Economic Impact of the Dairy Industry in Regional Victoria

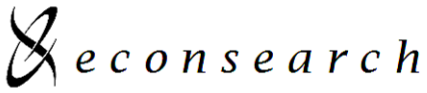
A report to

Dairy Australia

and

Victorian Department of Economic Development, Jobs, Transport and Resources

Prepared by



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ABBREVIATIONS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
DEDJTR	Victorian Department of Economic Development, Jobs, Transport and Resources
DEPI	Former Victorian Department of Environment and Primary Industries (now DEDJTR)
EBIT	earnings before interest or tax
fte	full time equivalent
GRP	gross regional product
GSP	gross state product
I-O	input-output
LGA	local government area
MS	milk solids
RDP	Regional Development Program
RISE	Regional Industry Structure and Employment

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EXECUTIVE SUMMARY

This report presents the economic impact of the dairy industry in 2014/15 and an accompanying set of regional economic multipliers for each of Dairy Australia's Regional Development Program (RDP) regions in Victoria and for Victoria as a whole. It provides a clear statement about the contribution made to the Victorian economy by both the Victorian dairy industry and the flow-on activity the industry creates.

Dairy production in Victoria is spread across three main RDP regions: Gippsland, Western Victoria and the Murray region. Whilst the Gippsland and Western Victoria RDP regions are located wholly within Victoria, the Murray region is located in both New South Wales and Victoria. As this report is focused on the economic activity in Victoria, the dairy activity that occurs in New South Wales has been omitted from the Murray region analysis. Consequently, the economic impact of the Murray region in its entirety (both NSW and Vic) will be larger than the impact estimated in the report.

From the analysis undertaken, the economic contribution of the Victorian dairy industry (both the farm and processing sectors) was estimated for each Victorian RDP region and for Victoria as a whole. The dairy industry's economic contribution was developed for four core indicators:

- *Output*: the total value of production
- *Gross Regional Product (GRP)*[1]: the contribution to the regional economy
- *Household income*: total value of income from wages, salaries and supplements
- *Employment*: Full-time equivalent (fte) jobs in the economy. Note, a typical job in the dairy industry works approximately 50 hours per week. This has been converted to an fte of 37.5 hours per week to ensure figures are comparable with other industries.

For each of these core indicators three impacts were measured:

- *Direct*: reflects the impact of the dairy industry activity
- *Flow-on*: reflects the subsequent activity created in the economy initiated by the dairy industry. This includes the production-induced effect (impacts created by the first round of expenditure made by the dairy industry and the subsequent 'waves' of expenditure this creates across the economy) and the consumption-induced effect (the impacts created by the increase in household expenditure due to the increase in household income associated with dairy industry employees).
- *Total*: reflects the combination of the direct and flow-on impacts

[1] In this report, Gross Regional Product (GRP) is used for each of the RDP regions and Gross State Product (GSP) is used for Victoria as a whole.

'The dairy industry contributes 2.0 per cent to Victoria's Gross State Product and underpins 54,635 fte jobs. This represent 2.2 per cent of the state's employment and creates 1.9 per cent of the state's household income.'

The dairy industry impacts illustrate the combined contribution of the dairy farming industry and the dairy processing industry. As shown in Table ES.1, the above figures represent the total contribution made by the dairy industry. This includes the direct contribution made by the dairy industry and the flow-on contribution made by other industries.

Among the three RDP regions in Victoria, the level of economic activity was directly related to the volume of milk produced and processed within the region. Consequently, the region with the highest volume of milk (Western Victoria) generated the largest amount of economic activity while the region with the lowest volume of milk (Gippsland) generated the least amount. This is largely a reflection of the higher output generated and the higher expenditure and employment needs associated with larger volumes of milk, both from production and processing.

It should be noted that the dairy industry's contribution to the total economic activity in Victoria is much greater than the sum of the RDP regions combined. This difference reflects the economic contribution made by the processing and corporate activity that occurs outside of the three RDP regions (mainly in Melbourne) as well as the flow-on activity this subsequently generates.

Table ES.1 Summary of the economic impacts of the Victorian dairy industry, 2014/15[a]

		Output ($m)	% of Region	% of Victoria	**GRP**[b] ($m)	% of Region	% of Victoria	**Income** ($m)	% of Region	% of Victoria	**Employment** (FTE)[c]	% of Region	% of Victoria
Western Victoria	Direct	2,361	5.0%	0.4%	794	3.1%	0.2%	401	2.9%	0.2%	6,885	3.9%	0.3%
	Flow-on	1,976	4.2%	0.3%	1,055	4.2%	0.3%	587	4.2%	0.3%	7,430	4.2%	0.3%
	Total	4,337	9.2%	0.7%	1,849	7.3%	0.5%	988	7.1%	0.5%	14,314	8.0%	0.6%
Murray	Direct	2,131	5.1%	0.3%	778	3.5%	0.2%	359	2.9%	0.2%	6,449	4.4%	0.3%
	Flow-on	1,840	4.4%	0.3%	991	4.5%	0.3%	557	4.5%	0.3%	7,189	4.9%	0.3%
	Total	3,971	9.6%	0.6%	1,769	8.0%	0.5%	916	7.4%	0.5%	13,638	9.4%	0.6%
Gippsland	Direct	2,116	3.7%	0.3%	778	2.3%	0.2%	352	2.2%	0.2%	6,024	2.9%	0.2%
	Flow-on	1,274	2.2%	0.2%	688	2.0%	0.2%	398	2.5%	0.2%	5,385	2.6%	0.2%
	Total	3,390	5.9%	0.5%	1,466	4.3%	0.4%	750	4.6%	0.4%	11,409	5.6%	0.5%
Victoria Total	**Direct**	**7,189**	**1.1%**	**1.1%**	**2,386**	**0.7%**	**0.7%**	**1,258**	**0.6%**	**0.6%**	**21,079**	**0.9%**	**0.9%**
	Flow-on	**8,916**	**1.4%**	**1.4%**	**4,645**	**1.3%**	**1.3%**	**2,620**	**1.3%**	**1.3%**	**33,556**	**1.4%**	**1.4%**
	Total	**16,105**	**2.5%**	**2.5%**	**7,031**	**2.0%**	**2.0%**	**3,878**	**1.9%**	**1.9%**	**54,635**	**2.2%**	**2.2%**

[a] See Section 3.2 for a breakdown of these economic indicators for the dairy farming and processing sectors in Victoria.

[b] For Victoria, GSP (Gross State Product) is used instead of the regional indicator, GRP (Gross Regional Product).

[c] A typical job in the dairy industry works 50 hours per week. This has been converted to an fte of 37.5 hours per week to ensure figures are comparable with other industries.

Source: EconSearch analysis

RISE models were developed for each RDP region and for Victoria as a whole. The RISE model used breaks the economy down into 78 sectors. Out of these, dairy farming was the 31st largest employer in Victoria, and the third largest employer in the agriculture sector (behind beef and sheep farming). Similarly, dairy processing was the 43rd largest employer in Victoria, and the second largest employer in the agricultural processing sector. In comparison, the five largest

employers in Victoria are currently the health and community services, retail trade, professional scientific and technical services, education and wholesale trade.

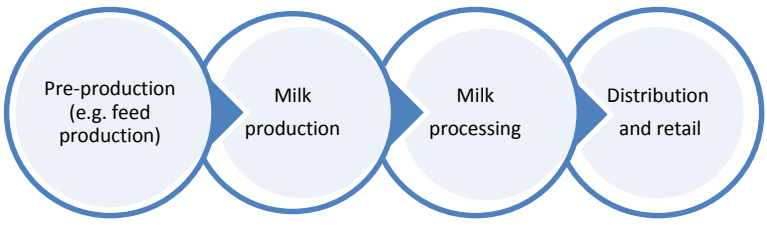
The RISE models highlight the greater presence the dairy industry has, in particular with employment, in regional economies in comparison to Victoria as a whole. This largely because economic impacts are typically experienced within the dairy region as a large amount of dairy economic activity occurs close to the area of production and is thus, within the dairy region. Consequently, the dairy farming sector is in the top ten sectors for employment in the Murray[2] and Western Victoria RDP regions, and in the top 15 sectors in Gippsland. Dairy processing also employs a relatively high number of people in the RDP regions, ranking within the top 20 sectors in Murray and Western Victoria, and 24th in Gippsland.

'For every $1 of dairy industry output in Victoria, $1.25 is created in flow-on economic activity, 99 cents is added to Gross State Product and 54 cents is created in household income in the state's economy. For every $1 million of dairy industry output, 7.61 fte jobs are created in Victoria'

Using the input-output relationships that are implied in each of the economic activity indicators (Table ES.1), various multipliers can be calculated. These summary measures can be used to indicate the current direct and flow-on economic contribution of an industry. Under certain circumstances multipliers can also be used for forecasting the impact of changes in demand for dairy industry output on other industries within an economy.

Because the RISE model (an extended version of the standard input-output model) is a demand driven model, multipliers represent the strength of linkages up the supply chain (i.e. the strength of the linkages between the dairy industry and the rest of the state or regional economy). The easiest way to consider this is to think of the dairy supply chain (Figure ES.1) in reverse. Consequently dairy farm multipliers (milk production) include linkages with pre-production industries but do not include linkages with dairy processing or distribution and retail sectors. The total dairy industry multipliers (dairy production and dairy processing), however, do include the linkages between dairy processing, dairy farming and pre-production.

Figure ES.1 Dairy industry supply chain



22 The Murray region considers the Victorian portion of the Murray RDP region and omits the NSW portion.

Multipliers are expressed in two ways in this report; as 'total' multipliers and as 'Type I and Type II' multipliers.

'Total' multipliers represent the impact on the rest of the economy of a unit increase in sales to final demand (i.e. what occurs in the economy if there is a unit increase in dairy industry sales). As shown in Table ES.2, 'total' multipliers have been calculated for output, GRP, household income and employment.

Table ES.2 Summary of the 'total' multipliers for the Victorian dairy industry, 2014/15[a]

		Output	GRP[b]	Household Income	Employment
Western Victoria	Direct	1.00	0.34	0.17	2.92
	Flow-on	0.84	0.45	0.25	3.15
	Total[c]	1.84	0.78	0.42	6.06
Murray	Direct	1.00	0.37	0.17	3.03
	Flow-on	0.86	0.46	0.26	3.37
	Total[c]	1.86	0.83	0.43	6.40
Gippsland	Direct	1.00	0.37	0.17	2.85
	Flow-on	0.60	0.33	0.19	2.55
	Total[c]	1.60	0.69	0.35	5.39
Victoria Total	**Direct**	**1.00**	**0.33**	**0.17**	**2.93**
	Flow-on	**1.25**	**0.66**	**0.37**	**4.68**
	Total[c]	**2.25**	**0.99**	**0.54**	**7.61**

[a] See Section 3.2 for a breakdown of these economic multipliers for the dairy farming and processing sectors in Victoria.

[b] For Victoria, GSP (Gross State Product) is used instead of the regional indicator, GRP (Gross Regional Product).

[c] Totals may not sum due to rounding.

Source: EconSearch analysis

Each of these multipliers are presented in 'per unit of output' terms, so that the total output multiplier represents the total dollar value of output per $1.00 of dairy industry output, the total GRP multiplier represents a total dollar value of GRP per $1.00 of dairy industry output, the total household income multiplier represents a total dollar value of household income per $1.00 of output and the total employment multiplier represents total fte jobs per *$1 million* of output.

The size of each multiplier depends on the ratio of the impact in relation to the direct output impact, which is used as the denominator in calculating the multiplier. For example, the total GRP multiplier for Western Victoria is 0.78, which is calculated from the Western Victoria figures presented in Table ES. 1: total GRP (1,849)/ direct output (2,361).

The difference in multipliers between each region is a reflection of this ratio, with larger multipliers simply having a higher indicator impact numerator in relation to the direct output denominator.

For 'direct' multipliers, this is a reflection of how the local dairy industry differs in each of the regions. For example:

- A larger output multiplier signifies that dairy industry has a greater flow-on impact across the regional economy (i.e. promotes a greater amount of economic activity). This may reflect a larger amount of regional purchase, a broader availability of dairy industry demanded products in that region or represent the size and integration of the local economy.
- A larger employment multiplier will signify that a region has a larger number of fte jobs per direct dairy output produced. This may be a reflection of the differences in the methods (i.e. technology) used in the region or other factors that result in a different level of employment.
- A larger household income multiplier will signify that a region has a larger amount of employee earnings per direct dairy output produced. This may be a reflection of the pay structure within the region or highlight a difference in the types of jobs within a region (i.e. higher paying positions).
- A larger GRP multiplier will signify that a region contributes more dollars to the economy per direct dairy output produced. This will reflect both a more profitable dairy industry (i.e. higher gross operating surplus) and/or a greater level of household income.

For 'flow-on' multipliers, the ratio is a reflection of how the rest of the economy links to the dairy industry. For example:

- The differences in the level of dairy industry input purchases.
- The capacity of the local economy to meet the dairy industry sector demands (i.e. are the dairy input demands purchased within the region).
- The size and integration of the local economy.

Each of these factors will influence the level of flow-on impacts that occur within a region. The extent of this flow-on effect in relation to the direct output impact will determine the value of the multiplier. As with the direct multipliers, if this ratio is high then the region will have a greater 'flow-on' multiplier.

This can clearly be seen in the difference between the RDP regions flow-on multipliers and those for Victoria as a whole. Victoria has a greater capacity to meet the dairy industry sector demands (i.e. less imports), has a larger economy, is more integrated (i.e. provides a greater amount of services and economic linkages) and contains a larger dairy industry (including the extra processing and corporate activity, mainly in Melbourne). Consequently, the flow-on impacts are greater in comparison to the direct output produced, resulting in Victoria having a much larger flow-on multiplier for each indicator than any of the RDP regions.

'Dairy industry to business interaction creates $1.59 of output, while dairy industry to business interaction plus household income expenditure creates $2.25.'

The second group of multipliers presented in this report are Type I and Type II multipliers. The Type I multiplier reflects the business to business interactions that occur within the economy. This is a reflection of the direct interaction the dairy industry has with other businesses and the

subsequent production-induced activity that occurs across the economy. The Type II multiplier reflects this same group of interactions but adds the subsequent consumption-induced activity that occurs within the economy when dairy industry employees spend their income.

Each of these multipliers is calculated using the 'total' direct and flow-on (production-induced plus consumption-induced) impact multipliers described in Table ES.2. The multiplier ratios are defined as follows:

Type I ratio = [direct impact + production-induced impact]/direct impact

and

Type II ratio = [direct impact + production-induced impact + consumption-induced impact]/direct impact

For example, the Western Victoria Type I and Type II employment multipliers have been calculated from the 'total' multipliers presented in Table ES.2; a direct multiplier of 2.92 and a flow-on multiplier of 3.15 (1.80 is production-induced and 1.34 is consumption-induced). The flow-on multipliers are broken down into both production-induced and consumption-induced within the report and may not always equal the total of their sum due to rounding.

As defined, the Type I multiplier includes just direct and production-induced effects. So to calculate the Western Victoria Type I employment multiplier (1.62, from Table ES.3) we apply the ratio to the Western Victoria employment multipliers from Table ES.2: (2.92+1.80)/2.92.

The same applies to the Western Victoria Type II multiplier. When we apply the Type II ratio discussed above, (2.92+1.80+1.34)/2.92, we get the Type II employment multiplier for Western Victoria, 2.08 (as shown in Table ES.3).

Table ES.3 Summary of Type I and II multipliers for the Victorian dairy industry, 2014/15[a]

		Output	GRP[b]	Household Income	Employment
Western Victoria	Type I	1.46	1.68	1.82	1.62
	Type II	1.84	2.33	2.46	2.08
Murray	Type I	1.51	1.71	1.95	1.68
	Type II	1.86	2.27	2.55	2.11
Gippsland	Type I	1.38	1.52	1.77	1.62
	Type II	1.60	1.88	2.13	1.89
Victoria Total	**Type I**	**1.59**	**1.86**	**2.03**	**1.78**
	Type II	**2.25**	**2.98**	**3.12**	**2.60**

[a] See Section 3.2 for a breakdown of these economic multipliers for the dairy farming and processing sectors in Victoria.

[b] For Victoria, GSP (Gross State Product) is used instead of the regional indicator, GRP (Gross Regional Product).

Source: EconSearch analysis

The Type I and Type II multipliers (Table ES.3) illustrate the same economic linkages as the 'total multipliers' but in a different format. Rather than be expressed per unit of output, the Type I

and Type II multipliers are expressed per unit of the relevant economic indicator. This means that the total output and the Type II output multipliers are the same because they are both expressed in terms of one unit ($1.00) of output. However, GRP, household income and employment Type I and Type II multipliers are different as they use GRP, household income and employment, respectively, instead of output.

For example, the Western Victoria 'total' employment multiplier is 6.06; 6.06 fte jobs for every $1 million of direct output (2.92 fte jobs directly in the dairy industry and 3.15 fte jobs in flow-on industries). The Western Victoria Type II employment multiplier, however, is 2.08, indicating that for each dairy industry job there are a total of 2.08 fte jobs in total, 1.00 fte jobs in the dairy industry and 1.08 fte jobs in other sectors of the economy (flow-on).

Like the 'total' multipliers, the difference between regions is a reflection of the difference in the ratio that calculates the multiplier. Regions with a larger Type I multiplier will have a larger production-induced impact in comparison to the direct impact. This reflects the actions of the dairy industry in that specific region. It may mean larger input purchases in the regional economy and/or a greater integration of the local economy with the dairy industry. The same applies to the Type II multiplier, but the consumption-induced impacts are added. Therefore, a larger Type II multiplier may reflect a larger production-induced impact and/or a larger level of dairy employee spending in the economy (i.e. consumption-induced effect).

'In Victoria, dairy farming is the second largest contributor to jobs in the agricultural sector and dairy processing is the second largest creator of jobs in the agricultural product processing sector.'

To provide perspective on the impact the dairy industry has in the Victorian economy, the Type I and Type II GSP and employment multipliers were compared to the corresponding multipliers for other sectors in the economy. Dairy farming was compared to five other agricultural industries, namely sheep, grains, beef cattle, vegetables and fruit and nut. Similarly, multipliers for dairy processing and comparative sectors, meat processing, fruit and vegetable processing and cereals processing (Table ES.4).

Table ES.4 Comparison of dairy multipliers to other agricultural industries, Victoria

	Agricultural Sectors						Agricultural Processing Sectors			
	Dairy Farming	Sheep	Grains	Beef Cattle	Vegetables	Fruit & Nut	**Dairy Processing**	Meat Processing	Fruit & Veg. Processing	Cereals Processing
GSP										
Type I	**2.06**	1.45	1.47	1.46	1.27	1.27	**1.72**	1.33	1.69	1.77
Type II	**3.29**	2.71	2.23	2.77	1.91	1.78	**2.75**	2.19	2.72	2.77
Employment										
Type I	**1.62**	1.26	1.53	1.16	1.29	1.40	**2.03**	1.21	2.07	1.95
Type II	**2.25**	1.94	2.34	1.60	1.95	2.12	**3.13**	1.63	3.49	3.06
Direct fte	**12,827**	14,062	9,474	19,937	5,203	4,426	**8,252**	10,732	5,639	1,959
Direct GSP ($m)	**1,019**	1,062	1,529	1,004	809	940	**1,368**	789	1,180	329

Source: EconSearch analysis, Victorian RISE model

Like the RDP region 'Type I and Type II' multipliers, the difference between the industries is a reflection of the difference in the ratio that calculates the multiplier. Regions with a larger Type I multiplier will have a larger production-induced impact in comparison to the direct impact (i.e. the actions of the industry in Victoria). Again, this may mean larger input purchases in the state economy and/or a greater integration of the state economy with that particular industry. The same applies to the Type II multiplier, but the consumption-induced impacts are added.

In Table ES.4, the processing sector multipliers have been adjusted to exclude flow-ons to their respective farming sectors. This has been done so that the processing sector multipliers are comparable to the dairy processing multipliers presented in this report.

Section 7 of this report presents a more comprehensive comparison of the economic impact of the dairy industry, including the impact of the key agricultural sectors in Victoria and the five largest sectors in each RDP region (Health & Community Services, Retail Trade, Education & Training, Professional Scientific & Technical Services and Construction Services).

'Why an increase in output may not reflect a similar increase in employment.'

Multipliers do have limitations and care should be taken when using them. Firstly, multipliers only measure impacts 'upstream' from the industry in question. For example, dairy farm multipliers do not take into account the linkages between dairy farming and dairy processing.

Secondly, multipliers reflect the economic linkages between the dairy industry and the rest of the Victorian economy in 2014/15. They do not capture the possible changes that may occur in the future to these linkages and consequently, are a rudimentary source for forecasting.

Thirdly, while multipliers are most commonly used to quantify the economic impacts (both direct and indirect) relating to policies and projects, the multipliers are based on a number of implicit assumptions, including:

- Lack of supply–side constraints: assume that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts.
- Fixed prices: In assessments using multipliers, where factors of production are assumed to be limitless, the prices of inputs does not change in response to changes in demand (i.e. no price sensitivity)
- Fixed ratios for intermediate inputs and production: Increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount.
- No allowance for purchasers' marginal responses to change: Economic impact analysis using multipliers assumes that households consume goods and services in exact proportions to their initial budget shares. For example, the household budget share of some goods might increase as household income increases. This equally applies to industrial consumption of intermediate inputs and factors of production.

- Absence of budget constraints: Assessments of economic impacts using multipliers that consider consumption-induced effects (Type II multipliers) implicitly assume that household consumption is not subject to budget constraints.

For each of these reasons, care needs to be taken when applying input-output multipliers to estimate economic impacts. For example, an increase in the value of industry output could arise from an increase in milk price alone. Using the multipliers to estimate the effects of the increased output may overstate the economic impact as it would imply that dairy farmers were spending more on farm inputs to produce the additional output when none had in fact occurred ('fixed ratios' assumption). There may be an increase in impacts from increased household expenditure but this is likely to be less than the existing industry multiplier would suggest ('no marginal response' assumption).

For most exercises aimed at quantifying the economic impacts relating to policies and projects it is recommended that the RISE economic impact models (provided as part of this project) be used rather than a simple application of multipliers.

1. INTRODUCTION

The Victorian dairy industry plays a significant role in employment and economic output in regional and rural communities across the state. This includes the direct activity generated through the production of milk on-farm and the flow-on activity the dairy industry generates in sectors such as transport, retail/wholesale trade and health and agricultural services.

Dairy is also one of Victoria's leading rural industries in terms of adding value through further downstream processing. Much of this processing occurs close to farming areas, thereby generating significant economic activity and employment in country regions.

Dairy production in Victoria is spread across three main Dairy Australia Regional Development Program (RDP) regions: Gippsland, Western Victoria and the Murray region (Figure 1.1). Whilst the Gippsland and Western Victoria RDP regions are located wholly within Victoria, the Murray region is located in both New South Wales and Victoria. As this report is interested in the economic activity in Victoria, the activity that occurs in New South Wales has been omitted from the analysis of the Murray region. For the remainder of the report this region will be referred to as the Murray region, however, it will only represent the Victorian section of the Murray RDP region.

Figure 1.1 Location of each RDP region in Victoria

It is important for the dairy industry to quantify the regional significance of the industry in Victoria as regional communities are increasingly looking to promote the industry's contribution to local economic activity and employment. Similarly, industry level representation to the

federal and state governments have been constrained by information gaps in support of claims of the regional importance of the dairy industry.

Economic impact analysis provides a snap shot of an industry's economic activity and the flow-on activity it generates within the wider economic region.

Analysing an industry and its linkages across an economy can assist policy makers understand the significance of an industry to an economy. In particular, it can assist with policy decisions that may impact the productivity of the industry and provide policy makers with an appreciation of the further impacts within the economy through disruptions to flow-on activity.

The purpose of this study is to provide an updated statement of the economic contribution of the dairy industry and an accompanying set of regional economic multipliers for each of Dairy Australia's RDP regions in Victoria. This will provide the Victorian dairy industry with greater certainty of the importance of the industry to regional economic activity and employment.

EconSearch (in conjunction with DEDJTR) was commissioned to undertake an economic impact assessment to demonstrate the economic contribution of the dairy industry in Victoria at both the regional and state levels. This assessment considers the direct and flow-on economic contribution the industry makes to:

- gross regional and state product
- employment
- output
- household income.

The remainder of this report is comprised of seven parts, as described below.

Section 2 – Methods: provides a guide to the method and the key concepts involved in this economic study, including economic activity, key indicators and categories of economic activity in the dairy supply chain. This section also provides an introduction to economic impact modelling in addition to the data and assumptions applied for this study.

Sections 3 to 6 – Profile each RDP region and Victoria as a whole: this includes a regional profile, economic impact analysis (including multipliers) and an outlook for the industry in each RDP region based on the forecasts made by farm sector and processing sector survey participants.

Section 7 – Industry comparison: compares the multipliers calculated for both dairy farming and processing with other agricultural and processing industries. These comparisons are provided for each RDP region and for Victoria as a whole.

Section 8 – Recommendations: provides some future data collection options to build on this initial analysis.

2. METHODS

Undertaking an economic impact assessment provides an opportunity to understand the economic activity of a single industry within an economy. How these estimates are created and the values presented are determined by the economic tool(s) used to calculate the impacts and the quality of the data collected.

The estimates of regional economic impact presented in this report are based on the use of an extension of the conventional input-output method. Over the past decade EconSearch has developed an extended input-output model known as the RISE model (Regional Industry Structure & Employment). The RISE model provides a comprehensive economic framework that is extremely useful in the resource planning process, particularly for regional economic impact applications[3].

For this project we needed to map the economic activity of the dairy industry in each RDP region and Victoria as a whole. To do this we accessed data from a variety of sources including ABARES, Dairy Australia and DEDJTR. As information was not available for all of the areas we required, two separate surveys were undertaken to collect data and context from suitable individuals and businesses involved in the dairy farming and processing sectors.

2.1 Survey

2.1.1 Farm sector questionnaire

The farm sector questionnaire (Appendix 1) focused on the initial two stages of the dairy value chain process, namely pre-production inputs and farm production. Pre-production inputs include external inputs required by dairy farms to support their dairy production, namely direct farm operating costs and capital and equipment. Questions in relation to these inputs revolved around the location of each purchase (i.e. the proportion of each expenditure item purchased within the dairy region) and the type of outlet or business engaged for each purchase.

On-farm production considered the milk produced by dairy farms in the individual regions and Victoria as a whole. This focused on the outputs of the farms in each dairy region, the level of inputs required to achieve these outputs and the market conditions. On-farm production indicators included:

- herd size
- milk price

[3] RISE models have been constructed for the Victorian Government at both a state and regional level (EconSearch 2013). For this analysis they were also created for each RDP region and the Victorian RISE model was updated to 2013/14.

- milk solids per cow
- labour efficiency
- net farm income.

Context was provided for each of these production indicators with the use of 5-year trends and comment sections. The comment sections allowed respondents to identify factors that influenced the value(s) of each farm production indicator. Participants were also asked to provide their opinion of the 3-year outlook for each indicator and the factors that would drive this result.

Individuals with expertise or familiarity in each dairy region were approached to complete the questionnaire. These included the Executive Officer of each RDP region, individuals involved with the Victorian Dairy Farm Monitoring reports and data collection, and individuals recommended by dairy experts within DEDJTR. Respondents could either complete a hard copy version of the questionnaire or complete an online version that had been created using SurveyMonkey.

A total of 17 farm-sector experts completed the farm sector questionnaire for Victoria. This resulted in 7 responses for Gippsland, 8 responses for Murray, and 6 responses for Western Victoria. Multiple responses were received from some individuals who worked across more than one dairy region.

2.1.2 Processing sector questionnaire

The processing sector questionnaire (Appendix 2) focused on the final two stages of the dairy value chain - processing and distribution of dairy products. We sought information on the inputs and costs of the processing business, including:

- volume, value and source of milk purchases
- number of employees
- operating costs.

Questions revolved around the location of each purchase (i.e. the proportion of each expenditure item purchased within the dairy region) and the type of outlet or business engaged for each purchase.

Distribution data focused on the production and sales of the processing business. These included:

- product composition
- market destination of products
- sales revenue.

As with the farm-sector questionnaire, 5-year trends and comment sections were used to provide context and allow the individual completing the survey to expand on any answers they

had given. Participants were also asked to provide their opinion of the 3-year outlook for each indicator and the factors that would drive this result.

Processing firms in each RDP region were approached to complete the questionnaire and were asked to nominate who, within their firm, would be most suited to respond. For larger firms this was often a group of people due to the way in which the business was managed and operated according to location, products or value-chain expertise.

A total of seven firms completed the processing sector questionnaire for Victoria. This resulted in four responses for Gippsland, three responses for Murray, and four responses for Western Victoria. Multiple responses were received from some companies that operate in more than one dairy region.

2.2 Estimation of Economic Effects- Key Concepts

2.2.1 Economic activity

Economic activity indicators: the primary focus of this report is the generation of economic activity resulting from the dairy industry. The key economic activity indicators considered in the analysis are output, gross regional product (GRP), household income and employment.

Economic impact: changes in economic activity are referred to as economic impacts. Generally, changes in *economic activity indicators* result from some stimulus or external shock imposed. In this analysis the concept of economic impact includes the increase in economic contribution from the production and processing of milk and dairy products, i.e. the contribution the dairy industry makes to the economy. This *economic impact* is measured in terms of the *economic activity indicators* referred to above.

2.2.2 Indicators of economic activity defined

Output is a measure of the gross revenue of goods and services produced by commercial organisations (e.g. farm-gate value of production) and gross expenditure by government agencies. Total output needs to be used with care as it includes elements of double counting (e.g. the value of dairy processing output may include the farm activity that generated the raw milk used) and overstates the real contribution to economic activity. Consequently, in this report, estimates of processing output **do not** include output from dairy farming and therefore do not double count.

Gross regional product (GRP)*:* is a measure of the contribution of an activity to the regional economy. GRP is measured as value of gross output (business revenue) less the cost of goods and services (including imports) used in producing the output. In other words, it can be measured as the sum of household income, gross operating surplus and gross mixed income minus payments to owner managers and taxes less subsidies on products and production. It represents payments to the primary inputs of production (labour, capital and land). Using GRP as a measure of economic impact avoids the problem of double counting that may arise from using value of output for this purpose.

Gross state product (GSP) is the same measure of the contribution of the activity as GRP, however, it is applied to the state economy (Victoria).

Household income is a component of GRP and is a measure of wages and salaries paid in cash and in kind, drawings by owner operators and other payments to labour including overtime payments, employer's superannuation contributions and income tax, but excluding payroll tax.

Employment units*:* Employment numbers are usually reported in either full time equivalent (fte) units or total job units defined as follows:

- *fte:* is a way to measure a worker's involvement in a project or industry activity. An fte of 1.0 means that the person is equivalent to a full-time worker, while an fte of 0.5 signals that the worker is only half-time.

  In this report an fte job is calculated as 37.5 hours per week. On average, the typical dairy farm employee works 50 hours a week so fte jobs in this report may overstate the number of people working within the industry.

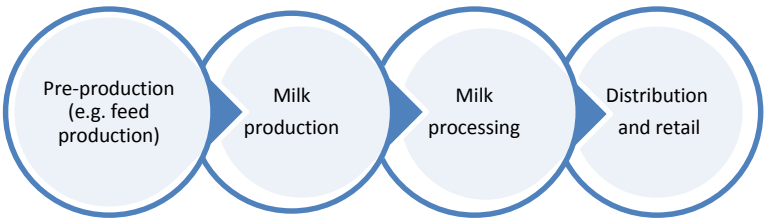
- *Jobs:* is used to refer to the number of workers employed in an industry or on a project at any point in time. It typically refers to either:
  - the *maximum* number of workers required at any point over the analytical period or the duration of the project; or
  - the *average* number of workers required over the analytical period/duration of the project. This can be calculated on a daily, weekly, monthly or annual basis.

In this report employment has been reported in terms of fte units on a per annum basis.

2.2.3 Categories of economic activity in the dairy supply chain

A useful way to think about economic activity and economic impact (as measured by employment, GRP, etc.) is using the concept of a 'supply chain'. The supply chain, in the context of the dairy industry, includes the pre-production of inputs, on-farm production, and dairy processing and distribution (Figure 2.1).

Figure 2.1 Dairy industry supply chain



Broadly speaking, each economic indicator has four levels of economic impact across the economy. For example, with respect to employment:

1. *Direct employment*– this is employment in those firms, businesses and organisations that are directly engaged in dairy activity. Typically this will include:
    a. dairy farms
    b. processing firms
    c. distribution services.
2. *First round employment* - refers to employment in firms that supply inputs and services to the 'direct employment' businesses, i.e. those categorised under #1 above.
    a. Farm-input sectors including all inputs used by agriculture such as fertiliser, transport and storage services
    b. Agricultural service sectors including grains, cattle suppliers and other agricultural services
    c. Milk and packaging for dairy processing
    d. business support services
    e. other inputs.
3. *Industrial-support employment* - is the term applied to 'second and subsequent round' effects as successive waves of output increases occur in the economy to provide industrial support, as a response to the original dairy expenditure, i.e. the activity in sectors that provide goods and services to those businesses that supply directly to the dairy industry. This category excludes any employment associated with increased household consumption.
4. *Consumption-induced employment* - is the term applied to those effects induced by increased household income associated with the original dairy expenditure. The expenditure of household income associated with all three categories of employment (direct, first round and industrial-support) will generate economic activity that will in itself generate jobs.

In this report we use the terms 'direct', 'production-induced', 'consumption-induced', 'flow-on' and 'total' to describe the economic impacts across the economy. In relation to the four categories above:

- 'direct' = the direct economic impact (1)
- 'production-induced' = the combination of the first round impact and the industrial support impact (2+3)
- 'consumption-induced' = the consumption-induced impact (4)
- 'flow-on' = the combination of the consumption-induced and production-induced economic impacts (2+3+4)
- 'total' = the combination of all the economic impacts in the economy, i.e. the combination of the direct and flow-on economic impacts (1+2+3+4)

Each of these economic impacts is provided for output, GRP, household income and employment.

Since this study is concerned solely with economic impact, it omits the wide variety of non-economic impacts of the industry on the region, many of which are clearly significant. The *economic* consequence of the presence of the dairy industry will be felt in many aspects of activity in the regions, ranging from levels of regional output, income and employment, to land prices (including residential, commercial and industrial land), house and building prices, local government rates, supply and demand of labour, demand and supply of urban infrastructure and so on. Unfortunately, fully comprehensive models, including all aspects of regional economic activity, are not available and more complex econometric models with an ability to include a wide variety of economic phenomena have not been satisfactorily developed for impact analysis at a regional level in Australia.

2.2.4 Multipliers

Using the relationship between dairy output and each of the key economic indicators, multipliers can be calculated. These multipliers indicate the strength of the linkages between the dairy industry and the rest of the state or regional economy. These summary measures can be used to indicate the current direct and flow-on economic contribution of an industry. Under certain circumstances multipliers can also be used for forecasting the impact of changes in demand for dairy industry output on other industries within an economy. The limitations of using multipliers as a forecasting tool to analyse the economic impacts of future changes in the dairy industry is discussed further in Section 7.

Because the input-output model is a demand driven model, multipliers represent the strength of linkages back along the supply chain. Consequently, the dairy farming multipliers do not include linkages to the dairy processing sector, although the multipliers for the dairy industry as a whole do.

Multipliers are expressed in two ways in this report; as 'total' multipliers and as 'Type I and Type II' ratios.

Total multipliers – quantifying the relationship between dairy output and employment, household income and GRP.

'Total' multipliers represent the change for each economic indicator in response to a change in dairy output. 'Total' multipliers can be disaggregated into a number of components as described below. Each of the components are explained in detail in Appendix 4.

- *The direct impact* refers to the assumed dollar increase in dairy sales.
- *The first round impact* refers to the effect of the first round of purchases by the dairy industry.
- *The industrial-support impact* refers to the 'second and subsequent round' effects as successive waves of output increases occur in the economy to provide support to those industries supporting the dairy industry, the industries supporting those industries, and

so on (industrial support), as a response to the original dollar increase in dairy sales. The term excludes any increases caused by increased household consumption.

- *The consumption-induced impact* is defined as those effects induced by increased household expenditure due to the increased household income associated with the original dollar increase in dairy sales.

In this report the direct impact, production-induced impact, consumption-induced impact and total impact are presented. Each is calculated in the same manner as the economic impact categories discuss previously (Section 2.2.3).

In this report, 'total' multipliers are presented for each of the four economic indicators, namely output, gross regional (or state) product, household income and employment. With the exception of employment, these multipliers are expressed in terms of a $1 change in dairy output. Employment multipliers, however, are expressed in terms of a $1 million change in dairy output.

- *Output multipliers* represent the total value of production required by all industries in the economy to meet an additional dollar of final demand for, say, dairy products. These multipliers are calculated on a 'per unit of initial effect' basis and represent the output responses to a one dollar change in dairy output.
- *Gross regional product multipliers* represents the total increase in the regional economy generated by a $1 increase in dairy output.
- *Income multipliers* are defined as the total value of income from wages, salaries and supplements generated by a $1 increase in dairy output.
- *Employment multipliers* provide a measure of the total increase in employment in the economy, generated by an increase of $1 million of output of dairy.

Type I and Type II multipliers – quantifying the interaction between the dairy industry and the economy.

The second group of multipliers presented in this report are Type I and Type II multipliers. The Type I multiplier reflects the business to business interactions that occur within the economy. This is a reflection of the direct interaction the dairy industry has with other businesses and the subsequent production-induced activity that occurs across the economy. The Type II multiplier reflects this same group of interactions but adds the subsequent consumption-induced activity that occurs within the economy when dairy industry employees spend their income.

Each of these multipliers is calculated using the 'total' direct and flow-on (production-induced plus consumption-induced) impact multipliers described above. The multiplier ratios are defined as follows:

Type I ratio = [direct impact + production-induced impact]/direct impact

and

Type II ratio = [direct impact + production-induced impact[4] + consumption-induced impact]/direct impact

As defined, the Type I multiplier includes just direct and production-induced effects while the Type II multiplier includes the consumption-induced effects as well.

Both 'total' and 'Type I and Type II' multipliers do have limitations and care should be taken when using them. Multipliers only measure impacts 'upstream' or the purchase side of the industry. Consequently, the dairy farm multipliers do not take into account the linkages between dairy farming and dairy processing. Also, these multipliers do not allow for changing prices in the economy which leads to adjustment and they describe average effects not the effect at the margin of an increase or decrease in industry output. Further discussion on the limitation of multipliers is provided in Section 7.2.

2.3 Economic Impact Models

Input-output (I-O) models are widely used to assess the economic impact of existing or changing levels of economic activity[5], such as regional agriculture. I-O models are available at the national, state and regional levels.

To assess the economic activity of the dairy industry in Victoria a RISE model was constructed for each of the RDP regions and Victoria as a whole.

While this report demonstrates that significant economic and social impacts are associated with dairy-related activity, measurement of these impacts does not, *per se*, constitute an economic evaluation of the industry. Such an evaluation is possible only through a comprehensive cost-benefit analysis of the industry, which would take into account both the direct and indirect impacts of the industry as recorded in this study.

2.4 Data and Assumptions

Local government areas (LGAs) were initially assigned to each RDP region using information from the Australian Bureau of Statistics, Dairy Australia and the Dairy Farm Monitoring Programs in Victoria. The detailed regional boundaries (for modelling purposes) were then established by cross referencing the initial LGA list with the LGA list provided by RDP Executive Officers.

Farm expenditure data were compiled for each RDP region and for Victoria as a whole by aggregating ABARES (2015) agricultural survey data by the three dairy regions (see Figure 1.1). These data were categorised according to a variety of cash receipt and cash cost categories.

[4] Where (first round + industrial support) = production-induced.

[5] Called an 'exogenous shock' in economic modelling terminology.

Information provided by our own dairy farm sector survey[6] was used to estimate the proportion of farm expenditure typically spent within each RDP region. These proportional allocations were applied to each expenditure category to establish the percentage of expenditure that occurred within the dairy region, elsewhere in Victoria and outside the state. For the spatial allocation of some expenditure items, specific assumptions were made to match the survey responses to detailed expenditure items, notably:

- contractors were treated in the same manner as hired labour
- electricity expenditure matched shed power expenditure
- plant hire was representative of miscellaneous machinery
- water for livestock (water purchased for livestock during droughts) was grouped with water charges
- motor vehicle expenses were representative of farm vehicle expenses, both of which were assumed to include all the administration costs and repair and maintenance costs associated with running a vehicle.

The processing sector survey was completed mostly by larger processing firms in each region. Smaller firms commented that their influence on market conditions was minimal and that their operational output and market penetration were predominately influenced by the bigger firms which also determined commodity market and farm-gate pricing. Consequently, it was assumed that the responses from the larger processing firms from each region provided a good representation of the processing industry as a whole.

Processors' breakdown of expenditure, collected through the survey[7], was used to establish the processing costs in each region. In the survey each processor provided a proportional breakdown of how costs were assigned in their business and the expenditure on raw milk. These data, together with regional milk production figures, enabled estimation of itemised processing costs in each region.

A rate of fte/cow for each RDP region and Victoria as a whole was taken from the Dairy Farm Monitoring reports created by DEDJTR. These reports define the standardised people unit as equal to 2,400 hours a year, calculated as 50 hours a week for 48 weeks of the year. To ensure consistency with economy-wide employment estimates, each of these rates was adjusted to reflect a fte of 37.5 hours per week, the fte rate used by EconSearch, in the regional and state RISE models.

Dairy Australia's data on milk processing (Appendix 3) was used to identify the volume of milk that was imported and exported to/from each dairy region, and calculate the volume of milk processed in each region.

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6 The questionnaire used in the farm sector survey is reproduced in Appendix 1.

7 The questionnaire used in the processing survey is reproduced in Appendix 2.

The expenditure data for processing in Melbourne included the costs and employment associated with corporate activity[8]. Discussions with industry experts and members of processing firms provided sufficient information to estimate corporate employment based in Melbourne (including on the road sales teams, drivers and other non-office jobs). Comparative business administration data from the Victorian RISE model was used to estimate corporate economic activity in Melbourne including household income, local operation expenditures and imports.

[8] Corporate activity includes dairy head office employees, regional sales teams based in Melbourne, etc. but does not include activity generated by food safety, industry policy development, environmental monitoring, etc. unless that activity is funded directly by the dairy industry. Dairy Australia's employment and economic activity is included by approximately the proportion that the organisation is funded by the dairy industry.

3. VICTORIA

3.1 State Profile

The dairy industry in Victoria is the largest in Australia, contributing around 66 per cent of Australia's total milk production and approximately 85 per cent of Australia's dairy product exports (DEDJTR 2015).

In 2014/15, the Victorian dairy herd totalled 1.1 million dairy cows, or approximately 65 per cent of the national dairy herd. The average herd size in Victorian dairy farms increased from 167 cows in 1999/00 to 350 in 2014/15, which appears to be a trend towards larger farm operations (Dairy Australia 2015b).

The 4,127 farms that make up the Victorian dairy industry are located across the three RDP regions within the state: Gippsland (South-East), Western Victoria (South West) and Murray (North). The unique level of rainfall, natural resources and seasonal variation in each RDP region results in differing performance levels. Some comparative data across the three RDP regions are provided in Table 3.1.

Table 3.1 Summary size and production data comparison, 2014/15

	Victoria	Gippsland	Murray	West Victoria
Average dairy herd	350	304	356	389
Average farm size (ha)	248	189	222	333
No. of farms	4,127	1,399	1,432	1,295
% Australia's milk production	66	21	24	22
Milk production (billion L)	6.4	1.9	2.3	2.1
Milk yield/ cow (L)	5,808	5,413	6,068	5,932

Source: ABARES (2015) and Dairy Australia (2015b)

Dairy producers in Victoria sell to processors who produce either liquid milk or manufactured dairy products. In 2014/15, the Victorian liquid milk processing plants processed 622 million litres, with a much larger volume (5.8 billion litres or 89 per cent of Victorian milk production) used in the manufacture of other dairy products (Dairy Australia 2015c). Half of these manufactured milk products are consumed domestically while the remainder are exported.

This chapter reports the state-wide dairy activity in Victoria, which represents the average activity of the three RDP regions. The following chapters of this report provide a more detailed overview of the location, production, financials and outlook for each of the three dairy regions in Victoria. This includes insight into the dairy value chain in each region, exploring both the farm and processing sector in Victoria.

Milk production in Victoria

The average dairy herd size has increased in Victoria since 2011/12 and overall productivity in the state has improved as well (Table 3.2). Between 2011/12 and 2014/15 both milk solids produced per cow and milk solids produced per usable hectare have improved.

Table 3.2 Farm sector physical parameters, Victoria, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Average dairy herd	328	323	335	350	354
Annual rainfall (mm)	812	586	792	604	-
Water used (irrigation + rainfall) (mm/ha)	967	818	993	818	-
Total useable area (ha)	237	232	242	248	250
Milking cows per usable hectares	1.6	1.6	1.6	1.6	1.6
Milk solids sold (kg MS/cow)	508	495	498	514	519
Milk solids sold (kg MS/ha)	800	781	810	845	853
Labour efficiency (milking cows/FTE)	98	99	105	110	111
Labour efficiency (kg MS/FTE)	49,752	49,558	52,251	56,586	57,152

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

In 2014/15, Victoria accounted for 66 per cent of Australia's total milk production. This equated to 6.4 billion litres of milk, or approximately 5,808 litres per cow (Dairy Australia 2015c). This was an increase from 2013/14 (just below 6.2 billion litres) as average farm milk output increased (Dairy Australia 2015b).

The average survey response across the three RDP regions indicated expectations of a small production increase in Victoria over the next three years. This is likely to be driven by an increase in the average dairy herd size and improvements in farm efficiency. Survey respondents' projections about milk production and financial performance in Western Victoria over the next three years is covered in more detail in Appendix 5.

Dairy farm financials in Victoria

Overall, the cost of production increased from $4.84/kg MS in 2011/12 to $5.36/kg MS in 2014/15 in Victoria. This was driven by an increase in both variable and fixed costs.

The 2014/15 average cost of production ($5.36/kg MS) decreased from the previous year, $5.42/kg MS in 2013/14, as repair and maintenance cost increases were offset by larger reductions in owner/operator and family labour. Variable costs, however, were constant between 2013/14 to 2014/15 (Table 3.3).

Production costs are expected to increase in the next three years with feed costs and labour the main factors driving this result. However, as production costs are reflective of market and environmental conditions, both of which are hard to predict, the projections for 2017/18 in Table 3.3 should be treated with care.

Table 3.3 Farm sector costs of production, Victoria, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Variable costs					
Herd costs	$0.25	$0.27	$0.28	$0.29	$0.29
Shed costs	$0.20	$0.22	$0.22	$0.20	$0.21
Purchased feed and agistment	$1.48	$1.70	$1.90	$1.91	$1.93
Home grown feed costs	$0.85	$0.89	$1.00	$0.99	$1.00
Total varibale costs ($/kg MS)	**$2.78**	**$3.08**	**$3.39**	**$3.39**	**$3.46**
Fixed costs					
Rates	$0.05	$0.05	$0.05	$0.05	$0.05
Registration and insurance	$0.02	$0.02	$0.02	$0.02	$0.02
Farm insurance	$0.05	$0.06	$0.06	$0.06	$0.06
Repairs and maintenance	$0.34	$0.31	$0.33	$0.34	$0.31
Bank charges	$0.01	$0.01	$0.01	$0.01	$0.01
Other costs	$0.11	$0.11	$0.11	$0.11	$0.11
Employed labour cost	$0.41	$0.43	$0.48	$0.48	$0.49
Total cash fixed costs ($/kg MS)	**$0.99**	**$0.99**	**$1.05**	**$1.08**	**$1.10**
Depreciation	$0.19	$0.19	$0.21	$0.22	$0.22
Imputed owner/operator and family labour	$0.88	$0.90	$0.76	$0.68	$0.69
Total fixed costs ($/kg MS)	**$2.06**	**$2.08**	**$2.03**	**$1.97**	**$2.01**
Changes in inventory ($/kg MS)	**-**	**$0.08**	**-$0.14**	**$0.00**	**$0.01**
Total cost of production ($/kg MS)	**$4.84**	**$5.24**	**$5.28**	**$5.36**	**$5.47**

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

The financial results for dairy production in Victoria are presented in Table 3.4. Overall, net income increased between 2011/12 and 2014/15, with 2012/13 a particularly tough year across Victoria. Not surprisingly, 2013/14 recorded the best year for net income as Victoria experienced its highest average milk price, over the four-year period, 2011/12 to 2014/15.

In Victoria in 2014/15, despite a decrease in the milk price from 2013/14, most businesses performed strongly with an average EBIT of $245,000 ($368,000 in 2013/14) and average net income of $135,000 ($257,000 in 2013/14). The average return on assets decreased to 5.3 per cent (8.5 per cent in 2013/14) and return on equity decreased to 5.4 per cent (11.6 per cent in 2013/14) (Table 3.4).

Table 3.4 Farm sector financial results and projections, Victoria, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Milk price ($/kg MS)	5.52	4.90	6.79	6.04	6.10
EBIT	228,305	59,092	367,765	244,511	246,956
Net income	102,115	-53,875	257,002	134,743	136,090
Return on assets	5.0%	0.7%	8.5%	5.3%	5.4%
Return on equity	4.4%	-7.3%	11.6%	5.4%	5.5%

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

As the survey responses across the three RDP regions indicated, on average, an expectation of a small increase in milk price over the next three years, each of the financial factors presented in Table 3.4 are expected to increase as well.

3.2 Economic Impact of Dairy in Victoria

The following sections looks at the economic impact of the dairy industry in Victoria. While the Victorian indicators represent the entire Victorian region, they may not equal the sum total of the indicators for each of the three Victorian RDP regions. This is because there is dairy industry activity occurring outside of the three dairy regions. For example, as a lot of drinking milk processing occurs in Melbourne, which does not lie within any of the RDP regions, none of the impacts of this economic activity can be observed in the results for any of the three dairy regions. They are, however, captured in the impacts for Victoria as a whole.

3.2.1 Dairy farming

Economic impacts of dairy farming in Victoria

The value of output generated in Victoria by dairy farming was almost $3.6 billion in 2014/15 (Table 3.5), while output generated by associated upstream activities (dairy farming inputs, transport, retail/food services) summed to approximately $4.5 billion. The total output from dairy farming in 2014/15 was $8.0 billion.

Table 3.5 Farm sector economic impacts, Victoria 2014/15

	Output ($m)	GSP ($m)	Household Income ($m)	Employment (fte)
Dairy Farming (direct)	3,565	1,019	562	12,827
Flow-on				
Production-induced	2,255	1,077	638	7,916
Consumption-induced	2,222	1,252	645	8,106
Total Flow-on	4,477	2,329	1,283	16,022
Total Impact[a]	**8,042**	**3,348**	**1,846**	**28,850**

[a] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, dairy farming was responsible for 28,850 fte jobs in Victoria (12,827 fte jobs directly in farming and 16,022 fte jobs in upstream activities). The total employment in dairy farming, 28,850 fte jobs, represents 1.2 per cent of total employment in the Victorian economy.

This employment generated personal income of $1.8 billion in Victoria, $562 million for farm employees and owner operators and $1,283 million for wage earners in upstream activities. The total household income created by dairy farming, $1.8 billion, represents 0.9 per cent of the household income generated in the Victorian economy.

In 2014/15, the total dairy farming related contribution to GSP in Victoria was estimated to be $3.3 billion, $1.0 billion generated by dairy farming directly and $2.3 billion generated in other

sectors in the Victorian economy. The total contribution to GSP from dairy farming, $3.3 billion, represents 1.0 per cent of the GSP of Victoria.

Economic multipliers for dairy farming in Victoria

Using the input-output relationships that are implicit in the results presented above (Table 3.5), multipliers have been calculated for each of the economic activity indicators (Table 3.6). Each of these multipliers are presented in 'per unit of output' terms, so that the total output multiplier represents a total $2.26 of output per $1.00 of farm output [*Table 3.5: 8,042/3,565 = 2.26*], the total GSP multiplier represents a total $0.94 of GSP per $1.00 of farm output [*Table 3.5: 3,348/3,565 = 0.94*], the total household income multiplier represents a total $0.52 of household income per $1.00 of output [*Table 3.5: 1,846/3,565 = 0.52*], and the total employment multiplier represents 8.09 jobs per *$1 million* of output [*Table 3.5: 28,850/3,565 = 8.09*].

Table 3.6 Farm sector multipliers, Victoria 2014/15

	Output	GSP	Household Income	Employment[a]
Direct	1.00	0.29	0.16	3.60
Production-induced	0.63	0.30	0.18	2.22
Consumption-induced	0.62	0.35	0.18	2.27
Total[b]	**2.26**	**0.94**	**0.52**	**8.09**
Type I	1.63	2.06	2.14	1.62
Type II	2.26	3.29	3.28	2.25

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Type I and Type II multipliers have also been calculated to illustrate the same economic linkages in a different format. Rather than be expressed per unit of output, the Type I and Type II multipliers are expressed per unit of the relevant indicator. This means that the total output and the Type II output multipliers are the same because they are both expressed in terms of one unit ($1.00) of output. GSP, household income and employment Type I and Type II multipliers are, however, different. For example, the total GSP multiplier represents a total $0.94 of GSP per $1.00 of farm output [*Table 3.5: 3,348/3,565 = 0.94*] whereas the Type II GSP multiplier represents a total $3.29 of GSP per $1.00 of farm GSP [*Table 3.6: 0.94/0.29 = 3.29*[9]].

As shown in Table 3.6, an initial $1 of output in the farming sector in Victoria leads to 1.26 cents of output [*Table 3.5: 4,477/3,565 = 1.26*] elsewhere in the state economy (63 cents production-induced [Table 3.5*: 2,255/3,565 = 0.63*] and 62 cents consumption-induced [*Table 3.5:*

[9] Note, the calculation taken directly from Table 3.6 [0.94/0.29 = 3.24] differs from the actual calculation [0.9390/0.2858 = 3.29] due to rounding.

2,222/3,565 = 0.62]). This can be summarised as a Type II output multiplier of 2.26 [*Table 3.6: 2.26/1.00 = 2.26*].

Each dollar of dairy farming output in Victoria generates 16 cents in direct household income [*Table 3.5: 562/3,565 = 0.16*] and a further 18 cents in production-induced effects [*Table 3.5: 638/3,565 = 0.18*] and 18 cents in consumption-induced effects [*Table 3.5: 645/3,565 = 0.18*]. This can be summarised as a Type II income multiplier of 3.28 [*Table 3.6: 0.52/0.16 = 3.28*[10]].

Similarly, each dollar of output results in 29 cents in direct contribution to gross state product [*Table 3.5: 1,019/3,565 = 0.29*] in the dairy farming sector and a further 30 cents in production-induced effects [*Table 3.5: 1,077/3,565 = 0.30*] and 35 cents in consumption-induced effects [*Table 3.5: 1,252/3,565 = 0.35*]. This can be summarised as a Type II GSP multiplier of 3.29 [*Table 3.6: 0.94/0.29 = 3.29*[9]].

The direct effect of 3.60 fte jobs per million dollars of output [*Table 3.5: 12,827/3,565 = 3.60*] results in a further 2.22 fte jobs in production-induced effects [*Table 3.5: 7,916/3,565 = 2.22*] and 2.27 fte jobs in consumption-induced effects [*Table 3.5: 8,106/3,565 = 2.27*] in associated industries. This can be summarised as a Type II employment multiplier of 2.25 [*Table 3.6: 8.09/3.60 = 2.25*].

The Type II employment and GSP multipliers for the Victorian dairy farming industry were compared with four other agricultural industries in Victoria, namely sheep, grains, beef cattle, vegetables and fruit and nut. Compared to these industries, the Victorian dairy farming industry creates the largest flow-on contribution to GSP and the second highest (behind the grain industry) flow-on of employment. Further discussion is provided in Section 7.1.

3.2.2 Dairy processing

Economic impacts of dairy processing in Victoria

Dairy processing in Victoria generated $3.6 billion in 2014/15, while output generated by associated upstream activities summed to approximately $4.5 billion (Table 3.7). The total output from dairy processing in 2014/15 was approximately $8.1 billion.

In 2014/15, dairy processing was responsible for 25,855 fte jobs in Victoria (8,252 fte jobs directly in processing and 17,603 fte jobs in upstream activities). The total employment in dairy farming, 25,855 fte jobs, represents 1.1 per cent of total employment in the Victorian economy.

[10] Note, the calculation taken directly from Table 3.6 [0.52/0.16 = 3.25] differs from the actual calculation [0.5177/0.1577 = 3.28] due to rounding.

Table 3.7 Processing sector economic impacts, Victoria. 2014/15

	Output ($m)	GSP ($m)	Household Income ($m)	Employment (fte)
Dairy Processing (direct)[a]	3,624	1,368	695	8,252
Flow-on[b]				
Production-induced	2,009	985	653	8,501
Consumption-induced	2,495	1,405	724	9,102
Total Flow-on	4,503	2,390	1,377	17,603
Total Impact[c]	**8,127**	**3,758**	**2,072**	**25,855**

[a] The direct value of output of dairy processing has been modified to exclude the farmgate value of milk processed in the state. This has been done so the value of production attributed directly to dairy processing is shown and the value of production attributable to dairy farming is excluded.

[b] The flow-on effects do not include on-farm activity or the flow-ons from on-farm activity and so the results reported in this table for the processing sector and those reported in Table 3.5 for the farm sector are additive.

[c] Totals may not sum due to rounding.

Source: EconSearch analysis

This generated $695 million in personal income for those involved in dairy processing in Victoria, and an additional $1.4 billion in wages for other businesses in the region as a result of dairy processing and associated upstream activities. The total household income created by dairy processing, approximately $2.1 billion, represents 1.0 per cent of the household income generated in the Victorian economy.

In 2014/15, the total Victorian dairy processing related contribution to GSP was estimated to be $3.8 billion, $1.4 billion generated by dairy processing directly and $2.4 billion generated in other sectors in the Victorian economy. The total contribution to GSP from dairy farming, $3.8 billion, represents 1.1 per cent of the GSP of Victoria.

Economic multipliers for dairy processing in Victoria

Multipliers for the Victorian processing sector were developed using the relationships between the economic impact indicators described above.

As shown in Table 3.8, an initial $1 of output in the dairy processing sector in Victoria leads to 1.24 cents of output elsewhere in the state economy (55 cents production-induced and 69 cents consumption-induced). This can be summarised as a Type II output multiplier of 2.24.

Each dollar of dairy processing output in Victoria generates 19 cents in direct household income and a further 18 cents in production-induced effects and 20 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.98.

Similarly, each dollar of output results in 38 cents in direct contribution to gross state product in the dairy processing sector and a further 27 cents in production-induced effects and 39 cents in consumption-induced effects. This can be summarised as a Type II GSP multiplier of 2.75.

Table 3.8 Multipliers for the processing sector, Victoria 2014/15

	Output	GSP	Household Income	Employment[a]
Direct	1.00	0.38	0.19	2.28
Production-induced	0.55	0.27	0.18	2.35
Consumption-induced	0.69	0.39	0.20	2.51
Total[b]	**2.24**	**1.04**	**0.57**	**7.13**
Type I	1.55	1.72	1.94	2.03
Type II	2.24	2.75	2.98	3.13

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

The direct effect of 2.28 fte jobs per million dollars of output results in a further 2.35 fte jobs in production-induced effects and 2.51 fte jobs in consumption-induced effects in associated industries. This can be summarised as a Type II employment multiplier of 3.13.

The Type II employment and GSP multipliers for the Victorian dairy processing industry were compared with three other processing industries in Victoria, namely meat processing, fruit and vegetable processing and cereals processing. Compared to these industries, the Victorian dairy processing industry creates the second largest flow-on contribution to GSP (behind cereals processing) but the second highest flow-on of employment (behind fruit and vegetable processing). Further discussion is provided in Section 7.1.

3.2.3 Dairy industry as a whole

Economic impacts of the entire dairy industry in Victoria

In 2014/15, the Victorian dairy industry was responsible for the direct employment of an estimated 21,079 fte jobs, with upstream activities creating further employment of around 33,625 fte jobs. The total employment impact was estimated to be 54,705 fte jobs, which represents around 2.2 per cent of the state's employed work force.

Table 3.9 illustrates the economic impact of the dairy industry in Victoria, combining the effects of both the farming and processing sectors but excluding post-processing wholesale, retail and export logistics activity. In 2014/15, the value of output generated by the Victorian dairy industry was almost $7.2 billion and the output generated by associated upstream activities summed to just below $9.0 billion.

In 2014/15, the Victorian dairy industry was responsible for the direct employment of an estimated 21,079 fte jobs, with upstream activities creating further employment of around 33,625 fte jobs. The total employment impact was estimated to be 54,705 fte jobs, which represents around 2.2 per cent of the state's employed work force.

Table 3.9 Dairy industry economic impacts, Victoria, 2014/15

	Output ($m)	GSP ($m)	Household Income ($m)	Employment (fte)
Direct				
Dairy Farming	3,565	1,019	562	12,827
Dairy Processing	3,624	1,368	695	8,252
Total Direct	7,189	2,386	1,258	21,079
Flow-on[a]				
Production-induced	4,263	2,062	1,291	16,417
Consumption-induced	4,717	2,657	1,369	17,208
Total Flow-on	8,980	4,719	2,660	33,625
Total Impact[b]	**16,169**	**7,105**	**3,918**	**54,705**

[a] Flow-on impacts represent the aggregate of farm and processing sector impacts.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Personal income of approximately $1.3 billion was earned in the dairy industry in Victoria. An additional $2.7 billion was earned by wage earners in other businesses in the region as a result of the dairy industry and associated upstream activities. The total household income impact was $3.9 billion for the dairy industry in Victoria, which represents 1.9 per cent of the household income in the state's economy.

In 2014/15, the total dairy industry related contribution to GSP in Victoria was approximately $7.1 billion, $2.4 billion generated by the dairy industry directly and $4.7 billion generated in other sectors in the Victorian economy. The total contribution to GRP from the dairy industry in Victoria, $7.1 billion, represents 2.0 per cent of the GSP generated in the Victorian economy.

Economic multipliers for the entire dairy industry in Victoria

Multipliers for the Victorian dairy industry were developed using the relationships between the economic impact indicators described above.

As shown in Table 3.10, an initial $1 of output in the dairy industry in Victoria leads to 1.25 cents of output elsewhere in the state economy (59 cents production-induced and 66 cents consumption-induced). This can be summarised as a Type II output multiplier of 2.25.

Each dollar of dairy farming output in Victoria generates 17 cents in direct household income and a further 18 cents in production-induced effects and 19 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 3.12.

Similarly, each dollar of output results in 33 cents in direct contribution to gross state product in the dairy industry and a further 29 cents in production-induced effects and 37 cents in consumption-induced effects. This can be summarised as a Type II GSP multiplier of 2.98.

The direct effect of 2.93 fte jobs per million dollars of output results in a further 2.28 fte jobs in production-induced effects and 2.39 fte jobs in consumption-induced effects in associated industries. This can be summarised as a Type II employment multiplier of 2.60.

Table 3.10 Dairy industry multipliers, Victoria, 2014/15

	Output	GSP	Household Income	Employment[a]
Direct	1.00	0.33	0.17	2.93
Production-induced	0.59	0.29	0.18	2.28
Consumption-induced	0.66	0.37	0.19	2.39
Total[b]	**2.25**	**0.99**	**0.54**	**7.61**
Type I	1.59	1.86	2.03	1.78
Type II	2.25	2.98	3.12	2.60

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

4. WESTERN VICTORIA

4.1 Regional Profile

The Western Victoria dairy region extends west from Melbourne towards the South Australian border with a large share of farms concentrated around the coastal areas near Warrnambool. Rainfall variability is low in these coastal areas, creating a consistent environment for pastures and fodder crops. Dairy farming in this region is largely reliant on rainfall but pasture and fodder production is enhanced by the use of ground water (DEDJTR 2014).

The Western Victoria dairy region contains 1,295 farms which hold approximately 36.3 per cent of the dairy cattle in Victoria.

Milk production in Western Victoria

While there has been a reduction in the size of the average dairy herd in Western Victoria since 2011/12, the productivity of the region has increased (Table 4.1). Milk solids produced per cow has increased in the region as well as the milk solids produced per usable hectare. These productivity gains not only reflect input improvements (better weather conditions, access to feed, evolved herd nutrition, etc.) but also reflect the improvements made by dairy farmers (improved feeding programs, milking techniques, pasture development, etc.).

In 2014/15, Western Victoria produced 22 per cent of Australia's total milk production and 33 per cent of Victoria's total milk production. This equated to 2.1 billion litres of milk, or approximately 5,932 litres per cow (Dairy Australia 2015c). This was a slight increase from 2013/14 (just under 2.1 billion litres) caused by increases in productivity (kg MS/cow) offsetting small decreases in the average dairy herd size in the region (Dairy Australia 2015b).

Milk production is expected to increase in Western Victoria in the next three years. This will be driven by an increase in the average dairy herd size and improvements in farm efficiency. Survey respondents' projections about milk production and financial performance in Western Victoria over the next three years is covered in more detail in Appendix 5.

Table 4.1 Farm sector physical parameters, Western Victoria, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Average dairy herd	442	411	390	389	393
Annual rainfall (mm)	682	638	943	637	-
Water used (irrigation + rainfall) (mm/ha)	687	647	951	643	-
Total useable area (ha)	327	308	330	333	325
Milking cows per usable hectares	1.2	1.2	1.2	1.2	1.2
Milk solids sold (kg MS/cow)	507	506	503	525	530
Milk solids sold (kg MS/ha)	605	601	600	627	633
Labour efficiency (milking cows/FTE)	87	91	102	104	105
Labour efficiency (kg MS/FTE)	44,344	46,885	51,524	55,008	55,558

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

Dairy farm financials in Western Victoria

The financial conditions for dairy farming are strongly linked to the cost of inputs (especially feed and labour) and the farm gate milk price. Input costs are influenced by seasonal conditions and the farm adaptions and investments made by producers throughout the year. Milk price is more market driven, with the price reflecting the demand from processors, level of supply from producers and the overall demand by consumers (both domestic and international).

Overall, the cost of production increased from $5.19/Kg MS in 2011/12 to $5.48/Kg MS in 2014/15 in Western Victoria (Table 4.2). This was due to an increase in variable costs (largely feed cost driven) which offset a decrease in fixed costs (especially operator labour costs) over the three-year period.

In 2014/15, production costs remained relatively stable in comparison to 2013/14, with the slight decrease in variable costs being offset by the slight increase in fixed costs. The 2014/15 average cost of production ($5.48/kg MS) was a slight increase on the cost of production in 2013/14, $5.34/ kg MS (Table 4.2). The increase in the cost of production was largely due to the increase in feed inventory and an increase in purchased feed and agistment.

Production costs are expected to increase in the next three years with feed costs and labour the main factors driving this result. However, as production costs are reflective of market and environmental conditions, both of which are hard to predict, the projections for 2017/18 in Table 4.2 should be treated with care.

Table 4.2 Farm sector costs of production, Western Victoria, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Variable costs					
Herd costs	$0.23	$0.24	$0.25	$0.25	$0.26
Shed costs	$0.21	$0.21	$0.23	$0.20	$0.20
Purchased feed and agistment	$1.51	$1.80	$1.94	$1.99	$2.03
Home grown feed costs	$0.84	$0.80	$0.96	$0.90	$0.92
Total varibale costs ($/kg MS)	**$2.79**	**$3.06**	**$3.37**	**$3.34**	**$3.41**
Fixed costs					
Rates	$0.05	$0.05	$0.06	$0.05	$0.05
Registration and insurance	$0.02	$0.02	$0.02	$0.02	$0.02
Farm insurance	$0.06	$0.05	$0.05	$0.06	$0.06
Repairs and maintenance	$0.40	$0.30	$0.41	$0.39	$0.40
Bank charges	$0.02	$0.02	$0.01	$0.01	$0.01
Other costs	$0.13	$0.12	$0.12	$0.12	$0.12
Employed labour cost	$0.43	$0.38	$0.47	$0.49	$0.50
Total cash fixed costs ($/kg MS)	**$1.11**	**$0.95**	**$1.14**	**$1.15**	**$1.17**
Depreciation	$0.21	$0.19	$0.24	$0.24	$0.24
Imputed owner/operator and family labour	$1.08	$1.01	$0.77	$0.69	$0.70
Total fixed costs ($/kg MS)	**$2.40**	**$2.15**	**$2.14**	**$2.08**	**$2.12**
Changes in inventory ($/kg MS)	**-**	**$0.07**	**-$0.18**	**$0.07**	**$0.07**
Total cost of production ($/kg MS)	**$5.19**	**$5.28**	**$5.34**	**$5.48**	**$5.59**

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

The financial results for dairy farming in Western Victoria are presented in Table 4.3. Net income increased between 2011/12 and 2014/15, with 2012/13 a particularly tough year. Not surprisingly, this trend reflects the change in milk price, demonstrating the influence milk price has on overall dairy farm earnings.

In 2014/15, Western Victoria recorded the highest milk price of all the Victorian RDP regions ($6.16/Kg MS). However, this was a decrease from the high 2013/14 price ($6.91/Kg MS). The drop in milk price did impact farm business profitability, though most businesses still performed strongly. The average earnings before interest and tax (EBIT) was $288,000[11] (approximately $425,000 in 2013/14) and the average net farm income was $149,000 (approximately $279,000 in 2013/14). The average return on farm assets decreased to 5.2 per cent and return on equity decreased to 6.4 per cent (Table 4.3).

Overall, survey respondents expect the milk price to increase in Western Victoria in the next three years, which suggests each of the financial indicators presented in Table 4.3 will improve marginally as well.

Table 4.3 Farm sector financial results and projections, Western Victoria, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Milk price ($/kg MS)	5.56	4.90	6.91	6.16	6.28
EBIT	154,311	61,888	424,647	288,209	293,974
Net income	51,108	-98,128	278,794	148,608	151,580
Return on assets	3.3%	0.2%	7.9%	5.2%	5.3%
Return on equity	-0.2%	-12.7%	10.0%	6.4%	6.5%

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

4.2 Economic Impact

4.2.1 Dairy farming

Economic impacts of dairy farming in Western Victoria

In 2014/15, the dairy farming industry generated almost $1.2 billion in dairy output (sales) in the Western Victoria RDP region (Table 4.4). This dairy farm activity generated approximately $985 million in associated upstream activities (dairy farming inputs, transport, retail/food services). The total output generated by the dairy farming sector in Western Victoria was estimated to be $2.2 billion.

[11] All farms in the RDP sample reported positive EBIT results. Consequently, no farms within the distribution made a loss.

Table 4.4 Farm sector economic impacts, Western Victoria, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Dairy Farming (direct)	1,176	329	199	4,609
Flow-on				
Production-induced	544	285	164	1,937
Consumption-induced	441	254	128	1,575
Total Flow-on	985	538	292	3,513
Total Impact[a]	**2,161**	**868**	**490**	**8,121**

[a] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, dairy farming was responsible for 8,121 full time equivalent (fte) jobs in Western Victoria (4,609 fte jobs directly in farming and 3,513 fte jobs in upstream activities). Upstream jobs were concentrated in road transport, agricultural services, retail/wholesale trade and professional, scientific and technical services. The total employment in dairy farming in Western Victoria, 8,121 fte jobs, represents 4.6 per cent of total employment in the Western Victoria economy and 0.3 per cent of total employment in the Victorian economy.

This employment generated personal income of $490 million in the Western Victoria RDP region ($199 million for farm employees and owner operators and $292 million for wage earners in upstream activities). The total household income created by dairy farming in Western Victoria, $490 million, represents 3.5 per cent of the household income generated in the Western Victoria economy and 0.2 per cent of the household income generated in the Victorian economy.

The contribution to GRP is measured as value of output less the costs of goods and services (including imports) used in producing the output. In 2014/15, the total dairy farming related contribution to GRP in Western Victoria was approximately $868 million (see Table 4.4 for source breakdown). The total contribution to GRP from dairy farming, $868 million, represents 3.4 per cent of the GRP generated in the Western Victoria economy and 0.2 per cent of the GSP generated in the Victorian economy.

Economic multipliers for dairy farming in Western Victoria

Using the input-output relationships that are implicit in the results presented above (Table 4.4), multipliers have been calculated for each of the economic activity indicators (Table 4.5). Each of these multipliers are presented in 'per unit of output' terms, so that the total output multiplier represents a total $1.84 of output per $1.00 of farm output [*Table 4.4: 2,161/1,176 = 1.84*], the total GRP multiplier represents a total $0.74 of GRP per $1.00 of farm output [*Table 4.4: 868/1,176 = 0.74*], the total household income multiplier represents a total $0.42 of household income per $1.00 of output [*Table 4.4: 490/1,176 = 0.42*], and the total employment multiplier represents 6.90 jobs per *$1 million* of dairy farm output [*Table 4.4: 8,121/1,176 = 6.90*].

Table 4.5 Farm sector multipliers, Western Victoria, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.28	0.17	3.92
Production-induced	0.46	0.24	0.14	1.65
Consumption-induced	0.38	0.22	0.11	1.34
Total[b]	**1.84**	**0.74**	**0.42**	**6.90**
Type I	1.46	1.86	1.83	1.42
Type II	1.84	2.63	2.47	1.76

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Type I and Type II multipliers have also been calculated to illustrate the same economic linkages in a different format. Rather than be expressed per unit of output, the Type I and Type II multipliers are expressed per unit of the relevant indicator. This means that the total output and the Type II output multipliers are the same because they are both expressed in terms of one unit ($1.00) of output. GRP, household income and employment Type I and Type II multipliers are, however, different. For example the total GRP multiplier represents a total $0.74 of GRP per $1.00 of farm output [*Table 4.4: 868/1,176 = 0.74*] whereas the Type II GRP multiplier represents a total $2.63 of GRP per $1.00 of farm GRP [*Table 4.5: 0.74/0.28 = 2.63*[12]].

As shown in Table 4.5, an initial $1 of output in dairy farming in Western Victoria leads to 84 cents of output elsewhere in the regional economy [*Table 4.4: (544+441)/1,176 = 0.84*]. This includes 46 cents from the purchase of goods and services from other local businesses (production-induced effect) [*Table 4.4: 544/1,176 = 0.46*] and 38 cents from the local purchase of goods and services by dairy farming families and their employees (consumption-induced effect) [*Table 4.4: 441/1,176 = 0.38*]. The output can be summarised as a Type II output multiplier of 1.84 [*Table 4.5: 1.84/1.00 = 1.84*].

Each dollar of dairy farming output in the Western Victoria RDP region also generates 17 cents in direct household income (i.e. wages and salaries paid to employees on dairy farms and drawings by owner operators) [*Table 4.4: 199/1,176 = 0.17*] and, for workers in associated industries, a further 14 cents in production-induced effects [*Table 4.4: 164/1,176 = 0.14*] and 11 cents in consumption-induced effects [*Table 4.4: 128/1,176 = 0.11*]. This can be summarised as a Type II income multiplier of 2.47 [*Table 4.5: 0.42/0.17 = 2.47*].

Similarly, each dollar of output results in 28 cents in direct contribution to gross regional product in the dairy farming sector [*Table 4.4: 329/1,176 = 0.28*] and a further 24 cents in production-

[12] Note, the calculation taken directly from Table 4.5 [0.74/0.28 = 2.64] differs from the actual calculation [0.7377/0.2800 = 2.63] due to rounding.

induced effects [*Table 4.4: 285/1,176 = 0.24*]and 22 cents in consumption-induced effects [*Table 4.4: 254/1,176 = 0.22*]. This can be summarised as a Type II GRP multiplier of 2.63 [*Table 4.5: 0.74/0.28 = 2.63*[12]].

In Table 4.5, the direct effect of 3.92 fte jobs per million dollars of dairy farm output [*Table 4.4: 4,609/1,176 = 3.92*] results in a further 1.65 fte jobs in production-induced effects [*Table 4.4: 1,937/1,176 = 1.65*] and 1.34 fte jobs in consumption-induced effects [*Table 4.4: 1,575/1,176 = 1.34*] in associated industries. The total employment of 6.90 fte jobs per million dollars of output from direct employment of 3.92 fte jobs can be summarised as a Type II employment multiplier of 1.76 [*Table 4.5: 6.90/3.92 = 1.76*].

4.2.2 Dairy processing

Economic impacts of dairy processing in Western Victoria

Dairy processing in Western Victoria generated $1.2 billion in output in 2014/15 (Table 4.6), while output generated by upstream activities (such as transportation, processing inputs, retail/wholesale trade and health services but excluding dairy farming) was approximately $991 million. The total output generated by the dairy processing sector in Western Victoria in 2014/15 was estimated to be $2.2 billion.

Table 4.6 Processing sector economic impacts, Western Victoria, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Dairy Processing (direct)[a]	1,185	465	202	2,276
Flow-on[b]				
Production-induced	543	259	166	2,318
Consumption-induced	448	258	130	1,599
Total Flow-on	991	516	295	3,917
Total Impact[c]	**2,176**	**981**	**498**	**6,193**

[a] The direct value of output of dairy processing has been modified to exclude the farmgate value of milk processed in the region. This has been done so the value of production attributed directly to dairy processing is shown and the value of production attributable to dairy farming is excluded.

[b] The flow-on effects do not include on-farm activity or the flow-ons from on-farm activity and so the results reported in this table for the processing sector and those reported in Table 3.4 for the farm sector are additive.

[c] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, dairy processing was responsible for 6,193 fte jobs in Western Victoria (2,276 fte jobs directly in processing and 3,917 fte jobs in upstream activities). The total employment in dairy processing in Western Victoria, 6,193 fte jobs, represents 3.5 per cent of total employment in the Western Victoria economy and 0.3 per cent of total employment in the Victorian economy.

This generated $202 million in personal income for those involved in dairy processing in Western Victoria, and an additional $295 million in wages for other businesses in the region as a result of dairy processing and associated upstream activities. The total household income created by the

dairy processing sector in Western Victoria, $498 million, represents 3.6 per cent of the household income generated in the Western Victoria economy and 0.2 per cent of the household income generated in the Victorian economy.

In 2014/15, dairy processing contributed $981 million to the GRP of Western Victoria; $465 million was generated by dairy processing directly and $516 million generated in other sectors in the Western Victoria RDP region economy. The total contribution to GRP from dairy processing in Western Victoria, $981 million, represents 3.9 per cent of the GRP generated in the Western Victoria economy and 0.3 per cent of the GSP generated in the Victorian economy.

Economic multipliers for dairy processing in Western Victoria

Multipliers for the Western Victoria processing sector were developed using the relationships between the economic impact indicators described above.

As shown in Table 4.7, an initial $1 of output in the dairy processing sector in Western Victoria leads to 84 cents of output elsewhere in the regional economy (46 cents production-induced and 38 cents consumption-induced). This can be summarised as a Type II output multiplier of 1.84.

Table 4.7 Processing sector multipliers, Western Victoria, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.39	0.17	1.92
Production-induced	0.46	0.22	0.14	1.96
Consumption-induced	0.38	0.22	0.11	1.35
Total[b]	**1.84**	**0.83**	**0.42**	**5.23**
Type I	1.46	1.56	1.82	2.02
Type II	1.84	2.11	2.46	2.72

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Each dollar of dairy processing output in the Western Victoria RDP region generates 17 cents in direct household income and a further 14 cents in production-induced effects and 11 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.46.

Similarly, each dollar of output results in 39 cents in direct contribution to gross regional product in the dairy processing sector and a further 22 cents in production-induced effects and 22 cents in consumption-induced effects. This can be summarised as a Type II GRP multiplier of 2.11.

The direct effect of 1.92 fte jobs per million dollars of dairy processing output results in a further 1.96 fte jobs in production-induced effects and 1.35 fte jobs in consumption-induced effects in associated industries. The total employment of 5.23 fte jobs per million dollars of output from

direct employment of 1.92 fte jobs can be summarised as a Type II employment multiplier of 2.72.

4.2.3 Dairy industry as a whole

Economic impacts of the entire dairy industry in Western Victoria

Table 4.8 illustrates the economic impact of the dairy industry in Western Victoria, combining the effects of both the farming and processing sectors but excluding post-processing wholesale, retail and export logistics activity. In 2014/15, the value of output generated in the Western Victoria RDP region by the dairy industry was almost $2.4 billion and the output generated by associated upstream activities summed to approximately $1.9 billion. The total output generated by the entire dairy industry in Western Victoria in 2014/15 was just over $4.3 billion.

Table 4.8 Dairy industry economic impacts, Western Victoria, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Direct				
Dairy Farming	1,176	329	199	4,609
Dairy Processing	1,185	465	202	2,276
Total Direct	2,361	794	401	6,885
Flow-on[a]				
Production-induced	1,087	543	329	4,256
Consumption-induced	889	511	258	3,174
Total Flow-on	1,976	1,055	587	7,430
Total Impact[b]	**4,337**	**1,849**	**988**	**14,314**

[a] Flow-on impacts represent the aggregate of farm and processing sector impacts.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis.

In 2014/15, the dairy industry was responsible for the direct employment of an estimated 6,885 fte jobs, with upstream activities creating further employment of around 7,430 fte jobs in Western Victoria. The total employment in the dairy industry in Western Victoria, 14,314 fte jobs, represents 8.0 per cent of the total employment in the Western Victoria economy and 0.6 per cent of the total employment in the Victorian economy.

Personal income of $401 million was earned in the dairy industry in Western Victoria. An additional $587 million was earned by wage earners in other businesses in the region as a result of the dairy industry and associated upstream activities. The total household income created by the dairy industry in Western Victoria, $988 million, represents 7.1 per cent of the household income generated in the Western Victoria economy and 0.5 per cent of the household income generated in the Victorian economy.

In 2014/15, the total dairy industry related contribution to GRP in Western Victoria was approximately $1.8 billion, $794 million generated by the dairy industry directly and just above $1.0 billion generated in other sectors in the Western Victoria RDP region economy. The total

contribution to GRP from the dairy industry in Western Victoria, approximately $1.8 billion, represents 7.3 per cent of the GRP generated in the Western Victoria economy and 0.5 per cent of the GSP generated in the Victorian economy.

Economic multipliers for the entire dairy industry in Western Victoria

Multipliers for the Western Victoria dairy industry were developed using the relationships between the economic impact indicators described above.

As shown in Table 4.9, an initial $1 of output in the dairy industry in Western Victoria leads to 84 cents of output elsewhere in the regional economy (46 cents production-induced; 38 cents consumption-induced). This can be summarised as a Type II output multiplier of 1.84.

Each dollar of dairy industry output in the Western Victoria RDP region generates 17 cents in direct household income and a further 14 cents in production-induced effects and 11 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.46.

Table 4.9 Dairy industry multipliers, Western Victoria, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.34	0.17	2.92
Production-induced	0.46	0.23	0.14	1.80
Consumption-induced	0.38	0.22	0.11	1.34
Total[b]	**1.84**	**0.78**	**0.42**	**6.06**
Type I	1.46	1.68	1.82	1.62
Type II	1.84	2.33	2.46	2.08

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Similarly, each dollar of output in the dairy industry results in 34 cents in direct contribution to gross regional product and a further 23 cents in production-induced effects and 22 cents in consumption-induced effects. This can be summarised as a Type II GRP multiplier of 2.33.

The direct effect of 2.92 fte jobs per million dollars of output results in a further 1.80 fte jobs in production-induced effects and 1.34 fte jobs in consumption-induced effects in associated industries. The total employment of 6.06 fte jobs per million dollars of output from direct employment of 2.92 fte jobs can be summarised as a Type II employment multiplier of 2.08.

5. GIPPSLAND

5.1 Regional Profile

The Gippsland dairy region spans an area from the edge of Melbourne to the eastern coast of Victoria. The region's relatively high rainfall supports strong pasture production with an irrigation district in the central part of the region. Due to the geographic spread in Gippsland, dairy farmers often experience variable seasonal conditions across the region which creates varying farming conditions (DEDJTR 2014).

The Gippsland dairy region contains 1,399 farms which hold approximately 30.6 per cent of the dairy cattle in Victoria.

Milk production in Gippsland

Both the average dairy herd size and milk solids produced per cow in Gippsland have decreased since 2011/12 (Table 5.1). However, milk solids produced per hectare have increased across this period reflecting the increase in milking cows per useable hectare.

In 2014/15, Gippsland produced 20 per cent of Australia's total milk production and 33 per cent of Victoria's total milk production. This equated to 1.9 billion litres of milk, or approximately 5,413 litres per cow (Dairy Australia 2015c). This was a slight increase from 2013/14 (just under 1.9 billion litres) as steady conditions (especially rainfall) maintained production levels (Dairy Australia 2015b).

Milk production is expected to increase in Gippsland in the next three years. This will be driven by an increase in the average dairy herd size and improvements in farm efficiency. Survey respondents' projections about milk production and financial performance in Gippsland over the next three years is covered in more detail in Appendix 5.

Table 5.1 Farm sector physical parameters, Gippsland, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Average dairy herd	317	290	284	304	310
Annual rainfall (mm)	1,113	770	905	831	-
Water used (irrigation + rainfall) (mm/ha)	1,182	906	1,044	956	-
Total useable area (ha)	189	194	186	189	190
Milking cows per usable hectares	1.7	1.7	1.8	1.8	1.7
Milk solids sold (kg MS/cow)	501	462	468	479	484
Milk solids sold (kg MS/ha)	843	781	836	890	899
Labour efficiency (milking cows/FTE)	100	99	104	118	119
Labour efficiency (kg MS/FTE)	50,244	46,047	48,617	56,954	58,093

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

Dairy farm financials in Gippsland

Overall, the cost of production increased from $4.59/kg MS in 2011/12 to $5.09/Kg MS in 2014/15 in Gippsland (Table 5.2). Both purchased feed and agistment and home grown feed costs experienced significant increases across this period, as did the cost of employed labour.

In 2014/15, the total cost of production ($5.09/Kg MS) was lower than it had been for the previous year, 2013/14 ($5.16/Kg MS). This was due to decreases in both variable and fixed costs in the region. In particular, while grain prices remained high, increased pasture levels meant there was less reliance on purchased feed. This resulted in lower purchased feed and agistment costs between 2013/14 and 2014/15 (Table 5.2).

Production costs are expected to increase in the next three years with feed costs and labour the main factors driving this result. However, as production costs are reflective of market and environmental conditions, both of which are hard to predict, the projections for 2017/18 in Table 5.2 should be treated with care.

Table 5.2 Farm sector costs of production, Gippsland, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Variable costs					
Herd costs	$0.29	$0.31	$0.31	$0.32	$0.33
Shed costs	$0.18	$0.22	$0.21	$0.20	$0.20
Purchased feed and agistment	$1.34	$1.53	$1.75	$1.71	$1.74
Home grown feed costs	$0.78	$0.79	$0.92	$0.91	$0.93
Total varibale costs ($/kg MS)	**$2.59**	**$2.85**	**$3.19**	**$3.14**	**$3.20**
Fixed costs					
Rates	$0.05	$0.07	$0.06	$0.07	$0.07
Registration and insurance	$0.02	$0.02	$0.02	$0.02	$0.02
Farm insurance	$0.05	$0.06	$0.06	$0.06	$0.06
Repairs and maintenance	$0.32	$0.36	$0.28	$0.30	$0.31
Bank charges	$0.01	$0.01	$0.01	$0.01	$0.01
Other costs	$0.10	$0.11	$0.10	$0.12	$0.12
Employed labour cost	$0.40	$0.47	$0.49	$0.46	$0.47
Total cash fixed costs ($/kg MS)	**$0.95**	**$1.09**	**$1.04**	**$1.05**	**$1.07**
Depreciation	$0.17	$0.20	$0.21	$0.20	$0.20
Imputed owner/operator and family labour	$0.88	$0.99	$0.86	$0.76	$0.78
Total fixed costs ($/kg MS)	**$2.01**	**$2.28**	**$2.11**	**$2.00**	**$2.04**
Changes in inventory ($/kg MS)	**-**	**$0.18**	**-$0.14**	**-$0.06**	**-$0.05**
Total cost of production ($/kg MS)	**$4.59**	**$5.30**	**$5.16**	**$5.09**	**$5.19**

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

The financial results for dairy farming in Gippsland are presented in Table 5.3. Overall, net income increased between 2011/12 and 2014/15, with 2012/13 a particularly tough year. Not surprisingly, 2013/14 was the best year for income as Gippsland experienced its highest milk price.

In Gippsland in 2014/15, despite a decrease in the milk price (down 11 per cent from 2013/14), most businesses performed strongly with an average EBIT of $216,000[13] ($285,000 in 2013/14) and average net income of $108,000 ($188,000 in 2013/14). The average return on assets decreased to 4.7 per cent (6.4 per cent in 2013/14) and return on equity decreased to 4.7 per cent (10.0 per cent in 2013/14) (Table 5.3).

Overall, survey respondents expect the milk price is in Gippsland to increase slightly in the next three years, which suggests each of the financial indicators presented in Table 5.3 are expected to improve marginally as well.

Table 5.3 Farm sector financial results and projections, Gippsland, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Milk price ($/kg MS)	5.37	4.75	6.62	5.88	5.94
EBIT	207,125	37,609	284,948	216,083	218,244
Net income	101,969	-58,784	188,387	108,042	109,122
Return on assets	4.4%	-0.2%	6.4%	4.7%	4.9%
Return on equity	4.4%	-6.2%	10.0%	4.7%	4.8%

[a] Projections derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

5.2 Economic Impact

5.2.1 Dairy farming

Economic impacts of dairy farming in Gippsland

The value of output generated in the Gippsland RDP region by dairy farming was approximately $1.1 billion in 2014/15 (Table 5.4), while output generated by associated upstream activities (dairy farming inputs, transport, retail/food services) was approximately $695 million. The total output generated by the dairy farming sector in Gippsland was estimated to be $1.8 billion.

In 2014/15, dairy farming was responsible for 6,712 fte jobs in Gippsland. This included around 3,989 fte jobs directly in farming and 2,732 fte jobs in upstream activities (Table 5.4). The total employment in dairy farming in Gippsland, 6,721 fte jobs, represents 3.3 per cent of total employment in the Gippsland economy and 0.3 per cent of total employment in the Victorian economy.

This employment generated personal income of $395 million in the Gippsland RDP region ($182 million for farm employees and owner operators and $213 million for wage earners in upstream activities). The total household income created by the dairy farming sector in Gippsland, $395

[13] All farms in the RDP sample reported positive EBIT results. Consequently, no farms within the distribution made a loss.

million, represents 2.4 per cent of the household income generated in the Gippsland economy and 0.2 per cent of the household income generated in the Victorian economy.

Table 5.4 Farm sector economic impacts, Gippsland, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Dairy Farming (direct)	1,132	317	182	3,989
Flow-on				
Production-induced	450	228	146	1,859
Consumption-induced	245	149	67	874
Total Flow-on	695	377	213	2,732
Total Impact[a]	**1,827**	**694**	**395**	**6,721**

[a] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, the total dairy farming related contribution to GRP in Gippsland was estimated to be $694 million, $317 million generated by dairy farming directly and $377 million generated in other sectors in the Gippsland RDP region economy. The total contribution to GRP from dairy farming in Gippsland, $694 million, represents 2.0 per cent of the GRP generated in the Gippsland economy and 0.2 per cent of the GSP generated in the Victorian economy.

Economic multipliers for dairy farming in Gippsland

Using the input-output relationships that are implicit in the results presented above (Table 5.4), multipliers have been calculated for each of the economic activity indicators (Table 5.5). Each of these multipliers are presented in 'per unit of output' terms, so that the total output multiplier represents a total $1.61 of output per $1.00 of farm output [Table 5.4*: 1,827/1,132 = 1.61*], the total GRP multiplier represents a total $0.61 of GRP per $1.00 of farm output [Table 5.4*: 694/1,132 = 0.61*], the total household income multiplier represents a total $0.35 of household income per $1.00 of output [Table 5.4*: 395/1,132 = 0.35*], and the total employment multiplier represents 5.94 jobs per *$1 million* of dairy farm output [Table 5.4*: 6,721/1,132 = 5.94*].

Table 5.5 Farm sector multipliers, Gippsland, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.28	0.16	3.52
Production-induced	0.40	0.20	0.13	1.64
Consumption-induced	0.22	0.13	0.06	0.77
Total[b]	**1.61**	**0.61**	**0.35**	**5.94**
Type I	1.40	1.72	1.80	1.47
Type II	1.61	2.19	2.17	1.69

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Type I and Type II multipliers have also been calculated to illustrate the same economic linkages in a different format. Rather than be expressed per unit of output, the Type I and Type II multipliers are expressed per unit of the relevant indicator. This means that the total output and the Type II output multipliers are the same because they are both expressed in terms of one unit ($1.00) of output. GRP, household income and employment Type I and Type II multipliers are, however, different. For example, the total GRP multiplier represents a total $0.61 of GRP per $1.00 of farm output [*Table 5.4: 694/1,132 = 0.61*] whereas the Type II GRP multiplier represents a total $2.19 of GRP per $1.00 of farm GRP [*Table 5.5: 0.61/0.28 = 2.19*[14]].

As shown in Table 5.5, an initial $1 of output in the farming in Gippsland leads to 61 cents of output [*Table 5.4: (450+245)/1,132 = 0.61*] elsewhere in the regional economy (40 cents production-induced [*Table 5.4: 450/1,132 = 0.40*] and 22 cents consumption-induced [*Table 5.4: 245/1,132 = 0.22*]). Note that this total is not 0.62 because of the rounding of multipliers in Table 5.5. This can be summarised as a Type II output multiplier of 1.61 [*Table 5.5: 1.61/1.00 = 1.61*].

Each dollar of dairy farming output in the Gippsland RDP region generates 16 cents in direct household income [*Table 5.4: 182/1,132 = 0.16*] and a further 13 cents in production-induced effects [*Table 5.4: 146/1,132 = 0.13*] and 6 cents in consumption-induced effects [*Table 5.4: 67/1,132 = 0.06*]. This can be summarised as a Type II income multiplier of 2.17 [*Table 5.5: 0.35/0.16 = 2.17*[15]].

Similarly, each dollar of output results in 28 cents in direct contribution to gross regional product [*Table 5.4: 317/1,132 = 0.28*] in the dairy farming sector and a further 20 cents in production-induced effects [*Table 5.4: 228/1,132 = 0.20*] and 13 cents in consumption-induced effects [*Table 5.4: 149/1,132 = 0.13*]. This can be summarised as a Type II GRP multiplier of 2.19 [*Table 5.5: 0.61/0.28 = 2.19*[14]].

The direct effect of 3.52 fte jobs per million dollars of output [*Table 5.4: 3,989/1,132 = 3.52*] results in associated industries, a further 1.64 fte jobs in production-induced effects [*Table 5.4: 1,859/1,132 = 1.64*] and 0.77 fte jobs in consumption-induced effects [*Table 5.4: 874/1,132 = 0.77*]. The total employment of 5.94 fte jobs per million dollars of output from direct employment of 3.52 fte jobs can be summarised as a Type II employment multiplier of 1.69 [*Table 5.5: 5.94/3.52 = 1.69*].

[14] Note, the calculation taken directly from Table 5.5 [0.61/0.28 = 2.18] differs from the actual calculation [0.6130/0.2798 = 2.19] due to rounding.

[15] Note, the calculation taken directly from Table 5.5 [0.35/0.16 = 2.18] differs from the actual calculation [0.3487/0.1608 = 2.17] due to rounding.

5.2.2 Dairy processing

Economic impacts of dairy processing in Gippsland

Dairy processing in Gippsland generated $984 million in output in 2014/15 (Table 5.6), while output generated by associated upstream activities summed to approximately $579 million. The total output generated by the dairy processing sector in Gippsland in 2014/15 was estimated to be just below $1.6 billion.

Table 5.6 Processing sector economic impacts, Gippsland, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Dairy Processing (direct)[a]	984	462	170	2,035
Flow-on[b]				
Production-induced	359	177	125	1,867
Consumption-induced	220	134	60	786
Total Flow-on	579	311	185	2,653
Total Impact[c]	**1,563**	**773**	**355**	**4,688**

[a] The direct value of output of dairy processing has been modified to exclude the farmgate value of milk processed in the region. This has been done so the value of production attributed directly to dairy processing is shown and the value of production attributable to dairy farming is excluded.

[b] The flow-on effects do not include on-farm activity or the flow-ons from on-farm activity and so the results reported in this table for the processing sector and those reported in Table 4.4 for the farm sector are additive.

[c] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, dairy processing was responsible for 4,688 fte jobs in Gippsland (2,035 fte jobs directly in processing and 2653 fte jobs in upstream activities). The total employment in dairy processing in Gippsland, 4,688 fte jobs, represents 2.3 per cent of total employment in the Gippsland economy and 0.2 per cent of total employment in the Victorian economy.

This generated $170 million in personal income for those involved in dairy processing in Gippsland, and an additional $185 million in wages for other businesses in the region as a result of dairy processing and associated upstream activities. The total household income created by the dairy processing sector in Gippsland, $355 million, represents 2.2 per cent of the household income generated in the Gippsland economy and 0.2 per cent of the household income generated in the Victorian economy.

In 2014/15, dairy processing contributed $773 million to the GRP of Gippsland; $462 million was generated by dairy processing directly and $311 million generated in other sectors in the Gippsland RDP region economy. The total contribution to GRP from dairy processing in Gippsland, $773 million, represents 2.3 per cent of the GRP generated in the Gippsland economy and 0.2 per cent of the GSP generated in the Victorian economy.

Economic multipliers for dairy processing in Gippsland

Multipliers for the Gippsland processing sector were developed using the relationships between the economic impact indicators described above.

As shown in Table 5.7, an initial $1 of output in the processing sector in Gippsland leads to 59 cents of output elsewhere in the regional economy (36 cents production-induced; 22 cents consumption-induced). This can be summarised as a Type II output multiplier of 1.59.

Table 5.7 Processing sector multipliers, Gippsland, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.47	0.17	2.07
Production-induced	0.36	0.18	0.13	1.90
Consumption-induced	0.22	0.14	0.06	0.80
Total[b]	**1.59**	**0.79**	**0.36**	**4.76**
Type I	1.36	1.38	1.74	1.92
Type II	1.59	1.67	2.09	2.30

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Each dollar of dairy processing output in the Gippsland RDP region generates 17 cents in direct household income and a further 13 cents in production-induced effects and 6 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.09.

Similarly, each dollar of output results in 47 cents in direct contribution to gross regional product in the dairy processing sector and a further 18 cents in production-induced effects and 14 cents in consumption-induced effects. This can be summarised as a Type II GRP multiplier of 1.67.

The direct effect of 2.07 fte jobs per million dollars of dairy processing output results in a further 1.90 fte jobs in production-induced effects and 0.80 fte jobs in consumption-induced effects in associated industries. The total employment of 4.76 fte jobs per million dollars of output from direct employment of 2.07 fte jobs can be summarised as a Type II employment multiplier of 2.30.

5.2.3 Dairy industry as a whole

Economic impacts for the entire dairy industry in Gippsland

Table 5.8 illustrates the economic impact of the dairy industry in Gippsland, combining the effects of both the farming and processing sectors but excluding post-processing wholesale, retail and export logistics activity. In 2014/15, the value of output generated in the Gippsland RDP region by the dairy industry was approximately $2.1 billion and the output generated by associated upstream activities summed to an estimated $1.3 billion. The total output generated by the dairy industry in Gippsland, approximately $3.4 billion, represents 5.9 per cent of the

total output generated in the Gippsland economy and 0.5 per cent of the total output generated in the Victorian economy.

In 2014/15, the dairy industry was responsible for the direct employment of an estimated 6,024 fte jobs, with upstream activities creating further employment of around 5,385 fte jobs in Gippsland. The total employment in the dairy industry in Gippsland, 11,409 fte jobs, represents 5.6 per cent of the total employment in the Gippsland economy and 0.5 per cent of the total employment in the Victorian economy.

Table 5.8 Dairy industry economic impacts, Gippsland, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Direct				
Dairy Farming	1,132	317	182	3,989
Dairy Processing	984	462	170	2,035
Total Direct	2,116	778	352	6,024
Flow-on[a]				
Production-induced	809	406	271	3,726
Consumption-induced	465	282	126	1,659
Total Flow-on	1,274	688	398	5,385
Total Impact[b]	**3,390**	**1,466**	**750**	**11,409**

[a] Flow-on impacts represent the aggregate of farm and processing sector impacts.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Personal income of $352 million was earned in the dairy industry in Gippsland. An additional $398 million was earned by wage earners in other businesses in the region as a result of the dairy industry and associated upstream activities. The total household income created by the dairy industry in Gippsland, $750 million, represents 4.6 per cent of the household income generated in the Gippsland economy and 0.4 per cent of the household income generated in the Victorian economy.

In 2014/15, the total dairy industry related contribution to GRP in Gippsland was approximately $1.5 billion, $778 million generated by the dairy industry directly and $688 million generated in other sectors in the Gippsland RDP region economy. The total contribution to GRP from the dairy industry in Gippsland, approximately $1.5 billion, represents 4.3 per cent of the GRP generated in the Gippsland economy and 0.4 per cent of the GSP generated in the Victorian economy.

Economic multipliers for the entire dairy industry in Gippsland

Multipliers for the Gippsland dairy industry were developed using the relationships between the economic impact indicators described above.

As shown in Table 5.9, an initial $1 of output in the dairy industry in Gippsland leads to 60 cents of output elsewhere in the regional economy (38 cents is production-induced and 22 cents is consumption-induced). This can be summarised as a Type II multiplier of 1.60.

Table 5.9 Dairy industry multipliers, Gippsland, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.37	0.17	2.85
Production-induced	0.38	0.19	0.13	1.76
Consumption-induced	0.22	0.13	0.06	0.78
Total[b]	**1.60**	**0.69**	**0.35**	**5.39**
Type I	1.38	1.52	1.77	1.62
Type II	1.60	1.88	2.13	1.89

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Each dollar of dairy processing output in the Gippsland RDP region generates 17 cents in direct household income and a further 13 cents in production-induced effects and 6 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.13.

Similarly, each dollar of output in the dairy industry results in 37 cents in direct contribution to gross regional product and a further 19 cents in production-induced effects and 13 cents in consumption-induced effects. This can be summarised as a Type II GRP multiplier of 1.88.

The direct effect of 2.85 fte jobs per million dollars of output results in a further 1.76 fte jobs in production-induced effects and 0.78 fte jobs in consumption-induced effects in associated industries. The total employment of 5.39 fte jobs per million dollars of output from direct employment of 2.85 fte jobs can be summarised as a Type II employment multiplier of 1.89.

6. MURRAY

6.1 Regional Profile

The Murray dairy region is one of the largest dairying regions in Australia, straddling the Murray River from the Alps to Swan Hill. The region includes land on both sides of the Murray River, including land in southern New South Wales and northern Victoria. Farms in the region are smaller than in the other two Victorian regions but nonetheless have higher stocking rates and produce larger volumes of milk than the national average (DEDJTR 2014). This high level of productivity is due to climate and proximity to fodder and grain growing regions (Dairy Australia 2014a). It also reflects the impact of the large irrigation network that supports the region (including the Murray- Goulburn reticulated system).

The Murray dairy region contains 1,432 farms which hold approximately 33.1 per cent of the dairy cattle in Victoria.

Please note: due to data constraints the following sub-sections on milk production and farm finance reflect the Murray region in its entirety (the dairy industry **in both Victoria and New South Wales**).

The remaining sub-sections, looking at the economic impact and multipliers for dairy farming, dairy processing and the dairy industry refer to the Murray region **in Victoria only**. The data used for these sub-sections have omitted the dairy activity in the New South Wales Murray region.

Milk production in the Murray region

Despite the average dairy herd increase in the Murray RDP region since 2011/12, the productivity in the region has improved (Table 6.1). Milk solids produced per cow has increased in the region as well as the milk solids produced per usable hectare across this time period.

In 2014/15, the Murray region produced 24 per cent of Australia's total milk production[16]. This equated to 2.3 billion litres of milk, or approximately 6,068 litres per cow (Dairy Australia 2015c). This was an increase from 2013/14 (just under 2.3 billion litres) as average farm milk output increased (Dairy Australia 2015b).

Milk production is expected to increase in the Murray RDP region in the next three years. This will be driven by an increase in the average dairy herd size and improvements in farm efficiency. Survey respondents' projections about milk production and financial performance in the Murray RDP region over the next three years is covered in more detail in Appendix 5.

[16] As this refers to the whole Murray region (both NSW and Vic) the percentage of Victorian milk has been omitted. In 2014/15, the Murray region (in Victoria only) produced 33 per cent of Victoria's total milk production.

Table 6.1 Farm sector physical parameters, Murray, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Average dairy herd	333	332	332	356	360
Annual rainfall (mm)	634	394	527	344	-
Water used (irrigation + rainfall) (mm/ha)	1,035	901	986	856	-
Total useable area (ha)	193	193	210	189	191
Milking cows per usable hectares	1.9	1.8	1.9	1.9	1.9
Milk solids sold (kg MS/cow)	516	518	522	537	542
Milk solids sold (kg MS/ha)	957	961	995	1,020	1,030
Labour efficiency (milking cows/FTE)	107	108	109	108	109
Labour efficiency (kg MS/FTE)	54,875	55,741	56,611	57,795	58,373

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

Dairy farm financials in the Murray region

Overall, the cost of production increased from $4.70/kg MS in 2011/12 to $5.53/kg MS in 2014/15 in the Murray RDP region. This was driven by an increase in both variable and fixed costs.

The 2014/15 average cost of production ($5.53/kg MS) increased from the previous year, $5.34/kg MS in 2013/14, as an increase in purchased feed led to higher average variable costs. This was largely due to weather impacts on pasture development depleting feedstocks. Fixed costs, however, remained relatively stable between 2013/14 to 2014/15 (Table 6.2).

Table 6.2 Farm sector costs of production, Murray, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Variable costs					
Herd costs	$0.26	$0.25	$0.27	$0.30	$0.30
Shed costs	$0.18	$0.24	$0.21	$0.19	$0.20
Purchased feed and agistment	$1.59	$1.77	$1.96	$2.02	$2.04
Home grown feed costs	$0.93	$1.08	$1.17	$1.17	$1.18
Total varibale costs ($/kg MS)	**$2.95**	**$3.34**	**$3.61**	**$3.69**	**$3.76**
Fixed costs					
Rates	$0.03	$0.04	$0.04	$0.04	$0.04
Registration and insurance	$0.02	$0.02	$0.02	$0.02	$0.02
Farm insurance	$0.05	$0.06	$0.06	$0.06	$0.06
Repairs and maintenance	$0.28	$0.27	$0.29	$0.32	$0.31
Bank charges	$0.01	$0.01	$0.01	$0.01	$0.01
Other costs	$0.11	$0.10	$0.11	$0.09	$0.09
Employed labour cost	$0.40	$0.44	$0.46	$0.49	$0.50
Total cash fixed costs ($/kg MS)	**$0.90**	**$0.94**	**$0.99**	**$1.03**	**$1.05**
Depreciation	$0.18	$0.18	$0.19	$0.21	$0.21
Imputed owner/operator and family labour	$0.67	$0.68	$0.66	$0.60	$0.61
Total fixed costs ($/kg MS)	**$1.75**	**$1.81**	**$1.83**	**$1.84**	**$1.88**
Changes in inventory ($/kg MS)	**-**	**$0.00**	**-$0.10**	**$0.00**	**$0.00**
Total cost of production ($/kg MS)	**$4.70**	**$5.15**	**$5.34**	**$5.53**	**$5.64**

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

Production costs are expected to increase in the next three years with feed costs and labour the main factors driving this result. However, as production costs are reflective of market and environmental conditions, both of which are hard to predict, the costs presented for 2017/18 in Table 6.2 should be treated with care.

The financial results for dairy farming in Gippsland are presented in Table 6.3. Overall, net income decreased between 2011/12 and 2014/15, with 2012/13 a particularly tough year.

The variable seasonal conditions paired with the drop in average milk price across the region made business conditions tougher in 2014/15 in comparison to those in 2013/14. The decrease in milk price, despite the increase in milk production, impacted the average business performance across the region. EBIT decreased to $210,000[17] (from $394,000 in 2013/14) and average net income was also down, falling to $112,791 (a decrease from $304,000 in 2013/14). The average return on assets decreased to 6.1 per cent and return on equity decreased to 5.1 per cent (Table 6.3).

Overall, survey respondents expect the milk price is the Murray to increase in the next three years, which suggests that each of the financial indicators presented in Table 6.3 are expected to improve marginally as well.

Table 6.3 Farm sector financial results and projections, Murray, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2017/18[a]
Milk price ($/kg MS)	5.61	5.05	6.83	6.09	6.15
EBIT	232,119	77,729	393,700	210,289	212,392
Net income	144,067	-4,711	303,825	112,791	113,919
Return on assets	7.6%	2.2%	11.3%	6.1%	6.2%
Return on equity	8.4%	-2.8%	14.7%	5.1%	5.2%

[a] Projections for 2017/18 derived from the farm-sector survey.

Source: Dairy Australia (2015b), DEPI (2014), DEDJTR (2015) and EconSearch analysis

6.2 Economic Impact

6.2.1 Dairy farming

Economic impacts of dairy farming in the Murray region

The value of output generated by dairy farming in the Murray RDP region was almost $1.3 billion in 2014/15 (Table 6.4), while output generated by associated upstream activities (dairy farming inputs, transport, retail/food services) summed to approximately $1.0 billion. The total output

[17] Only 8 per cent of farms in the RDP sample reported negative EBIT results. Consequently, only a small minority of farms within the distribution made a loss.

generated by the dairy farming sector in the Murray RDP region in 2014/15 was estimated to be almost $2.3 billion.

Table 6.4 Farm sector economic impacts, Murray, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Dairy Farming (direct)	1,257	373	182	4,230
Flow-on				
Production-induced	635	321	186	2,215
Consumption-induced	393	233	114	1,474
Total Flow-on	1,028	554	300	3,689
Total Impact[a]	**2,285**	**926**	**482**	**7,919**

[a] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, dairy farming was responsible for 7,919 fte jobs in the Murray RDP region (4,230 fte jobs directly in farming and 3,689 fte jobs in upstream activities). The total employment in dairy farming in the Murray RDP region, 7,919 fte jobs, represents 5.4 per cent of the total employment in the Murray economy and 0.3 per cent of total employment in the Victorian economy.

This employment generated personal income of $482 million in the Murray RDP region, $182 million for farm employees and owner operators and $300 million for wage earners in upstream activities. The total household income created by the dairy farming sector in the Murray RDP region, $482 million, represents 3.9 per cent of the household income generated in the Murray economy and 0.2 per cent of the household income generated in the Victorian economy.

In 2014/15, the total dairy farming related contribution to GRP in the Murray RDP region was estimated to be $926 million, $373 million generated by dairy farming directly and $554 million generated in other sectors by the Murray RDP region economy. The total contribution to GRP from dairy farming in the Murray RDP region, $926 million, represents 4.2 per cent of the GRP generated in the Murray economy and 0.3 per cent of the GSP generated in the Victorian economy.

Economic multipliers for dairy farming in the Murray region

Using the input-output relationships that are implicit in the results presented above (Table 6.4), multipliers have been calculated for each of the economic activity indicators (Table 6.5). Each of these multipliers are presented in 'per unit of output' terms, so that the total output multiplier represents a total $1.82 of output per $1.00 of farm output [*Table 6.4: 2,285/1,257 = 1.82*], the total GRP multiplier represents a total $0.74 of GRP per $1.00 of farm output [*Table 6.4: 926/1,257 = 0.74*], the total household income multiplier represents a total $0.38 of household income per $1.00 of output [*Table 6.4: 482/1,257 = 0.38*], and the total employment multiplier represents 6.30 jobs per *$1 million* of dairy farm output [*Table 6.4: 7,919/1,257 = 6.30*].

Table 6.5 Multipliers for the farm sector, Murray, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.30	0.14	3.37
Production-induced	0.51	0.26	0.15	1.76
Consumption-induced	0.31	0.18	0.09	1.17
Total[b]	**1.82**	**0.74**	**0.38**	**6.30**
Type I	1.51	1.86	2.03	1.52
Type II	1.82	2.49	2.65	1.87

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Type I and Type II multipliers have also been calculated to illustrate the same economic linkages in a different format. Rather than be expressed per unit of output, the Type I and Type II multipliers are expressed per unit of the relevant indicator. This means that the total output and the Type II output multipliers are the same because they are both expressed in terms of one unit ($1.00) of output. GRP, household income and employment Type I and Type II multipliers are, however, different. For example the total GRP multiplier represents a total $0.74 of GRP per $1.00 of farm output [*Table 6.4: 926/1,257 = 0.74*] whereas the Type II GRP multiplier represents a total $2.49 of GRP per $1.00 of farm GRP [*Table 6.5: 0.74/0.30 = 2.49*[18]].

As shown in Table 6.5, an initial $1 of output in the farming sector in the Murray RDP region leads to 82 cents of output [*Table 6.4: 1,028/1,257 = 0.82*] elsewhere in the regional economy (51 cents production-induced [*Table 6.4: 635/1,257 = 0.51*] and 31 cents consumption-induced [*Table 6.4: 393/1,257 = 0.31*]). This can be summarised as a Type II output multiplier of 1.82 [*Table 6.5: 1.82/1.00 = 1.82*].

Each dollar of dairy farming output in the Murray RDP region generates 14 cents in direct household income [*Table 6.4: 182/1,257 = 0.14*] and a further 15 cents in production-induced effects [*Table 6.4: 186/1,257 = 0.15*] and 9 cents in consumption-induced effects [*Table 6.4: 114/1,257 = 0.09*]. This can be summarised as a Type II income multiplier of 2.65 [*Table 6.5: 0.38/0.14 = 2.65*[19]].

Similarly, each dollar of output results in 30 cents in direct contribution to gross regional product [*Table 6.4: 373/1,257 = 0.30*] in the dairy farming sector and a further 26 cents in production-induced effects [*Table 6.4: 321/1,257 = 0.26*] and 18 cents in consumption-induced effects

[18] Note, the calculation taken directly from Table 6.5 [0.74/0.30 = 2.47] differs from the actual calculation [0.7370/0.2965 = 2.49] due to rounding.

[19] Note, the calculation taken directly from Table 6.5 [0.38/0.14 = 2.71] differs from the actual calculation [0.3836/0.1445 = 2.65] due to rounding.

[*Table 6.4: 233/1,257 = 0.18*]. This can be summarised as a Type II GRP multiplier of 2.49 [*Table 6.5: 0.74/0.30 = 2.49*[18]].

The direct effect of 3.37 fte jobs per million dollars of output [*Table 6.4: 4,230/1,257 = 3.37*] results in a further 1.76 fte jobs in production-induced effects [*Table 6.4: 2,215/1,257 = 1.76*] and 1.17 fte jobs in consumption-induced effects [*Table 6.4: 1,474/1,257 = 1.17*] in associated industries. The total employment of 6.30 fte jobs per million dollars of output from direct employment of 3.37 fte jobs can be summarised as a Type II employment multiplier of 1.87 [*Table 6.5: 6.30/3.37 = 1.87*].

6.2.2 Dairy processing

Economic impacts of dairy processing in the Murray region

Dairy processing in the Murray RDP region generated $874 million in 2014/15 (Table 6.6), while output generated by associated upstream activities summed to approximately $812 million. (Table 6.6). The total output generated by the dairy processing sector in the Murray RDP region, $1.7 billion, represents 4.1 per cent of the total output generated in the Murray economy and 0.3 per cent of the total output generated in the Victorian economy.

Table 6.6 Economic impact for the processing sector, Murray, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Dairy Processing (direct)[a]	874	405	177	2,219
Flow-on[b]				
Production-induced	458	228	154	2,172
Consumption-induced	354	209	103	1,327
Total Flow-on	812	437	257	3,499
Total Impact[c]	**1,686**	**842**	**434**	**5,718**

[a] The direct value of output of dairy processing has been modified to exclude the farmgate value of milk processed in the region. This has been done so the value of production attributed directly to dairy processing is shown and the value of production attributable to dairy farming is excluded.

[b] The flow-on effects do not include on-farm activity or the flow-ons from on-farm activity and so the results reported in this table for the processing sector and those reported in Table 5.4 for the farm sector are additive.

[c] Totals may not sum due to rounding.

Source: EconSearch analysis

In 2014/15, dairy processing was responsible for 5,718 fte jobs in the Murray RDP region (2,219 fte jobs directly in processing and 3,499 fte jobs in upstream activities). The total employment in dairy processing in the Murray RDP region, 5,718 fte jobs, represents 3.9 per cent of total employment in the Murray economy and 0.2 per cent of total employment in the Victorian economy.

This generated $177 million in personal income for those involved in dairy processing in the Murray RDP region, and an additional $257 million in wages for other businesses in the region as a result of dairy processing and associated upstream activities. The total household income created by the dairy processing sector in the Murray RDP region, $434 million, represents 3.5

per cent of the household income generated in the Murray economy and 0.2 per cent of the household income generated in the Victorian economy.

In 2014/15, the total Murray dairy processing related contribution to GRP was estimated to be $842 million; $405 million generated by dairy processing directly and $437 million generated in other sectors in the Murray RDP region economy. The total contribution to GRP from dairy processing in the Murray RDP region, $842 million, represents 3.8 per cent of the GRP generated in the Murray economy and 0.2 per cent of the GSP generated in the Victorian economy.

Economic multipliers for dairy processing in the Murray region

Multipliers for the Murray processing sector were developed using the relationships between the economic impact indicators described above.

As shown in Table 6.7, an initial $1 of output in the dairy processing sector in the Murray RDP region leads to 93 cents of output elsewhere in the regional economy (52 cents in production-induced effects and 40 cents in consumption-induced effects). This can be summarised as a Type II output multiplier of 1.93.

Table 6.7 Processing sector multipliers, Murray, 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.46	0.20	2.54
Production-induced	0.52	0.26	0.18	2.49
Consumption-induced	0.40	0.24	0.12	1.52
Total[b]	**1.93**	**0.96**	**0.50**	**6.54**
Type I	1.52	1.56	1.87	1.98
Type II	1.93	2.08	2.45	2.58

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Each dollar of dairy processing output in the Murray RDP region generates 20 cents in direct household income and a further 18 cents in production-induced effects and 12 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.45.

Similarly, each dollar of output results in 46 cents in direct contribution to gross regional product in the dairy processing sector and a further 26 cents in production-induced effects and 24 cents in consumption-induced effects. This can be summarised as a Type II GRP multiplier of 2.08.

The direct effect of 2.54 fte jobs per million dollars of dairy processing output results in a further 2.49 fte jobs in production-induced effects and 1.52 fte jobs in consumption-induced effects in associated industries. The total employment of 6.54 fte jobs per million dollars of output from direct employment of 2.54 fte jobs can be summarised as a Type II employment multiplier of 2.58.

6.2.3 Dairy industry as a whole

Economic impacts of the entire dairy industry in the Murray region

Table 6.8 illustrates the economic impact of the dairy industry in the Murray RDP region, combining the effects of both the farming and processing sectors but excluding post-processing wholesale, retail and export logistics activity. In 2014/15, the value of output generated by the Murray dairy industry was approximately $2.1 billion and output generated by associated upstream activities summed to an estimated $1.8 billion. The total output generated by the dairy industry in the Murray RDP region in 2014/15 was almost $4.0 billion.

In 2014/15, the Murray dairy industry was responsible for the direct employment of an estimated 6,449 fte jobs, with upstream activities creating further employment of around 7,189 fte jobs. The total employment in the dairy industry in the Murray RDP, 13,638 fte jobs, represents 9.4 per cent of the total employment in the Murray economy and 0.6 per cent of the total employment in the Victorian economy.

Table 6.8 Dairy industry economic impacts, Murray, 2014/15

	Output ($m)	GRP ($m)	Household Income ($m)	Employment (fte)
Direct				
Dairy Farming	1,257	373	182	4,230
Dairy Processing	874	405	177	2,219
Total Direct	2,131	778	359	6,449
Flow-on[a]				
Production-induced	1,093	549	340	4,387
Consumption-induced	747	442	217	2,801
Total Flow-on	1,840	991	557	7,189
Total Impact[b]	**3,971**	**1,769**	**916**	**13,638**

[a] Flow-on impacts represent the aggregate of farm and processing sector impacts.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Personal income of $359 million was earned in the Murray dairy industry. An additional $557 million was earned by wage earners in other businesses in the region as a result of the dairy industry and associated upstream activities. The total household income created by the dairy industry in the Murray RDP region, $916 million, represents 7.4 per cent of the household income generated in the Murray economy and 0.5 per cent of the household income generated in the Victorian economy.

In 2014/15, the total Murray dairy industry related contribution to GRP was approximately $1.8 billion, $778 million generated by the dairy industry directly and $991 million generated in other sectors in the Murray RDP region economy. The total contribution to GRP from the dairy industry in the Murray, $1.8 billion, represents 8.0 per cent of the GRP generated in the Murray economy and 0.5 per cent of the GSP generated in the Victorian economy.

Economic multipliers for the entire dairy industry in the Murray region

Multipliers for the Murray dairy industry were developed using the relationships between the economic impact indicators described above.

As shown in Table 6.9, an initial $1 of output in the dairy industry in the Murray RDP region leads to 86 cents of output elsewhere in the regional economy (51 cents production-induced and 35 cents consumption-induced). This can be summarised as a Type II output multiplier of 1.86.

Table 6.9 Multipliers for the dairy industry, Murray 2014/15

	Output	GRP	Household Income	Employment[a]
Direct	1.00	0.37	0.17	3.03
Production-induced	0.51	0.26	0.16	2.06
Consumption-induced	0.35	0.21	0.10	1.31
Total[b]	**1.86**	**0.83**	**0.43**	**6.40**
Type I	1.51	1.71	1.95	1.68
Type II	1.86	2.27	2.55	2.11

[a] Employment multipliers (direct, production and consumption-induced and total) are expressed in terms of jobs per million dollars of output. Type I and II employment multipliers are expressed as total jobs per direct job.

[b] Totals may not sum due to rounding.

Source: EconSearch analysis

Each dollar of dairy farming output in the Murray RDP region generates 17 cents in direct household income and a further 16 cents in production-induced effects and 10 cents in consumption-induced effects. This can be summarised as a Type II income multiplier of 2.55.

Similarly, each dollar of output in the dairy industry results in 37 cents in direct contribution to gross regional product and a further 26 cents in production-induced effects and 21 cents in consumption-induced effects. This can be summarised as a Type II GRP multiplier of 2.27.

The direct effect of 3.03 fte jobs per million dollars of output results in a further 2.06 fte jobs in production-induced effects and 1.31 fte jobs in consumption-induced effects in associated industries. The total employment of 6.40 fte jobs per million dollars of output from direct employment 3.03 fte jobs can be summarised as a Type II employment multiplier of 2.11.

7. INDUSTRY COMPARISON

7.1 Comparative Industry Multipliers

To provide perspective on the impact the dairy industry has in the Victorian economy the Type I and Type II GSP and employment multipliers were compared to the corresponding multipliers for other sectors in the economy.

Dairy farming multipliers are compared to five similar agricultural sectors, namely sheep, grains, beef cattle, vegetables and fruit and nuts. Similarly, multipliers for dairy processing are compared against three similar agricultural processing sectors; meat processing, fruit and vegetable processing and cereals processing.

To provide a wider perspective on how the agriculture and faming sectors fit within the Victorian economy, the five largest sectors, determined by their level of employment (fte), are also provided. These comparisons have been provided for each of the RDP regions in Victoria and for Victoria as a whole (Table 7.1 to Table 7.4).

Note that the processing sector multipliers have been adjusted to exclude flow-ons to their respective farming sectors. This has been done so that the processing sector multipliers are comparable to the dairy processing multipliers presented in Sections 3 to 6 of this report.

Some care should be taken when comparing the dairy multipliers to the multipliers presented for other industries. The multipliers developed for the dairy industry are based on dairy industry survey data while the multipliers for the remaining industries have been developed within the generalised RISE model database[20] (which relies on a combination of published and modelled data). Consequently, more confidence can be expected in the dairy industry multipliers in comparison to the other industries.

7.2 Multiplier Limitations

Multipliers do have limitations and care should be taken when using them. Firstly, users should be aware of the scope of the multiplier they intend to use. Multipliers only measure impacts 'upstream' from the industry in question. For example, dairy farm multipliers do not take into account the linkages between dairy farming and dairy processing. Further, to enable separation of the farm and processing impacts, the processing sector multipliers reported throughout this study have been adjusted to exclude the on-farm and farm-related effects. This means the dairy processing flow-on effects do not include on-farm activity or the flow-ons from on-farm activity.

[20] See EconSearch (2013)

Table 7.1 Multipliers for select Victoria industries

	Agricultural Sectors						Agricultural Processing Sectors				5 Largest Sectors in the State[a]				
	Dairy Farming	Sheep	Grains	Beef Cattle	Vegetables	Fruit & Nut	**Dairy Processing**	Meat Processing	Fruit & Veg. Processing	Cereals Processing	Health & Community Serv.	Retail Trade	Prof. Scientific Tech Serv.	Eduction & Training	Wholesale trade
GSP															
Type I	**2.06**	1.45	1.47	1.46	1.27	1.27	**1.72**	1.33	1.69	1.77	1.17	1.46	1.63	1.21	1.71
Type II	**3.29**	2.71	2.23	2.77	1.91	1.78	**2.75**	2.19	2.72	2.77	2.23	2.57	3.01	2.34	2.88
Employment															
Type I	**1.62**	1.26	1.53	1.16	1.29	1.40	**2.03**	1.21	2.07	1.95	1.12	1.29	1.55	1.15	1.57
Type II	**2.25**	1.94	2.34	1.60	1.95	2.12	**3.13**	1.63	3.49	3.06	1.76	1.91	2.72	1.87	2.45
Direct fte	**12,827**	14,062	9,474	19,937	5,203	4,426	**8,252**	10,732	5,639	1,959	264,653	223,705	215,226	200,751	130,763
Direct GSP ($m)	**1,019**	1,062	1,529	1,004	809	940	**1,368**	789	1,180	329	24,002	18,677	27,390	19,211	14,793

[a] Largest sectors in the state by fte employment.

Source: EconSearch analysis, Victoria RISE model

Table 7.2 Multipliers for select Western Victoria industries

	Agricultural Sectors						Agricultural Processing Sectors				5 Largest Sectors in the Region[a]				
	Dairy Farming	Sheep	Grains	Beef Cattle	Vegetables	Fruit & Nut	**Dairy Processing**	Meat Processing	Fruit & Veg. Processing	Cereals Processing	Health & Community Serv.	Retail Trade	Eduction & Training	Prof. Scientific Tech Serv.	Construction Serv.
GRP															
Type I	**1.86**	1.45	1.16	1.34	1.03	1.02	**1.56**	1.06	1.42	1.49	1.12	1.35	1.17	1.49	2.29
Type II	**2.63**	2.28	1.48	2.17	1.32	1.20	**2.11**	1.51	1.98	2.03	1.79	2.04	1.90	2.39	3.57
Employment															
Type I	**1.42**	1.26	1.23	1.13	1.05	1.03	**2.02**	1.03	1.51	1.48	1.08	1.24	1.12	1.40	1.81
Type II	**1.76**	1.83	1.79	1.50	1.53	1.49	**2.72**	1.21	2.14	1.97	1.45	1.64	1.59	2.10	2.40
Direct fte	**4,609**	3,272	678	3,224	238	66	**2,276**	942	774	678	24,622	17,286	15,969	8,372	8,038
Direct GRP ($m)	**329**	349	187	227	63	25	**465**	59	137	21	2,194	1,581	1,643	1,030	575

[a] Largest sectors in the region by fte employment.

Source: EconSearch analysis, Western Victoria RISE model

Table 7.3 Multipliers for select Gippsland industries

	Agricultural Sectors						Agricultural Processing Sectors				5 Largest Sectors in the Region[a]				
	Dairy Farming	Sheep	Grains	Beef Cattle	Vegetables	Fruit & Nut	**Dairy Processing**	Meat Processing	Fruit & Veg. Processing	Cereals Processing	Retail Trade	Health & Community Serv.	Eduction & Training	Construction Serv.	Personal & Other Serv.
GRP															
Type I	**1.72**	1.30	1.05	1.12	1.05	1.05	**1.38**	1.06	1.08	1.20	1.11	1.03	1.04	1.77	1.11
Type II	**2.19**	1.79	1.28	1.60	1.27	1.22	**1.67**	1.38	1.39	1.54	1.50	1.46	1.47	2.48	1.55
Employment															
Type I	**1.47**	1.16	1.07	1.07	1.06	1.07	**1.92**	1.03	1.11	1.13	1.09	1.02	1.03	1.59	1.05
Type II	**1.69**	1.41	1.27	1.22	1.26	1.28	**2.30**	1.15	1.41	1.37	1.29	1.25	1.28	1.88	1.20
Direct fte	**3,989**	760	150	3,950	1,472	662	**2,035**	975	500	46	22,493	20,679	18,643	13,033	9,177
Direct GRP ($m)	**317**	86	34	298	318	193	**462**	59	82	5	1,999	1,801	1,774	869	517

[a] Largest sectors in the region by fte employment.

Source: EconSearch analysis, Gippsland RISE model

Table 7.4 Multipliers for select Murray industries

	Agricultural Sectors						Agricultural Processing Sectors				5 Largest Sectors in the Region[a]				
	Dairy Farming	Sheep	Grains	Beef Cattle	Vegetables	Fruit& Nut	**Dairy Processing**	Meat Processing	Fruit & Veg. Processing	Cereals Processing	Health & Community Serv.	Retail Trade	Eduction & Training	Personal & Other Serv.	Public Admin.
GRP															
Type I	**1.86**	1.45	1.41	1.39	1.18	1.17	**1.56**	1.11	1.62	1.51	1.13	1.33	1.17	1.33	1.32
Type II	**2.49**	2.20	1.84	2.15	1.54	1.45	**2.08**	1.55	2.20	1.99	1.73	1.97	1.83	2.03	1.98
Employment															
Type I	**1.52**	1.24	1.51	1.16	1.22	1.28	**1.98**	1.08	1.77	1.56	1.09	1.25	1.13	1.15	1.25
Type II	**1.87**	1.72	2.08	1.48	1.67	1.76	**2.58**	1.26	2.45	2.03	1.44	1.62	1.56	1.42	1.69
Direct fte	**4,230**	2,009	2,353	3,977	449	1,556	**2,219**	1,593	1,748	595	19,735	14,568	11,200	6,328	5,957
Direct GRP ($m)	**373**	195	474	258	87	409	**405**	102	322	89	1,772	1,296	1,119	377	606

[a] Largest sectors in the region by fte employment.

Source: EconSearch analysis, Murray RISE model

Secondly, while multipliers are most commonly used to quantify the economic impacts (both direct and indirect) relating to policies and projects, the multipliers are based on a number of implicit assumptions about which the user should be aware. While their ease of use makes them a popular tool for economic impact analysis, the limiting assumptions on which they are based results in multipliers being a potentially biased estimator of the benefits or costs of a project.

Thirdly, the results of any economic analysis must, by the nature of the data and the techniques of analysis used, be interpreted in a broad accuracy framework. While the mathematical operations of the technique produce results which appear to be precise, a professional assessment of accuracy in general terms is necessary. The accuracy of the estimates in this study as in other studies of this nature, should be interpreted in an 'order of magnitude' holistic framework (Jensen 1980).

Further inherent shortcomings and limitations of multipliers for economic impact analysis are discussed in ABS (2013). These include:

- Lack of supply–side constraints: The most significant limitation of economic impact analysis using multipliers is the implicit assumption that the economy has no supply–side constraints. That is, it is assumed that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts. The actual impact is likely to be dependent on the extent to which the economy is operating at or near capacity. If it is operating near capacity the multipliers are likely to overstate the impacts.
- Fixed prices: Constraints on the availability of inputs, such as skilled labour, require prices to act as a rationing device. In assessments using multipliers, where factors of production are assumed to be limitless, this rationing response is assumed not to occur. Prices are assumed to be unaffected by policy and any crowding out effects are not captured in the simple application of multipliers.
- Fixed ratios for intermediate inputs and production: Economic impact analysis using multipliers implicitly assumes that there is a fixed input structure in each industry and fixed ratios for production. As such, impact analysis using multipliers can be seen to describe average effects, not marginal effects. For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount.
- No allowance for purchasers' marginal responses to change: Economic impact analysis using multipliers assumes that households consume goods and services in exact proportions to their initial budget shares. For example, the household budget share of some goods might increase as household income increases. This equally applies to industrial consumption of intermediate inputs and factors of production.
- Absence of budget constraints: Assessments of economic impacts using multipliers that consider consumption-induced effects (Type II multipliers) implicitly assume that household consumption is not subject to budget constraints.

For each of these reasons, care needs to be taken when applying input-output multipliers to estimate economic impacts. For example, an increase in the value of industry output could arise from an increase in milk price alone. The application of the new output value to the existing industry multipliers would overstate the impacts as it would imply an increase in intermediate expenditure by dairy farmers when none had in fact occurred ('fixed ratios' assumption). There may be an increase in impacts from increased household expenditure but this is likely to be less than the existing industry multiplier would suggest ('no marginal response' assumption).

For most exercises aimed at quantifying the economic impacts relating to policies and projects it is recommended that the RISE economic impact models (provided as part of this project) be used rather than a simple application of multipliers. The RISE model is an extension of the conventional input-output model that provides for non-linearity in production in both primary and intermediate inputs and thereby addresses many of the limitations of the conventional model listed above. The core algorithms in the extended model were originally developed by West and Jackson (2005). The model extension enables the calculation of simulated impacts that are more closely aligned with computable general equilibrium (CGE) modelling, yet with greater rigour and credibility for analysis at a local scale.

This functionality has been incorporated into the RISE model so that it is possible to view the results of the price sensitivity and related functions (the price model) as well as view the results of the standard I-O model (conventional model) which is comparable to others in common use.

CGE models are very complex and, as a result, their use requires high-level expertise. However, they can be used to assess the impacts of a broad range of actions. CGE models utilise input-output data, but also incorporate a detailed representation of the consumption and income sides of the economy, capturing the multiplicity of flow on interactions between different production sectors – hence the descriptive term general equilibrium.

The impact of dairy industry policies and projects will generally involve changes that will be small relative to state and national economies. Few dairy industry projects or policy changes will have more than a negligible impact economy wide and so it is unlikely that `CGE modelling would be necessary for dairy industry specific assessments.

As an example, major transport infrastructure investment may result in significant improvements in transport efficiency state wide. The impact of this type of long-term, significant public investment would be ideally estimated with the aid of a CGE model. However, if the focus was just on the implications for the dairy industry (and flow-on impacts of dairy industry change), it would be possible to take a simpler (in terms of modelling), two-step approach to the assessment. First, an analysis of what the improvement in transport efficiency might mean for the dairy industry would be needed; how it would reduce costs, increase competitiveness and ultimately increase sales either domestically or into export markets would need to be quantified. Second, the anticipated change in demand from the first step analysis could be used in the RISE model to estimate the impacts on the broader economy. In many instances this partial, two-step approach will be adequate for the purpose at hand, providing an appropriate basis for estimating the consequences of actions, investments or policy changes that impact on the demand side of the economy.

8. RECOMMENDATIONS

This economic analysis provides a base set of data and a modelling capability that can be used to describe the significance of the dairy industry to the Victorian economy and to the economy of its three dairy regions. As the data represent a snapshot of the dairy industry in 2014/15, the figures can be used as a baseline against which alternative policy and project scenarios can be compared. Two broad recommendations are made regarding this data set and the modelling capability that it provides. The first refers to a program for the ongoing maintenance and annual update of the data set. The second is in relation to the collection of data specific for impact analysis at the time of periodic update surveys.

Economic impact updates…

The project provides Dairy Australia and DEDJTR with the capacity to develop a time series of dairy industry economic impacts in Victoria and its regions. As much of the input data used in the analysis is already collected by Dairy Australia and DEDJTR through the Dairy Farm Monitoring program and other programs and processes, the updating method would simply require the use of a range of indices to update data that are only available in the surveys conducted specifically for this study. These indices could include, for example, the ABS transportation index, the Reserve Bank of Australia indicator lending rate, the wage price index and the CPI to adjust costs for which there are no published indices, such as legal, accounting, office and administration costs. The updated data would be used together with annually prepared data to reflect the costs, prices and interindustry relationships prevailing in the industry in the update year.

It is envisaged that the detailed surveys conducted in the farming and processing sectors could be undertaken every three or four years and, for the in-between years, the survey-based estimates could be updated using existing and secondary data as described above.

EconSearch is of the opinion that small, regular (annual) economic impact assessments can be produced within four to five weeks of full financial year reporting data becoming available, but they would be of a lesser scope than that provided in this comprehensive economic impact study.

It is envisaged that the ideal timeframe for Dairy Australia and DEDJTR would be an economic impact assessment of the finalised financial year being available for presentation to stakeholder events late in the year (November/December).

Given that financial year reporting (production of annual statistics) is often only in September/October of each year, it may be necessary to make use of draft financial year data with using any later amendments to ensure timely delivery of the economic impact assessment.

The reporting of the economic impact for the financial year would focus on the importance of trend-lines as opposed to discussing the detail of changes from year-to-year. This would make it easier to produce the annual assessments according to the suggested timeframe.

It would be possible to provide a similar level of detail / breakdown as for the current comprehensive study for the items:

- Total economic impact (direct and flow-on) for dairy farming, dairy processing and the industry as a whole
- Economic impact by Victoria's three RDP regions and for the state as a whole.

The robustness of the update impact analysis would depend on the rate of structural change within the dairy industry businesses, particularly in the processing sector. If there is significant adoption of new technology, merger of significant players or other forms of substantial structural adjustment within the industry, then the accuracy of the estimates would be somewhat affected. If there has been minimal change of this type then we would expect the estimates to be very robust (assuming the data listed above is available and reliable).

A possible method for regular assessments would involve the following tasks:

1. Set up base data set using 2014/15 as the baseline.
2. Develop a dairy expenditure and employment model utilising the relationships implicit in the base data (some expenditures/activity will vary according to volume of milk produced, some will vary according to productivity changes, etc.). The model will provide estimates of expenditures and employment by industry segment (farm and processing) and region.
3. Collect and collate data described above (regularly produced industry data as well indices and other secondary data to facilitate updating).
4. Apply update data (from #3) to the model described in #2 above to produce estimates of expenditures and employment by industry segment and region.
5. Apply expenditure and employment data (from #4) to RISE models for the three RDP regions and Victorian economies to estimate updated dairy industry impacts.
6. Reporting.

It is recommended that a regular, perhaps three or four-yearly, cycle be established. The initial year, 2014/15, has been used to undertake the detailed surveys and build suitable RISE models. The estimates in the following two or three years would be prepared using the method outlined above.

In the fourth (or fifth) year the process would be repeated so a new set of survey data would be collected and new RISE models developed. The RISE models would not need to be updated on an annual basis as they have the functionality to allow for inflation and productivity changes between the base year and the update year. However, it would be advisable to update the models every three to four years, preferably in line with the conduct of the detailed industry surveys.

Impact scenarios…

The input data developed for each RISE model represents a detailed specification of the interindustry transactions of both the farming and processing sectors. In some instances, the

analyst may be interested in knowing how shifts in one or more of the variables that comprise these sectors may impact the dairy industries economic contribution. This could include changes in variables such as milk price, milk production and input costs. It may also reflect changes in other elements that, in turn, will impact dairy industry variables. For example, weather impacts or water restrictions.

Often, these types of scenarios require a good deal of additional information that can only be provided by operators within the industry or experts and advisors to the industry. Because it is this group of people who are contacted in the course of the industry surveys (farm and processing), it would be beneficial for Dairy Australia and DEDJTR to consider at the time the surveys are being conducted the types of scenarios they would like to assess so that the specific data required for those assessments can be collected. This would reduce survey fatigue for the respondents (not coming back soon after the main survey for further information) and would provide an immediate opportunity for analysts within Dairy Australia and DEDJTR to apply the model.

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Disclaimer

We have prepared the above report exclusively for the use and benefit of our client. Neither the firm nor any employee of the firm undertakes responsibility in any way whatsoever to any person (other than to the above mentioned client) in respect of the report including any errors or omissions therein however caused.

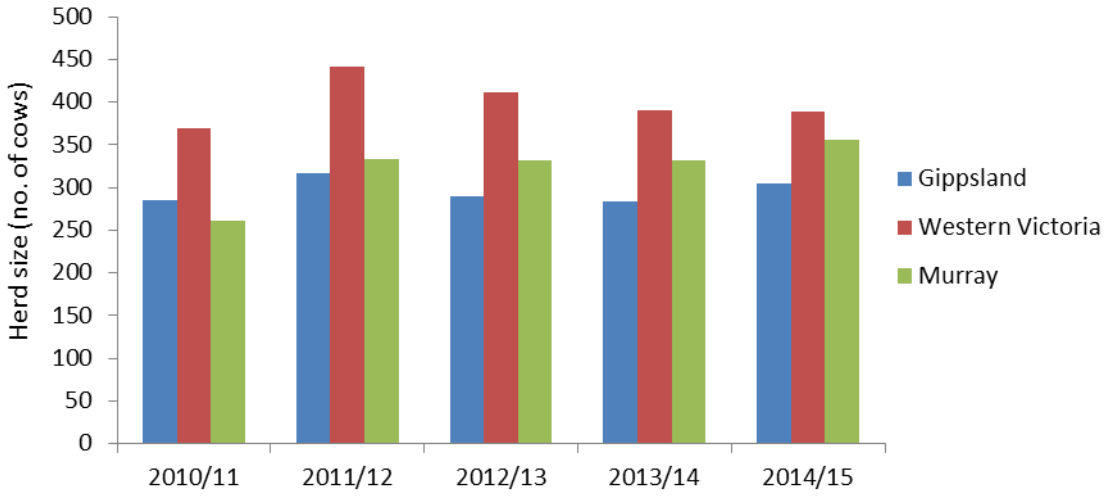
APPENDIX 1 FARM SECTOR QUESTIONNAIRE

Which Dairy Australia Regional Development Program region(s) (RDP) do you work with (see map and list below)?

☐ Gippsland Dairy ☐ Western Victoria Dairy ☐ Murray Dairy

PART A FARM PHYSICAL PARAMETERS

1. (a) Please consider the size of the <u>average dairy herd</u> shown in the figure below and briefly comment on the reason(s) for any notable changes that have occurred over the 5-year period.[a]



[a] Data from the Dairy Farm Monitor Project, run by DEDJTR and Dairy Australia http://www.depi.vic.gov.au/agriculture-and-food/dairy/business-management/farm-monitoring-dairy

(b) Was 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

(c) Do you expect any change to the size of the average dairy herd over the next 3 years? (*Tick appropriate response*)

Average dairy herd	**2014/15** (no. of	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to	**Large increase** (>7.5%)
Gippsland	304					
Western Victoria	389					
Murray	356					

Please comment on the main factor(s) that you believe will drive this trend:

2. (a) Please consider the trend in the amount of milk solids produced per cow in the figure below and briefly comment on the reason(s) for any notable changes that have occurred over the 5-year period.[a]

[a] Data from the Dairy Farm Monitor Project, run by DEDJTR and Dairy Australia http://www.depi.vic.gov.au/agriculture-and-food/dairy/business-management/farm-monitoring-dairy

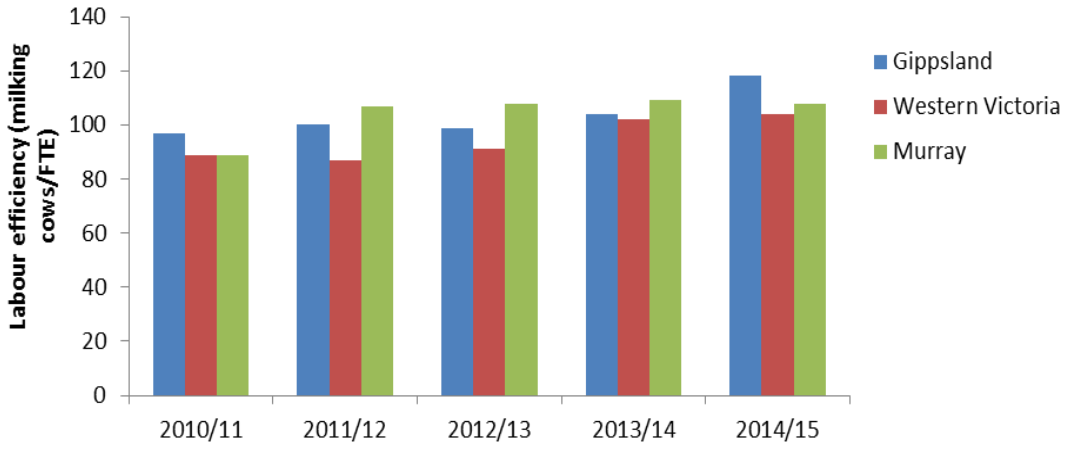
(b) Was 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

(c) Do you expect any change to the amount of milk solids produced per cow over the next 3 years? (*Tick appropriate response*)

Milk solids sold	**2014/15** (Kg	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to	**Large increase** (>7.5%)
Gippsland	479					
Western Victoria	525					
Murray	537					

Please comment on the main factor(s) that you believe will drive this trend:

3. (a) Please consider trends in <u>labour efficiency,</u> as measured by average no. of milking cows per FTE, shown in the figure below. Briefly comment on the reason(s) for any notable changes that have occurred over the 5-year period.[a]



[a] Data from the Dairy Farm Monitor Project, run by DEDJTR and Dairy Australia http://www.depi.vic.gov.au/agriculture-and-food/dairy/business-management/farm-monitoring-dairy

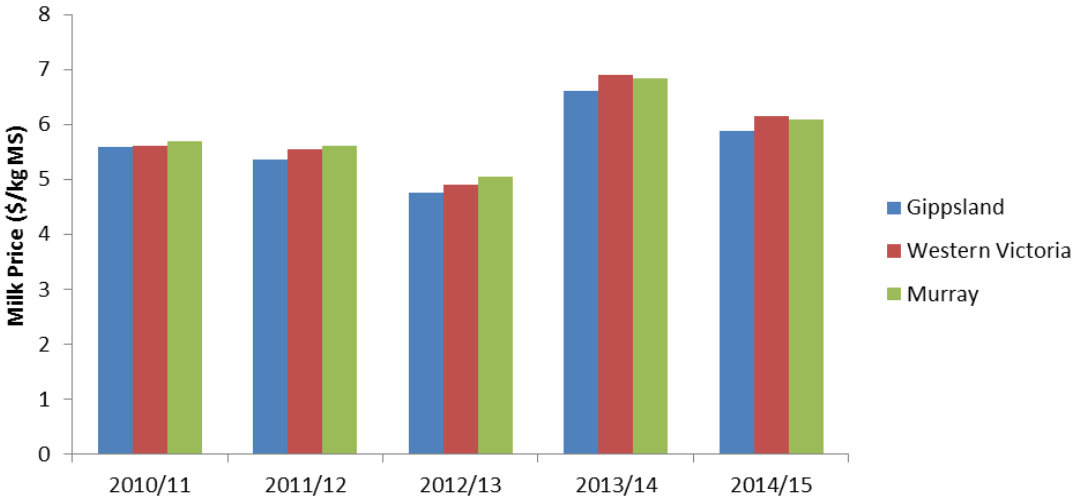
(b) Was 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

(c) Do you expect any change in <u>labour efficiency</u> over the next 3 years? (*Tick appropriate response*)

Labour efficiency	**2014/15** (milking cows/	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to 7.5%)	**Large increase** (>7.5%)
Gippsland	118					
Western Victoria	104					
Murray	108					

Please comment on the main factor(s) that you believe will drive this trend:

4. (a) Please consider the trend in <u>milk price</u> shown in the figure below and briefly comment on the reason(s) for any notable changes that have occurred over the 5-year period. [a] [b]



[a] Please note these figures are in nominal terms and have not been adjusted for inflation.

[b] Data from the Dairy Farm Monitor Project, run by DEDJTR and Dairy Australia http://www.depi.vic.gov.au/agriculture-and-food/dairy/business-management/farm-monitoring-dairy

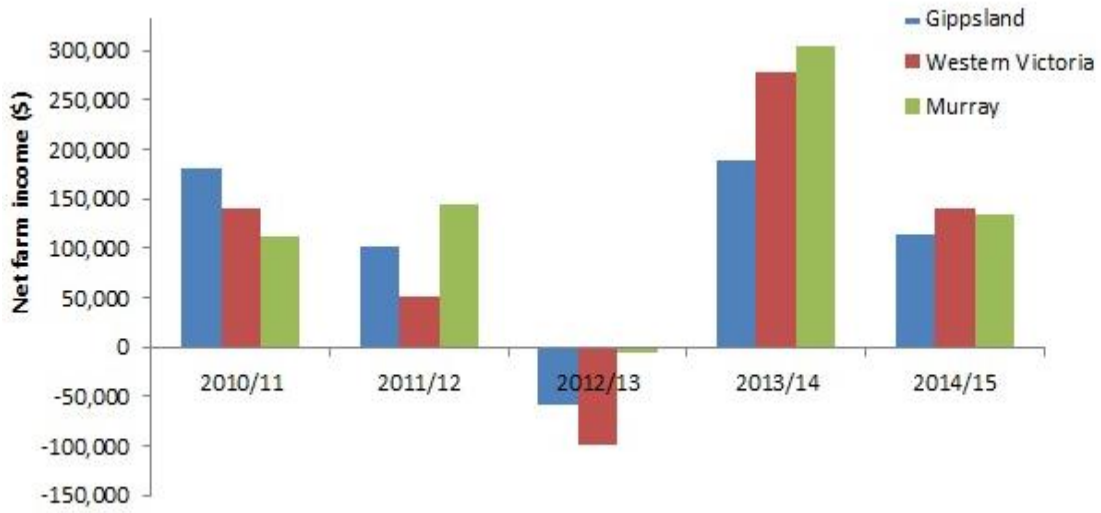
(b) Was 2014/15 unusual in any way? Is so, please comment on the main factor(s) that made it unusual.

(c) Do you expect any change to the milk price over the next 3 years? (*Tick appropriate response*)

Milk price	**2014/15** **($/kg MS)**	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to	**Large increase** (>7.5%)
Gippsland	5.88					
Western Victoria	6.16					
Murray	6.09					

Please comment on the main factor(s) that you believe will drive this trend:

5. (a) Please consider the trend in average net farm income[21] shown in the figure below and comment on the reason(s) for any notable changes that have occurred over the 5-year period.[a] [b]



[a] Please note these figures are in nominal terms and have not been adjusted for inflation.

[b] Data from the Dairy Farm Monitor Project, run by DEDJTR and Dairy Australia http://www.depi.vic.gov.au/agriculture-and-food/dairy/business-management/farm-monitoring-dairy

[21] Net farm income is the farm's Earnings Before Interest and Tax (EBIT) minus interest and lease costs.

(b) Was 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

(c) Do you expect any change to the average net farm income over the next 3 years? (*Tick appropriate response*)

Net income	**2014/15 ($)**	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to	**Large increase** (>7.5%)
Gippsland	108,402					
Western Victoria	148,608					
Murray	112,791					

Please comment on the main factor(s) that you believe will drive this trend:

PART B OPERATING COSTS

1. For the average farm business in the _____ dairy region in 2014/15, please indicate what proportion of each farm business input is purchased in the following regions (i.e. its point of sale):

Inputs	Within region (%)	Outside region, within Victoria (%)	Outside Vic, within Australia (%)	Imported (%)	Total
AI and herd testing					100%
Animal health					100%
Shed power					100%
Dairy supplies (water hoses, teat spraying equipment, tubing, milk filters and liners)					100%
Home grown feed (direct and temporary water charges, hay and silage making, pasture improvement/cropping, fuel and oil)					100%
Fertiliser					100%
Agistment costs					100%
Purchased feed (fodder, grains, concentrates, by-products and other feed)					100%
Overheads (vehicle registration and insurance, farm insurance, banking, administration)					100%
Repairs and maintenance					100%
Labour					100%

2. If known, please comment on whether any business inputs are typically purchased in the region but are sourced from outside the region.

Input	Comment
e.g. hay	*Bought in Gippsland, but retailer sources from north east Victoria*

PART C CAPITAL AND EQUIPMENT

1. For the average farm business in the _____ dairy region in 2014/15, please indicate what proportion of each capital item is purchased in the following regions (i.e. its point of sale):

Capital equipment	Within region (%)	Outside region, within	Outside Vic, within Australia (%)	Imported (%)	Total
Livestock					100%
Feeding equipment (e.g. calf feeders, troughs)					100%
Fencing equipment (e.g. fencing supplies, stockyards)					100%
Sheds					100%
Tractor and accessories					100%
Farm vehicle					100%
Dairy Plants, stall gates, milk clusters, milk vats, refrigeration, etc.					100%

2. If known, please comment on whether any capital items are typically purchased in the region but are sourced from outside the region.

Input	Comment
e.g. troughs	*Bought from local retailer, but sourced from New South Wales*

PART D OTHER COMMENTS

1. Do you have any other comments about the economic impact of the dairy industry in your region?

Thank you for completing our survey!

APPENDIX 2 PROCESSING SECTOR QUESTIONNAIRE

Please read this first:

- Please only include information about the dairy processing business you work with.
- To measure the impact of dairy at a state level, the Murray dairy region is split into the Victorian Murray and New South Wales Murray regions.

PART A —LOCATION OF DAIRY PROCESSING BUSINESS

1. Which dairy region do you work in?[22]

☐ Gippsland ☐ Western Victoria ☐ Murray (Vic) ☐ Murray (NSW)

In 2014/15, did your dairy processing business operate only in the region(s) selected above?

☐ Yes ☐ No

[22] See attached list of Local Government Areas for each RDP

2. If 'No', which other regions was your business operate in during 2014/15?

☐ Gippsland ☐ Western Victoria ☐ Murray (Vic) ☐ Murray (NSW) ☐ NSW

☐ Tasmania ☐ Western Australia ☐ Sub Tropical ☐ South Australia

PART B —EXPENDITURE

1. (a) How much milk did your business purchase in 2014/15 and at what price?

Milk Source	Milk purchased (L)	Average price ($/kg MS)
Gippsland		
Western Victoria		
Murray (Vic)		

(b) Was 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

(c) Over the past 5 years, has the amount of milk your business purchases and/or the price it pays for milk changed? If so, please comment on the main factor(s) that have driven this change.

(d) Do you expect any change to the volume (L) of milk your business purchases over the next 3 years? (*Tick appropriate response for the region(s) you work with)*

	Large decrease (<-7.5%)	**Small decrease** (-7.5% to -2.5%)	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to 7.5%)	**Large increase** (>7.5%)
Gippsland					
Western Victoria					
Murray (Vic)					

Please comment on the main factor(s) that you expect to drive this trend:

(e) Do you expect any change to the price of milk ($/kg MS) your business pays over the next 3 years? (*Tick appropriate response for the region(s) you work with)*

	Large decrease (<-7.5%)	**Small decrease** (-7.5% to -2.5%)	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to 7.5%)	**Large increase** (>7.5%)
Gippsland					
Western Victoria					
Murray (Vic)					

Please comment on the main factor(s) that you expect to drive this trend:

2. (a) Where did your business source milk from in 2014/15?

Milk source	Gippsland processing (%)	West Vic processing (%)	Murray (Vic) processing (%)
Gippsland	%	%	%
Western Victoria	%	%	%
Murray (Vic)	%	%	%
Murray (NSW)	%	%	%
NSW	%	%	%
Tasmania	%	%	%
Western Australia	%	%	%
Sub-tropical	%	%	%
South Australia	%	%	%
Total	**100%**	**100%**	**100%**

(b) Was your regional sourcing of milk in 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual:

(c) How will your business's regional sourcing of milk change over the next 3 years? (*Tick appropriate response)*

Source	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -2.5%)	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to 7.5%)	**Large increase** (>7.5%)
Gippsland processing					
Within region					
Outside region, within Vic					
Outside Vic, within Aus					
West Vic processing					
Within region					
Outside region, within Vic					
Outside Vic, within Aus					
Murray (Vic) processing					
Within region					
Outside region, within Vic					
Outside Vic, within Aus					

Please comment on the main factor(s) that you expect to drive these changes:

3. (a) The table on the following page asks about your business's operating costs and where inputs were sourced from in 2014/15.

   Were your operating costs in 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

   (b) Do you expect your business's operating costs to change over the next 3 years? If so, comment why.

(c) What percentage of your business's total operating costs were attributable to each of the following items in 2014/15?

Please also provide a percentage breakdown of the location in which you bought your inputs in 2014/15 (in other words, the point of sale).

Operating Costs $ (excl. GST)[23]	2014/15 Costs (%)		Point of sale (%)				
	Our estimate[24] *	Your estimate	Within region	Outside region, within Vic	Outside Vic, within Aus	Imported	Total
Raw milk (including milk collection)	35%						**100%**
Manufactured food and beverage products	28%						**100%**
Wages	13%						**100%**
Equipment	4%						**100%**
Freight, distribution, marketing	4%						**100%**
Repairs and maintenance	3%						**100%**
Energy and water	3%						**100%**
Communication-telephone, email	1%						**100%**
Rent	1%						**100%**
Administration	1%						**100%**
Insurance	1%						**100%**
Legal and accounting	<1%						**100%**
Chemicals	<1%						**100%**
Rates	<1%						**100%**
Travel accommodation	<1%						**100%**
Total Operating Costs	**100%**	**100%**					

[23] Operating costs exclude GST, depreciation, tax and interest payments.

[24] Derived from the National Accounts

PART C EMPLOYMENT

1. How many people (including contractors) were employed by your dairy processing business in 2014/15?

	Full time Employees	Part Time Employees		Contractors
		No. of persons	Full Time Equivalent	
Gippsland processing				
West Vic processing				
Murray (Vic) processing				

2. Was 2014/15 unusual in any way with respect to the number of people you employ? If so, please comment on the main factor(s) that made it unusual.

3. Do you expect any change to employment over the next 3 years? If so, comment why.

PART D PRODUCTION AND SALES

1. What were the sales (gross turnover) and volume of dairy products made by your processing business in 2014/15?

   Please also estimate the percentage of products made by your processing business that went to the domestic and export market in 2014/15.

Products	2014/15 Production		2014/15 Market Destination		
	Quantity	Sales ($)	Domestic (%)	Export (%)	Total
Drinking milk (fresh and UHT)					**100%**
Skim/ butter milk powder					**100%**
Butter/ casein					**100%**
Cheese					**100%**
Whole milk powder					**100%**
Other products (yoghurt, custards, desserts, etc.)					**100%**
Specialised ingredients (Whey proteins, nutraceuticals, etc.)					**100%**

2. Was 2014/15 unusual in any way? If so, please comment on the main factor(s) that made it unusual.

3. Do you expect the quantity of dairy products your business produces to change over the next 3 years? (*Tick appropriate response for each product)*

Product	**Large decrease** (<-7.5%)	**Small decrease** (-7.5% to -2.5%)	**No change** (-2.5% to 2.5%)	**Small increase** (2.5% to 7.5%)	**Large increase** (>7.5%)
Drinking milk (fresh and UHT)					
Skim/ butter milk powder					
Butter/ casein					
Cheese					
Whole milk powder					
Other products (yoghurt, custards, desserts, etc.)					
Specialised ingredients (Whey proteins, nutraceuticals, etc.)					

Please comment on the main factor(s) that you believe will drive this trend:

4. Altogether, do you expect any change in the level of exports of your business's dairy products over the next 3 years? (*Tick appropriate response for domestic and export)*

Exports from:	**Large decrease**	**Small decrease** (-7.5% to -2.5%)	**No change** (-2.5% to	**Small increase**	**Large increase**
Gippsland					
West Vic					
Murray (Vic)					

Please comment on the main factor(s) that you believe will drive this trend:

PART E OTHER COMMENTS

Do you have any other comments about the economic impact of the dairy industry in your region?

Your assistance in this study is very much appreciated.

APPENDIX 3 MILK DISTRIBUTION

Appendix Table 3.1 Litres of milk produced and processed by dairy RDP region, 2014/15

		Processing											
		Gippsland	Murray(Vic)	Murray(NSW)	WestVic	NSW	Subtropical	SA	Tas	Western	Melb_city	Syd_city	**TOTAL (production)**
Production	Gippsland	1,899,915,415	22,719,840	-	3,697,869	-	-	-	-	-	153,865,696	-	**2,080,198,820**
	Murray(Vic)	22,893,008	1,843,449,469	-	9,735,917	-	-	-	-	-	251,432,111	-	**2,127,510,505**
	Murray(NSW)	-	40,274,023	159,849,197	-	9,838,170	-	-	-	-	25,000,000	-	**234,961,390**
	WestVic	-	29,982,757	-	2,054,885,414	-	-	-	-	-	97,458,858	-	**2,182,327,029**
	NSW	-	-	24,417,278	-	345,911,427	-	-	-	-	-	417,075,802	**787,404,507**
	Subtropical	-	-	-	-	197,674	547,715,022	-	-	-	-	-	**547,912,696**
	SA	-	-	-	77,473,367	-	-	439,015,744	-	-	-	-	**516,489,110**
	Tas	-	-	-	-	-	-	-	891,353,091	-	-	-	**891,353,091**
	Western	-	-	-	-	-	-	-	-	363,521,836	-	-	**363,521,836**
	Melb_city	-	-	-	-	-	-	-	-	-	-	-	**-**
	Syd_city	-	-	-	-	-	-	-	-	-	-	-	**-**
	TOTAL (processing)	**1,922,808,423**	**1,936,426,089**	**184,266,475**	**2,145,792,566**	**355,947,271**	**547,715,022**	**439,015,744**	**891,353,091**	**363,521,836**	**527,756,665**	**417,075,802**	

Source: Dairy Australia and EconSearch analysis

APPENDIX 4 AN OVERVIEW OF ECONOMIC IMPACT ANALYSIS

This study will provide estimates of the economic impact of dairy-related activity on the economies of the Gippsland, Western Victoria, and Murray RDP regions and the state of Victoria. The methodological basis for the study is input-output analysis. In this appendix the concept of economic impact, the process of impact measurement and the use of input-output models in impact measurement are briefly reviewed. The research method applied in this study is outlined in more specific terms in Section 2.

The input-output models are suitable for the detailed description of regional economies and for measuring the impacts of existing industries, new industries or changes in the size of industries on the regional economies. It is therefore appropriate to apply the model in estimating the impact of dairy-related activity on the economies of the Gippsland, Western Victoria, and Murray RDP regions.

In the following sections the method of economic impact analysis is outlined and the structure of the input-output model and multipliers, the tools used in the estimation of economic impacts, are detailed.

Economic impact analysis

The term *impact* has no unambiguous meaning; it is used in a wide variety of contexts, and synonymously with several terms such as *results*, *incidence*, *effect*, *significance*, *contribution*, *consequence* and *importance*. It is therefore important to define clearly the concept of economic impact, and the particular use of the term applied in this study.

One of the main ends of economic research is the study of impacts, where the term refers generally to the consequences of some expected or hypothetical phenomenon, either physical or social. For example, the recent emergence of environmental impact statements reflects a desire on the part of authorities to be informed on the likely consequences of a new development, both in terms of effects on the physical environment and the socio-economic environment. An impact study is intended to isolate and identify the more significant consequences of an event or phenomenon for planning purposes.

It is necessary to distinguish between the *impacting agent*, which is the phenomenon or event under study, and the *impacts*, which are the results of the existence of, or change in, the impacting agent. Socio-economic impact studies tend to be restricted to the consequences of significant existing or new phenomena. These phenomena cause a wide variety of impacts to occur in economic, sociological, political, physical and welfare terms. For example, the activity associated with the Victorian dairy industry has resulted in a wide variety of impacts on the regional, social and economic structure of the Gippsland, Western Victoria, and Murray RDP regions as a whole. Apart from the economic consequences of the dairy industry, some of which

are the subject of this study, virtually every facet of the regional social structure will be affected by the existence of the industry.

Since this study is concerned solely with economic impact, it omits the wide variety of non-economic impacts of the industry on the region, many of which are clearly significant. The *economic* consequence of the presence of the dairy industry will be felt in many aspects of activity in the regions, ranging from levels of regional output, income and employment, to land prices (including residential, commercial and industrial land), house and building prices, local government rates, supply and demand of labour, demand and supply of urban infrastructure and so on. Unfortunately, fully comprehensive models, including all aspects of regional economic activity, are not available and more complex econometric models with an ability to include a wide variety of economic phenomena have not been satisfactorily developed for impact analysis at a regional level in Australia.

The input-output model was considered the most appropriate for this economic impact assessment. This model is, however, limited to those aspects of impact which can be represented in the input-output model, i.e. output, income, employment and value added. The procedures used in input-output analysis are detailed in the following section.

While it is quite clear that significant economic and social impacts are associated with dairy-related activity, measurement of these impacts does not, *per se*, constitute an economic evaluation of the industry. Such an evaluation is possible only through a comprehensive cost-benefit analysis of the industry, which would take into account both the direct and indirect impacts of the industry as recorded in this study.

In summary, an economic impact may be defined in general terms as the measured economic effect of, or change which is attributable to, the impacting agent[25] on the economy in question.

Multipliers and impact measurement

The essence of impact measurement is the empirical measurement of the relationship between cause and effect, or between the impacting agent and the expected impact. This relationship can be expressed in two ways:

(i) on a 'per unit of impact' basis. This is normally expressed in terms of a multiplier which expresses the cause-effect relationship in empirical terms. In this study, output, income, employment and value added multipliers are used to express impacts in terms of a 'per unit of output of dairy-related activity'.

(ii) on an aggregate value basis. This expresses the total absolute effect, measured in terms of output, income, employment, and value added of the existence of dairy-related activity.

[25] The impacting agent may be an actual or potential source of economic change, or an industry which is established and operating in the economy.

The selection of methodology for impact measurement is therefore selection of the most appropriate method of estimation of multipliers. Four general methods are available for this purpose, namely economic base multipliers, regional Keynesian multipliers, econometric models and input-output models. The consultants had access to an established methodological and research structure for the calculation of an input-output table for the regions, and to methods of calculating multipliers from these tables. There was, therefore, a distinct advantage in the use of the input-output technique, apart from the fact that it is generally considered to be methodologically superior to the simpler techniques such as the economic base approach or the use of regional Keynesian employment multipliers. This superiority is generally considered to be attributable to the following factors :

(i) In terms of the incidence of impact, the economic base and the Keynesian approaches normally provide impact measurement only in aggregate terms, i.e. the total impact felt by all sectors collectively. Input-output multipliers allow the analyst to examine the manner in which the total impact is distributed among the sectors of the economy. This is a reflection of the internal linkages and interdependencies in the economy which are specified in the input-output table.

(ii) Input-output multipliers also allow the identification of the components of the multiplier; the economic base and Keynesian models do not, in their standard form, provide all of these details. The components are as follows:

(a) the **initial** effect, which is the stimulus for the impact analysis – normally assumed to be a dollar change in sales to final demand

(b) the **first-round** effect, which refers to the purchases of inputs required from other sectors in the economy in order to produce the additional output

(c) the **industrial-support** effect, which refers to second, third and subsequent-round industrial flow-on effects triggered by the purchases in the first round

(d) the **consumption-induced** effects, which stem from the spending of household income received as payments for labour used in producing the additional output.

Regional econometric models, including models of the general equilibrium family, were not available for the regions or project in question, and were not considered necessary for the view of impact taken in this study.

Input-output analysis

An outline of the input-output technique can be found in any one of a number of standard texts dealing with the subject. An input-output table is a simple mathematical representation of the production aspects of an economy viewed at a particular point in time. In the purely hypothetical case of no significant change in the economy from one time period to another, the table would remain relatively unchanged over that period. In reality, any economy continually experiences many types of shocks or stimuli (positive and negative) and these may be ephemeral in nature or lead to long-term structural changes in the nature of the economy. Many of these stimuli can

be represented in the input-output model by appropriate adjustments to the input-output table. Some of these methods are outlined in the following section.

Methods of impact measurement using input-output analysis

The task of measuring economic impacts through the input-output model is largely one of representing the impact in the most appropriate manner in the transactions table. Once this has been completed, the analytical derivation of the impact is possible through multiplier calculation in the conventional manner.

The responsibility of the input-output analyst is to determine the nature of the impact under study, the relationship of the impacting agent with the economy in question, and to simulate this relationship as closely as possible in the transactions table of the regional economy. Some common types of impact, requiring different treatment of the input-output table, are listed below.

1. A change in the level of output of a sector or sectors, due to changes in the level of final demand, may be traced by use of multipliers or by matrix multiplication using the table in its original form.

2. A change in the technology or trading patterns of an existing industry would be reflected in changed column or row entries in the existing transactions table. The effects of this type of change would be measured by comparing multipliers, output levels and employment levels before and after the impact occurred.

3. A new or existing firm or industry can be incorporated into the study in either of two ways. If the impact is regarded as of little significance, or if the firm is thought to show a cost structure (i.e. a column in the A matrix) similar to the average existing firm in the table, the new firm can be adequately represented by the existing sector of the table without any significant strain on the assumptions of the model. If, however, the firm or industry to be examined is considered to be of some significance, or if the requirements of the study called for a detailed study of the firm or industry *per se*, a new row and column representing that firm or industry should be prepared and incorporated into the input-output table and normal multiplier calculation carried out. Only in this manner is a detailed study of the impact of the firm or industry possible. The latter procedure was used in this study and new rows and columns were prepared for each aspect of dairy industry activity

Input-output multipliers

Input-output multipliers are an indication of the strength of the linkages between a particular sector and the rest of the state or regional economy. As well, they can be used to estimate the impact of a change in that particular sector on the rest of the economy.

Detailed explanations on calculating I-O multipliers, including the underlying assumptions, are provided in any regional economics or I-O analysis textbook (see, for example, Jensen and West

(1986)). They are calculated through a routine set of mathematical operations based on coefficients derived from the I-O transactions model, as outlined below.

The transactions table may be represented by a series of equations thus:

$$X_1 = X_{11} + X_{12} + \ldots\ldots\ldots\ldots\ldots + X_{1n} + Y_1$$
$$X_2 = X_{21} + X_{22} + \ldots\ldots\ldots\ldots\ldots + X_{2n} + Y_2$$
$$X_n = X_{n1} + X_{n2} + \ldots\ldots\ldots\ldots\ldots + X_{nn} + Y_n$$

where X_i = total output of intermediate sector *i* (row totals);

X_{ij} = output of sector *i* purchased by sector *j* (elements of the intermediate quadrant); and

Y_j = total final demand for the output of sector *i*.

It is possible, by dividing the elements of the columns of the transactions table by the respective column totals to derive coefficients, which represent more clearly the purchasing pattern of each sector. These coefficients, termed 'direct' or 'I-O' coefficients, are normally denoted as aij, and represent the direct or first round requirements from the output of each sector following an increase in output of any sector.

In equation terms the model becomes:

$$X_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots\ldots\ldots\ldots + a_{1n}X_n + Y_1$$
$$X_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots\ldots\ldots\ldots + a_{2n}X_n + Y_2$$
$$X_n = a_{n1}X_{11} + a_{n2}X_2 + \ldots\ldots\ldots\ldots\ldots + a_{nn}X_n + Y_n$$

where a_{ij} (the direct coefficient) = X_{ij}/X_j. This may be represented in matrix terms:

$X = AX + Y$

where A = $[a_{ij}]$, the matrix of direct coefficients.

The previous equation can be extended to:

$(I\text{-}A)X = Y$

where $(I\text{-}A)$ is termed the Leontief matrix,

or $X = (I\text{-}A)^{-1}Y$

where $(I\text{-}A)^{-1}$ is termed the 'general solution', the 'Leontief inverse' or simply the inverse of the open model.

The general solution is often represented by:

$Z = (I\text{-}A)^{-1} = [z_{ij}]$

The I-O table can be 'closed' with respect to certain elements of the table. Closure involves the transfer of items from the exogenous portions of the table (final demand and primary input quadrants) to the endogenous section of the table (intermediate quadrant). This implies that the analyst considers that the transferred item is related more to the level of local activity than to external influences. Closure of I-O tables with respect to households is common and has been adopted in this project.

The 'closed' direct coefficients matrix may be referred to as A^*. The inverse of the Leontief matrix formed from A^* is given by:

$Z^* = (I - A^*)^{-1} = [z^*_{ij}]$

Z^* is referred to as the 'closed inverse' matrix.

A multiplier is essentially a measurement of the impact of an economic stimulus. In the case of I-O multipliers the stimulus is normally assumed to be an increase of one dollar in sales to final demand by a sector. The impact in terms of output, contribution to gross regional product, household income and employment can be identified in the categories discussed below.

(i) The initial impact: refers to the assumed dollar increase in sales. It is the stimulus or the cause of the impacts. It is the unity base of the output multiplier and provides the identity matrix of the Leontief matrix. Associated directly with this dollar increase in output is an own-sector increase in household income (wages and salaries, drawings by owner operators etc.) used in the production of that dollar. This is the household income coefficient h_j. Household income, together with other value added (OVA), provide the total gross regional product from the production of that dollar of output. The gross regional product coefficient is denoted v_j. Associated also will be an own-sector increase in employment, represented by the size of the employment coefficient. This employment coefficient e_j represents an employment/output ratio and is usually calculated as 'employment per million dollars of output'.

(ii) The first round impact: refers to the effect of the first round of purchases by the sector providing the additional dollar of output. In the case of the output multiplier this is shown by the direct coefficients matrix $[a_{ij}]$. The disaggregated effects are given by individual a_{ij} coefficients and the total first-round effect by Σa_{ij}. First-round household income effects are calculated by multiplying the first-round output effects by the appropriate household income coefficient (h_j). Similarly, the first-round gross regional product and employment effects are calculated by multiplying the first-round output effects by the appropriate gross regional product (v_j) and employment (e_j) coefficients.

(iii) Industrial-support impacts. This term is applied to 'second and subsequent round' effects as successive waves of output increases occur in the economy to provide industrial support, as a response to the original dollar increase in sales to final demand. The term excludes any increases caused by increased household consumption. Output effects are calculated from the open Z inverse, as a measure of industrial response to the first-round effects. The industrial-support output requirements are calculated as the elements of the columns of

the Z inverse, less the initial dollar stimulus and the first-round effects. The industrial support household income, gross regional product and employment effects are defined as the output effects multiplied by the respective household income, gross regional product and employment coefficients. The first-round and industrial-support impacts are together termed the production-induced impacts.

(iv) Consumption-induced impacts: are defined as those induced by increased household income associated with the original dollar stimulus in output. The consumption-induced output effects are calculated in disaggregated form as the difference between the corresponding elements in the open and closed inverse (i.e. $z^*_{ij} - z_{ij}$, and in total as $\Sigma(z^*_{ij} - z_{ij})$. The consumption-induced household income, gross regional product and employment effects are simply the output effects multiplied by the respective household income, gross regional product and employment coefficients.

(v) Flow-on impacts: are calculated as total impact less the initial impact. This allows for the separation of 'cause and effect' factors in the multipliers. The cause of the impact is given by the initial impact (the original dollar increase in sales to final demand), and the effect is represented by the first-round, industrial-support and consumption-induced effects, which together constitute the flow-on effects.

Each of the five impacts are summarised in Appendix Table 1.1. It should be noted that household income, gross regional product and employment multipliers are parallel concepts, differing only by their respective coefficients h_j, v_j and e_j.

The output multipliers are calculated on a 'per unit of initial effect' basis (i.e. output responses to a one dollar change in output). Household income, gross regional product and employment multipliers, as described above, refer to changes in household income per initial change in output, changes to gross regional product per initial change in output and changes in employment per initial change in output. These multipliers are conventionally converted to ratios, expressing a 'per unit' measurement, and described as Type I and Type II ratios. For example, with respect to employment:

Type I employment ratio = [initial + first round + industrial support]/initial

and

Type II employment ratio = [initial + production-induced[26] + consumption-induced]/initial

[26] Where (first round + industrial support) = production-induced.

Appendix Table 4.1 The structure of input-output multipliers for sector *i* [a]

Impacts	General formula
Output multipliers ($)	
Initial	1
First-round	$\Sigma_i a_{ij}$
Industrial-support	$\Sigma_i z_{ij}$-1-$\Sigma_i a_{ij}$
Consumption-induced	$\Sigma_i z^*_{ij}$-$\Sigma_i z_{ij}$
Total	$\Sigma_i z^*_{ij}$
Flow-on	$\Sigma_i z^*_{ij}$-1
Household Income multipliers ($)	
Initial	h_j
First-round	$\Sigma_i a_{ij} h_i$
Industrial-support	$\Sigma_i z_{ij} h_i$- h_j-$\Sigma_i a_{ij} h_i$
Consumption-induced	$\Sigma_i z^*_{ij} h_i$-$\Sigma_i z_{ij} h_i$
Total	$\Sigma_i z^*_{ij} h_i$
Flow-on	$\Sigma_i z^*_{ij} h_i$-h_j
Gross regional product multipliers ($)	
Initial	v_j
First-round	$\Sigma_i a_{ij} v_i$
Industrial-support	$\Sigma_i z_{ij} v_i$- v_j-$\Sigma_i a_{ij} v_i$
Consumption-induced	$\Sigma_i z^*_{ij} v_i$-$\Sigma_i z_{ij} v_i$
Total	$\Sigma_i z^*_{ij} v_i$
Flow-on	$\Sigma_i z^*_{ij} v_i$-v_j
Employment multipliers (full time equivalents)	
Initial	e_j
First-round	$\Sigma_i a_{ij} e_i$
Industrial-support	$\Sigma_i z_{ij} e_i$- e_j-$\Sigma_i a_{ij} e_i$
Consumption-induced	$\Sigma_i z^*_{ij} e_i$-$\Sigma_i z_{ij} e_i$
Total	$\Sigma_i z^*_{ij} e_i$
Flow-on	$\Sigma_i z^*_{ij} e_i$-e_j

[a] In a DECON model, Z^* (the 'closed inverse' matrix), includes a population and an unemployed row and column (see below for details).

Model assumptions

There are a number of important assumptions in the I-O model that are relevant in interpreting the analytical results.

- Industries in the model have a linear production function, which implies constant returns to scale and fixed input proportions.
- Another model assumption is that firms within a sector are homogeneous, which implies they produce a fixed set of products that are not produced by any other sector and that the input structure of the firms are the same. Thus it is preferable to have as many sectors as possible specified in the models and the standard models for this study were compiled with 66 sectors (see Appendix 1 for further detail).

- The model is a static model that does not take account of the dynamic processes involved in the adjustment to an external change, such as a permanent change in natural resources management.

Limitations of input-output analysis

The input-output model, like all economic models, is not capable of a perfect or near-perfect simulation of economic reality. It is therefore important to clarify the limitations of the model. Two points are made in the context of the present study.

The first point refers to the accuracy of multiplier estimates. The results of any social or economic analysis must, by the nature of the data and the techniques of analysis used, be interpreted in a broad accuracy framework. While the mathematical operations of the technique produce results which appear to be precise, a professional assessment of accuracy in general terms is necessary. The accuracy of the estimates in this study as in other studies of this nature, should be interpreted in an 'order of magnitude' holistic framework (Jensen 1980).

The second point refers to the question of the linearity assumption of the input-output model. The notion of linearity is common to most methods of impact analysis, including most of the alternative methods discussed above. This or some other equally convenient assumption is usually necessary to achieve workable economic models. The main question is not the existence of the assumption but the extent to which it results in unacceptable inaccuracies in empirical work. In this study it was felt that since port-related activity is long-established, and clearly a 'permanent' and integrated part of the regional economy, the linearity assumption posed no problem in the estimation and interpretation of the significance of the industry in the economy of the region.

APPENDIX 5 THREE-YEAR PROJECTIONS

The following appendix contains a summary of the three-year projections provided for each RDP region in Victoria by respondents of the farm sector questionnaire. These have been aggregated to provide some insight into the three-year projections for Victoria.

These projections have been used in this report as a basis for how the dairy industry will look in three years. These projections do not purport to be modelled forecasts but are the opinions of dairy industry experts and analysts who participated in the farm sector questionnaire. As such, care should be taken when using the figures provided.

Three-year projections for Victoria

This section provides a summary of the survey responses for each of the RDP regions in Victoria. While no survey was conducted for Victoria as a whole, the aggregate of responses from each of the RDP region surveys provides some insight into the possible changes at the state level over the three-year period.

Each category contains a table which illustrates the majority response for each RDP region in Victoria. In some instances the respondents were evenly divided between two of the possible responses. Where this is the case both responses have been reported.

Herd size

Overall, respondents felt that herd size would undergo a small increase in Victoria in the next three years (Appendix Table 5.1). This would be a continuation of the historical trend in the region as inputs that impact herd size (farm breeding programs, milk cost, input costs, climatic conditions, etc.) are expected to be favourable and, therefore, promote herd growth.

Appendix Table 5.1 Projected change in herd size, Victoria, 2014/15 to 2017/18

Region	Direction of change	Magnitude of change
Western Victoria	small increase	2.5 to 7.5 per cent
Gippsland	small increase	2.5 to 7.5 per cent
Murray	small increase/ small decrease	2.5 to 7.5 per cent/ -2.5 to -7.5 per cent

Source: EconSearch farm-sector survey

Milk production

Respondents across the three RDP regions expected milk production to remain unchanged or experience a small increase in the next three years (Appendix Table 5.2). The direction milk production was projected to take was linked to projected changes in both market and on-farm

factors. These included milk price, climatic conditions, supplement technology, irrigation efficiency and the level of input costs.

Appendix Table 5.2 Projected change in milk production, Victoria, 2014/15 to 2017/18

Region	Direction of change	Magnitude of change
Western Victoria	no change	-2.5 to 2.5 per cent
Gippsland	no change	-2.5 to 2.5 per cent
Murray	small increase	2.5 to 7.5 per cent

Source: EconSearch farm-sector survey

Labour efficiency

Changes in labour efficiency (milking cows/fte) are commonly linked to a shift in herd size rather than a shift in employed labour. Subsequently, the changes in each region were linked to projections of how herd sizes would change.

'No change' projections were expected in areas that would struggle to maintain the current trend of herd size growth. This was often related to factors such as climatic pressures or shifts in balance between fodder and milk price. Respondents who made 'Small increase' projections were more optimistic and expected a continuation of on-farm efficiency gains as farmers maintain their interest in improving their productivity.

Appendix Table 5.3 Projected change in labour efficiency, Victoria, 2014/15 to 2017/18

Region	Direction of change	Magnitude of change
Western Victoria	no change/ small increase	-2.5 to 2.5 per cent/ 2.5 to 7.5 per cent
Gippsland	no change/ small increase	-2.5 to 2.5 per cent/ 2.5 to 7.5 per cent
Murray	small increase	2.5 to 7.5 per cent

Source: EconSearch farm-sector survey

Milk price

As shown in Appendix Table 5.4, respondents felt that milk price would be stronger in Gippsland and Murray (no change to small increase) but a little less competitive in Western Victoria (small decrease to no change). Conservative respondents expected suppliers to maintain prices at the current or lower levels to the 2014/15 prices. More optimistic respondents thought a favourable exchange rate and an increase in global demand would result in farmers receiving a higher milk price.

Appendix Table 5.4 Projected change in milk price, Victoria, 2014/15 to 2017/18

Region	Direction of change	Magnitude of change
Western Victoria	small decrease/ no change	-2.5 to -7.5 per cent -2.5 to 2.5 per cent
Gippsland	no change/ small increase	-2.5 to 2.5 per cent/ 2.5 to 7.5 per cent
Murray	no change/ small increase	-2.5 to 2.5 per cent/ 2.5 to 7.5 per cent

Source: EconSearch farm-sector survey

Net farm income

Net farm income is difficult to predict as it is dependent on several external factors (such as world milk price and seasonal conditions) resulting in farmers constantly working to make the most of the good years to offset the effects of the difficult ones.

Overall, respondents felt that net farm income would change only slightly, leaning towards a small decrease. The respondents who expected no change to occur suggested that the effects of cost increases would be offset with increases in efficiency. Others, expecting a small decrease in net farm income, projected cash income would deteriorate due to lower prices and higher input costs. Others suggested that poorer terms of trade may develop which could negatively impact income.

Appendix Table 5.5 Projected change in net farm income, Victoria, 2014/15 to 2017/18

Region	Direction of change	Magnitude of change
Western Victoria	small decrease	-2.5 to -7.5 per cent
Gippsland	no change	-2.5 to 2.5 per cent
Murray	no change	-2.5 to 2.5 per cent

Source: EconSearch farm-sector survey

Three-year projections for Western Victoria

Herd size

The majority of the farm sector respondents expected a small increase (2.5 to 7.5 per cent) to occur in herd size in Western Victoria in the next three years (2017/18). Many respondents felt the driving factor behind this growth would be the recent historical trend and the expectation that the average farmer would have reared adequate replacements in the last couple of years to allow for ongoing herd growth.

Several respondents expected no change (-2.5 to 2.5 per cent) in herd size in the next three years citing the influence of El Nino and poorer climatic conditions. These respondents felt that such conditions, if continued, could lead farmers to reduce or maintain their current stock levels. Respondents noted that if the seasonal conditions were particularly bad a significant decline could be expected (greater than 7.5 per cent decrease).

Milk production

'No change' was the common response about the expected three-year shift in milk production as seasonal variation, a stabilising milk price and steady input costs would culminate in a manner that would maintain current production levels. As it is not possible to forecast some of these factors with confidence, respondents often mentioned that one or more adverse shifts could change the projection, leading to a possible small production decrease (-2.5 to -7.5 per cent).

Some respondents were slightly more optimistic suggesting the current historical trend could continue with farmers continuing to improve business earnings through increased and more efficient production.

Labour efficiency

Respondents were divided over the three-year trend in labour efficiency. Those who expected no change (approximately half) felt that dairy producers would struggle to improve current efficiency levels. Several respondents also mentioned that, if growth was needed, the ability to attract and retain labour could be a restraint in such rural and regional locations.

The remaining half of respondents felt a small increase could occur. This would be a continuation of the current trend with respondents indicating that when needed farmers find a way to lift efficiency as good businesses are always chasing continued improvements.

Milk price

Responses were mixed in relation the expected change in milk price in Western Victoria over the next three years. Respondents expecting a decrease in the milk price expressed concern that there was an oversupply of the product globally which would not be absorbed in the short term. However, 'no change' respondents suggested that price levels would be maintained by processors in the region. They also suggested that any dips in price could cause production reductions which, in turn, would encourage retirements, prompting the price of milk to return to its current price.

Some respondents were more optimistic about milk price suggesting that exchange rates and global supply would instead improve and create a positive price shift for domestic producers.

Net farm income

Net farm income is difficult to predict as it is dependent on several external factors (such as world milk price and seasonal conditions) resulting in farmers constantly working to make the most of the good years to offset the effects of the difficult ones. This was reflected in respondents' answers which were quite varied and often included a caveat referring to these complexities.

The majority of respondents expected net farm income to experience a small decrease (-2.5 to -7.5 per cent) across the next 3 years. This trend would be influenced by the impact that the milk price, cost of production, product sales and seasonal conditions have on farm income. While

many respondents suggested that some of these factors may in fact improve, many felt that the overall balance would be negative.

Other respondents felt that there would be no real change to net farm income due to the offsetting nature of the above group of factors. While some would improve and others would worsen, overall the effects would counteract each other. This would result in no significant change to the current level of income.

Three-year projections for Gippsland

Herd size

The majority of the farm sector respondents expected a small increase (2.5 to 7.5 per cent) to occur in herd size in Gippsland in the next three years (by 2017/18). This would represent a continuation of the trend seen over the past few years with improvements in milk price, consolidation of operations, the reduction of overheads per cow and improvements in farm management directing the herd size growth.

Several respondents expected no significant change (-2.5 to 2.5 per cent) in herd size in the next three years citing the influence of El Nino and poorer climatic conditions. These respondents felt that such conditions, if continued, could lead farmers to reduce or maintain their current stock levels. Other respondents expected milk prices to be closer to the 10-year average (i.e. lower than the previous two years) which would ease confidence and not promote herd expansion.

Milk production

'No change' was the common response about the expected three-year shift in milk production as seasonal variation, a stabilising milk price and steady input costs would not shift production levels. Several respondents were slightly more optimistic stating favourable feed prices relative to the milk price would promote a small increase in production.

Labour efficiency

Respondents were divided over the three-year trend in labour efficiency. Those who expected no change (approximately half) felt that relatively stable operating conditions would continue. The remaining half of respondents felt a small increase would occur. This would be a continuation of the current trend with respondents suggesting infrastructure upgrades and herd growth as the main catalysts. Many also felt a small increase would be the natural progression of the industry as businesses are constantly striving towards more efficient operation.

Milk price

The majority of respondents expected the milk price to continue to be volatile but, as a trend, expected either no significant change or a small increase. The consensus was that, while the price does fluctuate from year to year, the average price in real terms has remained relatively consistent over the past 15 years. Respondents also commented that any benefits from the increased China/Asia demand for dairy would not drive any major increases in the short term.

However, respondents reiterated the link between milk price and the market, commenting on the impact of inflation, currency markets, global trade prices and export demand. As these factors are difficult to predict, estimates of future milk prices should be viewed with some care.

Net farm income

The respondents who expected no change to occur suggested that the effects of cost increases would be offset by increases in efficiency. Others simply expected milk prices to remain steady resulting in similar earnings.

Those predicting a small increase in farm net income expected to see a lift in export prices mixed with favourable exchange rates. Several noted, however, that the dairy industry had been experiencing shorter and sharper business cycles so there could be a down turn in between more profitable years.

Several respondents expected there to be a small decrease (-2.5 to -7.5 per cent) in income with cash income deteriorating due to lower prices and higher input costs. Others suggested that poorer terms of trade (lower export prices relative to imports) may develop which could negatively impact net farm income.

Three-year projections for Murray

Herd size

Respondents were divided over the expected trend in herd size in the Murray region over the next three years. Half expected herd size to experience a small decrease through to 2017/18 as seasonal conditions became variable under El Nino and irrigation heavy regions reduced stock levels to cope.

The other half of respondents predicted a small increase following the current historical trend. These respondents expected that this would not be a general trend across the Murray region but rather a few farms growing significantly that would alter the mean herd size.

Milk production

The majority of respondents suggested that there would be a small change (2.5 to 7.5 per cent) in the level of milk production in the Murray region over the next three years. Respondents felt farmers in the region would have access to improved supplements and more efficient irrigation which would maintain or increase milk production. Others suggested that farming systems in the region may change in the future leading to greater intensification and increased milk production per cow.

Other respondents suggested no change in milk production would occur. These respondents felt low or unstable milk prices and input costs would cause business operators to be wary about any shifts that would increase primary production. Respondents noted that if operating conditions became variable, smaller producers may leave the industry. While larger producers would fill this gap, increasing their milk supply, the overall effect for the region is likely to be neutral.

Labour efficiency

The likelihood of improved production efficiencies led many respondents to believe the Murray region would experience a small improvement in labour efficiency over the next three years. This included the automation of irrigation practices, a drop in the number of smaller dairy operators, increased business partnerships between dairy practices and the environment, and small reductions in labour intensive activities (due to R&D and technological advancements). Other respondents felt the improvements would be simply due to scaling, with larger herds and feed improvements promoting efficiency.

Other respondents felt there would be no change in the level of labour efficiency over the next three years. The consensus among these respondents was that the industry was already performing at a highly efficient rate and any positive improvements across the industry (such as improved milk production) would be offset by a slight decrease in efficiency (i.e. higher feeding rates or labour). As such, these respondents expected the overall level of labour efficiency to remain constant.

Milk price

The majority of respondents expected the milk price to continue to be volatile expecting either no significant change or a small increase. Those who expected no significant change felt that relatively stable market conditions would continue as processors continued to drive the price of milk in the region.

Respondents expecting a small increase thought favourable currency exchange and an increase in global demand would promote a stronger milk price. It was also suggested the Murray region would see a greater focus on niche markets which would promote milk prices.

Net farm income

The respondents who expected no change to occur suggested that the effects of cost increases would be offset by increases in efficiency. Others simply expected milk prices to remain steady resulting in similar earnings.

Those predicting a small increase in net farm income expected to see a lift in export prices due to favourable exchange rates. Several noted, however, that the dairy industry had been experiencing shorter and sharper business cycles so there could be a down turn in between more profitable years.

Several respondents expected there to be a small decrease (-2.5 to -7.5 per cent) in income with cash income deteriorating due to lower prices and higher input costs. Other respondents suggested that poorer terms of trade may develop which could impact net farm income levels.