



IMPACT Center
WASHINGTON STATE UNIVERSITY

The 2019 Economic Contributions of Washington Dairy Production and Processing: An Input-Output Analysis

A report by Washington State University's IMPACT Center



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Washington Dairy Economic Contribution Statement

J. Shannon Neibergs
Extension Economic Specialist and Professor

and

Timothy P. Nadreau, Ph.D.
Assistant Research Professor

Impact Center
School of Economic Sciences
Washington State University
Pullman, WA 99164

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Executive Summary

In 2019 the Washington Dairy Commission and WSU Extension partnered with the IMPACT Center to assess the economic contributions of dairy production, processing, and dairy cull cow sales to the state's economy. Washington currently ranks as the 10th highest milk producing state in the nation, producing roughly 6,783 million pounds of milk in 2019. Milk ranks second or third in all agricultural products sold in Washington, behind fruits and sometimes potatoes.

Because milk is both directly exported, and used in dairy manufacturing locally, the contributions of the dairy sector are broken out between production and processing. Cull cows are a byproduct of the dairy industry and those contributions are broken out as well. Contributions are further disaggregated to the regional level with the majority of the effects being generated by the Central and Northwestern regions (see Table E.1). Total statewide contributions from the dairy sector amounted to \$1.76 billion dollars in 2019. The Eastern, Northwestern, and Southwestern regions generate more value added, or gross regional product, from their processing operations than their production operations. Central has the largest production sector and is the largest total dairy region.

Table E.1: *Washington Value Added Dairy Contributions by Region*

	Washington	Eastern	Central	Northwestern	Southwestern
Production	\$1,239,874,550	\$4,662,419	\$687,828,948	\$228,747,229	\$46,152,566
Processing	\$486,712,948	\$36,581,136	\$69,689,814	\$331,166,488	\$64,990,460
Cull Cows	\$35,504,727	\$5,654,613	\$564,003	\$26,071,212	\$1,687,071
Total	\$1,762,092,225	\$46,898,168	\$758,082,765	\$585,984,929	\$112,830,097

Source: IMPACT Center and IMPLAN

The Washington totals are not the sum of the regional contributions. This is because 1) regions have different multipliers than the state as a whole and 2) A region may export milk or product outside of the region but within the state. It is possible that the Central region is exporting milk to the Northwestern region for processing and then the Northwestern region exports the processed product out of the state. The whole is not the sum of the parts in disaggregating economic contribution through regional analysis.

Distribution of the dairies by region and size are reported in Table E.2. Small dairies are those with less than or equal to 199 mature animals. Medium dairies have between 200 and 699 mature animals. Large dairies have 700 or more mature animals. Mature animals are those that are milking or dry. The total dairies in each region is not always the sum of those reported by size because a few dairies of unknown size may have a permit to operate. Those dairies are included in the regional totals but do not appear in the size counts.

Table E.2: Regional Descriptions and Dairy Distributions by Size

Region	Counties*	Dairies	Small	Medium	Large	Unknown
Northwest	San Juan, Whatcom, Skagit, Snohomish, King, Clallam	158	59	61	34	4
Southwest	Kitsap, Pierce, Thurston, Lewis, Pacific, Wahkiakum, Cowlitz, Clark, Skamania, Klickitat	67	44	14	9	0
Central	Grant, Yakima, Benton, Franklin	78	3	13	61	1
Eastern	Stevens, Spokane, Pend Oreille	12	9	3	0	0
Washington	All Counties	322	115	91	104	5

Source: Washington State Department of Agriculture

http://geo.wa.gov/datasets/26add7da921d4aa68ccb50ce191c6182_0/data

While contributions are measured in terms of value added to avoid double counting, total sales, income, and employment may be reported as contributions as well. Table E.3 shows the statewide impacts for all of these measures. It is critical to realize that the employment figures do not represent farm employment. These are the full-time equivalent jobs supported through dairy sector operations and includes the backwards linked effects from the dairies' vendors, including but not limited to employment in the feed and silage sectors, bottling and container manufacturing, transportation, etc.

Table E.3: Statewide Dairy Sector Contributions by Type

Impact Type	Sales	Value Added	Income	Employment
Eastern	\$145,520,125	\$46,898,168	\$25,907,677	491
Central	\$1,744,575,619	\$758,082,765	\$561,591,691	6,943
Northwest	\$1,548,377,353	\$585,984,929	\$352,100,007	4,966
Southwest	\$373,335,355	\$112,830,097	\$63,050,360	1,103
Washington	\$4,204,298,504	\$1,762,092,225	\$1,129,960,298	15,694

Source: IMPACT Center and IMPLAN

SECTION 1: Introduction and Background

In September of 2019 the Washington Dairy Commission and WSU Extension partnered with the IMPACT Center to assess the contributions of dairy production, dairy processing, and cull cow sales on the state's economy. The intent was to move beyond the standard USDA measures of production and sales and see how the exports of dairy products brought money into the economy and how that money then rippled through the state economy.

While this type of analysis had been done in the past, it became clear that different markets in Washington had evolved and that it would be instructive to see how these different regions operated within the state itself. The goal was to move beyond the state level analysis and into particular dairy regions. Several Reports had been published in 2017 and 2018 by the International Dairy Foods Association, U.S. Dairy Export Council, and the National Milk Producers Federation. It was time to see if the off the shelf reports, conducted by national organizations, lined up with the data directly generated by the actual dairymen in the state.

To that end a survey was developed and distributed to various members of the Washington Dairy Commission. A total of 64 dairies responded in part, or in full, to the survey. That data was used to assess overall production by region and to see how the cost structures of the dairies differed by each of the identified regions in the state.

National Situation

National milk prices have risen from \$16.30 per cwt in 2018 to \$18.60 per cwt in 2019. This was coupled with the ongoing trend of increased production from 217,568 million lbs. in 2018 to 218,383 million lbs. in 2019. National commercial exports of all dairies have declined by over 3 billion lbs. The number of dairy herds saw one of the largest drops, nearly 9%, in recent memory, falling from 37,468 in 2018 to 34,187 in 2019. Table 1.1 Synthesizes this information.

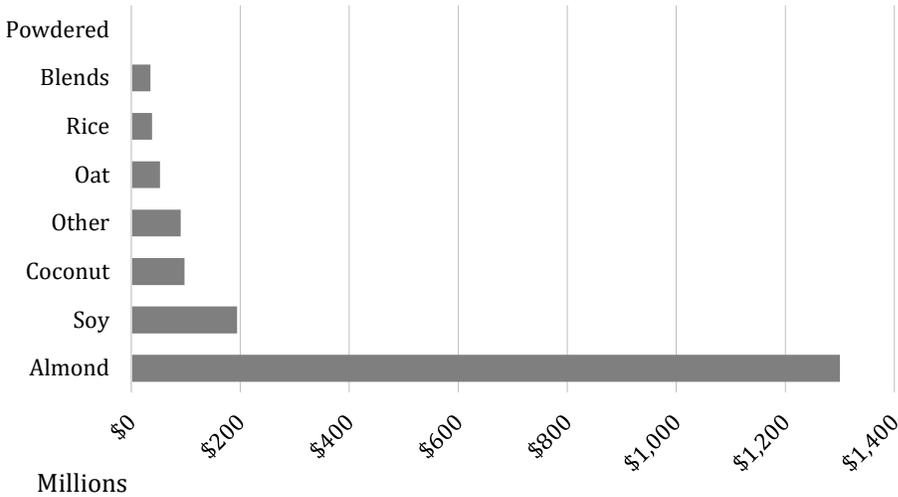
Table 1.1: *National Situation*

	Unit	2018	2019
Production (U.S. estimate)	Mil. lb.	217,568	218,382
Price (all milk)	\$/cwt	16.30	18.60
Milk equivalent exports (all products)	Mil. lb.	55,035	50,686
Licensed Dairy Herds	Count	37,468	34,187

Source: USDA NASS and ESR

Pressure from non-milk alternatives, represents growing competition to the dairy sector. Issues of profitability, pricing from federal marketing orders, and regulatory burdens continue to plague the industry. Figure 1.1 shows the 2019 sales in non-dairy alternatives.

Figure 1.1: Non-dairy Alternatives by Sales



Source: Nielsen

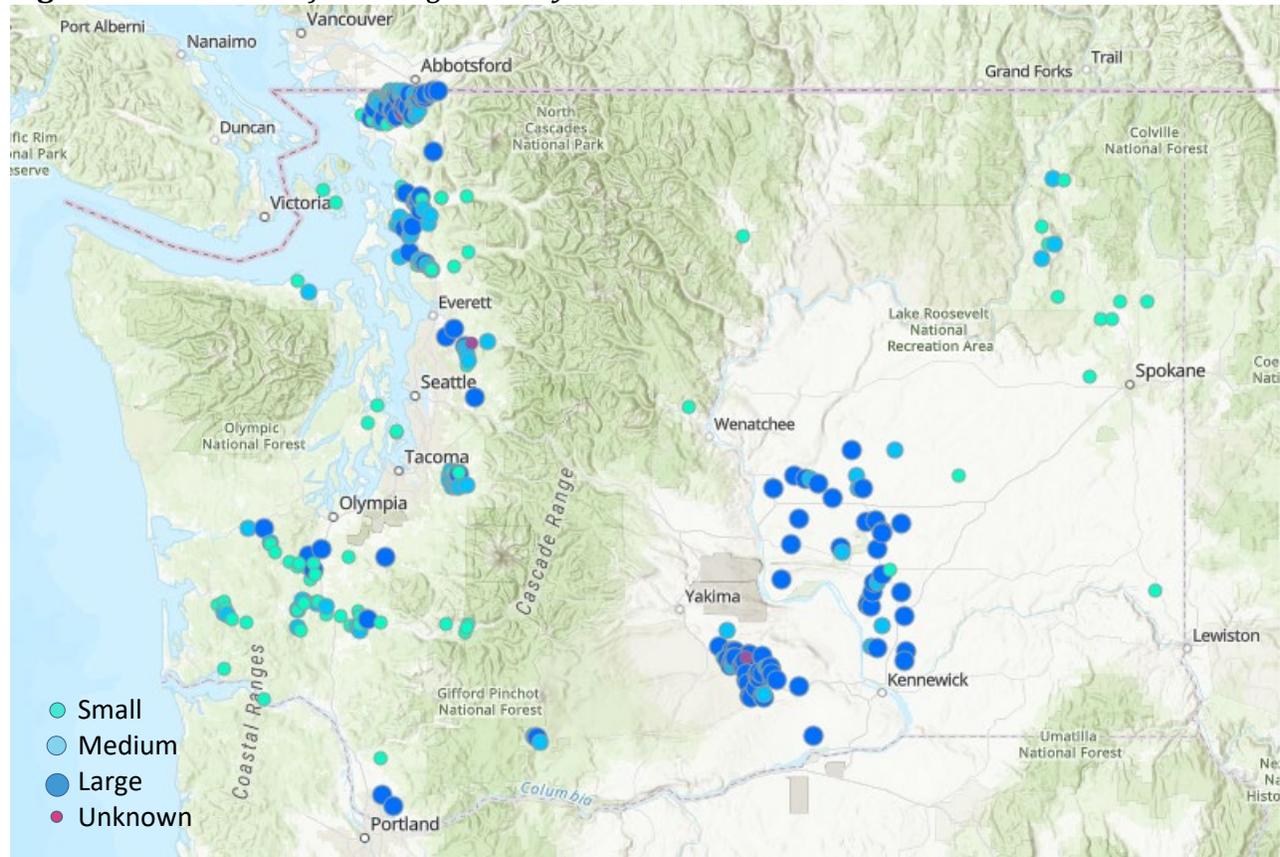
For more on the national and state dairy situation see report 5 in the 2020 Washington Agribusiness: Status and Outlook report (http://ses.wsu.edu/impact-center/wp-content/uploads/sites/2/2020/01/WASO_2020_v2_nobleed.pdf).

State and Regional Descriptions

Based on a dot density map from the Washington Department of Agriculture (WSDA), we determined that the state had four unique producing regions in the state. Figure 1.2 shows the size and location of the dairy farms in Washington.¹ The four regions were the Northwest, Southwest, Central, and Eastern counties. Table 1.2 shows the county breakdown by region and shows the number of dairies and production levels for each. Milk exports from each region are reported as well.

¹ Dairies having up to 199 mature animal are considered small (light green), 200-699 are medium (light blue), and 700 or more are large (dark blue).

Figure 1.2: Location of Washington Dairy Farms



Source: <https://www.arcgis.com/home/item.html?id=26add7da921d4aa68ccb50ce191c6182>

Table 1.2: Regional data and counties

Region	Counties*	Dairies	Production (\$)	Exports (\$)
Northwest	San Juan, Whatcom, Skagit, Snohomish, King, Clallam	158	\$241,781,696	\$128,464,075
Southwest	Kitsap, Pierce, Thurston, Lewis, Pacific, Wahkiakum, Cowlitz, Clark, Skamania, Klickitat	67	\$63,316,505	\$84,581,526
Central	Grant, Yakima, Benton, Franklin	78	\$818,363,686	\$612,050,109
Eastern	Stevens, Spokane, Pend Oreille	12	\$5,162,112	\$4,616,947
Washington	All Counties	322	\$1,128,624,000	\$790,083,998

*The small dairies in Okanogan, Chelan, Kittitas, Whitman, and Lincoln are captured in the state totals but are not located in a dairy oriented region of the state.

Source: WA Open Data Portal, IMPLAN, USA Trade Online.

The Central region, with relatively few dairies, is out producing and out exporting the other regions, but a great deal more of the dairies in that region are classified as large while the dairies in the other regions are predominantly medium or small. Table 1.3 shows the distribution of dairies by size and region.

Table 1.3: Dairies by Size and Region

Region	Large	Medium	Small	Unknown	Total
Northwest	34	61	59	4	158
Southwest	9	14	44	0	67
Central	61	13	3	1	78
Eastern	0	3	9	0	12

Source: WA Open Data Portal

A critical part of this analysis, that the reader must understand, is that exports from the state do not equal the sum of the exports from the individual regions. The whole is not the sum of the parts. That is because regions may be selling products, forage crops for example, within the state but outside their region. Exports in a regional context do not refer exclusively to international exports.

USA Trade Online is the U.S. Census Bureau’s repository for all import and export data. The data in their files are broken out by industry (NAICS) and according to the Harmonized Tariff Schedule. Table 1.4 shows Washington State dairy exports by national destination. We find it more instructive to outline the exports by percentage of value since the Census Bureau’s methodology for apportioning exports to states does not reconcile with local export information. This avoids any data abortions between reporting sources but still allows readers to see where dairy commodities are destined.

Asia remains the dominate importer for Washington dairy exports followed by Mexico. Japan Indonesia, and the Philippines have been primary importers of Washington dairy products, but Vietnam and Malaysia have become critical markets for in recent years. China has historically been a small market destination, but the hope is for this market to increase as the bilateral U.S. – China trade agreement develops over time. Dairy exports to Mexico have seen a recent market share decline into 2019, but expectation is for this market to improve with the signing of the USMCA trade agreement in January 2020.

Table 1.4: Washington Dairy Exports by Destination Country

Country/Region	2015	2016	2017	2018	2019
Vietnam	6.6%	3.5%	3.8%	9.8%	16.4%
Mexico	18.3%	22.1%	24.4%	17.6%	15.8%
Japan	17.2%	14.1%	19.1%	18.6%	14.3%
Indonesia	13.8%	13.6%	6.6%	10.4%	14.0%
Philippines	13.0%	15.0%	10.3%	10.8%	10.2%
Malaysia	9.7%	6.5%	8.2%	11.0%	10.0%
Sri Lanka	3.0%	3.1%	2.7%	2.1%	3.1%
Thailand	4.0%	3.6%	2.9%	2.1%	3.1%
Korea, South	1.0%	2.0%	1.8%	3.0%	2.1%
Saudi Arabia	0.7%	1.1%	0.7%	1.1%	1.5%
Australia	0.3%	2.2%	3.3%	1.6%	1.5%
Canada	2.0%	4.2%	3.7%	2.7%	1.3%
Chile	1.3%	0.7%	2.2%	0.4%	0.9%
Peru	0.9%	0.3%	0.1%	0.7%	0.7%
China	5.0%	3.4%	7.1%	2.0%	0.6%
Colombia	0.4%	1.1%	0.2%	0.1%	0.6%
Singapore	0.3%	0.3%	0.4%	1.2%	0.5%
Dominican Republic	0.0%	0.1%	0.1%	0.4%	0.4%
Pakistan	0.0%	0.0%	0.3%	0.4%	0.4%
Egypt	1.8%	0.8%	0.2%	0.7%	0.4%
Taiwan	0.0%	0.2%	0.1%	0.4%	0.3%
New Zealand	0.0%	0.3%	0.3%	0.2%	0.3%
Panama	0.0%	0.0%	0.0%	0.1%	0.0%
Hong Kong	0.2%	0.0%	0.0%	0.1%	0.0%
Honduras	0.0%	0.0%	0.0%	0.3%	0.0%
United Arab Emirates	0.0%	0.0%	0.0%	0.1%	0.0%
El Salvador	0.1%	0.1%	0.0%	0.0%	0.0%
Guatemala	0.1%	0.1%	0.1%	0.0%	0.0%
All Other Nations	0.2%	1.6%	1.3%	2.4%	1.4%
Asia	74.6%	66.9%	64.1%	73.6%	78.1%
Australia and Oceania	0.3%	2.4%	3.6%	1.8%	1.8%
Africa	1.8%	1.7%	1.3%	2.1%	0.4%
Europe	0.0%	0.0%	0.0%	0.3%	0.0%

Source: USA Trade Online

SECTION 2: Dairy Survey Data

This section is designed to synthesize the data collected from dairy producers of the Washington Dairy Federation. The entire survey can be seen in Appendix 1. In reviewing the data not all respondents answered all questions. Thus, some of the summary data does not capture the data items adequately. For example, reported annual labor expense divided by FTE employment ranges from \$78,451 to \$498,976. This level of variance in the data requires us to use the data very carefully. Respondents, in some cases, reported what looks like a true wage bill but did not report employment. Some amount of discretion had to be used when allowing this data to inform adjustments to our modeling effort. This type of data analysis is commonly done for these economic contribution studies.

Data Survey Results by Region

The survey was designed to mitigate the time commitment of the dairies and to ask broad questions that would provide anonymity for respondents. Limited detail was requested regarding revenue sources and expenses. However, the location of expenditures was critical for determining how the purchasing patterns differed by region. Those differences in turn resulted in differentiated multipliers for each region within the state. Table 2.1 shows the aggregate number of dairies that responded by region, the number of cows from those dairies, along with daily milk production. Total farm milk sales and other dairy farm income are reported as well.

Table 2.1: *Regional Dairy Revenue Data*

Region	# of Dairy Respondents	# of Cows	Daily Milk (cwt)	Farm Milk Sales	Farm Dairy Income
Northwest	35	16,285	10,933	\$59,298,721	\$693,197
Southwest	9	2,140	1,712	\$6,034,178	\$35,775
Central	16	54,965	39,946	\$138,343,621	\$1,267,000
Eastern	1	22	6	\$90,000	\$0
<i>Total</i>	<i>61</i>	<i>73,412</i>	<i>52,596</i>	<i>\$203,766,520</i>	<i>\$1,995,972</i>

Source: SESRC Dairy Survey

Table 2.2 shows the total expenditures of the dairies by region and emphasizes the labor expense. The average labor expense by dairy statewide is 24.3%, but ranges between 18% in the Northwest to 27.3% in the Central region. The one respondent from the eastern region did not report FTE employment or labor expenses but did report total costs of \$80,000.

Table 2.2: Regional Dairy Expense Data

Region	# of Dairy Respondents	FTE Employment	Annual Labor Expense	Annual Cost	Labor Costs as a Percent of Total
Northwest	35	113	\$8,864,936	\$49,270,127	18.0%
Southwest	9	11	\$1,226,000	\$4,993,195	25.0%
Central	16	59	\$29,439,597	\$108,015,994	27.3%
Eastern	1	0	\$0	\$80,000	N/A
<i>Total</i>	<i>61</i>	<i>183</i>	<i>\$39,530,533</i>	<i>\$162,359,316</i>	<i>24.3%</i>

Source: SESRC Dairy Survey

Table 2.3 summarizes the regional spending profiles of the dairies outlining what portion of their total reported spending was utilized on local, regional, or out-of-state purchases. These differences in spending profiles result in differences in regional multipliers for the dairies because the dollars they spend do not all circulate in the regional economies to the same extent before exiting to purchase imports.

Table 2.3: Regional Dairy Spending Profile

Region	# of Dairy Respondents	Avg. Annual Cost	Avg. Expenses Local	Avg. Expenses Regionally	Avg. Expenses Out-of-State
Central	16	\$13,502,000	53%	42%	4%
Eastern	1	\$80,000	40%	50%	10%
Northwest	35	\$1,915,011	60%	34%	7%
Southwest	9	\$832,199	50%	36%	14%
<i>Total</i>	<i>61</i>	<i>\$4,082,302</i>	<i>54%</i>	<i>41%</i>	<i>5%</i>

Source: SESRC Dairy Survey

Converting Survey Data to Input-Output Vectors

The data collected in the survey provided the ability to customize the Input-Output data for the state and regions. The dairy vectors in the model are the same nationwide but may be tailored using state specific enterprise budgets (see Willis and Holland 1997). In this approach spending by the dairies would be mapped to industry sectors, adjusted for import spending, and margined (converting purchaser prices into producer prices) to avoid overstating of multiplier effects in sectors such as wholesale, retail, and transportation.

The amount of data collected allowed us to properly adjust the margins in our model and to adjust the regional purchase coefficients (RPCs) in the model. While the IMPLAN model has default values for both margins and RPCs the primary data collected in the survey allowed us to adjust them to be region specific. By determining the average amount of purchases a dairy makes within region and out-of-region we are able to determine how much of their spending stays in the economy and circulates locally, vs. leaking out of the economy for the importing of production inputs. This allows us to more appropriately reflect the contributions the dollars have in the region.

SECTION 3: Model and Methodology

This section of the report covers the technical aspects of the model and the nuances made to various components of it in order to ensure its accuracy. We begin by explaining the basics of any input-output model as well as the data used for this particular analysis. Next, we discuss how the model needed to be modified to ensure there was no double counting when evaluating the contributions of the production vs. processing components of the dairy sector. Lastly, we outline the direct effects, sometimes referred to as the shock, the dairy sector provides to the economy. The subsequent effects and total contributions are reported in section 4 of the report.

Basics of Input-Output Analysis

The system of accounts known as Input-Output (I-O) tables represent an economist’s version of double-entry bookkeeping for industries. Figure 3.1 below shows a simplified version of an I-O matrix with just a hand full of industries. Each cell, in this table of accounts, is populated by dollar transactions.

Figure 3.1: Aggregated form Input-Output Matrix

		Producers as Consumers					Final Demand				
		Agric.	Min.	Const.	Manuf.	Services	Other	Households	Investment	Government	Net exports
Producers	Agric.										
	Min.										
	Const.										
	Manuf.										
	Services										
	Other										
Value Added	Labor							Gross Domestic Product			
	Returns to Capital										
	Taxes										

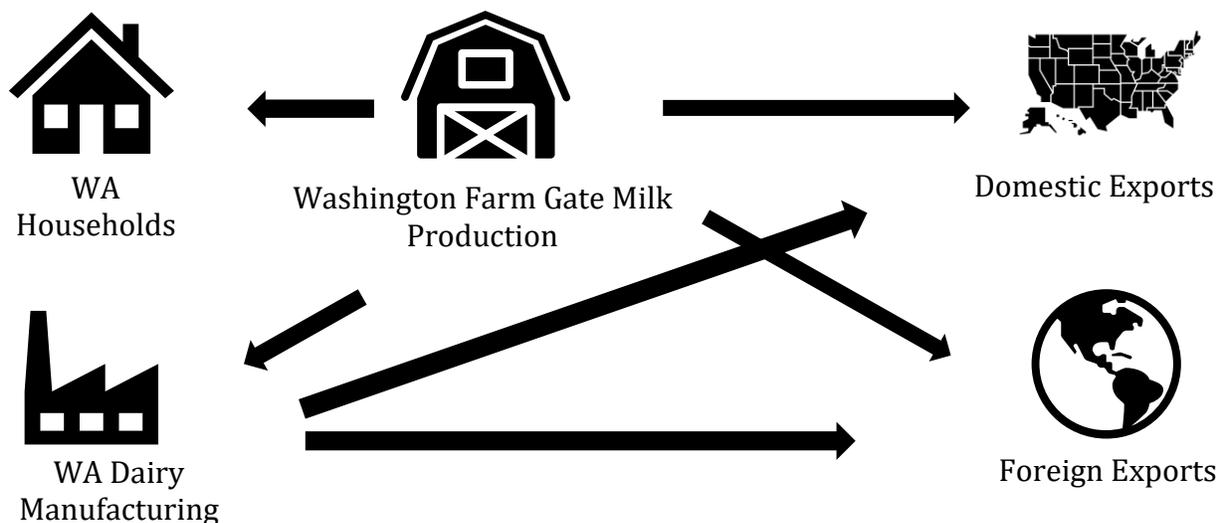
Reading down a column of this table shows what inputs an industry is buying in order to produce their output. The Agriculture column, for example, may buy seed from themselves, fertilizer and farm equipment from the manufacturing sector, and legal and accounting services from the service sector. Payments to agricultural employees are captured in the “Labor” row. Payments must be made to owners of capital, and the industry pays taxes to the government. Reading across a row tells us where an industry’s income originates. Sticking with agriculture, they sell seed to others in the agricultural sector; their crops may be sold to processing plants in the manufacturing sector, as is the case with dairy producers and processors, or perhaps the dairy sells directly to consumers. A portion of a household’s expenditures will go to buying agricultural goods, and even government may

purchase agricultural goods. Lastly, the agricultural industry will sell its output abroad, via the “Net exports” column.

Summing all the labor, capital, and tax payments for all industries gives the sum of all value added and will equal the Gross Domestic Product (GDP) of the region. Similarly summing all of the expenditures of households, government, investment, and net exports yields the GDP of the region. These two methods of calculating GDP are known as the Income and Expenditure approaches, respectively, and they represent a check for ensuring all accounts balance. It is through the I-O system that we are able to trace the dollars through the economy and calculate multiplier effects.

However, it is only through selling products outside of the region that an economy is able to attract new dollars into the region. Economists distinguish between industries that are export-oriented and those that serve the local economy, recirculating the dollars once they are in the economy. We call export-oriented industries “basic” and locally oriented industries “non-basic.” Dairies, as with most agricultural and natural resource industries, are considered basic industries. Even though dairies in Washington sell most of their product to processors, the majority of processed milk product is exported outside of the region or state. The basic industries that bring dollars into the economy support the non-basic industries, which could not exist locally without the income to the economy from exports. As such the employment contributions of basic industries support more than the employment directly within the industry.

Figure 3.2: Flow of Raw Milk from Washington Dairies



Dairies sell some of their milk directly to local consumers, recirculating dollars in the economy, a non-basic activity. However, dairies also export some of their milk outside of the region providing a basic activity, see Figure 3.2. Similarly, a barber, predominantly a non-basic industry, will sell services to local residents. On occasion a barber will cut the hair of a visitor to the region, thus bringing income to the region. This is the same as exporting the service to the visitor’s home region. It is the distinction between basic and

non-basic that is of importance in these models because it allows us to determine which industries the economy truly rests on.

Basic vs. Non-Basic Impacts: Which Industry Support the Economy?

A small agricultural town may seem to have a large medical industry in terms of employment, while the number of farm employment is fairly low, and often seasonal. However, the farms are exporting their product and bringing money into the economy. The doctor's offices are predominantly serving the residents. In this story it is the farmers that are supporting the economy and the doctors are retaining the money within the economy. However, it should be clear that the farms would continue to exist in the absence of the doctor's offices, while the doctor's offices would not be likely to stay in the absence of the farms. In this story the non-basic medical jobs rely on the basic agricultural jobs. The employment impacts, including many of the doctors and nurses, would be attributed to the non-basic agricultural industries.

Production vs. Processing: Avoiding Double Counting

One of the primary concerns when doing economic contribution studies is the potential for double counting. If we were to claim all the backward links from the dairy producers, and then also claim all the backward links of the processors, all of the producer contributions would be counted twice, once from the producers themselves, and once from the processing side. This is because the dairy producers are an input in the processing supply chain. However, we cannot claim only the direct effects of the processors either. Doing so would miss the non-dairy portion of the processing supply chain, i.e., leaving out electricity, transportation, lab testing expenses, etc. In order to capture the processors contributions through their supply chain, but prevent the double counting from the producers, we can sever the expenditure link between the processors and producers (Steinback 2004).

This gives slightly more weight to the producers. Had we maintained the producer-processor transactional links and only shocked the processor exports, processors would appear much larger and the producers would appear much smaller. Severing the transactional link is, in our opinion, a more equitable approach for allocating contributions amongst the firms within the dairy sector.

The other important component in avoiding double counting is to report value added, also known as gross state product, rather than sales. Though the model is built on producer prices and sales transactions, summing up sales receipts will overstate the actual productivity of a region. If a dairy produces milk, milk is sold to a processor, the processor sells cheese to a commercial pizzeria, and the pizzeria sells pizzas to a retailer, the value of the milk is being incorporated and captured in each round of transactions. To prevent this double, triple, and quadruple counting we report contributions on a value-added basis.

Sales vs. value-added

A way to explain why sales overstates impacts is to imagine individuals spending money in a regional economy. Suppose an individual spends \$40,000 on a new truck. Another individual spends the same amount on an appendectomy at the regional hospital. From a sales perspective, the impacts are the same, \$40,000. However, from a value-added perspective the purchase of the truck provides less to the regional economy. Perhaps \$30,000 of the truck purchase had to immediately go to the manufacturer back in Detroit or Japan. Conversely, the appendectomy at the hospital probably saw the majority of the spending stay local as income to the doctors and nurses. Perhaps only \$10,000 leaves the region for importing of capital assets like the hospital bed, scalpels, et cetera. From a value-added perspective the hospital is more valuable than the auto dealership even though they are equivalent from a sales perspective.

Direct Effects

The direct effects are the sales to the final demand sectors, primarily exports. We calculate direct effects for the producers, processors, and cull cow processing exports. These direct effects represent the initial shock, or pebble in the pond, that brings new dollars into the state or regional economies, depending on the geography being analyzed. The model will then take those direct effects and calculate the backward expenditure links to determine the extent of the contributions, or ripple effects, supported by the shock.

The direct effects for the state represent those sales to final demand from the state, because the regions within the state sell to one another, the direct effects at the state level will not be the sum of the regional sales to final demand. Table 3.1 shows the direct effects reported

Table 3.1: *Direct Effects by Region and Source*

Source	Washington	Eastern	Central	Northwestern	Southwestern
Dairy Production	\$1,128,624,000	\$5,162,112	\$818,363,686	\$241,781,696	\$63,316,505
Dairy Manufacturing	\$703,405,477	\$66,258,585	\$161,936,418	\$517,782,108	\$194,480,505
Cull Cow	\$51,737,302	\$11,732,700	\$1,362,084	\$47,933,684	\$4,391,048
<i>Total Direct Effect</i>	<i>\$1,883,766,779</i>	<i>\$83,153,398</i>	<i>\$981,662,188</i>	<i>\$807,497,488</i>	<i>\$262,188,059</i>

Source: USDA, IMPLAN, IMPACT Center

Direct effects do not include any ripple effects. Direct effects represent dollars are brought into the economy and how those dollars ripple through it, that creates the contributions. Direct effects are similar to the jobs within the industry, but it does not include the additional jobs supported by the new dollars in the economy.

Direct effects in the dairy industry are driven by milk production and prices, both of which have been trending up in the past decades. Figure 3.3 shows the trend from 1999 through 2019. Over that time prices increased 11% and production increased 25%. The highest price in those past two decades came in 2014 at \$27.66 per cwt, which is also the year total sales peaked at \$1.6 billion. Total dairy sales fell from its peak in 2014 by 30%, from \$1.6 billion to \$1.1 billion.

Figure 3.3: Washington Milk Prices and Milk Production Volumes by Year (1999-2019)



Source: USDA Quick Stats

SECTION 4: Model Results

This section of the report synthesizes the state results and main impacts by region. The detailed tables for the regions may be found in appendix 4. Spending differs significantly between the production and processing segments. Table 4.1 shows the primary inter-industry spending for the producers and processors as a share of their total spending. Note that processors spend 25% of their spending to purchase the raw milk from the Dairy producers. That link is severed in the model as described in section three of this report. But it still represents a significant line item in the processor supply chain. These represent the bulk of the indirect impacts stemming from the direct spending of the producers and processors.

Table 4.1: Supply Chain Expenditures Within the Production and Processing sectors

Production Expenditures Categories	
Proprietor Income	25%
Other animal food manufacturing	17%
Domestic Trade	12%
Wholesale trade	10%
Other Property Type Income	8%
Employee Compensation	6%
Support activities for agriculture and forestry	5%
Foreign Trade	3%
Petroleum refineries	2%
All other crop farming	2%
Processing Expenditure Categories	
Domestic Trade	26%
Dairy cattle and milk production	25%
Wholesale trade	10%
Employee Compensation	7%
Fluid milk manufacturing	7%
Other Property Type Income	6%
Truck transportation	4%
Foreign Trade	3%
Dry, condensed, and evaporated dairy product manufacturing	2%
Creamery butter manufacturing	1%

Source: IMPLAN

State Contributions

Tables 4.2 through 4.5 show the indirect, also known as business-to-business, effects and induced, household-to-business, transactions that ripple through the Washington economy as a result of the dairy sector. Table 4.2 covers the dairy producers' direct, indirect, and induced contributions. Table 4.3 shows the processors contributions, and table 4.4 shows the cull cow contributions. Table 4.5 synthesizes the results by summing the contributions

across source. Total 2019 statewide contributions attributed to the Washington dairies were \$1.24 billion, equivalent to \$827.2 million in income, 11,000 jobs, and \$2.65 billion in sales.

Table 4.2: Washington Dairy Production Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$1,128,624,000	\$432,650,525	\$345,009,890	2,559
Indirect Effect	\$778,340,200	\$341,934,981	\$214,086,455	3,708
Induced Effect	\$741,305,951	\$465,289,044	\$268,119,544	4,733
Total Effect	\$2,648,270,151	\$1,239,874,550	\$827,215,889	11,000

Source: IMPACT Center and IMPLAN

Contributions from the processing segment of the dairy sector added another \$486.7 million in gross state product, \$351 million of which was household income. This represented an additional 4,318 jobs supported through processing activities.

Table 4.3: Washington Dairy Processor Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$703,405,477	\$84,724,681	\$41,175,343	682
Indirect Effect	\$444,155,808	\$208,621,748	\$124,551,555	1,662
Induced Effect	\$304,161,092	\$193,366,520	\$114,333,319	1,973
Total Effect	\$1,451,722,377	\$486,712,948	\$280,060,217	4,318

Source: IMPACT Center and IMPLAN

Cull cows represent a byproduct of the dairy industry that, nonetheless, represents an economic contribution to the state. Exports of dairy cull cows, processed and then shipped out of state, contributed \$35.5 million in gross state product and supported an additional 376 full time equivalent jobs.

Table 4.4: Washington Dairy Cull Cow Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$51,737,302	\$8,773,487	\$6,332,625	99
Indirect Effect	\$30,902,789	\$13,083,795	\$8,420,492	139
Induced Effect	\$21,665,884	\$13,647,444	\$7,931,075	139
Total Effect	\$104,305,975	\$35,504,727	\$22,684,192	376

Source: IMPACT Center and IMPLAN

In total the dairy sector in Washington generated \$4.2 billion in sales, contributed \$1.7 billion in gross state product, and provided \$1.1 billion in income to approximately 15,694 employees in the dairy sector and throughout its supply chain. This is captured in the final row of Table 4.5.

Table 4.5: Total Washington Dairy Sector Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$1,883,766,779	\$526,148,693	\$392,517,858	3,340
Indirect Effect	\$1,253,398,797	\$563,640,524	\$347,058,502	5,509
Induced Effect	\$1,067,132,927	\$672,303,008	\$390,383,938	6,845
Total Effect	\$4,204,298,504	\$1,762,092,225	\$1,129,960,298	15,694

Source: IMPACT Center and IMPLAN

Northwest

Results from the contribution analysis for the Washington Northwestern Region are listed separately in Tables 4.6 Total Northwest Washington dairy sector contributions to the region were \$585.9 million, \$352.1 of which went to household income and supported nearly 5,000 jobs regionally. All of this stemmed from \$1.5 billion in spending and approximately \$807.5 million in exports from the region.

Table 4.6: Northwest Washington Dairy Sector Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$807,497,488	\$169,302,391	\$101,773,222	1,352
Indirect Effect	\$434,440,347	\$215,436,736	\$131,103,848	1,707
Induced Effect	\$306,439,518	\$201,245,802	\$119,222,937	1,907
Total Effect	\$1,548,377,353	\$585,984,929	\$352,100,007	4,966

Source: IMPACT Center and IMPLAN

Southwest

Results from the contribution analysis for the Washington Southwestern Region are listed in Tables 4.7. The Southwest Washington region ranks third in size out of the four regions in Washington. Contributions to the region were \$112.8 million, \$63.1 of which went to household income and supported just over 1,100 jobs regionally. All of this stemmed from \$373.3 million in spending and approximately \$262.1 million in export sales from the region.

Table 4.7: Southwest Washington Dairy Sector Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$262,188,059	\$49,141,690	\$25,233,747	372
Indirect Effect	\$58,599,818	\$30,157,590	\$18,438,469	349
Induced Effect	\$52,547,478	\$33,530,817	\$19,378,143	383
Total Effect	\$373,335,355	\$112,830,097	\$63,050,360	1,103

Source: IMPACT Center and IMPLAN

Central

The Central dairy region in Washington is the largest in the state in terms of contributions, driven primarily through its production. Contributions to the region were \$758.1 million, \$561.6 million of which went to household income and supported nearly 7,000 jobs. All of this stemmed from \$1.7 billion in spending and approximately \$981.6 million in export

sales from the region.

Table 4.8: Central Washington Dairy Sector Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$981,662,188	\$332,223,394	\$297,032,354	1,608
Indirect Effect	\$372,763,116	\$187,409,602	\$125,880,695	2,351
Induced Effect	\$390,150,315	\$238,449,768	\$138,678,642	2,985
Total Effect	\$1,744,575,619	\$758,082,765	\$561,591,691	6,943

Source: IMPACT Center and IMPLAN

Eastern

The Eastern Washington dairy region was the smallest of the four in the state. The region exported \$83.2 million in product which induced \$145.5 million in contribution spending. That resulted in gross regional product of \$46.9 million and \$25.9 million in income. That income supported nearly 500 jobs regionally.

Table 4.9: Eastern Washington Dairy Sector Contributions

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$83,153,398	\$13,017,115	\$5,734,075	106
Indirect Effect	\$33,013,321	\$15,768,810	\$9,267,486	162
Induced Effect	\$29,353,405	\$18,112,243	\$10,906,115	223
Total Effect	\$145,520,125	\$46,898,168	\$25,907,677	491

Source: IMPACT Center and IMPLAN

SECTION 5: Conclusions

The economic contributions of the dairy sector remain strong. The dairy sector as a whole produced over \$526 million in direct value-added economic contribution for the state. That represents dollars that would not have existed in the state without the sectors' activity and critical exports, which bring new dollars into the economy. Those added dollars to the state then circulate in the economy traveling backwards through the dairy sectors' supply chain supporting nearly another \$635 million in indirect, business-to-business, value-added transactions. Employee income is also spent in the state's economy, generating activity in those industries that support household activities such as food retailers, automotive maintenance, electricity, etc. Those household-to-business expenditures and the associated ripple effects generate approximately another \$656 million in value-added. The Dairy sector in Washington is responsible for just under \$1.86 billion dollars in economic activity and supports over 16,500 full time equivalent jobs.

Even with increased regulations and an overall growth in milk substitutes, such as soy or almond milk, dairies in Washington are maintaining a competitive and comparative advantage over many states. The strong processing components in the Central and Northwestern regions continue to provide a stable demand for producers. The strong export and transportation availability out of the ports makes Washington a critical provider of milk and dairy product to the Asian markets.

Total contributions to the state amount to \$1.86 billion in gross state product or value added. Of that \$1.86 billion \$1.2 billion can be attributed to the dairies themselves. \$580.8 million are attributed to the processors, and \$35.5 million are attributed to the cull cows from the dairy. While contributions are reported in terms of value added they are often reported in terms of jobs. The entire dairy sector supports 16,510 jobs in the state. Table 5.1 provides the state's contributions by type and source.

Table 5.1: Washington Dairy Contributions by Type and Source

Impact Type	Sales	Value Added	Income	Employment
Direct Effect	\$1,883,766,779	\$526,148,693	\$392,517,858	3,340
Indirect Effect	\$1,253,398,797	\$563,640,524	\$347,058,502	5,509
Induced Effect	\$1,067,132,927	\$672,303,008	\$390,383,938	6,845
Total Effect	\$4,204,298,504	\$1,762,092,225	\$1,129,960,298	15,694

Source: IMPACT Center and IMPLAN

Appendix 1: Survey

**Washington Dairy Commission
and WSU Extension
2019 Dairy Economic Impact Survey**



Thank you for taking the time to complete this voluntary survey. The survey should be completed by the individual on your dairy who deals directly with expenses, revenue, and employment. All responses will be kept confidential.

The purpose of this survey is to collect the information necessary to conduct an economic contribution study of Washington’s Dairy Industry **using 2019 cost and return** data. Your participation is needed to produce study results that can be used to promote Washington’s dairy industry. The survey is completely anonymous. If you have any questions on the survey contact Shannon Neibergs, WSU Extension, 509-335-6360, sneibergs@wsu.edu or Danna Moore, SESRC 1-800-833-0867 or 509-335-1117, sesrcweb7@wsu.edu.

Dairy Operation Characteristics (Reference year on all questions is 2019)

Q1. What county your dairy is located in?	Q2. How long has the dairy operated at this location?
_____ County	_____ Years

Q3. How many cows do you milk?	Q4. What is your <u>average daily</u> milk shipped?
_____ Number	_____ Cwt
Q5. Do you raise crops (for example hay, grain, or silage) that are used as feed in your dairy?	Q6. Do you raise crops that are sold off of the farm?
<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No

Q7. Approximately how many acres in your dairy are:

	Owned	Leased	Lease Rate (\$/acre)
Pasture	_____ acres	_____ acres	_____ \$/acre
Cropping	_____ acres	_____ acres	_____ \$/acre
Nutrient Management (not included above)	_____ acres	_____ acres	_____ \$/acre
Other (Buildings, forest, etc.)	_____ acres	_____ acres	_____ \$/acre

Q8. What is your total annual labor expense for the dairy? *(Do not include benefits)*

\$ _____ annual labor expense

Q9. What is your annual labor benefit expense for the dairy *(e.g. workers comp, social security, insurance)?*

\$ _____ annual labor benefit expense

Q10. Please complete the table of employment information for your dairy operation:

	Number Employed as	Estimated average percent of full time employment	Estimated average annual amount paid**
Full time year round – category 1*	_____	100%	\$ _____
Full time year round – category 2*	_____	100%	\$ _____

Part time year round	_____	_____ %	\$ _____
Seasonal labor	_____	_____ %	\$ _____
Family labor not included above	_____	_____ %	\$ _____

* Categories 1 and 2 are to separate full time higher paid eg. a foreman versus full time lower skilled/paid labor

** Annual salary for full time. For part time just what you pay them in a year. Do not adjust part time to a full time wage.

Q11. What benefits do you provide?

	Benefit Provided (check)	If yes, number of employees provided	Estimated annual cost per employee
Workers Compensation	Yes ___ No ___	_____	\$ _____
Health Insurance	Yes ___ No ___	_____	\$ _____
Housing	Yes ___ No ___	_____	\$ _____
Transportation	Yes ___ No ___	_____	\$ _____
Other	Yes ___ No ___	_____	\$ _____

2019 Dairy Revenues

Q12. What are your annual 2019 revenues for each of the following dairy categories:

Milk / Farm Sales		Livestock Sales	
Milk sales	\$ _____	Cull Cows	\$ _____
Other Dairy Income	\$ _____	Calves	\$ _____
Crop Sales	\$ _____	Replacement Heifers	\$ _____

Q13. What is your estimated total annual cost of operating your dairy? (Excluding labor and benefits given above and excluding capital depreciation expense).

\$ _____ Total annual operating costs

Q14. For your annual total dairy expenses in a typical year, please estimate the percent of the total that is spent:

	Percent of Total
Locally (25-30 miles)	_____ %
Regionally (over 30 miles but in Washington State)	_____ %
Out of state (for example mail order)	_____ %
Total adds to 100%	100%

2019 Dairy Capital Expenses (Capital refers to facilities, equipment, machinery, and cow replacements)

Q15A. How many heifer replacements were ...

	Number
raised on your dairy	_____ (head)
purchased	_____ (head)

Q15B. If you purchase heifer replacements, what was the 2019 total purchased replacement expense?

\$ _____ total purchased heifer replacement expense

Check here if none or not applicable

Q16. Considering the past five years, what has been your average annual capital investment?

(Excluding replacements above)

\$ _____ average annual capital investment

See Next Page 

17. For your dairy, please rank the following issues from 1 = not at all important to 5 = highly important. (Add issues of concern to you that are not listed).

<i>Issues</i>	Not at All Important	Slightly Important	Moderately Important	Very Important	Highly Important
Environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Urban encroachment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gov. milk policy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feed costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal well being	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrient management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Estate planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
International Trade	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Labor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Herd health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other 1: _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other 2: _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. Thank you for completing this important survey. Please feel free to write any additional comments you may have in the space provided below.

Appendix 2: References

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Appendix 3: Dairy Sector Support Industries

Table A3.1: Top Washington State *Dairy Industry Purchases (\$ million)*

Industry	Dairy cattle and milk production spending (\$ million)
Proprietor Income	293.3
Other animal food manufacturing	198.7
Domestic Trade	139.1
Wholesale trade	118.4
Other Property Type Income	95.5
Employee Compensation	69.8
Support activities for agriculture and forestry	56.8
Foreign Trade	35.8
Petroleum refineries	20.7
All other crop farming	18.3
Real estate	16.0
Grain farming	14.3
Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming	14.1
Truck transportation	10.8
Soybean and other oilseed processing	8.6
Electric power transmission and distribution	5.9
Accounting, tax preparation, bookkeeping, and payroll services	5.3
Rail transportation	4.2
Maintenance and repair construction of nonresidential structures	4.1
Monetary authorities and depository credit intermediation	3.8
Water transportation	3.5
Pesticide and other agricultural chemical manufacturing	3.3
Farm machinery and equipment manufacturing	3.0
Local government electric utilities	3.0

Appendix 4: Detailed Regional Contribution Tables.

Northwest

Table A4.1: Northwest Washington Dairy Production Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$241,781,696	\$92,685,403	\$61,266,321	716
Indirect Effect	\$126,009,921	\$62,219,631	\$37,966,808	565
Induced Effect	\$112,949,429	\$73,842,195	\$43,296,824	699
Total Effect	\$480,741,046	\$228,747,229	\$142,529,954	1,980

Table A4.2: Northwest Washington Dairy Processors Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$517,782,108	\$67,964,831	\$34,245,503	546
Indirect Effect	\$291,364,004	\$144,894,927	\$88,040,409	1,044
Induced Effect	\$179,585,278	\$118,306,729	\$70,570,745	1,122
Total Effect	\$988,731,389	\$331,166,488	\$192,856,657	2,712

Table A4.3: Northwest Washington Dairy Cull Cow Contribution

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$47,933,684	\$8,652,156	\$6,261,398	90
Indirect Effect	\$17,066,422	\$8,322,179	\$5,096,631	98
Induced Effect	\$13,904,812	\$9,096,877	\$5,355,368	86
Total Effect	\$78,904,918	\$26,071,212	\$16,713,397	274

Source: IMPACT Center and IMPLAN

Southwest

Table A4.4: Southwest Washington Dairy Production Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$63,316,505	\$24,271,963	\$13,325,333	193
Indirect Effect	\$17,091,823	\$9,143,103	\$6,060,771	138
Induced Effect	\$20,151,222	\$12,737,500	\$7,222,557	146
Total Effect	\$100,559,549	\$46,152,566	\$26,608,661	476

Table A4.5: Southwest Washington Dairy Processors Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$194,480,505	\$24,277,058	\$11,476,051	170
Indirect Effect	\$40,337,615	\$20,452,734	\$12,029,982	199
Induced Effect	\$31,559,438	\$20,260,668	\$11,849,110	232
Total Effect	\$266,377,558	\$64,990,460	\$35,355,144	601

Table A4.6: Southwest Washington Dairy Cull Cow Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$4,391,048	\$592,669	\$432,363	9
Indirect Effect	\$1,170,381	\$561,754	\$347,716	12
Induced Effect	\$836,819	\$532,649	\$306,476	6
Total Effect	\$6,398,248	\$1,687,071	\$1,086,555	27

Source: IMPACT Center and IMPLAN

Central**Table A4.7: Central Washington Dairy Production Contributions**

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$818,363,686	\$313,714,354	\$286,181,829	1,453
Indirect Effect	\$319,045,734	\$159,000,617	\$108,751,169	2,088
Induced Effect	\$352,838,062	\$215,113,977	\$124,572,358	2,692
Total Effect	\$1,490,247,482	\$687,828,948	\$519,505,356	6,233

Table A4.8: Central Washington Dairy Processors Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$161,936,418	\$18,369,163	\$10,753,095	152
Indirect Effect	\$53,115,111	\$28,161,798	\$16,954,743	261
Induced Effect	\$37,026,940	\$23,158,853	\$14,000,814	290
Total Effect	\$252,078,468	\$69,689,814	\$41,708,653	703

Table A4.9: Central Washington Dairy Cull Cow Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$1,362,084	\$139,878	\$97,430	3
Indirect Effect	\$602,272	\$247,186	\$174,783	2
Induced Effect	\$285,313	\$176,939	\$105,470	2
Total Effect	\$2,249,668	\$564,003	\$377,682	7

Source: IMPACT Center and IMPLAN

Eastern**Table A4.10: Eastern Washington Dairy Production Contributions**

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$5,162,112	\$1,978,862	\$564,097	22
Indirect Effect	\$2,154,934	\$1,137,781	\$704,235	17
Induced Effect	\$2,523,656	\$1,545,776	\$919,877	19
Total Effect	\$9,840,703	\$4,662,419	\$2,188,209	58

Table A4.11: Eastern Washington Dairy Processors Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$66,258,585	\$9,238,680	\$3,879,931	61
Indirect Effect	\$28,066,847	\$13,138,630	\$7,635,003	126
Induced Effect	\$22,969,653	\$14,203,826	\$8,580,604	175
Total Effect	\$117,295,085	\$36,581,136	\$20,095,538	362

Table A4.12: Eastern Washington Dairy Cull Cow Contributions

Contribution Type	Sales	Value Added	Income	Employment
Direct Effect	\$11,732,700	\$1,799,573	\$1,290,047	23
Indirect Effect	\$2,791,541	\$1,492,399	\$928,248	19
Induced Effect	\$3,860,096	\$2,362,641	\$1,405,634	29
Total Effect	\$18,384,337	\$5,654,613	\$3,623,930	71

Source: IMPACT Center and IMPLAN