

The Economic Contribution of the Potato Industry in Washington State

Key Points

- The Washington State potato industry generates \$7.42 billion in total economic output in the State
- The Washington State potato industry employs a total of 35,860 people in the State (through direct, indirect and induced effects).

Executive Summary

The primary objective of this report is to estimate the total economic contribution of the potato industry to Washington's economy for 2015. These contributions are made by taking into account the linkages between Washington's potato production and processing sectors with other economic activities in the state. In order to determine the contribution of the potato industry to the Washington economy, the study must not only look at the industry itself but also incorporate the economic activities of other industries directly and indirectly related to potato production.

The potato industry in Washington State generated approximately \$3.07 billion in direct economic output from the five sectors in the industry – potato farming, frozen potato processing, fresh packed potatoes, dehydrated potato products, and potato chip manufacturing. Indirect and induced effects of this economic output generated a further \$4.35 billion in economic activity in the State.

Direct employment in the potato industry sectors noted above was approximately 5,846; this direct employment lead to the creation of a further 30,014 jobs in Washington State. Alternatively, every job in the potato industry supported a further 5.1 jobs in the economy in sectors such as support services for agriculture, transportation, wholesale trade, real estate, and food and beverage retail stores.

The major point from this research is that one sector does not drive the potato industry; without the potato farming sector the frozen manufacturing sector would more than likely not exist in Washington State, and the potato farming sector needs the various processing sectors to remain viable in the long run. Therefore, to maintain and grow the economic value generated by the potato industry to the State's economy, supporting a vibrant potato industry is essential to maintaining the economic health of regions of the state where the potato industry, farming and processing, is located.

Overview of the Potato Industry in Washington

Washington is the second largest producer of potatoes in the United States. In 2014, Washington growers harvested 160,000 acres of potatoes, representing 15.7% of total U.S. acres and 22.7% of total production. Potatoes are grown in Adams, Benton, Franklin, Grant, Kittitas, Lincoln, Skagit, Snohomish, Walla Walla, Whatcom and Yakima counties (USDA NASS, 2009). Potato production acreage has been changing over the past decade, and planted acreage increased by 3% between 2013 and 2014 (USDA NASS, 2015). The majority of potato acres in Washington (69.5%) are planted to processing varieties such as Russet Burbank, Umatilla Russet, and Russet Ranger as of 2014. Fresh potato production comprises 13.5% of total planted acres and is primarily planted to the Russet Norkotah variety. Other varieties for fresh or processing make up the remaining 17% (i.e., 5% chipping potatoes, 12% other).

This report focuses on five potato and potato-related sectors: farm-based potato production, and four potato-related processors — fresh pack¹, dehydrated, chips, and frozen, utilizing data for the year 2013. Table 1 shows how potatoes are allocated within the economy. The largest demand center for potatoes is frozen potato products (\$643 million)². The next largest processing sector is the fresh pack industry where potatoes are sorted and packaged for fresh consumption (\$90 million). The dehydrated potato industry uses an estimated \$50 million of potatoes, while the potato chips industry uses about \$33 million worth of product. Compared to the estimates of a similar study that used 2008 data (Brady, 2011), there is increased demand for potatoes in 2013 by three of the processing sectors — fresh pack, frozen, and chips. Furthermore, the frozen

¹ Although fresh packed potatoes are not “processed” in any form, the fresh pack sector is considered as a processing sector in the context of this study as value is added to the raw potatoes through packaging.

² Industry demand only includes processing and fresh pack demand for Washington State.

potato industry and potato chips industry showed growth as they absorbed about 78% and 4% of the potato crop respectively in 2013 relative to 75% and 3% respectively in 2008.

The total value of output for the four potato processing sectors is estimated to be \$2.65 billion as of 2013. Total value of output is the sum of value of products from each of the sectors shown in Figure 1. The total value of output does not include the value of potatoes grown, only the value of products produced from those potatoes. The value that the processing industry places on these potatoes is the Value of Potato Demand for Processing. The value of output from the frozen potato products industry is by far the largest at \$1.98 billion. The fresh pack industry has an estimated output of \$178 million; the potato chip industry has \$372 million; and the dehydrated potato industry has a value of output at \$127 million.

Table 1. Industry demand for potatoes, 2013.

| Industry | This study | | Comparison with 2008 study | |
|--------------|----------------------------------|----------------------|----------------------------------|----------------------|
| | Potato Use Value (\$ million) | Use as % of Total | Potato Use Value (\$ million) | Use as % of Total |
| Fresh Pack | \$89.80 | 10.9% | \$85.90 | 12.3% |
| Dehydrated | \$49.78 | 6.1% | \$60.80 | 8.70% |
| Frozen | \$642.86 | 78.3% | \$524.90 | 75.10% |
| Chips | \$32.53 | 4.0% | \$18.90 | 2.70% |
| Other* | \$5.78 | 0.7% | \$8.40 | 1.20% |
| Total | \$820.75 | 100.00% | \$698.90 | 100.00% |

*Other processed.

Sources: Beleiciks (2005); Brady (2011); Potato Disposition Report 2013-2014; USDA NASS (2015).

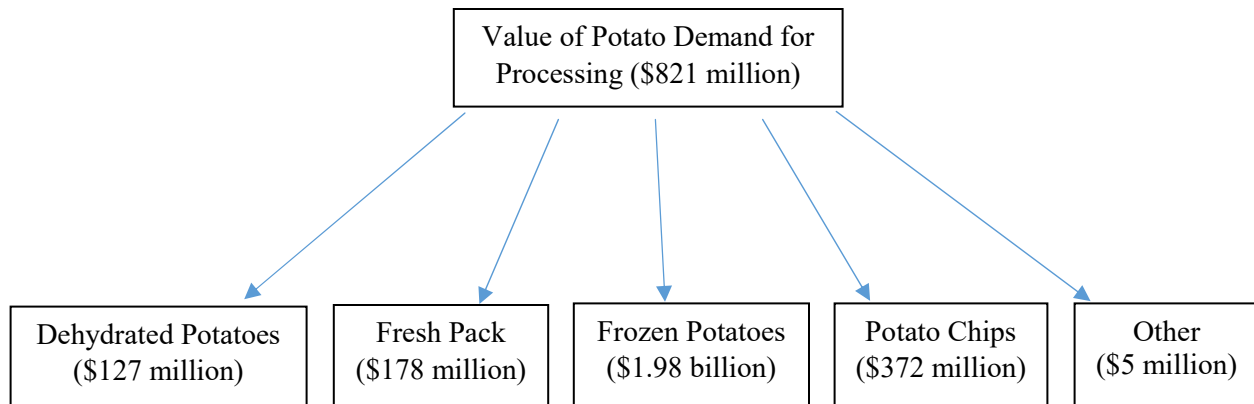


Figure 1. Value of intermediate potato demand and the output values of potato processing sectors in Washington State.

Method

For estimating the economic contribution of the potato industry, the IMPLAN input-output (I/O) model of the Washington State economy for 2014 (IMPLAN Group LLC) is used. The I/O model also represents the interdependencies between different industries in the economy, and is used to calculate the economic contribution of each sector of the potato industry through backward linkages. More in-depth details about the I/O framework of analysis applied in this report can be found in Brady (2011) and Holland and Beleiciks (2003).

Raw potato production and potato processing sets off a chain of transportation, warehousing, and marketing activities after the commodity leaves the farm or factory gate. For example, the motor freight and warehousing sector includes not only trucking but also the activities involved in storage and handling of the product. Accordingly, the economic contribution analysis includes estimates of the sectors that accompany the finished product after it leaves the processing plant or fresh-pack shed, or in the case of raw potatoes, the farm. Output streams from the potato industry considered in this report include raw potato production, fresh packing of potatoes, dehydrated potato products, frozen potato products, and potato chip production.

The direct effects of these sectors are estimated from the following: WSU enterprise budget for raw potato production (Galinato and Tozer, 2015), and spending for inputs of production confidentially obtained from representatives of the different potato processing sectors. The raw potato enterprise budget is translated into an input-output accounting framework following the method described by Willis and Holland (1997). The input expenses in an enterprise budget are in terms of purchaser prices, and since the I/O model utilizes producer prices, the conversion needs to be made. Also, it is necessary to “margin” inputs where the farmer is paying a purchaser price. Margining translates purchase price into producer price by taking out the portion of the price that goes to industries along the supply chain. For example, \$1 spent on fertilizer by a potato producer goes not only to the producer of the fertilizer but also industries that warehoused, transported, and retailed the fertilizer, including and up to the delivery to the potato producer. IMPLAN provides estimates of these margins and the margined values are allocated to the relevant industries.

Spending data obtained from representatives of potato processors are used to form the production function of each processing sector, which is then incorporated into the potato-oriented I/O model for the Washington State economy. In estimating the economic contributions of individual sectors, the backward linkages between raw potato production and a given potato processing sector (fresh pack, dehydrated, frozen or chips) are broken in order to avoid double counting when aggregating the effects for the entire potato industry. This is done by running the IMPLAN model for each processing sector that excludes raw potato as an input in production.

Baseline data gathered are for the year 2013, and estimates of economic contribution are shown as of 2015 using the built-in GDP deflators in IMPLAN for 2015.

Results

The IMPLAN software and the 2014 IMPLAN model for Washington were used to estimate the economic contributions of the potato industry. The contribution of the industry to the Washington economy is measured by different types of impact: direct effects, the immediate effects related to the production and processing of potato; indirect effects, changes arising from inter-industry transactions as supplying industries respond to the demand from the directly

affected industry; and induced effects, the effects due to the local spending on goods and services by employees in the directly and indirectly affected industry sectors. IMPLAN reports the contribution to a regional economy in terms of effects on employment, labor income, value added, and total output (Table 2).

Employment, as defined in IMPLAN, refers to the number of jobs, including full time, part time and temporary jobs. The direct effects on employment for the raw potato production sector are taken directly from the Washington State Employment Security Division (ESD) that tracks the number of employees and average wages for all industries at the 6-digit NAICS level. For the potato processing sectors, wages are assumed to be the same as the wages for their equivalent NAICS sector; and the immediate effects on employment are estimated by dividing the average wage in the processing sector by the same sector's employee compensation.

Table 2 shows that the potato industry generated the equivalent of 35,860 jobs in 2015. There were 5,846 people directly employed, and an additional 30,014 jobs supported in other industry sectors in the State. Thus, for every job directly related to the potato industry, about 5.1 additional jobs are supported due to indirect effects (facilitation of business-to-business transactions) and induced effects (provision of privately demanded goods and services).

Labor income is comprised of employee compensation (wages, salaries and benefits) and proprietor income (i.e., payments received by self-employed individuals and unincorporated business owners; includes capital consumption allowance and is recorded on Federal Tax form 1040C). The direct labor income of about \$290 million to the potato industry resulted in an additional \$1.54 billion (indirect and induced effects) of labor income within the State's economy, for a total impact of about \$1.83 billion of personal income (Table 2).

The value added is the sum of employee compensation, proprietor income, other property-type income and taxes. The estimated \$294 million of direct value added for the potato industry generated an additional \$2.62 billion indirect and induced value added, thus bringing the potato industry's total value-added contribution of \$2.91 billion to the economy of Washington State.

Table 2. Economic contribution of the Washington potato industry by type of impact.

| Variables and Sectors | Impact Type | | | |
|---|-------------------|---------------------|--------------------|-------------------|
| | Direct Effects | Indirect Effects | Induced Effects | Total Effects |
| Employment¹ | | | | |
| Potato Industry Total | 5,846 | 22,509 | 7,505 | 35,860 |
| Raw potato production | 1,610 | 7,409 | 2,034 | 11,052 |
| Production of frozen potato products | 3,290 | 10,436 | 3,992 | 17,718 |
| Fresh packing of potato | 407 | 915 | 349 | 1,671 |
| Production of dehydrated potato products | 150 | 698 | 242 | 1,090 |
| Potato chips production | 389 | 3,051 | 888 | 4,328 |
| Labor income (\$ million)² | | | | |
| Potato Industry Total | \$289.97 | \$1,178.42 | \$364.16 | \$1,832.55 |
| Raw potato production | \$60.13 | \$339.25 | \$98.65 | \$498.02 |
| Production of frozen potato products | \$181.28 | \$598.44 | \$193.73 | \$973.45 |
| Fresh packing of potato | \$19.42 | \$48.59 | \$16.94 | \$84.95 |
| Production of dehydrated potato products* | \$6.83 | \$40.60 | \$11.76 | \$59.19 |
| Potato chips production* | \$22.31 | \$151.54 | \$43.09 | \$216.94 |
| Total Value Added (\$ million)³ | | | | |
| Potato Industry Total | \$294.40 | \$1,946.36 | \$668.84 | \$2,909.59 |
| Raw potato production | \$60.13 | \$547.75 | \$181.15 | \$789.03 |
| Production of frozen potato products | \$183.21 | \$1,026.15 | \$355.83 | \$1,565.19 |
| Fresh packing of potato | \$21.91 | \$80.44 | \$31.11 | \$133.47 |
| Production of dehydrated potato products* | \$6.83 | \$68.22 | \$21.60 | \$96.66 |
| Potato chips production* | \$22.31 | \$223.80 | \$79.15 | \$325.25 |
| Total Output (\$ million)⁴ | | | | |
| Potato Industry Total | \$3,068.59 | \$3,211.55 | \$1,142.74 | \$7,422.88 |
| Raw potato production | \$842.80 | \$841.66 | \$309.49 | \$1,993.95 |
| Production of frozen potato products | \$1,664.90 | \$1,764.64 | \$607.96 | \$4,037.50 |
| Fresh packing of potato | \$120.37 | \$124.39 | \$53.16 | \$297.92 |
| Production of dehydrated potato products | \$97.25 | \$108.67 | \$36.91 | \$242.83 |
| Potato chips production | \$343.26 | \$372.19 | \$135.23 | \$850.68 |

Definition (Source: IMPLAN):

¹ Employment = number of jobs.

² Labor income = employee compensation + proprietor income.

³ Value added = labor income + proprietor income + other property income + indirect business taxes.

⁴ Output = intermediate expenditures + value added.

*The direct labor income and direct total value added are the same because data are available only for employee compensation (i.e., no data for proprietor income, other property income and indirect business taxes).

The Washington potato industry generated about \$3.07 billion in direct output (total industry sales), of which approximately 54% came from the frozen potato processing sector and 27% from the potato farming sector. The total sales (the direct impact) of the potato industry generated an additional \$4.35 billion of economic output from other sectors within the State (the sum of indirect and induced effects).

Table 3. Estimated multipliers.

| Variables | Type I* | Induced | Type SAM* |
|-------------------|---------|---------|-----------|
| Employment | 4.9 | 1.2 | 6.1 |
| Labor income | 5.1 | 1.2 | 6.3 |
| Total Value Added | 7.6 | 2.3 | 9.9 |
| Total Output | 2.0 | 0.4 | 2.4 |

*Accounts only for the impacts of business-to-business transactions.

Calculated as: (Direct Effects + Indirect Effects)/Direct Effects.

**Accounts for the impacts of inter-business transactions and local household spending. Calculated as: (Direct Effects + Indirect Effects + Induced Effects)/Direct Effects.

Table 3 shows the multipliers which calculate the impact expressed as a rate of change. A multiplier describes the resultant change that occurs in the overall economy given a change in an industry. The potato industry's employment multiplier is 6.1, which means that every direct potato industry job supports 6.1 jobs in the total economy: the original job plus 5.1 additional jobs. A labor income multiplier of 5.1 indicates that for every dollar of direct labor income in the potato industry, an additional \$5.10 of labor income is generated in the local economy through business-to-business transactions. The total output multiplier for the potato industry is 2.4. These estimates imply that for every dollar of raw potato production and processing, \$2.40 is generated in the local economy; that is for every potato industry dollar, an additional \$1.00 is generated in sectors providing inputs to the potato industry (indirect effects), and an additional \$0.40 earned by businesses providing goods and services to employees of the potato industry and indirectly affected sectors (induced effects).

Table 4. Employment impacts of the potato industry in Washington, top ten affected sectors.

| Sectors | Direct | Indirect | Induced | Total |
|--|--------|----------|---------|-------|
| Support activities for agriculture and forestry | 0 | 5,079 | 7 | 5,086 |
| Retail - Food and beverage stores | 0 | 4,675 | 239 | 4,913 |
| Frozen fruits, juices and vegetables manufacturing | 3,290 | 0 | 2 | 3,292 |
| Wholesale trade | 407 | 2,092 | 229 | 2,727 |
| Warehousing and storage | 0 | 1,932 | 24 | 1,957 |
| Vegetable and melon farming | 1,610 | 159 | 9 | 1,778 |
| Real estate | 0 | 1,338 | 334 | 1,672 |
| Truck transportation | 0 | 972 | 56 | 1,028 |
| Commercial and industrial machinery and equipment repair and maintenance | 0 | 654 | 12 | 666 |
| Retail - Building material and garden equipment and supplies stores | 0 | 527 | 106 | 633 |

The top ten sectors with employment supported by the potato industry are shown in Table 4. Frozen fruits, juices and vegetables manufacturing, and vegetable and melon farming are related to the sectors within the potato industry (i.e., frozen potato processing and raw potato production, respectively) while other employment occurred in sectors providing goods and services to the potato industry such as support activities for agriculture and forestry (e.g., custom field work, and transport of product to or from the farm, as different to transport of finished product), retail stores, wholesale trade (e.g., packaging supplies), warehouse and storage, transportation, and repair and maintenance of industrial machinery/equipment. Real estate employment is associated with land for raw potato production, land occupied by potato processing facilities, and other business-related spaces, including rental of land and or facilities. Employment is also supported through induced effects, generated by employees and proprietors spending their income on goods and services; for example, the food and beverage retail stores where a total of 239 jobs are supported through the induced effects.

Discussion

This report shows that farm-based potato production stimulates economic activity in industries that supply resources necessary for producing potatoes, such as the manufacturers and suppliers of the inputs of production (e.g., fertilizer, chemicals), transportation, and banking and credit. All economic activities from the potato industry complex sum to a value much larger than the value of the potato crop alone. The total output effects of the potato complex in Washington for 2015 is estimated to be \$3.07 billion in direct, \$3.21 billion in indirect, and \$1.14 billion in induced impacts for a total of \$7.42 billion. To provide some comparison, the total direct effect for 2008 is estimated to be \$2.33 billion and total output impact is \$4.6 billion (Brady, 2011). The total contribution to employment is estimated to be 35,860 jobs in 2015, up from 23,500 jobs estimated in 2008. These economic impacts include all the interconnections between industries that cause ripple effects across the region.

The potato industry's economic contribution in Washington State is led by the frozen potato processing sector, followed by the potato farming sector, and by far both sectors employ the most number of people. The potato farming sector contributes about 27% of the value of the potato industry's contribution to the State's economy. Also, of the four processing sectors, those that produce frozen potato products and potato chips account for 54% and 11% respectively of the total economic contribution. These results imply that any changes to these three sectors, especially frozen potato processing, will have a substantial economic impact to the potato industry in the State.

From the results of this study it is possible to see that the linkages between the potato farming sector and the processing sector contribute significant value to the State's economy. It is important to understand that potato farming by itself, while generating a total value of output of \$2 billion, does not generate the main source of value in the potato industry. The major source of value in the potato industry is in the frozen potato manufacturing sector, which generated approximately \$4 billion in value. The key point from this research is that one sector does not drive the potato industry. Without the potato farming sector the frozen potato manufacturing sector would more than likely not exist in Washington State. At the same time, the potato

farming sector needs the various processing sectors to remain viable in the long run. Therefore, to maintain and grow the economic value generated by the industry to the State's economy, supporting a vibrant potato industry is essential to maintaining the economic health of parts of the state where the potato industry, farming and processing, is located.

References

Beleiciks, N. 2005. "The Economic Impact of Potato Production and Processing in Washington State." Master's Thesis. School of Economic Sciences, Washington State University, Pullman, WA.

Brady, M. 2011. "The Economic Impact of Potatoes in Washington State." School of Economic Sciences, Washington State University, Pullman, WA.

Holland, D. and N. Beleiciks. 2003. "The Economic Impact of Potatoes in Washington State." Farm Business Management Reports EB1953E. School of Economic Sciences, Washington State University, Pullman, WA.

Galinato, S.P. and P.R. Tozer. 2016. "2015 Costs Estimates of Producing Fresh and Processing Potatoes in Washington." Washington State University Extension Publication (In Press).

USDA NASS (U.S. Department of Agriculture-National Agricultural Statistics Service). 2009. Potato Data by County, Washington State. USDA NASS, Northwest Regional Office, Olympia, WA.

USDA NASS. 2015. "Quick Stats Lite." Available at http://www.nass.usda.gov/Quick_Stats/.

Willis, D. and D. Holland. 1997. "Translating Farm Enterprise Budgets into Input-Output Accounts: Another Example from Washington State." Department of Agricultural Economics, Washington State University, Pullman, WA.

Acknowledgements

This study was funded by the Washington State Potato Commission. We are grateful for the feedback and contributions from Mike Brady, Matt Harris, potato growers, and various companies and individuals from the potato processing sectors who wish to remain anonymous to maintain the confidentiality of the information supplied.



This report was prepared by **Ms. Suzette P. Galinato**, Research Associate; and **Dr. Peter R. Tozer**, Assistant Research Professor, IMPACT Center, P.O. Box 646210, School of Economic Sciences, Washington State University, Pullman , WA 99164-6210. (Email: sgalinato@wsu.edu; peter_tozer@wsu.edu)