15.7 billion in revenue**.^{xi,ii} Dairy processing increases the value of the raw milk it receives through its manufacturing activities (which requires capital expenditure, use of other ingredients and energy), and the industry's other supply chain activities such as transport, marketing and storage.^{iii,iv} Reflecting industry costs incurred and consumer demand met by processors, products produced by the dairy processing industry are valued at 3.3 times the cost of raw milk received by processors.^{ii,vii}

In 2019-20, drinking milk accounted for 32% of dairy processing milk utilisation with dairy products accounting for just over two thirds of milk utilisation (Chart 1.1).^v Within these broad categories, the dairy processing industry supplies a diversified range of products that are continually evolving to meet consumer demand in Australia and overseas. Cheese is the main product supplied by Australian processors, and this primarily consists of Cheddar (24% of dairy product production). Significant volumes of fresh (11%) and semi-hard (8%) cheeses are also produced, alongside smaller volumes of hard and mouldy cheese varieties (both around 1%).^v

Similarly, milk powders, as well as butter and butter-oils consist of an array of products to meet various consumer demands. This is demonstrated by the further specialisation of products such as skim milk powder which is used as an ingredient in various other parts of food manufacturing in Australia. Uses for skim milk powder (SMP) in Australia include high value infant milk formula (the dominant product manufactured), as well as other dairy based products (such as yoghurt, ice cream, reduced fat milks and milk chocolates), and other food (such as ready-to-cook meals and other baby foods) and industrial (mainly animal feed) uses.^v

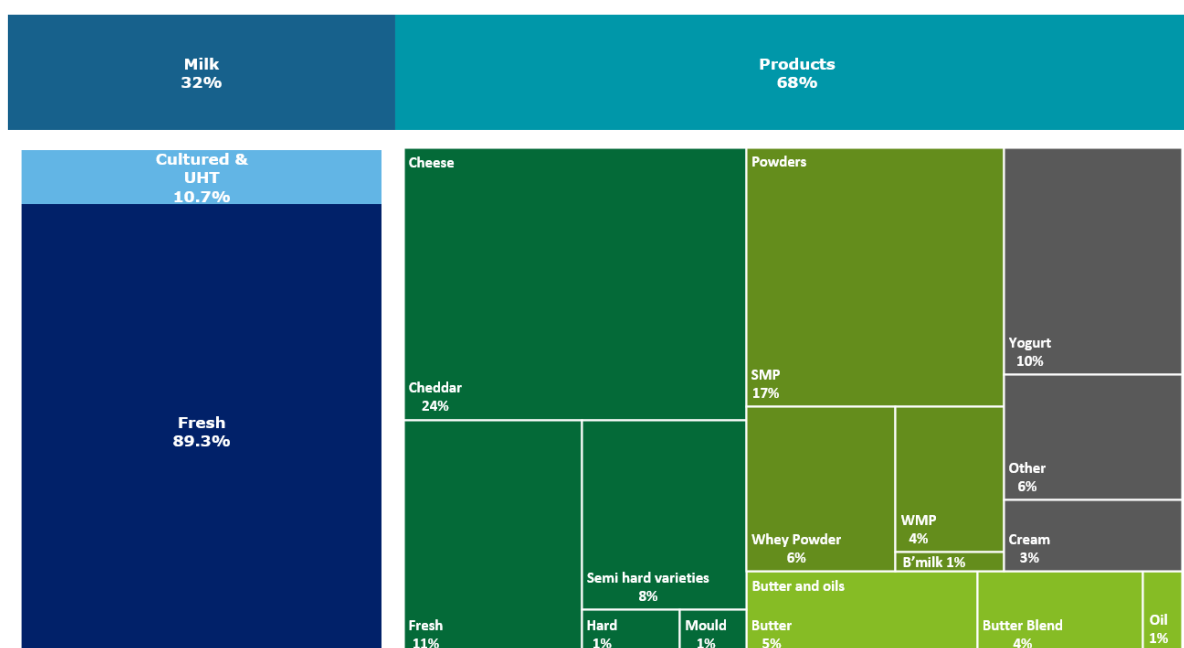
The continued evolution of Australia's dairy processing industry is demonstrated by the industry's shift to cheese production as a higher value product. However, processors within the cheese category have also shifted towards non-cheddar products in response to consumer and market demands. In the three decades to 2019-20 for example, non-cheddar share of total cheese production has steadily increased from around 30% to 47%.^{xiii}

The market structure of dairy processing in Australia features a small number of larger organisations. The four largest producers are Saputo, Fonterra, Lactalis and Bega Cheese, who are collectively estimated to account for around half of industry revenue^{xxviii,xxix,xxx,xxxi} and receive the

bulk of Australia's raw milk. These four large processors collectively operate 40 processing plants around Australia and all produce a diverse range of products.^{xxvii}

The current structure of the dairy processing industry in Australia reflects a recent history of steady consolidation⁵ since deregulation in the early 2000s. Two large acquisitions in recent years include Saputo's purchase of Murray Goulburn in 2018 and the acquisition of Lion's dairy business by Bega Cheese in January 2021.^{xxxii,xxxiii} Transactions since 2000 have also involved smaller firms, including asset divestments and processors seeking growth opportunities in specific regions or product categories.^{xxvi}

Chart 1.1: Dairy processing milk utilisation and share of milk and products production, 2019-20



Note: UHT refers to Ultra-High Temperature milk.

Source: Dairy Australia^v

Despite this recent history of consolidation, the industry remains relatively diverse with around 140 processing sites across Australia in 2019.^{xxvii} This includes medium sized (e.g. Burra Foods, Australian Consolidated Milk (ACM), Freedom Foods, Norco Co-operative, Bulla Dairy Foods and Brownes Dairy) and micro-processors (e.g. Maleny Dairies and Fleurieu Milk Company) that produce niche products or focus on regional markets.^{xxvi}

Ownership structures among Australia's dairy processors have also changed in recent decades. Prior to 2000, four of the largest dairy processors in Australia (Dairy Farmers Group, Murray Goulburn, Bonlac and Bega Cheese) were Australian farmer-owned cooperatives. Since 2000, some co-operatives have become publicly listed companies (i.e. Murray Goulburn⁶ and Bega Cheese), while others have been acquired by foreign owned companies such as Fonterra (New Zealand), Parmalat (a subsidiary of French company Lactalis) and Saputo (a majority Canadian company).^{xxvi,xxxiv,xxxv}

⁵ For more information see the ACCC^{xxvi} and Productivity Commission^{xxv} which provide reviews of historical dairy processing consolidation.

⁶ Note that Murray Goulburn has since been privatised by Saputo.

2 Methodology overview

This section outlines the approach used to estimate the dairy processing industry's economic contribution in Australia (as reported in Chapter 3). It also outlines the approach used to analyse the industry's footprint in other areas, beyond jobs and value-added as reported in Chapter 4.

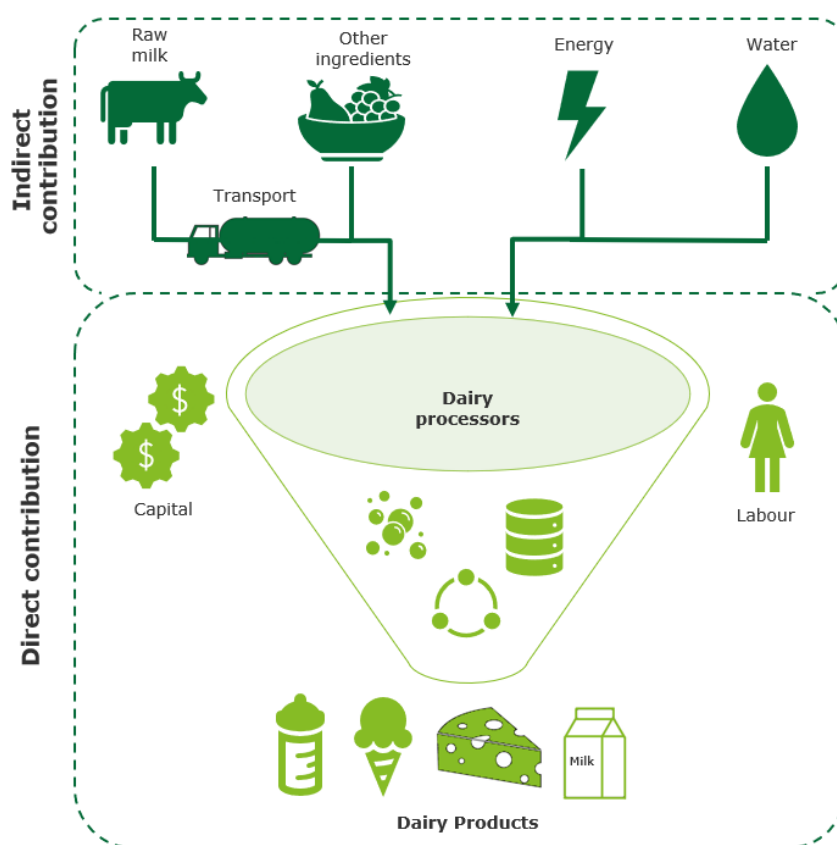
2.1 Contribution analysis using Input-Output Modelling

Economic contribution modelling captures the contribution of a given business or industry to the economy at a particular point in time in terms of value-added (the contribution of an industry to GDP) and employment.

The dairy processing industry directly and indirectly supports a range of economic activity in Australia, both as a result of the activities of the processing businesses themselves and their demand for inputs from upstream suppliers.

The industry's total contribution is calculated as the sum of both direct and indirect contributions, for value-added and employment, as illustrated in Figure 2.1. The direct contribution of the dairy processing industry is defined to include all processing activities that employ capital and labour.

Figure 2.1: Stylised representation of direct and indirect dairy processing activities



Raw milk, utilities and other inputs supplied from upstream industries form the dairy processing industry's indirect contribution. The dairy processing industry undertakes transport activities to support the receipt of milk and delivery of dairy products (see Section 4.1.2). Because of this, transport forms part of the industry's indirect and direct economic contribution.

All direct, indirect and total contributions are reported as gross operating surplus (GOS), labour income, value-added and employment (with these terms defined in Table 2.1).

Table 2.1: Definitions of economic contribution estimates

Estimate	Definition
Gross operating surplus (GOS)	The value of income generated by direct capital inputs, generally measured as earnings before interest, tax, depreciation, and amortisation (EBITDA).
Labour income	A subcomponent of value-added that represents the value of output generated by direct labour inputs, as measured by the income to labour
Value-added	Value-added measures the value of output (i.e. goods and services) generated by the industry's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value-added across all industries in the economy equals gross domestic product, as such value-added can be thought of as the increased contribution to welfare.
Employment	It measures the number of workers (in full-time equivalent terms) that are employed by the industry (rather than the value of the workers' output) and is therefore a different measure of activity to those outlined above.
Direct economic contribution	The direct economic contribution represents the flow of labour and capital committed in the economic activity.
Indirect economic contribution	The indirect contribution measures the demand for goods and services produced in other sectors as a result of demand generated by economic activity.
Total economic contribution	The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

To allow comparison with other parts of the economy, the approach to modelling the dairy processing's economic and employment contribution has also been extended to other selected industries including: manufacturing of meat processing, grain milling and cereal products and petroleum and coal products.

The economic modelling has focussed on 2019-20 as the latest period for which industry revenue estimates are reported by the Australian Bureau of Statistics (ABS).

2.2 Analysis of other dairy processing contributions

In addition to estimating the economic contribution of the Australian dairy processing sector, this report discusses the dairy processing industry's contribution in other areas. This includes for example how it interacts with the broader dairy supply chain, its environmental footprint, and its position as a large employer in regional areas. Across each of these themes estimates specific to the dairy processing industry are reported, with an analysis of the industry's relative contribution and how this contribution has changed over time.

A diverse array of data sources have been drawn upon to inform the analysis of the dairy processing industry's other contributions. This includes the ABS, the Australian Bureau of Agriculture and Resource Economics and Science (ABARES) and Dairy Australia. The analysis presented in this report has generally used publicly available estimates published by independent and primary sources. Where discrepancies were found to exist across primary sources, they were not assessed to materially affect estimates of the industry's contribution in Australia.

Analysis of the dairy processing industry's other contributions has aimed to report on the most up-to-date data. For most topics covered, Australian dairy processing estimates are for the 2019-20 fiscal year, in line with that covered by the economic contribution modelling. Some industry relevant data information, such as milk production volumes or direct labour force estimates were available for 2020-21 and have been included. Other items relevant to the dairy processing industry have also been included that were published before 2019-20. These items are generally informed by ad hoc or infrequent publications (such as one-off reports into food waste or the ABS' census data). These items, while older, reflect the latest available data and illustrate key aspects of the dairy processing industry's contribution that remain relevant at the time of publication.

In addition to information from the ABS, ABARES, Dairy Australia and other public sources, the analysis of other dairy processing contributions has been informed by a survey of the dairy

processing industry. Topics informed by the survey focus on direct dairy processing activities and include:

- capital employed
- on-going investment
- employment
- research and development investment
- processing sites
- raw milk receivals
- revenue.

Survey respondents comprise a broad sample of organisations currently operating in Australia's dairy processing industry, accounting for nearly 75% of annual milk receivals over the period from 2017-18 to 2019-20. In 2019-20, survey respondents operated 49 dairy processing sites, with 37 of these located in regional areas.

Deloitte Access Economics has not verified the survey data provided by ADPF or industry.

3 Economic and employment contribution of Australia's dairy processing industry

For every dollar of direct value-added generated in the dairy processing industry, \$3.0 is generated upstream in indirect industries. For every dairy processing job, 2.4 jobs are supported elsewhere in the Australian economy.

The primary way through which the footprint of an industry or business is measured in Australia (and abroad) is through the estimation of its contribution to economic activity (through value-added) and employment. This chapter reports estimates of the dairy processing industry's economic and employment contribution using Input-Output modelling (see section 2.1).

3.1 Contribution to gross domestic product

The \$15.7 billion in revenue generated by the industry in 2019-20ⁱⁱ is estimated to contribute a total of \$12.4 billion of associated economic activity to the Australian economy.

The dairy processing industry directly contributes around \$3.1 billion to value-added, comprised of around \$1.2 billion in gross operating surplus (GOS, effectively returns to capital), and \$2.0 billion in wages.⁷

Most of the dairy processing industry's total economic contribution (74.8%) comes from indirect value-added (\$9.3 billion). This means that for every dollar of value-added in dairy processing, the industry supports \$3.0 of value-added elsewhere in the economy.

Table 3.1: Economic contribution of the Australian dairy industry, 2019-20

Value-added	\$m
Direct contribution	3,135.0
Gross Operating Surplus	1,192.2
Wages	1,942.8
Indirect contribution	9,308.2
Gross Operating Surplus	5,578.6
Wages	3,729.6
Total	12,443.2

Source: Deloitte Access Economics.

The direct contribution of the dairy processing industry accounts for 14% of food manufacturing in Australia. Food manufacturing has been a strong performer amidst a broader decline in Australian

⁷ Values do not sum to the total due to rounding.

manufacturing in recent decades.^{xxxvi} Dairy processing's role in the Australian economy is consequently highlighted as an important contributor to this sector.

This large indirect share is high relative to that observed across other industries. In part, this reflects the high payments to third parties (particularly the agricultural sector) relative to the cost of processing and industry revenue. It also reflects the low margin activities dairy processors undertake, as well as the relatively high operating costs – mainly raw milk – relative to total revenue. This is demonstrated through comparing direct payments to labour (\$2.0 billion) and capital (\$1.2 billion) to indirect payments (\$9.3 billion; Table 3.1), most of which flow to the agriculture sector (\$3.1 billion; Table 3.2).⁸

These third-party payments form the indirect contribution of dairy processing. Primarily, these consist of payments to the Dairy Cattle farming⁹ industry (\$2.6 billion), reflecting the role of dairy processors as the primary users of raw milk. Payments to other agriculture industries (\$454.1 million) also forms an important,¹⁰ albeit smaller, component of the dairy processing industry's indirect contribution (Table 3.2).

Significant indirect contributions are also made to professional services (\$821.2 million), reflecting the industry's associated activities in research, development, and supply chain expenditure such as payments made to road transport (\$571.5 million) and wholesale trade (\$565.9 million).

Table 3.2: Indirect contribution of the Australian dairy processing industry, 2019-20

Contribution	Industry value-added	
	<i>Units</i>	
	<i>\$m</i>	<i>% of total</i>
Dairy cattle ⁷	2,621.3	28.2%
Professional, Scientific and Technical Services	821.2	8.8%
Road Transport	571.5	6.1%
Wholesale Trade	565.9	6.1%
Finance	455.2	4.9%
Other Agriculture	454.1	4.9%
Non-Residential Property Operators and Real Estate Services	363.1	3.9%
Employment, Travel Agency and Other Administrative Services	325.0	3.5%
Auxiliary Finance and Insurance Services	273.5	2.9%
Transport Support services and storage	229.7	2.5%
All other industries	2,627.7	28.2%
Total	9,308.2	100%

Note: Dairy cattle also includes Sheep, Grains and Beef farming.

Source: Deloitte Access Economics.

The level of indirect economic activity supported by a dollar of value-added in the dairy processing industry is similar to that of meat processing (about \$2.90 per dollar value-added). Both industries apply a similar degree of processing to convert raw inputs into consumable products, and have a strong presence in regional labour markets.

However, a dollar of value-added by the alcoholic beverage (beer) manufacturing industry supports just \$1.70 in value-added elsewhere in the economy. Both the beef and beer

⁸ Indirect value-added from Agriculture includes Dairy Cattle and Other Agriculture ANZSIC industries.

⁹ Also includes Sheep, Grains and Beef farming.

¹⁰ As well as agriculture industry support services (\$159.7 million in value-added).

manufacturing industries draw on raw agricultural inputs to produce consumable goods. However, the dairy processing sector has stronger linkages to agricultural markets upstream.

Relative to other non-agricultural manufacturing supply chains, dairy processing's large indirect share is also atypical. For example, the petroleum and coal product manufacturing industry's total revenues are similar to that of dairy processing, at \$16.9 billion in 2019-20. However, petroleum and coal manufacturing support far less indirect activity (about \$4.1 billion) than dairy processing. This reflects dairy processing's stronger linkages with other industries in the Australian economy and their supply of intermediate inputs (namely raw milk). Because of this, petroleum and coal manufacturing supports just \$0.80 of value-added elsewhere in the economy for every dollar of its value-add.

3.2 Employment contribution

In addition to the dairy processing industry's contribution to value-add, it also contributes a total of **70,158 Full Time Equivalent (FTE) jobs** to Australian employment. Of these, 28% are direct employees (**20,394 FTEs**), with the industry supporting a further **49,764 FTE** employees in other parts of the Australian economy.

For every job in dairy processing, the industry supports 2.4 indirect FTE positions in upstream industries.

Table 3.3: Employment contribution of the Australian dairy processing industry, 2019-20

Contribution	FTE positions
Direct	20,394
Indirect	49,764
Total	70,158

Source: Deloitte Access Economics.

As with value-added, most of the indirect employment contribution of the dairy processing industry is predominantly within agriculture. For Dairy cattle farming⁷ in particular, dairy processing supported around 16,431 jobs in 2019-20, 33.0% of the total. A further 2,488 FTE positions were also supported in Other Agriculture.

Table 3.4: Indirect employment contribution of the Australian dairy processing industry, 2019-20

Contribution	FTE positions	% of total
Dairy cattle ⁷	16,431	33.0%
Professional, Scientific and Technical Services	4,822	9.7%
Road Transport	4,562	9.2%
Wholesale Trade	2,978	6.0%
Finance	859	1.7%
Non-Residential Property Operators and Real Estate Services	830	1.7%
Other Agriculture	2,488	5.0%
Employment, Travel Agency and Other Administrative Services	1,011	2.0%
Auxiliary Finance and Insurance Services	941	1.9%
Transport Support services and storage	868	1.7%
All other industries	13,975	28.1%
Total	49,764	100.0%

Note: Dairy cattle also includes Sheep, Grains and Beef farming.

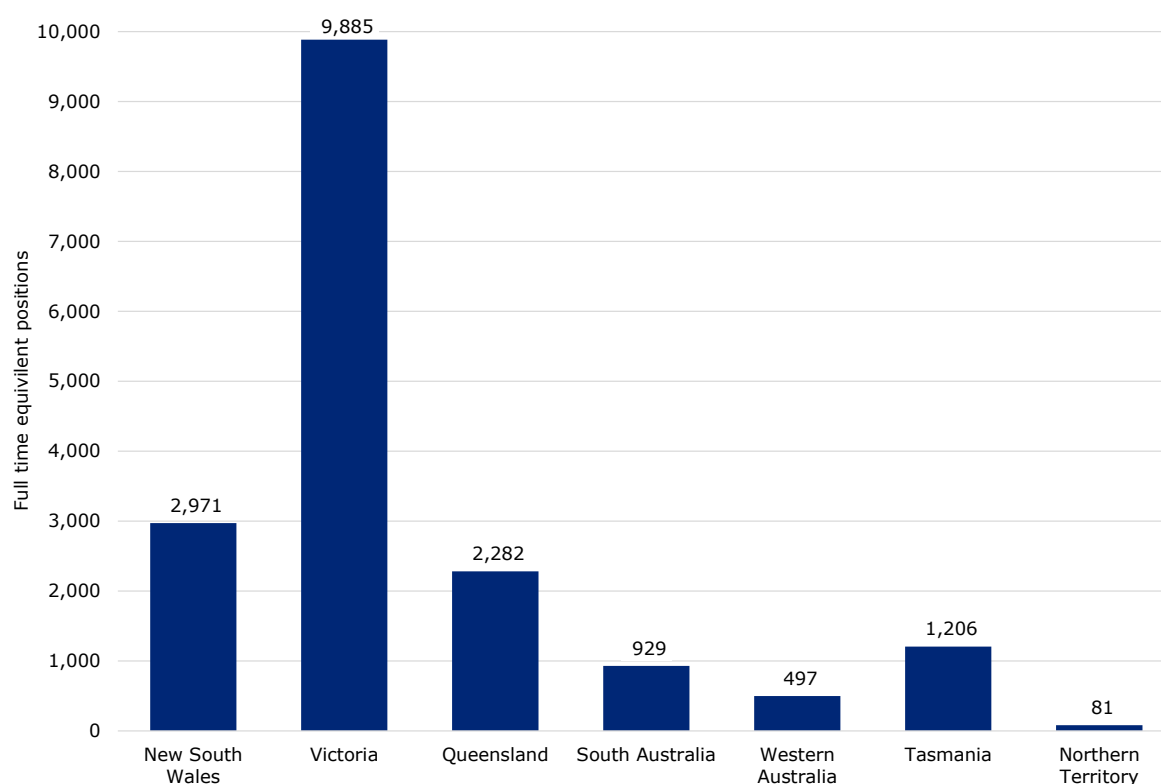
Source: Deloitte Access Economics.

The dairy processing sector's indirect employment is relatively large, reflecting its reliance on upstream industries that also incur significant labour costs. Because of this, dairy processing sits above meat processing (which supports just 1.1 indirect FTE positions in its upstream industries), but below that of Grain Mill and Cereal product manufacturing (which supports about 3.1 indirect FTE positions in upstream industries). Both dairy processing and Grain Mill and Cereal product manufacturing require similar levels of upstream labour to produce intermediate production inputs (e.g. raw milk and crops).

3.2.2 Regional employment

Reflecting the distribution of milk production, dairy processing activity and direct employment is concentrated in south-east Australia. Most dairy processing jobs are located in Victoria (9,885 FTE positions in 2020-21) with the state accounting for around 55.4% of the national total (17,851 FTEs). New South Wales (2,971 FTEs) is the second largest, accounting for 16.6% of employment (Chart 3.1). This is followed by Queensland (2,282 FTEs), Tasmania (1,206 FTEs), South Australia (929 FTEs), Western Australia (497 FTEs) and the Northern Territory (81 FTEs).^{xxi}

Chart 3.1: Dairy processing FTE employment by state, 2020-21



Note: Average employment in 2020-21, includes metropolitan and regional employees.

Source: ABS^{xxi}

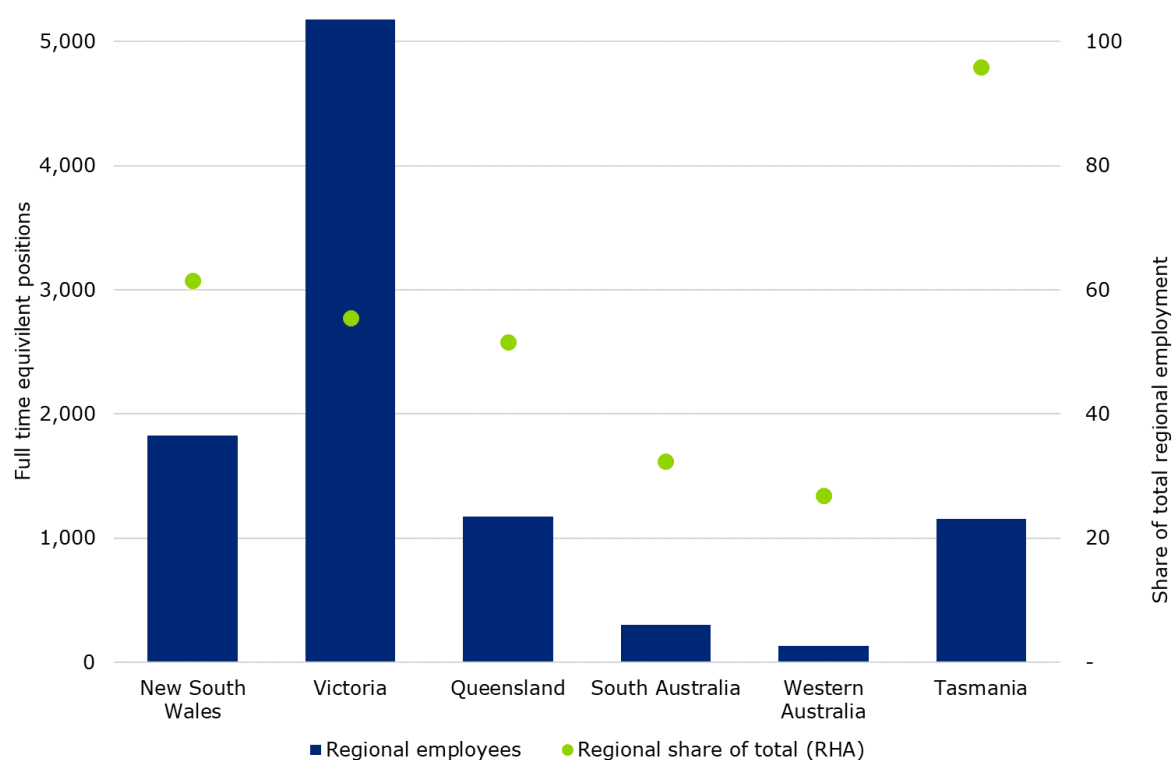
Of the dairy industry's direct employment, 56.5% is estimated to be located in regional Australia. This share is considerably higher than the averages for other food processing (42%) and the broader manufacturing industry as a whole (31%).^{11,xxi} This large regional footprint also likely extends to the industry's indirect contribution (Section 4.1.1). Because payments to dairy farms account for a significant portion of the total indirect contribution, and raw milk is transported

¹¹ Food manufacturing and total manufacturing regional shares are 2016 ABS Census values.

an average of 150 to 200km,^{xxvi} most indirect activity for a given region either occurs in the same or adjacent regions.

Dairy processing's regional employment share is particularly high for Tasmania, where 95.9% of all employees are located in regional areas. New South Wales (NSW; 61.6%), Victoria (55.5%) and Queensland (51.6%) each have more than half of dairy processing employment located in regional areas (Chart 3.2).^{xxii} While significant portions of South Australian (32.4%) and Western Australian (26.9%) employment are also regionally based.

Chart 3.2: Estimated proportion of FTE employees employed in regional areas, 2020-21



Note: Regional employment estimates are forward projections of census distributions by changes in ABS detailed labour force estimates between 2019-20 and 2015-16.

Source: ABS^{xxii,xxi}

Table 3.5 outlines the regional share of state dairy processing employment in Australia. In most states, a single region dominates employment. In Tasmania and Queensland for example, the Cradle Coast and South East account for 76.9% and 79.0% of their respective state totals.

In contrast Victorian and NSW dairy processing employment is spread throughout the state. In Victoria, four NRM regions (Goulburn Broken, Glenelg Hopkins, West Gippsland and Corangamite) each employ more than 900 FTEs in dairy processing. Meanwhile, in NSW, South East NSW (919 FTEs) and the North Coast (522 FTEs) are particularly important.^{xxi,xxvii}

The latest available data shows that dairy processing makes up a high proportion of total employment in some local government areas (LGAs). For instance, in NSW, dairy processing comprises 5.6% and 3.2% of total employment in the Bega Valley and Bellingen LGAs. In Victoria, dairy processing comprises 11.7%, 7.0% and 4.2% of total employment in the Moyne, Moira and Gippsland South LGAs respectively. Similarly, dairy processing accounts for 9.8% and 3.9% of employment in the King Island and Circular Head LGAs in Tasmania.^{xxxvii}

Table 3.5: Estimated direct dairy processing FTE employment in selected NRM regions and region share (%) of state total, 2020-21

	1	2	3	4	5	6	7	8	9	State total
NSW	Greater Sydney	South East NSW	North Coast	Murray	Hunter	Riverina	Central Tablelands	Central West	North West NSW	2,971
	1,097 (36.9%)	919 (30.9%)	522 (17.6%)	234 (7.9%)	90 (3.0%)	82 (2.8%)	19 (0.6%)	5 (0.2%)	4 (0.1%)	
Vic.	Port Phillip and Western Port	Goulburn Broken	Glenelg Hopkins	West Gippsland	Corangamite	North Central	North East			9,885
	4,711 (47.7%)	1,446 (14.6%)	1,045 (10.6%)	947 (9.6%)	915 (9.3%)	540 (5.5%)	281 (2.8%)			
Qld.	South East Queensland	Condamine	Terrain NRM	Burnett Mary	Fitzroy Basin	North Queensland Dry Tropics				2,282
	1,803 (79.0%)	204 (8.9%)	93 (4.1%)	88 (3.9%)	76 (3.3%)	19 (0.8%)				
SA	Adelaide and Mount Lofty Ranges	South East	South Australian Murray Darling Basin	Northern and Yorke						929
	660 (71.0%)	117 (12.6%)	109 (11.7%)	44 (4.7%)						
WA	Perth	South West	Peel-Harvey							497
	339 (68.3%)	90 (18.2%)	67 (13.6%)							
Tas.	Cradle Coast	North	South							1,206
	927 (76.9%)	230 (19.1%)	49 (4.0%)							

Note: Table excludes the Northern Territory. Employment estimates are forward projections of census distributions, based on state-level difference between 2020-21 and 2015-16 estimates of the industry's labour force by the ABS.

Source: ABS^{xxi}

4 Beyond the economic contribution

In 2019-20 dairy processing made significant contributions to its broader supply chain and the environment including \$4.8 billion in payments to Australian farmers and a 23.5% reduction in emissions from 2016-17.

Australian dairy processing makes a range of contributions to Australian society beyond just that to GDP and employment. This chapter discusses these contributions, focussing on the industry's footprint along the supply chain in addition to key environmental and investment contributions. The approach to measuring these contributions is outlined in section 2.2.

4.1 Supply chain contribution

The dairy processing industry does not operate in isolation, working closely with farmers, transport and other supply chain participants to meet consumer needs in Australia and overseas. Parts of these relationships are captured in the economic and employment contribution estimates reported in Chapter 3. This section outlines other aspects of these relationships to which the dairy processing industry contributes.

4.1.1 Milk production and prices

The dairy products supply chain begins on the dairy farms from which processors purchase raw milk. In 2019-20, there were an estimated 5,055 dairy farms in Australia with raw milk production totalling around 8.8 billion litres.^{v,vii} For these businesses payments for milk production are the main source of income, accounting for 85% of annual receipts on average.^{xxxviii,12}

In 2019-20, Australian dairy farmers received \$4.8 billion in payments from the dairy processing sector for their raw milk. Most payments are concentrated in south-east Australia, reflecting where most dairy farming takes place. Victoria (\$3.0 billion) accounts for the bulk (more than 60%) of payments to dairy farms, with NSW (\$647 million) and Tasmania (\$506 million) accounting for most of the remaining amount. Dairy farmers in Queensland (\$212 million), South Australia (\$262 million) and Western Australia (\$190 million) also receive significant payments from the dairy processing industry for raw milk.^{vi}

Australia's largest milk producing NRM region is West Gippsland with \$898 million paid to the region's famers for raw milk in 2019-20 (Table 4.1). Other major milk producing NRM regions include Corangamite (\$542 million) in Victoria, the North Coast (\$145 million) in NSW, and the South East (\$141 million) in South Australia.^{vi}

The dairy supply chain's important contribution to Australia's regional industries is further highlighted through its share of the total value of agriculture production. **Payments to farmers for milk accounted for 8.0% of the total value of farmgate production in Australia in 2019-20.**^{vi} In regions suited to dairy production, payments by dairy processors account for a significant portion of the value of agricultural production. For example, in Tasmania raw milk accounts for 27.0% of the total value of agricultural production, while Victoria contributes 17% of the total (Table 4.1). **Similarly high shares are observed in regions such as West Gippsland (48.0%), Corangamite (29.6%) and the Hunter (21.7%).**^{vi,xxii}

¹² The remainder consists largely of livestock transfer payments (i.e. dairy and other cattle sold).

Table 4.1: Gross value of milk production by State and NRM region, \$m, and milk's share of gross value of agricultural production, 2019-20

	1	2	3	4	5	6	7	8	9	Total
NSW	North Coast	South East NSW	Hunter	Murray	Central West	North West NSW	Greater Sydney	Central Tablelands	Northern Tablelands	\$647m (5.8%)
	\$145m (14.1%)	\$139m (16.9%)	\$134m (21.7%)	\$123m (8.8%)	\$41m (3.9%)	\$25m (2.6%)	\$25m (2.9%)	\$8.9m (1.4%)	\$5.2m (0.9%)	
Vic.	West Gippsland	Corangamite	Glenelg Hopkins	Goulburn Broken	North Central	Port Phillip and Western Port	North East	East Gippsland	Wimmera	\$3,012 (16.9%)
	\$898m (48.0%)	\$542m (29.6%)	\$526m (18.8%)	\$340m (16.1%)	\$321m (13.6%)	\$198m (10.6%)	\$139m (20.5%)	\$45m (14.2%)	\$1.7m (0.1%)	
Qld.	Burnett Mary	South East Queensland	Condamine	Terrain NRM	Fitzroy Basin	Queensland Murray Darling Basin	North Queensland Dry Tropics	South West Queensland	Reef Catchments	\$212m (1.6%)
	\$52m (3.1%)	\$51m (3.3%)	\$49m (4.2%)	\$39m (3%)	\$13m (0.7%)	\$5.2m (0.5%)	\$1.3m (0.1%)	\$0.1m (0.1%)	<\$0.1m (<0.1%)	
SA	South East	South Australian Murray Darling Basin	Adelaide and Mount Lofty Ranges							\$262m (4.0%)
	\$141m (11%)	\$76m (3.7%)	\$45m (5.8%)							
WA	South West	South Coast	Peel-Harvey	Wheatbelt	Rangelands					\$190m (2.2%)
	\$124m (8.1%)	\$35m (2.2%)	\$31m (5.4%)	<\$0.1m (<0.1%)	<\$0.1m (<0.1%)					
Tas.	Cradle Coast	North	South							\$506m (27%)
	\$264m (38.7%)	\$232m (27%)	\$11m (3.2%)							

Source: ABS^{vi,xxii}

Total payments to Australian dairy farmers remained relatively stable around an average of \$4.6 billion per annum¹³ in the decade to 2019-20, despite lower milk production (down 4.3% in volume terms).^{xiii} Weighted average prices for Australia's southern dairy farmers (which accounts for the majority of milk production) increased during this period, up 6.1% to \$6.99 per kilogram of milk solids (in 2019-20 dollars).^{ix}

On a per litre of milk basis, the percentage increase in prices paid to farmers in the 10 years to 2019-20 was greater than that received by Australia's dairy processing industry. In 2019-20, the dairy processing industry generated 179.0 cents of revenue per litre of milk received, up 4.2% on that in 2010-11 (171.8 cents per litre in 2019-20 Australian dollars).^{ii,xiii} This relationship varies considerably over time and is driven by a range of time and market specific factors.

Raw milk is by far the largest single cost incurred by processors, this is demonstrated by the dairy cattle's share of processing' total economic contribution (21.1%; see section 3.1). However, a range of other costs are incurred by Australia's dairy processing industry, including the direct costs of manufacturing (e.g. in standardising, pasteurising and homogenising raw milk) as well as costs incurred in undertaking marketing, research and development, transportation, distribution and storage.^{xxv} In light of the significant costs incurred by processors, long-term profits have remained modest with annual profit margins averaging between 3 and 5% in the decade to 2019-20.^{xxviii,xxx}

4.1.2 Transport

Transport is an integral part of the dairy supply chain with processors typically involved in both collection from farm and distribution after processing. Dairy processors are increasingly outsourcing transport services although processors retain responsibility for getting freight to market, including raw milk from farm to processing point.

Collection and transport is an important cost for dairy processors and varies depending on a range of factors. From the farm, collection occurs regularly (every 24 or 48 hours) due to the high perishability of raw milk. Distances travelled from farms and processing plants, can range from just a few kilometres to as much as 600 km. Transport costs also reflect the impact of weather (as an appropriate temperature must be maintained).

Once processed, dairy products are typically transported to other plants for packaging (if required), on-or off-site cold storage facilities, or distribution centres. After packaging, products for the domestic market are typically moved to centralised warehousing systems of retail outlets or directly to consumers.^{xxv} Increasingly, specialist milk distributors are contracted by processors to deliver dairy products to customers.¹⁴

As dairy processing is concentrated in regional areas in south-eastern Australia, dairy products must often be transported significant distances from processing plants to customers. This is again complicated by the perishable nature of dairy products (particularly drinking milk), which requires additional logistical and refrigeration costs. Dairy products destined for export markets are generally warehoused in storage facilities, prior to being trucked to port and shipped as containerised sea freight.

Based on CSIRO modelling (which focussed only on milk and cheese production), **it is estimated that one megalitre of raw milk supports around 575 vehicle trips and 1.5 unique origin-destination paths¹⁵ in Australian dairy processing supply chains.**^{16,xxxix} For 2020-21 (with around 8.8 billion litres of raw milk), **this equates to an estimated 5.1 million vehicle trips and 12,888 unique origin-destination paths.** Most of the associated transport costs (78.4%) are expected to result from trips occurring after the point of processing (Figure 4.1).

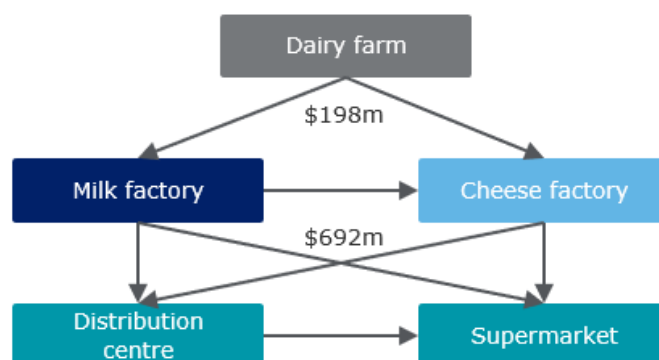
¹³ In 2019-20 dollars

¹⁴ Correspondence with ADPF. Limited data exists on milk distribution and transport. The Productivity Commissionⁱⁱⁱ reported in 2011 there were 745 milk distributors in Australia employing about 2,200 staff.

¹⁵ A path can be a specific farm to a specific storage or processor

¹⁶ Based on 5.5 million vehicle trips between 2013 and 2016, and an average of 9.6 billion litres of milk produced during that period.

Figure 4.1: Stylised dairy freight task map and transport costs



Source: Adapted from CSIRO¹⁶

CSIRO also estimated freight transport associated with the dairy supply chain cost industry around 9 cents per litre between 2013 and 2016. **For 2019-20, the cost of freight transport in Australia's dairy processing supply chain is estimated at around \$890 million.**¹⁷

As a share of total transport costs incurred by agricultural supply chains in Australia, CSIRO estimated dairy to have accounted for approximately 15.1% of the total between 2013 and 2016.¹⁶ However, this share is expected to have varied considerably over the period, largely due to variation in seasonal conditions. For example, widespread and timely rainfall saw Australian crop production 34% higher in 2020-21 relative to that averaged between 2013 and 2016, when cropping accounted for a third of all freight costs. By contrast, meat production was 7.6% lower in 2020-21 than that averaged between 2013 to 2016 (when the industry accounted for around 20% of freight costs) as herd and flock rebuilding accelerated across Australia.

4.1.3 Domestic consumers and export markets

4.1.3.1 Australian consumption of dairy products

According to Dairy Australia, Australians consumed around 319 litres of dairy products in 2019-20.^{18,ix} Milk is the primary dairy product consumed in Australia (on a weight basis) with Australians consuming, on average, 97 litres of milk per person in 2019-20 (Table 4.2).^{xi} This in part reflects Australia's high coffee intake. Around 85% of coffee consumed in Australia is drunk with milk, with lattes, flat white and cappuccinos accounting for 72% of coffee sold.^{xii}

Australia's milk and coffee consumption patterns are reflected in the high share of dairy sales that occur through food services and hospitality venues (27%). This is however not the largest share, with supermarkets accounting for 38% of domestic sales. Convenience stores are also significant avenues through which Australian consumers purchase dairy products (33%).^v

Table 4.2: Australian per capita dairy product consumption

Year	Milk	Cheese	Butter	Yogurt
<i>Units</i>	<i>Litres</i>	<i>kg</i>	<i>kg</i>	<i>kg</i>
2017-18	100.7	13.6	4.7	9.0
2018-19	98.6	13.5	4.0	9.5
2019-20	97.0	13.6	4.1	9.4

Source: Dairy Australia^{xi}

¹⁷ This is largely unchanged from that estimated by CSIRO, with CSIRO estimates projected forward using milk production and transport prices indexed by transport Consumer Price Index changes (ABS cat. No. 6401.0)

¹⁸ In milk equivalent terms.

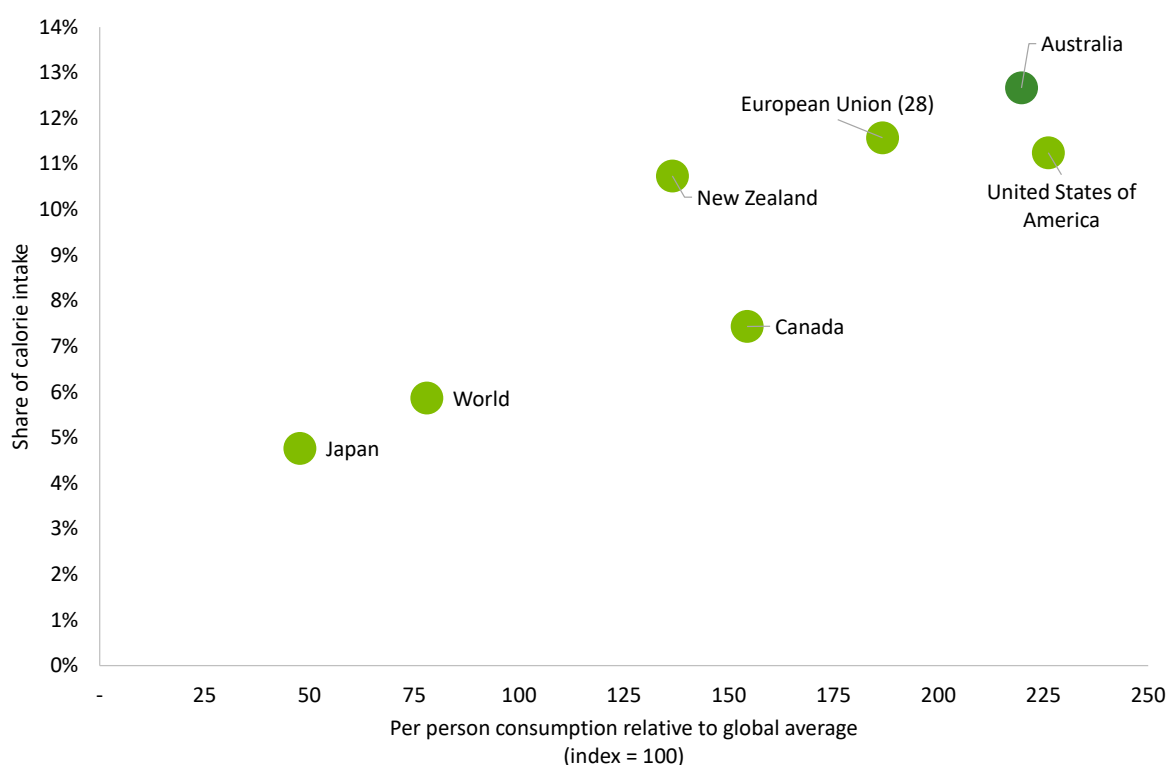
Not only does the dairy processing industry service a diverse set of supply chains, but it produces an expansive array of products to meet evolving consumer demands. For example, a recent survey found strong growth in purchases of prepared products between 2015-16 and 2018-19 alongside greater soft cheese purchases such as Brie and Camembert.^{xlii}

While remaining relatively high, dairy consumption has experienced a decline in recent years. This in part reflects strengthening competition from alternatives to cow's milk. A range of plant-based products have grown strongly in terms of market presence and consumer preferences in Australia in recent years. This has been led by soy and almond milk which experienced an annual growth rate of 7.2% between 2015-16 and 2019-20 with revenue estimated at around \$300 million in 2019-20.^{xliii}

Cow's milk consumption also varies considerably across Australia's diverse population. Dairy is of particular importance for Australia's lowest income households, providing a cost-effective source of protein and fats. For households in the lowest income quintile (bottom 20%), expenditure on dairy products are estimated to account for more than 8% of total food expenditure. This compares with 5.4% for Australia's highest income households and 6% on average across Australia.^{xliv}

Compared to other countries, Australia is one of the largest consumers of dairy products in per capita terms. On average, Australians consumed around 220 kilograms of dairy products between 2014 and 2018, nearly 3-times the global average.^{19,xlv} Compared to other developed countries, Australia sits alongside the United States (226 kg) as outliers compared to the European Union (189 kg), New Zealand (137 kg) and Canada (154 kg).¹⁹

Chart 4.1: Dairy product consumption, average per person and share of total food intake, 5-year average to 2018



Note: Includes milk products and butter

Source: United Nations¹⁹

¹⁹ Differences between Dairy Australia and United Nations estimates of consumption reflect differences in scope, approach and conversion factors.

This relatively high level of consumption in part is driven by high Australian incomes which mean total food intake more generally is relatively high. However, it also reflects strong preferences among Australian consumers for dairy products with dairy's share of total calorie intake around 13% in Australia.¹⁹ This is also similar to the European Union and United States, which are both more than double the global average.¹⁹

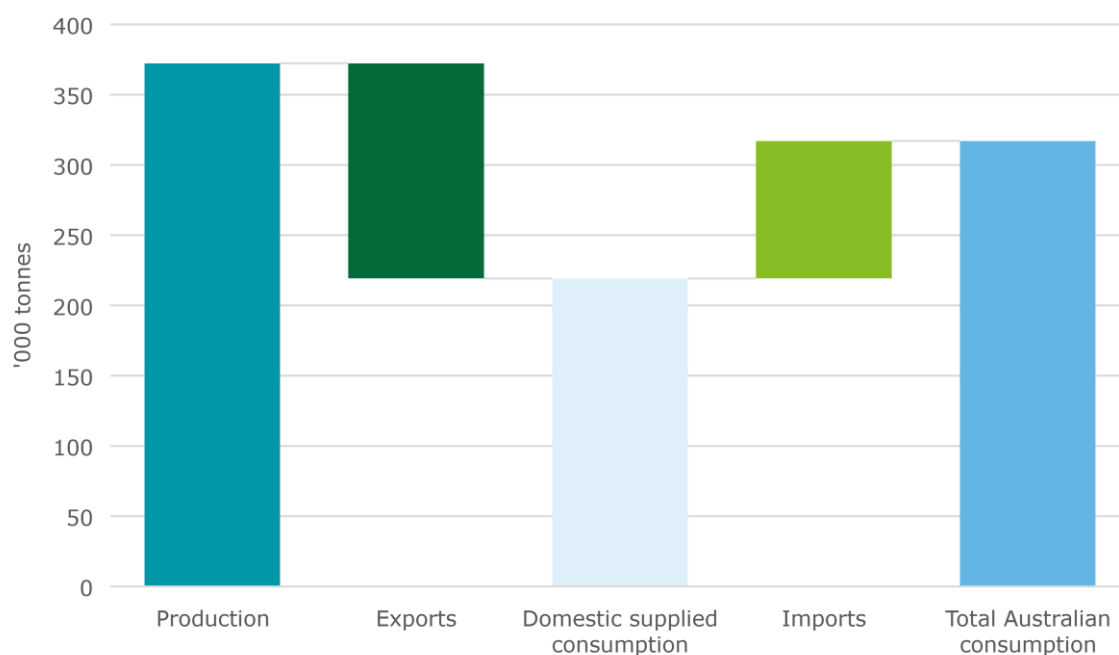
4.1.3.2 Dairy imports

Not all dairy products consumed by Australians are produced by the domestic market. Australia imports a range of dairy products which generally face a limited number of tariff and non-tariff barriers.^{xxv} **In 2019-20 Australia imported \$1.7 billion of dairy products** accounting for 0.6% of the total value of imports.^{xlvi}

Most dairy imports (90% by value) are cheese and consist of lower value processed and block cheeses from New Zealand and the United States, as well as higher value specialty cheeses, (e.g. Gouda, parmesan and brie) from Europe.^{xxv} In 2019-20, imports from New Zealand accounted for half of the total, followed by the European Union (around 30%) and the United States (15.1%).^{xlvi}

Dairy imports are mainly used to complement Australian production. In 2020 for example, imports accounted for 31% of total cheese consumption and were around two-thirds the Australian volume exported that year (Chart 4.2).^{xxv}

Chart 4.2: Estimated Australian cheese supply and use, 2020



Source: Dairy Australia^{xlvii}, UN Comtrade^{xlvi}

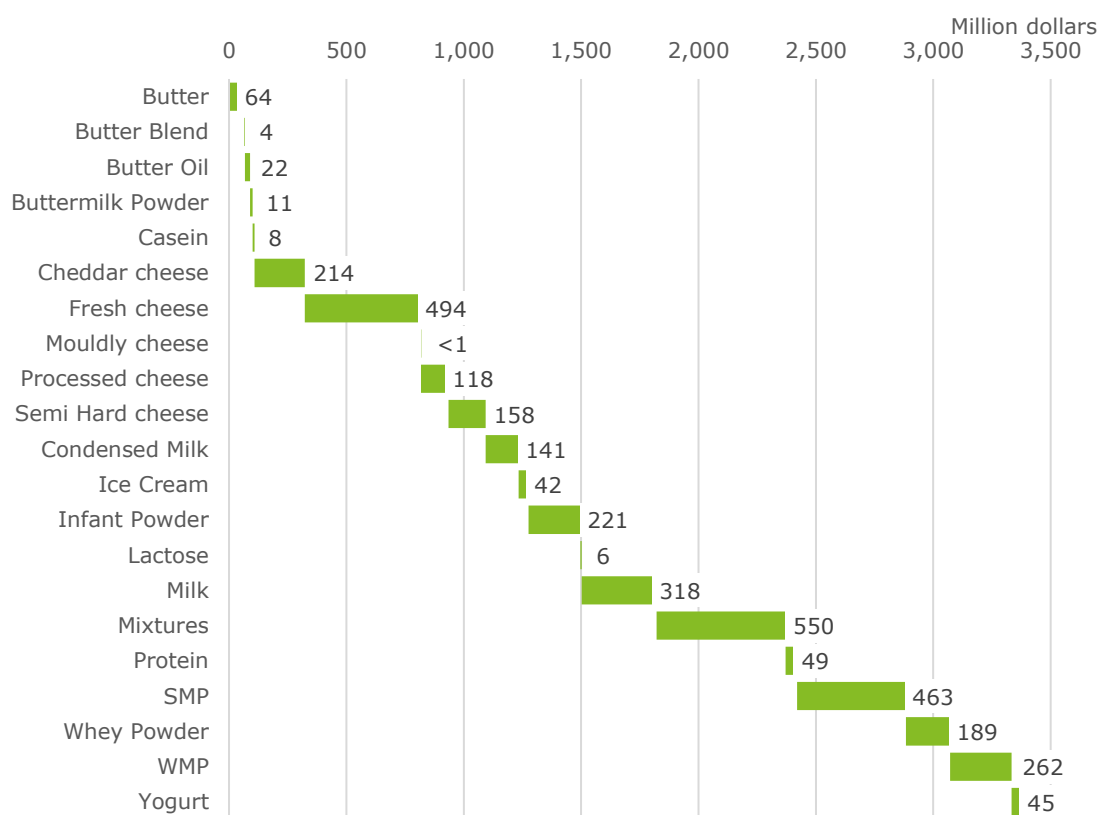
4.1.3.3 Exports

In addition to servicing Australia's sizeable domestic market, dairy processors also supply a diverse array of export products and supply chains. **Dairy Australia estimates that 29% of production is exported with the value of trade totalling \$3.4 billion in 2019-20.**^v Export shares vary considerably across Australia, with exports accounting for 74% of Tasmanian production, but just 3% in Queensland (as the state focuses on the domestic market).^v

The value of Australian dairy exports in 2019-20 was 5.0% higher than the average of the last 10-years (\$3.2 billion in 2019-20 dollars).^v This recent increase has mostly been driven by milk (up \$125.3 million), mixtures (\$105.3 million) and fresh cheese (up 149.4 million).^v Higher exports of these products was somewhat offset by large reductions in skim and whole milk powders (collectively down \$221.8 million) as the industry steadily shifted toward a more diversified

portfolio of higher value products.^v The diverse array of dairy product exports is detailed in Chart 4.3.

Chart 4.3: Value of dairy product exports by category, 2019-20



Source: Dairy Australia^v

Recent growth in dairy exports has also resulted in a growing share of total agricultural exports.

In 2019-20 dairy is estimated to have accounted for 7.0% of all agricultural exports up from 6.2% in 2016-17. Despite this growth, dairy's share of exports remain well below the 10% shares observed in the late 1990s and early 2000s.^{v,vii}

Exports are concentrated in south-east Australia as a result of a number of factors including climatic conditions and milk production. In 2019-20, Victoria accounted for 69.4% of the total volume of Australian dairy exports (at 526,000 tonnes). Tasmania (70,000 tonnes and 6.9% of the total) was the next largest contributor, followed by NSW and Western Australia (both 52,000 tonnes). Smaller volumes were exported from Queensland (17,000 tonnes) and South Australia (40,000 tonnes) (Chart 4.4).^v

Around 85% of all dairy exports are shipped through the Port of Melbourne. This in part reflects the dominant proportion of production and export orientation of Victorian processors. However it is also because Victoria plays a co-ordination and consolidation role, pulling export ready products from across Australia. For example, almost all of Tasmanian exports were loaded at the Port of Melbourne as well as around 90% South Australian exports. Smaller but significant Port of Melbourne volumes were also recorded for NSW (36%) and Queensland (17%) dairy exports.^v

Fremantle, Western Australia was the second major port for dairy products, accounting for around 10% of total exports, while ports in Sydney (3%) and Brisbane (2%) saw only small volumes of dairy exports.^{xlviii}

Most imports are also unloaded at the Port of Melbourne (around two-thirds of the national total). Sydney (around a quarter of the total) and Brisbane account for the remainder, reflecting their large populations.^{xlix}

Chart 4.4: Share of dairy product export volume by state of origin, 2019-20



Source: Dairy Australia^v

4.2 Environmental and sustainability contributions

Through its activities and relationship with its supply chain, the dairy processing industry has an environmental footprint. This section outlines the environmental challenges the industry faces and its efforts in the sustainability arena.

4.2.1 Stationary energy use

Dairy processing consumes energy through the use of refrigeration, space heating and cooling in addition to machinery operation to process raw milk.^{xvi} In 2019-20, Australia's dairy processing industry consumed 10.9 Petajoules (PJ) of energy.^{xv}

This was 4.6% lower than the previous year (11.4 PJs) with the industry accounting for a small share of the manufacturing (1.3%) and Australian totals (0.2%).^{20,xiv} Compared to other industries in Australia, dairy processing is relatively less energy intensive. In 2018-19 for example, dairy processing used 926.7 GJ of energy per million dollars in revenue. This was around a third of the average for manufacturing as a whole (2,656.4 GJ/\$m in revenue).^{ii,xiv}

Across the dairy products supply chain, dairy processing is roughly twice as energy intensive as on-farm milk production.ⁱ However compared to overseas dairy processors, Australian energy intensity (at 1.2 TJ per ML of milk received in 2019-20) is broadly comparable. In New Zealand for example Fonterra reported an energy intensity of 1.4 TJ per ML in 2017-18.^{ii,21}

Energy costs for Australian dairy processors tend to be split evenly between grid electricity and natural gas.ⁱⁱⁱ However energy sources (and intensity) differ markedly by product. For example, milk powders require 1.7 times as much electricity as cheddar, and 6.0 times as much thermal energy due to evaporative processes.^{liii}

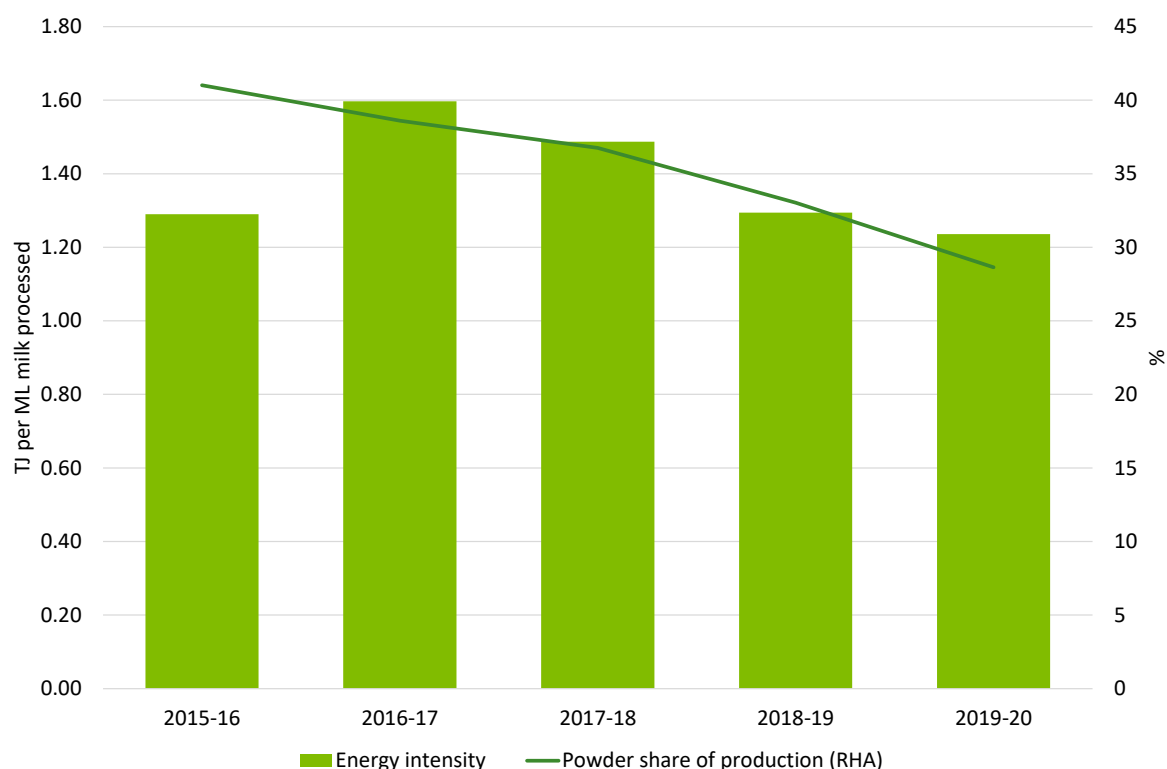
²⁰ Comparative shares are for 2018-19, as latest available data.

²¹ The Productivity Commissionⁱⁱⁱ reported energy intensity statistics for Australia's dairy processing industry, Ireland and Netherlands as being comparable across butter, cheese, milk powder and whey products.

Dairy processing's energy intensity in 2019-20 was 12.8% below the average of the 5 years prior (1.4 TJ per ML; Chart 4.5).^{xv} Much of this decline has occurred over the last three years, **driving a 24.5% reduction in total energy use to 2019-20.**

Reduced energy use has been driven in part by a shift in industry focus away from energy-intensive skim milk powders to higher value products (principally cheese). It also reflects improved energy efficiency within the dairy processing industry, integrating renewables and other energy saving innovations into manufacturing sites. Burra Foods for example installed 600 square meters of solar panels in 2017 before entering into a 10-year agreement to source up to 90% of its energy needs from renewable sources.^{xvi,liv}

Chart 4.5: Dairy processing energy intensity and milk powder share of dairy product production volumes



Notes: Powders includes skim milk and whole milk powder; total production includes cheese, butter and powders.

Sources: Dairy Australia^{xv}; ABARES^{vii}

4.2.2 Greenhouse gas emissions

Greenhouse gas emissions ("emissions") are generated throughout the dairy products supply chain. In 2019-20 dairy processing generated 1.2 million tonnes of carbon dioxide equivalent (CO₂e; includes scope 1, 2 and 3 emissions) **accounting for 0.2% of Australia's total emissions.**^{xv,liv} As a share of total supply chain emissions dairy processing accounts for only a small portion with approximately 70% to 95% of emissions generated on-farm.^{lvi}

Most emissions (more than 90%) associated with dairy processing are a direct result of the industry's energy consumption and the national grid's reliance on non-renewables.^{xvi} Dairy processing also generates emissions through the combustion of Liquid Natural Gas.²²

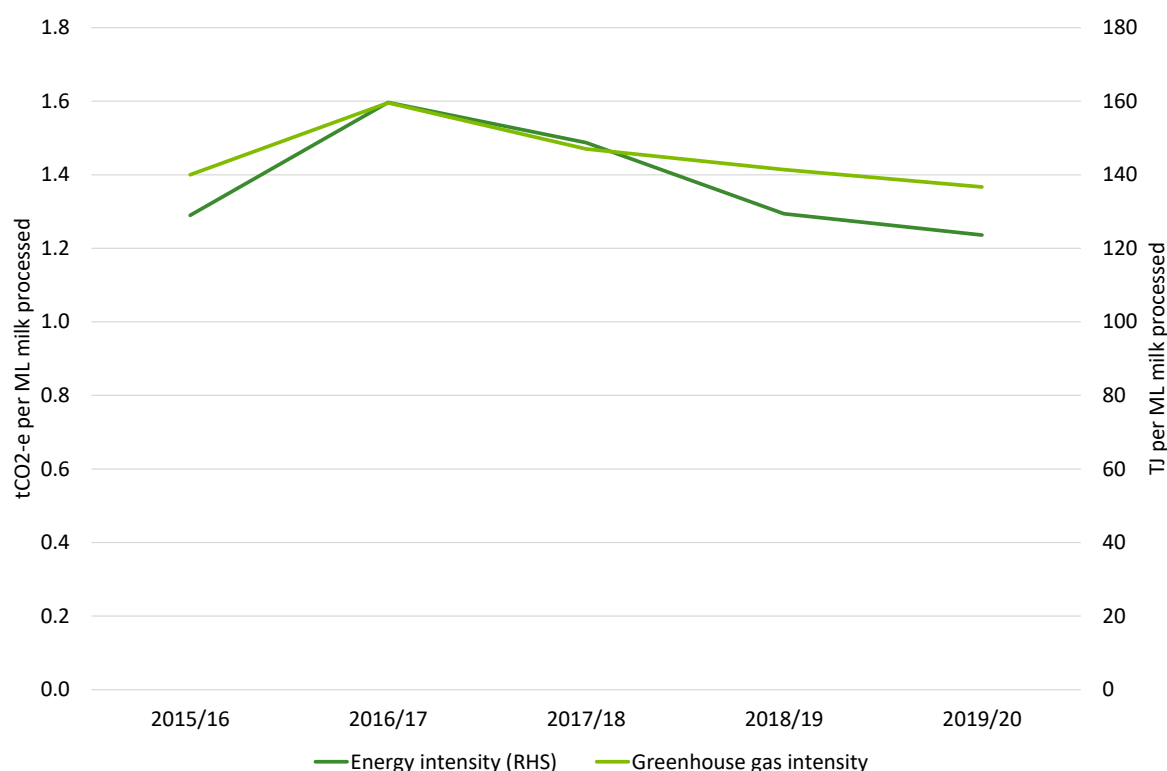
Emissions intensity differs considerably across Australia's jurisdictions reflecting the sources used to generate electricity. Dairy processing facilities in Tasmania, for example, principally make use of renewable (hydro) electricity. This contrasts with New South Wales and Victoria where renewable sources accounted for just 15.6% and 21.9% of electricity respectively in 2018-19.^{xiv}

²² In 2012-13 (latest available) dairy processing accounting for 42% of food manufacturing industrial gas use.^{liv}

In 2019-20 Australia's dairy processing industry was estimated to produce around 137 tonnes of CO₂e per ML of milk processed. In recent years, emissions intensity has declined, falling 14.4% from a recent peak of 160 tonnes of CO₂e per megalitre in 2016-17. This fall in emissions intensity has driven **a 23.5% reduction in total dairy processing industry emissions.**^{xv} During this period, Australian dairy processing reduced emissions by a larger degree than the Australian total, which fell 11.1%.^{lv}

This trend likely reflects, in part, the growing use of alternative energy sources among Australian dairy processing. According to Dairy Australia,^{lvii} an increasing number of processors are supplementing fuel supplies with biogas alongside a growing numbers of food processors utilising renewable energy sources, mainly solar Photovoltaic (PV). These changes have been supported by a steady decarbonisation of the Australian electrical grid.²³

Chart 4.6: Emissions and energy intensity of Australia's dairy processing industry



Source: Dairy Australia^{xv}

Australia's dairy supply chain is considered to be relatively low emissions intensive in a global context.^{lvi} However, despite the reductions noted above, when focusing on processing's emissions Australian lags much of the rest of the world owing to the high portion of non-renewable energy use. In New Zealand for example emissions intensity in 2018-19 was estimated at 103 tCO₂-e per ML of milk collected, nearly 25% below that of Australia despite relatively similar energy use requirements (Section 4.2.1).

In recognition of the whole dairy supply chain's contribution to this global problem, processors are supporting emissions abatement on dairy farms. In 2020 for example Fonterra partnered with Sea Forest to commence on farm trials of a seaweed feed supplement in Tasmania, trials of which demonstrated the potential to reduce methane emissions by more than 80%.^{lviii}

²³ In 2018-19 renewables' share of electricity generation was 19.7%, up from 8.6% at the start of the decade.

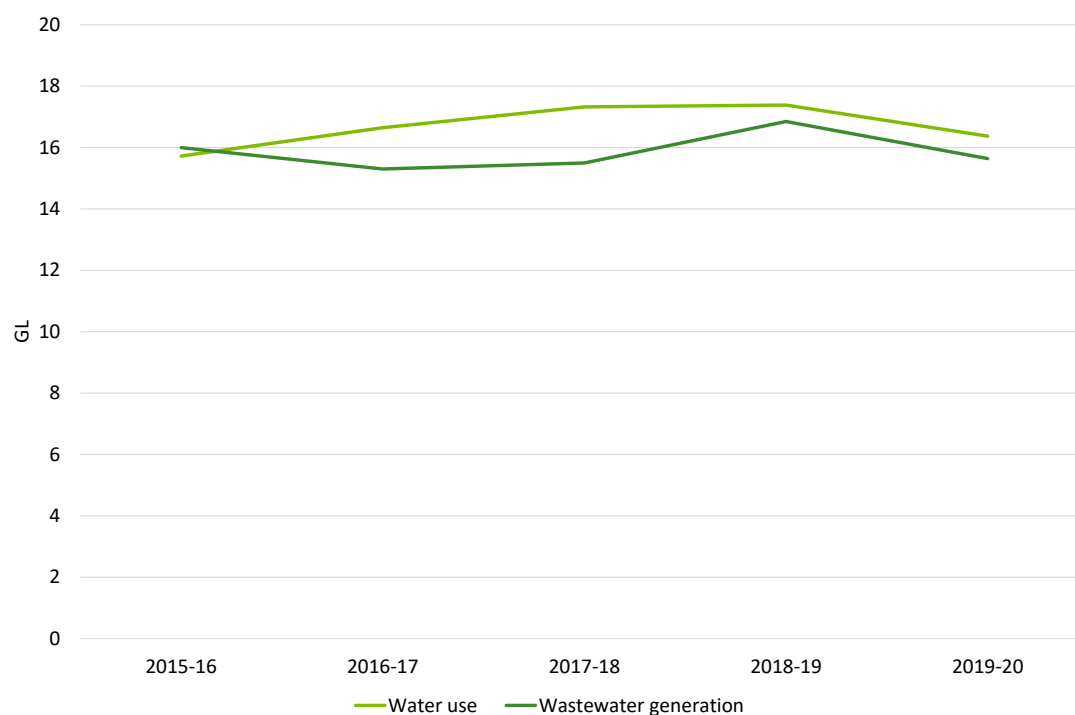
4.2.3 Water use

Water is used in dairy processing predominantly for site and equipment cleaning. A range of other processes also require water including pasteurisation, cooling towers and supplying boilers. Most often processors use town water, but other sources include river water, irrigation channel water and bore water. Reclaimed condensate also accounts for a significant portion of total water use and is typically limited to activities separate from food products.

In 2019-20 Australian dairy processing used 16.4 gigalitres of water.^{xv} This was 5.8% lower than 2018-19, but contrasts with a recent trend of increased water use. Between 2015-16 and 2018-19 water intensity rose 21.4% to 2.0 litres of water per litre of milk processed.^{xv} This increase has been driven by a shift to higher value but more water intensive products (such as cheese and yoghurt).^{xxv}

Over the entire life cycle of dairy products (including milk production on farm, transportation and dairy processing) 99% of total water consumption is attributable to the farm.^{lix} Globally, Australia's dairy processing industry is a moderate water user. Australian dairy processing is comparable to Ireland which uses 0.7 – 2.0 Litres of water per Litre of milk processed (L/L). Australia is also comparable to the United Kingdom (0.6-1.8 L/L), but well below that in continental Europe, where water intensity ranges between 2 and 4 L/L.^{lx, lxi, lxi, lxiii}

Chart 4.7: Australia's dairy processing industry water use and wastewater generation (Gigalitres)



Source: Dairy Australia^{xv}

Rising water use by Australia's dairy processing industry has occurred alongside significant investments in improving in water use efficiency. In 2020 for example, Bega's Koroit site introduced water monitoring to identify 20 megalitres of potable water being diverted to effluent during milk evaporation. A subsequent process change allowed the equivalent of eight Olympic swimming pools each year to be recovered.^{24, lxiv}

4.2.4 Landfill diversion

Solid waste generated by dairy processors predominantly includes packaging waste such as cardboard, cartons, paper and plastic, as well as general building, office and maintenance waste.^{xvi}

²⁴ Assumes an average Olympic swimming pool contains 2.5 megalitres.

A 2019 report^{xvii} found dairy processing accounted for 36% of food waste generated by the food manufacturing sector (around 634,000 tonnes per annum). However, most of this is either evaporated or recovered through land application. According to Dairy Australia,^{xv} **14,891 tonnes of waste was sent to landfill in 2019-20, down 3.0% on the previous year.**

Waste disposal rates have remained largely unchanged in the past 5 years at around 1.5 tonnes per million litres of milk processed. The rate of waste diversion from landfill²⁵ has also fluctuated around 80% during this period. In 2019-20, the dairy processing industry reported diverting 39.2 million tonnes of waste.^{xv}

As a ratio of its direct contribution to the Australian economy, dairy processing waste rates equate to around 70 tonnes per million dollars of value-add. This is significantly below that for the manufacturing sector which averaged 115 tonnes per million dollars in value-added between 2016-17 and 2018-19. However dairy processing produces more waste per dollar of value-added compared to the economy as a whole, which averaged 35 tonnes per million dollars in value-added over the same period.^{lxv}

The dairy industry are currently developing a Dairy Sector Food Waste Action Plan that will identify practical and commercially-relevant solutions to halve food waste across the dairy supply chain by 2030.^{lxvi} The action plan will build on existing efforts including the Dairy Packaging Roadmap which will provide a blueprint for the industry to help meet various 2025 packaging targets, across packaging formats, collection and recycling systems. While the Wastes to Profits Project is developing business solutions and new technologies to find markets for the industry's waste materials.^{xv} One example of innovation in managing the industry's waste footprint includes the integration of renewable cartons (made from wood fibres and sugarcane) across Brownes Dairy's entire milk carton range in 2019.^{lxvii}

4.2.5 Corporate social responsibility

Individual processors approach the issue of Corporate Social Responsibility (CSR) independently based on their own priorities and commercial environment. Bega Cheese's CSR framework^{lxiv} for example lists priorities that include: food nutrition; diversity; inclusion and equality; greenhouse gases; water sustainability; and packaging. The dairy processing industry does not have a defined collective approach to CSR.

The Australian Dairy Industry Sustainability Framework covers many of the above CSR elements, including human rights. Legislative changes in 2018 also require any company operating in Australia with revenue greater than \$100 million to report on supply chain risks of modern slavery.^{lxviii} Subsequently a human rights industry position statement was publicly released in 2019 and Saputo Dairy Australia was the first dairy processor to provide its modern slavery report. Other dairy companies have, or are in the process of meeting their regulatory requirements (see for example 2020 statements by Bega Cheese^{lxiv} and Brownes Dairy^{lxix}).

4.3 Contributions to regional Australia business environment

Most dairy processing activities occur in Australia's regions. A survey of processors for this report found that of the 49 processing sites managed by respondents in 2019-20, 37 were located in regional areas. Dairy processing's decentralised footprint means the industry makes important contributions to regional economies. The sector also contributes other elements to support regional businesses, such as investment, skills and training, achieving social responsibility goals, and promoting health and safety.

4.3.1 Capital investment

Capital investment is a direct measure of manufacturers' spending or investment on assets such as machinery and equipment. For dairy processors, ongoing capital investment serves a range of purposes, supporting turnover, replacing assets and sustaining a pipeline of future innovation and growth. Dairy processing requires significant capital investment to acquire the specialised equipment and logistics capabilities required to handle raw milk. It also reflects the required

²⁵ Includes materials recycled or recovered

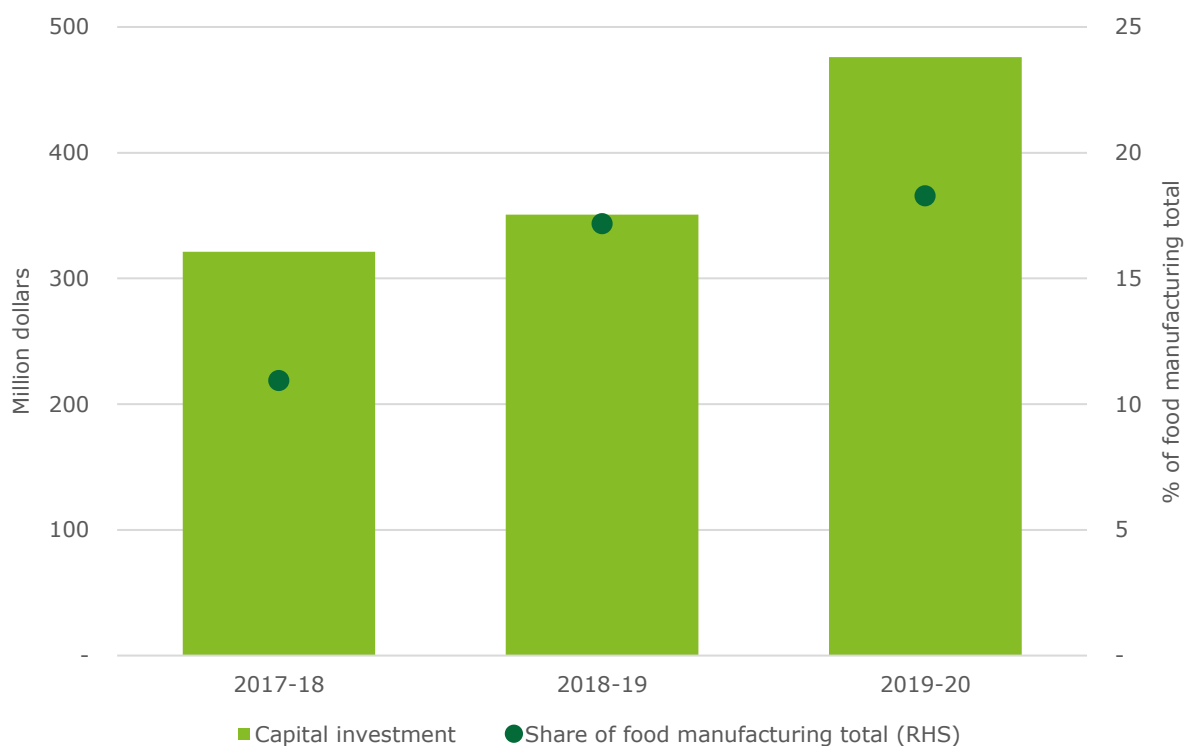
distribution channels and the importance of branding and market presence for the processing industry.

The magnitude of modern capital requirements in Australia is demonstrated through recent investments made by the processing sector. In 2014, \$150 million was invested by Murray Goulburn to build two new processing plants in Victoria and NSW.^{lxx} More recently, Fonterra doubled the processing capacity of its Stanhope cheese plant in 2018 at a cost of \$125 million, following a \$140 million rebuild and expansion in 2017.^{lxxi}

A survey of processors indicates that **capital investment for the industry averaged around \$383 million a year between 2017-18 and 2019-20.**^{xix} Annual industry investment grew significantly over the period, increasing from about \$321 million in 2017-18 to nearly \$476 million in 2019-20. Most capital investment occurred in regional areas, consistent with the distribution of dairy processing sites across Australia.

In recent years, dairy processing is estimated to have accounted for an average of 15% of total food manufacturing capital investment, although in 2019-20 it reached 18.3%.^{lxxii}

Chart 4.8: Processor capital investment and share of food manufacturing total



Sources: Survey of processors; ABS.

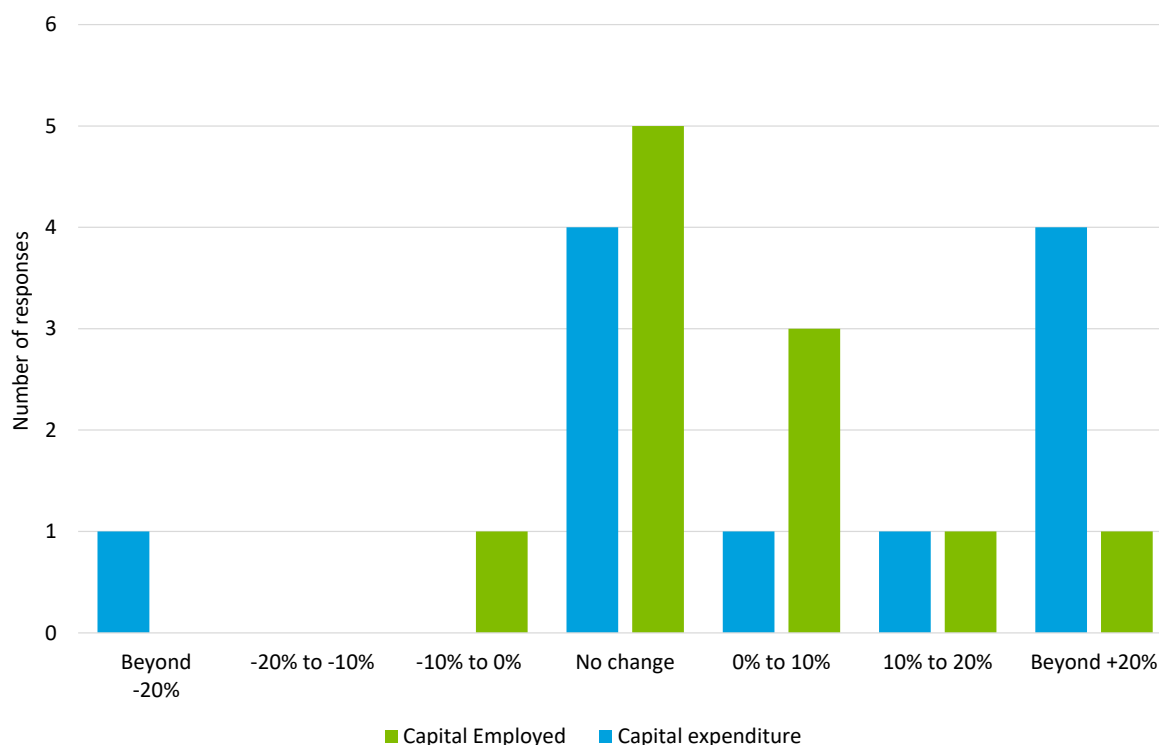
4.3.2 Capital employed

Capital employed refers to the accumulated investment in productive capacity in the dairy processing industry. The existing stock of capital, plus ongoing capital investment will drive the industry's economic contribution in the near future. **In 2019-20, an estimated \$6.1 billion in capital was employed across the dairy processing industry.**

Compared to 2017-18, the value of capital employed has more than doubled (up 115%).^{xix} The increase in capital also reflects recent significant acquisitions within the industry including for example, Saputo's purchase of Murray Goulburn.^{xxxii} These acquisitions support a higher value for the dairy processing's employed capital, alongside expanding capital expenditure that is contributing to the industry's stock of fixed capital.

Future capital employed and investment by dairy processors is expected to remain at current levels or increase. In response to the survey **five processors expect the stock of capital employed to increase in 2021-22 (relative to that in 2019-20) with four respondents anticipating capital employed to remain unchanged.** Only one respondent anticipated a reduction from current levels in capital employed (Chart 4.9).^{xix}

Chart 4.9: Expected change in capital employed and investment 2019-20 to 2021-22, number of processors



Sources: Survey of processors^{xix}

4.3.3 Research and Development investment

Innovation is a core aspect of dairy processing and is a fundamental pillar that supports competitiveness in domestic and export markets. Research and development (R&D) activities for the dairy processing industry include developing new or adapting existing products (for example, in response to changing consumer preferences processors have increased the range of sizes and packaging options available and introduced a range of health focused products).²⁶ R&D activities also include the adaptation of manufacturing activities (Bruinenberg, et. al^{lxxiii} for example provides a summary of innovations related to enzymes and cheese flavour).

Between 2017-18 and 2019-20, dairy processors were estimated to have invested around \$36 million in research and development.^{27,lxxiv} This equates to \$12.1 million per annum, although it has been highly variable with R&D investment made by Australian processors

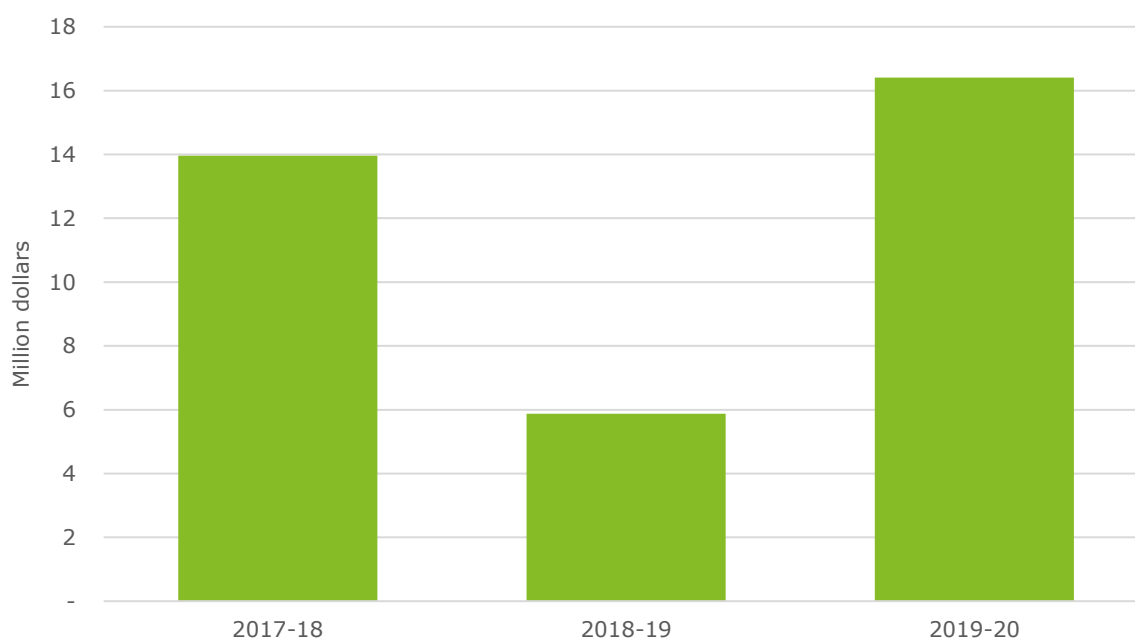
²⁶ See for example McMahon, Issues with lower fat and lower salt cheeses (2010). Australian Journal of Dairy Technology; Melbourne Vol. 65, Iss. 3: 200-205.

²⁷ The Australian tax incentive includes experimental activities:

- whose outcome cannot be known or determined in advance on the basis of current knowledge, information or experience, but can only be determined by applying a systematic progression of work that:
 - is based on principles of established science; and
 - proceeds from hypothesis to experiment, observation and evaluation, and leads to logical conclusions
- that are conducted for the purpose of generating new knowledge (including about creating new knowledge or improved materials, products, devices, processes or services).

in 2018-19 (\$5.9 million) around a third of that in 2017-18 (\$14.0 million) and 2019-20 (\$16.4 million; Chart 4.10).

Chart 4.10: Dairy processing R&D expenditure, million dollars



Sources: Survey of processors.^{xix}

The dairy processing sector's R&D expenditure accounts for **3.2% of the \$443.8 million invested by food manufacturing** in 2017-18.^{xx}

4.3.4 Occupational Health and Safety

The physical and mental health of employees is a key priority for the dairy processing industry and dairy supply chain more broadly. A range of hazards and risks exist on dairy processing sites, including for example, chemical risks (from cleaning and sanitation products), mechanical risks (from forklifts and other machinery) and manual handling (with cheese blocks for example weighing around 20kg).

This priority is reflected in Goal 3 of the Australian dairy industry's sustainability framework with targets that cover workplace fatalities, implementation of safety practices, lost time injury rates and workload measures. In 2018 (most recent data available) no fatalities were reported in dairy processing. In 2016-17 the rate of lost time injury frequency was estimated at 6.4, up from 5.6 on the previous report. Data on other indicators is either being collected or has not yet been reported.^{lxxv}

The dairy processing industry's performance in workplace health and safety has received formal recognition on a number of occasions. This includes for example Fonterra whose 2017 commitment to workplace health and wellbeing received an award in the 2017 WorkSafe Victoria Awards.^{lxxvi}

4.3.5 Diversity and inclusion

Workplace gender distributions and more broadly diversity are an increasingly important focus for across the Australian business landscape. It makes intuitive sense for Australian workplaces to better reflect the diversity of the national population and numerous studies identify internal business benefits from doing so.

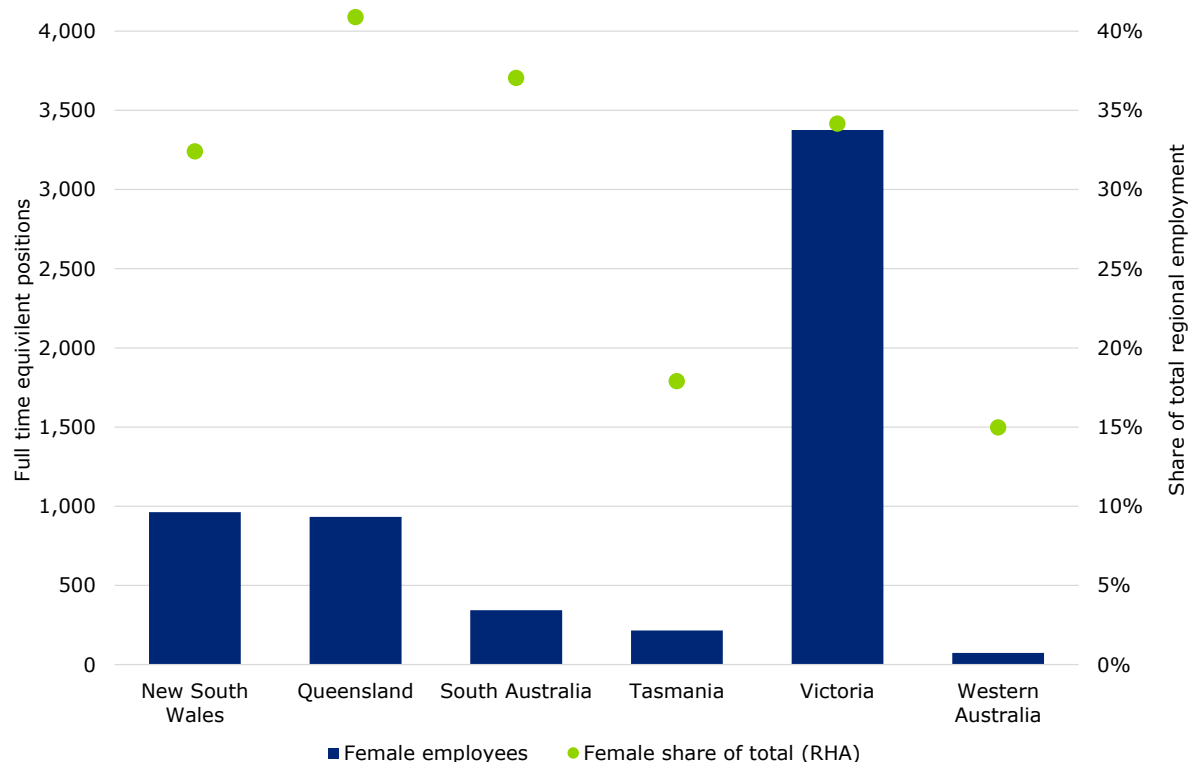
In 2020-21, the dairy processing industry employed 5,906 FTE women, accounting for 33% of total employment. This figure varies across Australia with Queensland (40.9%) having the highest female employee share. In NSW and Victoria females account for around a third of the total FTE

workforce. While Western Australia (15.0%) and Tasmania (17.9%) possess the lowest shares (Chart 4.11).^{xxi}

On average the female share of the dairy processing workforce sits marginally below that of the food processing industry where females account for 36% of the total. However, the industry compares favourably to the manufacturing industry where females only account for 24% of the total. The female share of the dairy processing workforces also sits below the share of females within the regional workforce and the Australian workforce at large (both 49%).^{xxi}

Based on businesses who are required to report to the Workplace Gender Equality Agency, the dairy product manufacturing industry performs well across many measures of gender equality in the workplace. In 2020, the full-time gender wage gap in the industry was 13% (compared to 20% across all industries) and the wage gap for managers was 8% (compared to 23% across all industries). The industry also compares favourably on metrics such as support for carers and paid parental leave policies with 82% of employers offering paid primary and secondary carer's leave (compared to approximately 50% across all industries).^{lxxvii}

Chart 4.11: Female FTE employees in dairy processing proportion of FTE workforce, 2020-21



Note: Excludes the Northern Territory.

Sources: ABS^{xxi}

4.3.6 Skills and training contribution of dairy processing

Human capital development is critical for regional socio-economic development. As such, many government policies focus on education, skills and training. The challenges of attracting and retaining skilled persons in regional Australia is highlighted by the Australian Small Business and Family Enterprise Ombudsman in a 2019 discussion of *"The workforce challenges of rural and regional Australia"*.^{lxxviii}

The Australian dairy processing industry plays an important role in regional development by offering employment opportunities across a range of both higher and lower skilled jobs in regional areas.

In 2016 (latest available data), **nearly a quarter (23%) of the dairy processing sector's workforce was categorised as being in the two highest skilled categories of jobs** (Chart

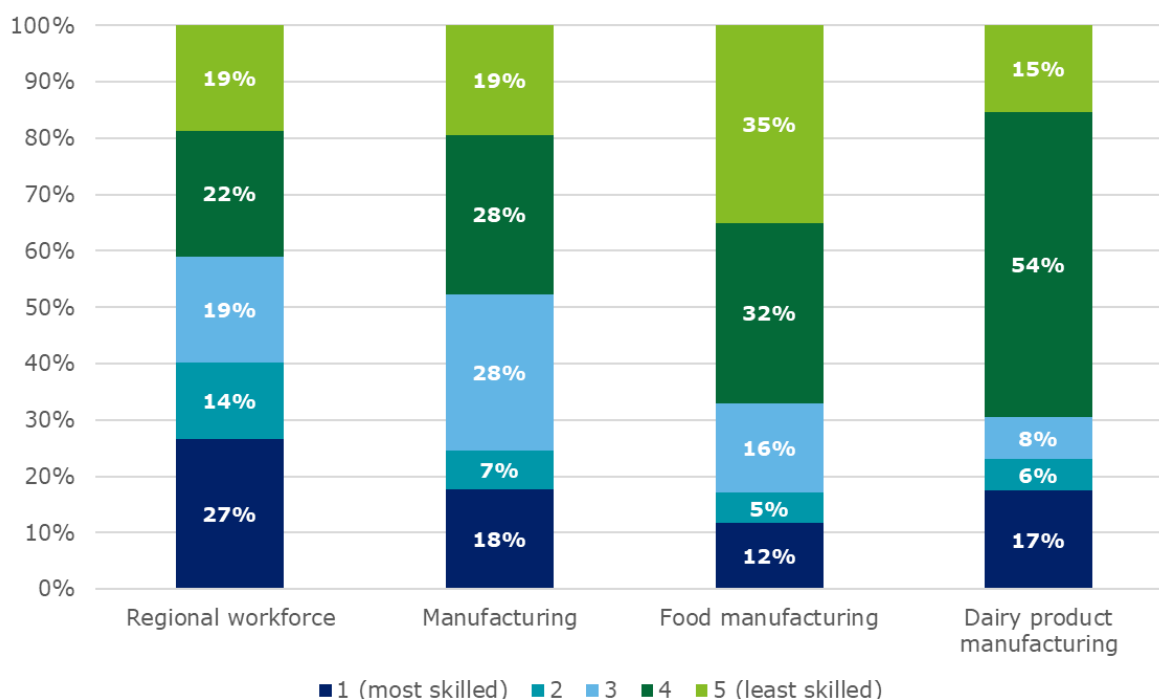
4.12). While most of these positions are based in urban areas, it is consistent with that of manufacturing as a whole (25%) and above the average for the food manufacturing industry (17%).^{xxii,xxiii}

Most dairy processing jobs are relatively lower skilled occupations.²⁸ In 2016 (latest available data) over half of all jobs within the industry were categorised as skill level 4.^{xxii,xxiii} These roles, predominantly comprising factory workers and truck drivers, provide important opportunities for people in regional areas who typically have access to fewer employment opportunities than their metropolitan counterparts.

Importantly too, the relatively low skilled workforce of the dairy processing industry is in fact more skilled than comparable industries. Only 15% of the dairy processing workforce is categorised as skill level 5 (the lowest level), compared to more than a third of all food manufacturing employees and 19% of the manufacturing sector.^{xxii,xxiii}

Dairy processors also take an active role in attracting people to the industry and upskilling their existing workforce. Bega Cheese for example, in partnership with TAFE NSW, has provided a nine-day-course to provide people with job ready skills and facilitate a rapid entry into the industry.^{lxxix} Hundreds of their existing production workers have also undertaken training in TAFE NSW's Institute's General Education, facilitating progression within the company.^{lxxx}

Chart 4.12: Skills distribution of selected industries and sectors in regional Australia



Note: Skill levels are as defined in the Australian and New Zealand Standard Classification of Occupations.²²

Sources: ABS^{xxii, xxiii}

²⁸ The *Australian and New Zealand Standard Classification of Occupations Skill levels* is a classification of all occupations by required skill. Each occupation is ranked on a five-point scale base on required education and training, previous experience and on-the-job training. Occupations at Skill Level 1 have a level of skill commensurate with a bachelor degree or higher qualification and those at Level 5 only require compulsory secondary education. Years of experience and training are substituted for formal qualifications for some occupations.

5 Conclusion

The dairy processing industry is a key part of Australia's agri-food supply chain and the Australian economy more broadly. This report provides a timely analysis of the industry's contribution to Australian GDP, employment and other aspects of the industry's predominantly regional operations.

From \$15.7 billion in revenue in 2019-20, dairy processing contributed a total of \$12.4 billion of associated value-added to the Australian economy and 70,158 FTE jobs. Most of dairy processing's contribution is indirect, with upstream industries accounting for three quarters of dairy processing's value-added (\$9.3 billion) contribution and 71% of its employment (49,764 FTEs) contribution.

Importantly, many of these aspects are concentrated outside Australia's capital cities. Of dairy processing's direct workforce, 56.5% are estimated to be located in regional areas. In addition, the dairy processing industry's strong indirect contribution means that for every dollar of value-added in dairy processing, the industry supports \$3.0 of value-added elsewhere in the economy. Each FTE position in dairy processing also supports 2.4 FTE jobs elsewhere in the economy. These multipliers are similar to that observed in other food processing industries, but generally much higher than for other non-food manufacturing industries.

Beyond jobs and growth, the dairy processing industry also makes valuable contributions in areas such as sustainability. This is best demonstrated through recent strong reductions in energy use and emissions intensity (down around 24.5% and 23.5% respectively in the last three years).

Dairy processing has also demonstrated its ability to be a significant attractor of capital in Australia. Between 2017-18 and 2019-20, around \$383 million per annum of capital expenditure has been invested by Australian dairy processors. This accounted for around 15% of the total across all food manufacturing and when combined with around \$6.1 billion in employed capital will drive industry growth in the future.

Dairy processing's investment in the future also includes around \$12 million a year in research and development activities. The critical role of innovation in supporting competitiveness of Australian industry cannot be understated. In particular, research and development investments will assist dairy processors as they look to continue to deliver premiums on the commodity value of raw milk.

Through its manufacturing (which requires capital expenditure, use of other ingredients and energy), and other supply chain activities such as transport, marketing and storage, dairy processing increases the value of the raw milk it receives. Reflecting costs incurred by industry and consumer demand met by processors, products produced by Australian dairy processors were valued in 2019-20 at 3.3 times the cost of raw milk paid by processors.^{ii,vii}

The contributions of the dairy processing industry are occurring amidst an ever-evolving background of international and domestic challenges. Global megatrends affecting agribusiness industries are likely to impact the industry and its contribution to the Australian economy in the future. This includes issues such as productivity growth, global trade tensions, the need to attract investment, and rising consumer demand for sustainable outcomes. Future analysis will likely need to consider these issues and how they may impact the regional communities which rely on dairy processing.

Appendix A Input-Output modelling

Economic contribution studies are intended to quantify measures such as value-added, exports, imports and employment associated with a given industry or firm, in a historical reference year. The economic contribution is a measure of the value of production by a firm or industry.

All direct, indirect and total contributions are reported as gross operating surplus (GOS), labour income, value-added and employment (with these terms defined in Table A.1).

Table A.1: Definitions of economic contribution estimates

Estimate	Definition
Gross operating surplus (GOS)	GOS represents the value of income generated by the entity's direct capital inputs, generally measured as the earnings before interest, tax, depreciation, and amortisation (EBITDA).
Labour income	Labour income is a subcomponent of value-add. It represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour
Value-add	Value-added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value-added across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value-added measure can be thought of as the increased contribution to welfare.
Employment (FTE)	Employment is a fundamentally different measure of activity to those above. It measures the number of workers (measured in full-time equivalent terms) that are employed by the entity, rather than the value of the workers' output.
Direct economic contribution	The direct economic contribution is a representation of the flow from labour and capital committed in the economic activity.
Indirect economic contribution	The indirect contribution is a measure of the demand for goods and services produced in other sectors as a result of demand generated by economic activity.
Total economic contribution	The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

A.2. Definitional notes

When calculating the GOS for a typical for-profit firm or industry, income streams from government (such as transfers or production subsidies) are excluded as they are a transfer of public funds, not reflective of income generated by the activities of the firm or industry.

Similarly, value-added is typically calculated as GOS plus labour income net of subsidies; under the ABS Australian System of National Accounts (ASNA):

"A subsidy on a product is a subsidy payable per unit of a good or service. An enterprise may regard a subsidy as little different from sales proceeds. However, in the national accounts, subsidies are regarded as transfer payments from general government, enabling enterprises to sell their output for less than would otherwise be the case."

A.3. Value-added

The measures of economic activity provided by this contribution study are consistent with those provided by the Australian Bureau of Statistics. For example, value-added is the contribution the sector makes to total factor income and gross domestic product (GDP). There are a number of ways to measure GDP, including:

- expenditure approach – measures expenditure: of households, on investment, government and net exports; and
- income approach – measures the income in an economy by measuring the payments of wages and profits to workers and owners.

Below is a discussion measuring the value-added by an industry using the income approach.

A.4. Measuring the economic contribution – income approach

There are several commonly used measures of economic activity, each of which describes a different aspect of an industry's economic contribution.

Value-added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value-added across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value-added measure can be thought of as the increased contribution to welfare.

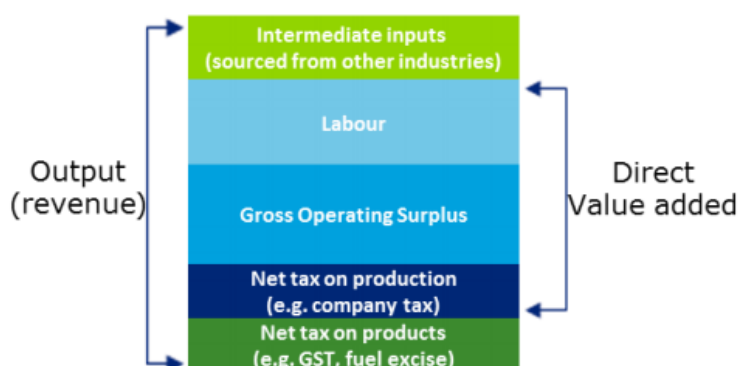
Value-added is the sum of:

- Gross operating surplus (GOS), which represents the value of income generated by the entity's capital inputs, generally measured as the earnings before interest, tax, depreciation and amortisation (EBITDA).
- Tax on production less subsidy provided for production. Note: given the manner in which returns to capital before tax are calculated, company tax is not included or this would double count that tax. In addition, it excludes goods and services tax, which is a tax on consumption (i.e. levied on households).
- Labour income, which represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour.

Figure A.1 shows the accounting framework used to evaluate economic activity, along with the components that make up output. Output is the sum of value-added and the value of intermediate inputs used by the firm or industry.

The value of intermediate inputs can also be calculated directly by summing up expenses related to non-primary factor inputs

Figure A.1: Definitions of economic contribution estimates



Contribution studies also generally outline employment generated by a sector. Employment is a fundamentally different measure of activity to those above. It measures the number of workers that are employed by the entity, rather than the value of the workers' output.

A.4.1. COVID-19 impacts on contribution estimates

The inter-industry linkages that underpin Australia's 2017-18 IO tables are likely to vary from that observed in 2019-20 and subsequent COVID impacted periods. This is because COVID-19 affects estimates of the economic contribution through both impacts to revenue and any shift in production processes or good and services produced.

As with the broader Australian and global economy, COVID-19 significantly impacted Australia's dairy processing sector over the last 3 to 4 months of the 2019-20 financial year. The onset of the pandemic (and the subsequent control measures) disrupted normal purchasing behaviours and supply chains. Dairy processing revenue fell marginally for the year (down just 0.4% on 2018-19) in part because milk production remained steady.^{ii,xiii}

In many instances, Australian dairy product supply chains were flexible and able to adapt. This is best demonstrated through Australian dairy product export volumes, which declined through the first half of 2020 before quickly recovering later in 2020. Domestically, some saw sales channels effectively disappear as demand from foodservice outlets, restaurants and cafes, and route-trade (i.e. service stations, mini-markets and corner stores) substantially decreased.^{lxxxi}

However, larger processing companies that produced consumer ready goods and serviced takeaway outlets saw a substantial increase in sales. Consumer product purchases also shifted in response to the pandemic. Flavoured milk sales, for example, were lower and route-trade diminished, while demand for butter surged as cooking (and baking) at home experienced a renaissance (referred to some as the 'Masterchef Effect').^v

A.5. Direct and indirect contributions

The **direct** economic contribution is a representation of the flow of labour and capital in the sector.

The **indirect** contribution is a measure of the demand for goods and services produced in other sectors as a result of demand generated by the direct economic activity of philanthropy in Australia. Estimation of the indirect economic contribution is undertaken in an Input-Output (IO) framework using Australian Bureau of Statistics IO tables which report the inputs and outputs of specific sectors of the economy.^{lxxxii}

The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

Other measures, such as total income or total exports are useful measures of economic activity, but these measures alone cannot account for the contribution made to GDP. Such measures overstate the contribution to value-added because they include activity by external firms supplying inputs. In addition, they do not discount the inputs supplied from outside Australia.

A.6. Input-output analysis

Input-output tables are required to account for the intermediate flows between sectors. These tables measure the direct economic activity of every sector in the economy at the national level. Importantly, these tables allow intermediate inputs to be further broken down by source. These detailed intermediate flows can be used to derive the total change in economic activity associated with a given direct change in activity for a given sector.

A widely used measure of the spill-over of activity from one sector to another is captured by the ratio of the total to direct change in economic activity. The resulting estimate is typically referred to as 'the multiplier'. A multiplier greater than one implies some indirect activity, with higher multipliers indicating relatively larger indirect and total activity flowing from a given level of direct activity.

The IO matrix used for Australia is derived from the ABS 2017-18 IO tables, the latest available IO data at the time of the analysis. The industry classification used for IO tables is based on the Australian and New Zealand Standard Industrial Classification (ANZSIC), with 114 sectors in the modelling framework.

A.7. Limitations of economic contribution studies

While describing the geographic origin of production inputs may be a guide to a firm or industry's linkages with the local economy, it should be recognised that these are the type of normal industry linkages that characterise all economic activities.

Unless there is unused capacity in the economy (such as unemployed labour) there may not be a strong relationship between a firm's economic contribution as measured by value-added (or other static aggregates) and the welfare or living standard of the community. The use of labour and capital by demand created from the industry comes at an opportunity cost as it may reduce the amount of resources available to spend on other economic activities.

In a fundamental sense, economic contribution studies are simply historical accounting exercises. No 'what-if', or counterfactual inferences – such as 'what would happen to living standards if the firm or industry disappeared?' – should be drawn from them.

The analysis – as discussed in the report – relies on a national IO table modelling framework and there are some limitations to this modelling framework. The analysis assumes that goods and services provided to the sector are produced by factors of production that are located completely within the defined region and that income flows do not leak to other regions.

The IO framework and the derivation of the multipliers also assume that the relevant economic activity takes place within an unconstrained environment. That is, an increase in economic activity in one area of the economy does not increase prices and subsequently crowd out economic activity in another area of the economy. As a result, the modelled total and indirect contribution can be regarded as an upper-bound estimate of the contribution made by the supply of intermediate inputs.

Similarly, the IO framework does not account for further flow-on benefits as captured in a more dynamic modelling environment like a Computerised General Equilibrium (CGE) model.

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