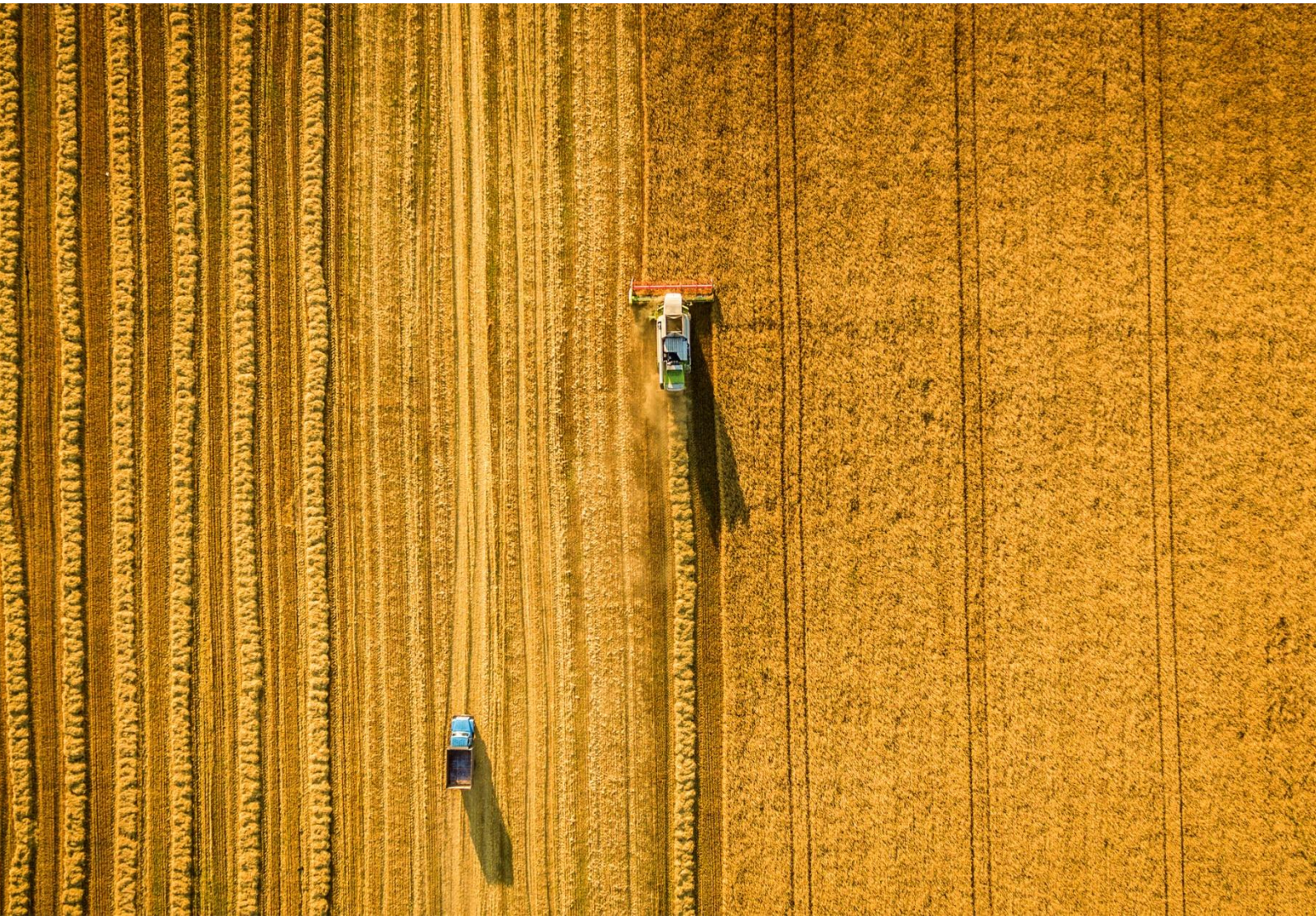
GlobalData.



Agri

June 2025

Economic Impact of Canadian Grains Sector

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Introduction

Canada Grains Council (CGC) commissioned GlobalData to undertake research to quantify the benefit of key crops to the Canadian economy, in terms of:

1. ***Economic impact***
2. ***Number of jobs dependent on the sector***
3. ***Contribution to Canadian GDP and exports***

This study provides the results of that independent analysis.

The crops covered are wheat (all wheat, including spring, winter and durum), barley, oats, corn, canola, flax, sunflower, soybeans and pulses (peas, lentils, chickpeas, faba beans and dried beans).

The economic impact analysis spans several steps in the value chain, from farm cultivation, elevation and delivery, via primary and secondary processing, including biofuels and animal feed, through to the delivery of value-added products to end users or port of export.

The results capture:

1. The ***direct*** benefit from these stages
2. The ***indirect*** benefit from the associated economic and market activities and industries
3. The ***induced*** benefit from household spending of the income earned.

The data are presented for ***Direct*** benefits and ***Total*** benefits (the sum of the direct, indirect and induced benefits above) for each stage for Canada.

The objective is to develop an up-to-date assessment, using:

- Official data as far as possible
- The latest complete data set, 2022/23 at the start of research, and previous years (which are officially revised over time)
- Best practice in estimating economic benefits.

The analysis aims to provide the most accurate and independent assessment possible. To this end, we took guidance from industry participants, applied the most recent official data where relevant and used *Statistics Canada* multipliers to arrive at our totals in each category. The total results reflect the government's most recent multipliers for each sector.

*Note: Values throughout the study are presented in **Canadian dollars**, whether noted as dollars, or with the symbols $ or C$, unless otherwise specified.*

Summary of Results

For the average of the past three years of full data, ***2020/21-2022/23***:

- The total combined ***economic impact*** on the Canadian economy from the featured sectors averaged almost C$172 billion per year. This represents 6.3% of total Canadian GDP.
- 600,000 ***full time equivalent jobs*** are generated by these sectors within Canada.
- The ***direct economic impact*** on the Canadian economy from these sectors is over C$70 billion per year, accounting for 2.6% of Canadian GDP. The ***direct employment impact*** is almost 232,000 *full time equivalent jobs*.
- These sectors combined contributed an annual average of C$42.8 billion to Canadian exports over the last three years. This represents 4.75% of total Canadian export value in those years.
- The largest contribution to economic impact came from the wheat sector, averaging C$60 billion per year, followed by canola.
- The largest contribution to full-time equivalent jobs came from the wheat sector, with 243,000 paid jobs, followed by barley and canola.
- The farming and processing sectors are the largest employers and have the greatest economic impact within Canada.
- The greatest contribution to Canadian exports came from the canola sector, averaging C$14.7 billion per year, and combined wheat sector, averaging C$15.0 per year.

The economic benefits from these crops increase when prices and output are higher. The economic impact today is therefore likely to be at historically high levels.

This report details the results and methodology for each stage of the value chain covered in the analysis. We do not detail the exhaustive methodology employed in every crop in every sector. Instead, as the methodology is common and consistent across sectors, we describe the common methodology for each stage of the value chain.

Results

This study evaluates the impact along the value chain for our featured crops via several different metrics:

- ***Economic impact:*** quantifies the value added to the Canadian economy by each crop and its downstream value chain
- ***Employment impact:*** estimates the number of full-time equivalent (FTE) jobs contributed by each crop's value chain in Canada
- ***Contribution to Canadian GDP and exports:*** expresses the economic impact (value added) and value of exports for each crop sector as a proportion of total Canadian GDP and export value.

We evaluate the Canadian value chains at several distinct steps, tracing the impact through the value-added sectors of elevation, primary and secondary processing (where relevant), biofuels, feed milling, end uses, and transport of raw materials and primary products.

It is important point to note that the value chain includes only the value added to the Canadian crop in question, e.g. if a Canadian ethanol producer imports US corn, no account is taken of the value added to the US corn in the ethanol facility: the value added is calculated solely as the value added to Canadian corn processed in the Canadian ethanol mill. The reason for this is that we are estimating the value added to the Canadian economy by growing the featured crops. If US corn were included, this would be a study of the value added to the Canadian economy *by ethanol milling* in Canada.

Another important point is that the analysis ends at the point where 1. the crop is exported, or 2. where products are exported or processed into secondary products (such as doughs and mixes for wheat flour) and consumed or 3. Where the crop or primary processed products cross from Canada into the United States for overland export.

The economic indicators for each step of the value chain are presented at two levels: ***Direct effects*** only, and ***Total effects*** (which is the sum of Direct, Indirect and Induced effects).

- ***Direct effects:*** the economic and employment impact that can be directly attributed to the crop value chain. These results are calculated by GlobalData based on models driven by publicly and privately available data, industry knowledge, and interviews with industry stakeholders.
- ***Indirect effects:*** the economic and employment impact created by those industries that supply the crop value chains, or by individuals who work at the periphery of the sector.
- ***Induced effects:*** the economic and employment impact that stems from household spending of the income earned in each sector.

Note: The indirect and induced effects of the sectors are estimated based on input-output tables developed by Statistics Canada (StatCan). The use of these multipliers is discussed in greater detail later.

Table 1: Value chain for crop economic impact assessment, by component

Value chain	Description	Economic impact	Employment	Multiplier used
Farming	Production of crops by farmers using land and inputs such as seed, fertilizers and crop protection	yes	yes	yes
Elevation	Primary elevation of crops	yes	yes	yes
Crop delivery	Delivery of crops to elevators, processing plants or point of export via truck, rail and barge	yes	yes	yes
Primary processing	Initial processing of crop for food and fuel products	yes	yes	yes
Feed milling	Milling of crops and by-products for animal feed	yes	yes	yes
Further processing and downstream activities	Further processing of outputs from primary processing plus appropriate retail and end use sectors	yes	yes	yes
Product delivery	Delivery of products and by-products to end users or point of export	yes	yes	yes
Impact at ports	Loading ocean-going vessels for overseas export	yes	yes	yes

The economic impact of key crops on the Canadian economy

This section presents the economic impact (value added) for the entire value chain of each crop averaged across the past three years. *Note that the results for wheat, whether common or durum wheat or spring or winter wheat, are aggregated in the table, as are the results for the pulses (dry peas, lentils, chickpeas, faba/broad beans and dried beans). The following diagram, however, breaks out the individual crops.* We apply sectoral multipliers from StatCan in order to calculate the ***total*** economic impact of our featured crops after estimating the direct impact.

- Between 2020/21 and 2022/23, ***the combined total economic impact of these crops on the Canadian economy averaged almost C$172 billion***. This value has been supported in recent years by higher output and higher prices.

- Of this, the farming sector is by far the largest contributor, contributing C$83 billion, with processing also being very significant.

- Among the featured crops, wheat (C$60 billion) and canola (C$43 billion) generate the largest economic impact.

Table 2: Economic impact of selected crops on the Canadian economy (C$ million)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact										
Farming	12,969	2,911	1,354	11,298	3,978	3,634	3,894	69	460	**40,568**
Elevation	233	106	45	542	9	21	110	0	6	**1,071**
Crop delivery	942	401	146	2,028	296	234	354	2	26	**4,428**
Primary processing	921	338	211	1,865	2,078	128	346	2	46	**5,936**
Feed milling	51	432	9	333	441	79	21	0	10	**1,376**
Further processing and downstream activities	2,911	4,313	145	7,411	27	564	149	0	26	**15,547**
Product delivery	219	93	35	174	177	40	12	1	12	**764**
Impact at ports	191	40	9	253	28	75	80	0	3	**680**
Total	**18,437**	**8,633**	**1,954**	**23,904**	**7,035**	**4,777**	**4,967**	**73**	**589**	**70,369**
Total economic impact										
Farming	26,560	5,961	2,774	23,139	8,148	7,443	7,975	141	942	**83,083**
Elevation	413	187	79	961	15	37	195	1	10	**1,900**
Crop delivery	2,131	792	337	4,260	836	438	668	5	74	**9,541**
Primary processing	5,526	2,030	1,263	10,371	8,829	770	2,078	10	276	**31,152**
Feed milling	252	2,143	44	1,652	2,191	392	0	0	49	**6,724**
Further processing and downstream activities	7,248	8,159	372	18,926	69	1,390	296	0	52	**36,513**
Product delivery	382	230	59	480	510	69	13	2	22	**1,767**
Impact at ports	339	70	16	450	50	134	148	0	6	**1,212**
Total	**42,851**	**19,574**	**4,944**	**60,238**	**20,649**	**10,675**	**11,373**	**158**	**1,431**	**171,893**

Diagram 1: Total economic impact of selected crops on the Canadian economy

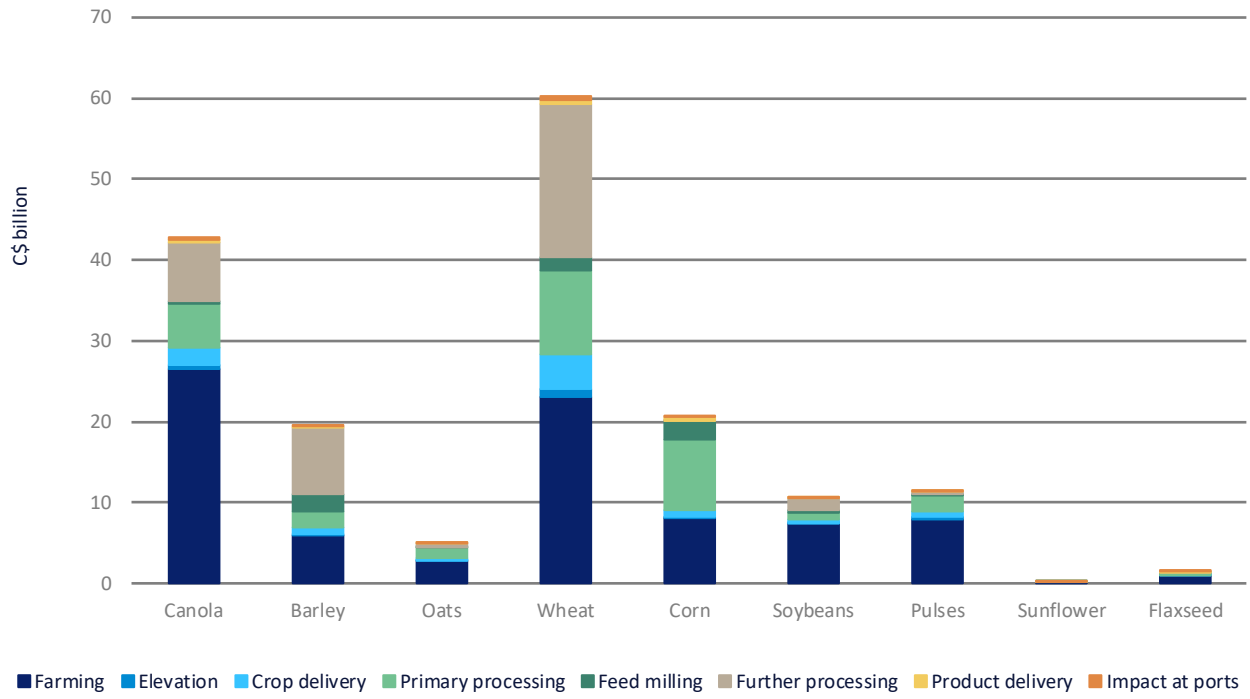
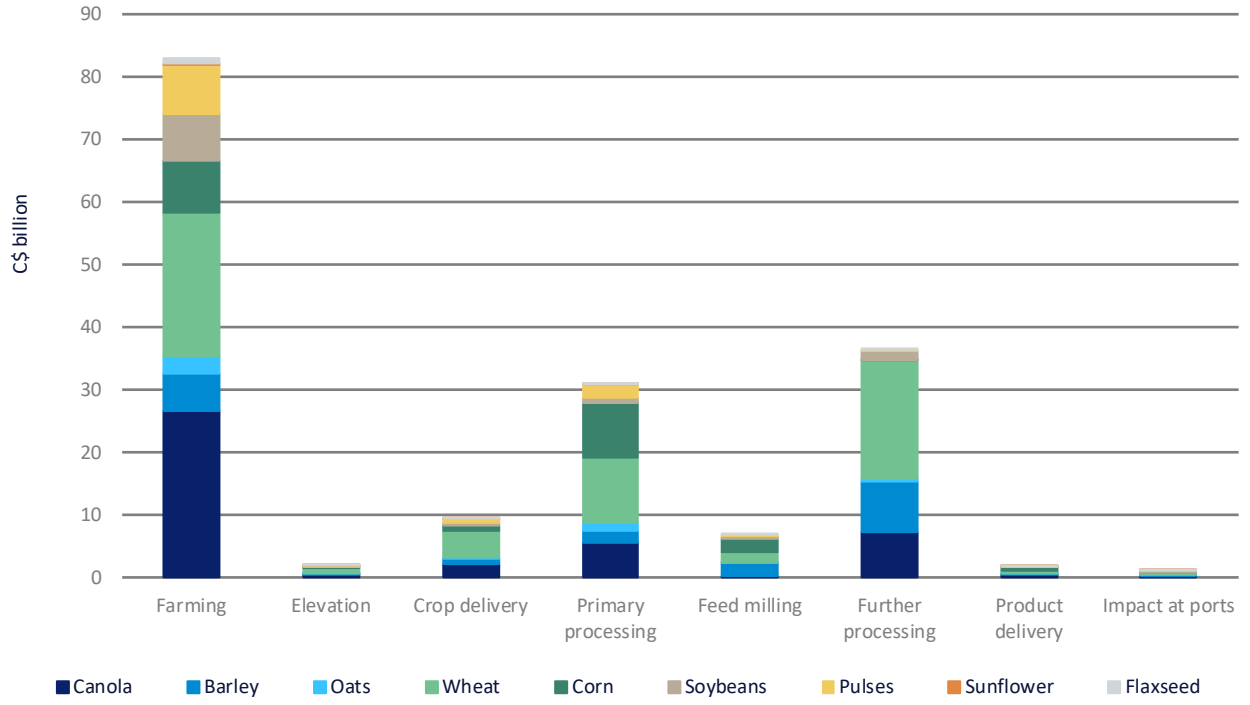


Diagram 2: Total economic impact of selected crops on the Canadian economy, by stage in value chain



The employment impact of key crops on the Canadian economy

The employment impact (measured in full-time equivalent jobs) of each of our featured crops on the Canadian economy is presented here, with the shares of employment illustrated for all crops, with wheat and pulses disaggregated. We present the results for the entire value chain averaged across the past three years and apply employment multipliers from StatCan in order to calculate the ***total*** employment impact after estimating the direct employment.

- The total ***employment effect*** of the featured crops averaged ***600,000*** full time equivalent jobs.
- Of this, the farming sector is the largest contributor, with further processing — notably in the wheat flour baking sector — also being a substantial employer.
- Among the featured crops, wheat (243,000 jobs), barley (111,000 jobs, almost half of which come from brewing) and canola generate the largest number of jobs.

Table 3: Employment impact of selected crops on the Canadian economy (full-time equivalent jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct employment impact										
Farming	34,759	12,485	6,178	39,996	5,995	8,273	14,250	146	1,459	**123,540**
Elevation	1,368	315	254	3,385	211	178	426	2	45	**6,184**
Crop delivery	2,023	961	303	4,577	973	536	674	8	35	**10,090**
Primary processing	450	660	116	1,899	437	90	38	13	226	**3,930**
Feed milling	323	3,062	688	2,387	3,164	503	125	0	37	**10,287**
Further processing and downstream activities	3,509	19,899	500	44,496	6	2,283	517	0	173	**71,383**
Product delivery	920	292	49	660	591	169	52	3	25	**2,761**
Impact at ports	941	216	50	1,688	120	321	364	0	14	**3,714**
Total	**44,294**	**37,890**	**8,138**	**99,088**	**11,497**	**12,353**	**16,446**	**172**	**2,013**	**231,890**
Total employment impact										
Farming	81,406	29,239	14,470	93,670	14,041	19,375	33,373	341	3,416	**289,332**
Elevation	2,087	480	388	5,163	321	271	649	3	68	**9,431**
Crop delivery	4,880	2,284	731	11,019	2,289	1,277	1,609	20	82	**24,190**
Primary processing	5,061	7,424	1,305	20,996	2,519	1,014	428	143	2,547	**41,436**
Feed milling	1,829	17,365	3,900	13,534	17,940	2,851	709	0	210	**58,338**
Further processing and downstream activities	9,462	53,469	1,072	94,697	41	6,151	691	0	232	**165,814**
Product delivery	2,197	689	117	1,554	672	404	124	7	59	**5,824**
Impact at ports	1,436	329	76	2,575	183	490	554	0	21	**5,664**
Total	**108,358**	**111,279**	**22,058**	**243,208**	**38,006**	**31,834**	**38,138**	**513**	**6,635**	**600,029**

Diagram 3: Total employment impact of selected crops on the Canadian economy

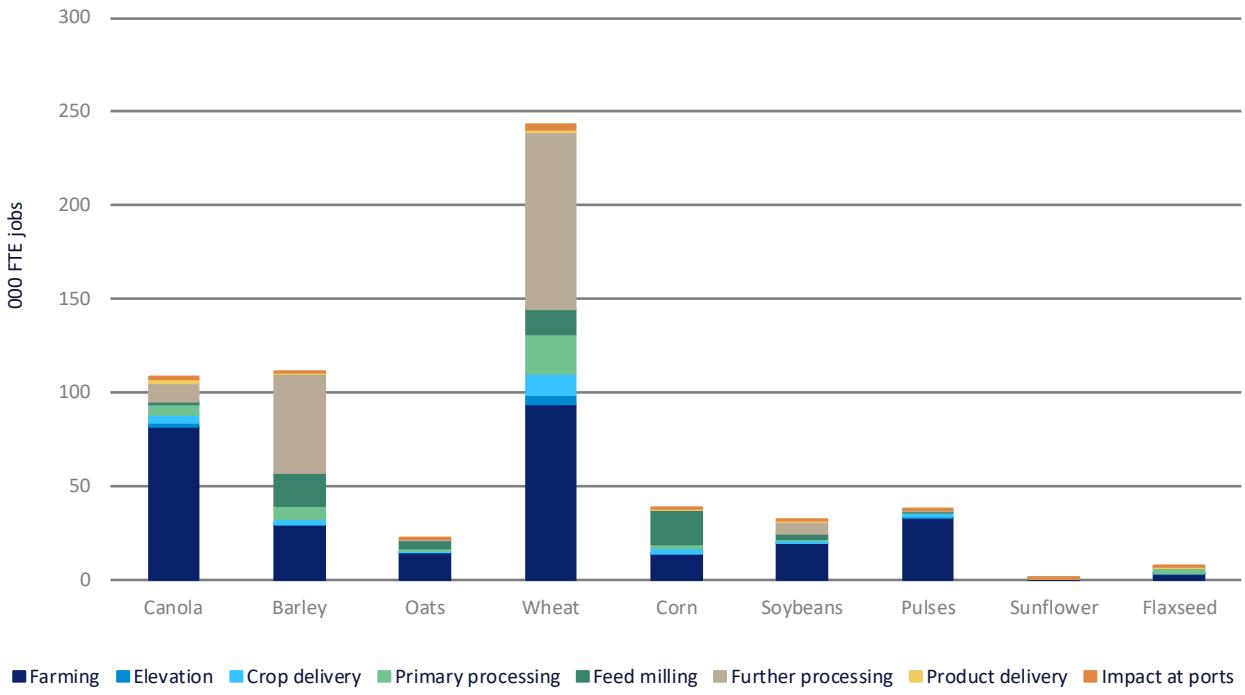
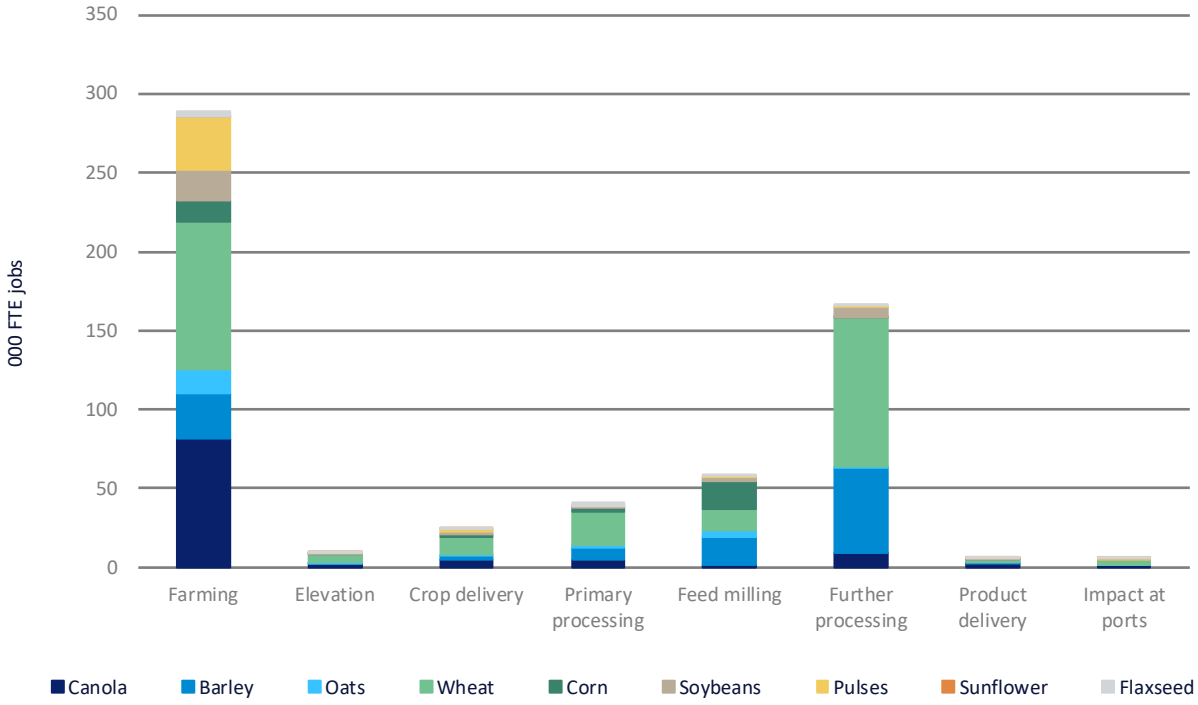


Diagram 4: Total employment impact of selected crops on the Canadian economy, by stage in value chain

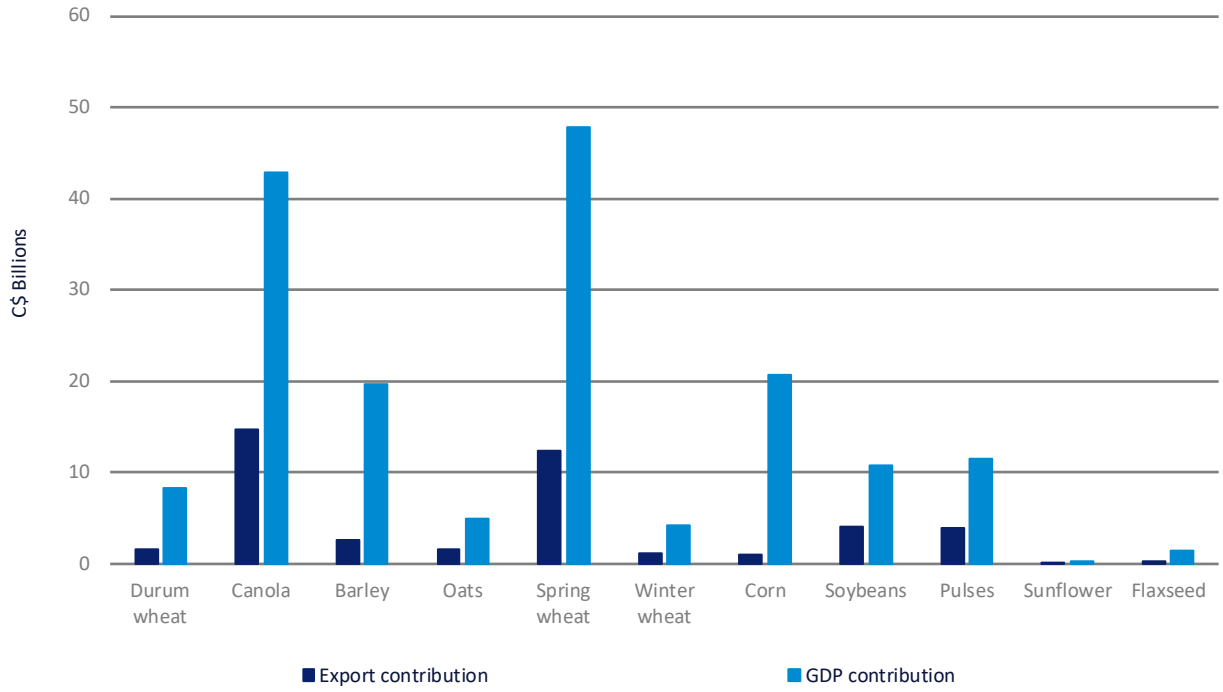


The contribution to Canadian GDP and exports of key crops

We also assess the role of each of these sectors in the Canadian economy in terms of:

- ***Contribution to Canadian GDP***, measured as the **total** economic value added by the crop sector and expressed as a proportion of total Canadian GDP.
- ***Contribution to Canadian export value***, measured as the export value of each crop and its products as covered in the study and expressed as a proportion of total Canadian exports by value.

Diagram 5: Contribution to Canadian exports and GDP (average 2020/21 to 2022/23)



- The total value of Canadian exports dependent on these sectors averaged C$42.8 billion, amounting to 4.75% of Canada's total exports. The largest contributors were canola and wheat.
- The average **total** economic impact of the sectors was $172 billion per year which amounts to 6.3% of Canada's GDP on average over the three years.

Use of multipliers to evaluate indirect and induced impact

We have presented our results both for direct and total economic and employment effects. The direct effects of each crop on the Canadian economy are significant, but they ignore the important economic effect that a core industry generates via a ripple effect on supporting industries. This is known as the **indirect** effect. For some steps in the crop value chain, the indirect effect can be significant.

This is especially true for capital-intensive aspects of the sector, such as processing sectors. Many jobs associated with keeping a facility operational, from white collar jobs in engineering to trade professions like electricians, plumbers and pipefitters, are done on a contractual basis with outside firms, making the true impact of the processing facility much higher.

Similarly, direct effects fail to capture the economic activity stemming from expenditures of households drawing a salary from a given sector. While these "**induced**" effects are typically smaller than indirect effects, they can still constitute a sizeable economic force, particularly in a local area.

These economic and employment spin-offs are known as the ***multiplier effect*** in established economic literature. Multipliers measure the impact on the broader economy from an exogenous shock to a specific sector of the economy.

In this report, we employ different multipliers for the economic and employment effects. The magnitude of the multiplier effect also varies geographically and across different subsectors of the value chain. Fortunately, ***Canada maintains industry multipliers at a detailed sectoral level.***

Use of StatCan multipliers in this study

Statistics Canada's Industry Accounts Division has estimated over 250 economic multipliers.

We adopt the most recent national-level multipliers available when estimating the total impact of each crop on the Canadian economy.

Canadian multipliers are available for 1) economic impact and 2) employment impact at the direct + indirect and the direct + indirect + induced levels. We use the latter of these measures in this report in order to capture the whole multiplier effect.

Table 4: National-level multipliers derived from StatCan input-output tables

Value-added activity	StatCan Industry Designation	Multipliers	
		Economic Impact	Employment Impact
Farming	Crop Production	2.05	2.34
Elevation	Warehousing and Storage	1.77	1.53
Rail Transport	Rail Transportation	1.64	2.39
Truck Transport	Truck Transportation	2.89	2.35
Barge Transport	Water Transportation	3.31	3.16
Processing	Grain and Oilseed Milling	6.00	11.25
Feed milling	Animal Food Manufacturing	4.96	5.67
Biofuel production	Basic Chemical Manufacturing	2.59	6.71
Downstream activities	Food Manufacturing	2.57	2.14
Retail sales	Food and Beverage Stores	1.98	1.34
Port Activities	Warehousing and Storage	1.77	1.53
Brewing	Breweries	1.89	2.69
End uses & bottling	Other Food Manufacturing	2.45	2.70
Flour processing	Bakeries and Tortilla Manufacturing	2.57	2.14

Value Chain Results and Methodology

Below we discuss the methodology employed in accounting for the direct economic and employment impact across the distinct steps in the value chains of our featured crops.

Farming

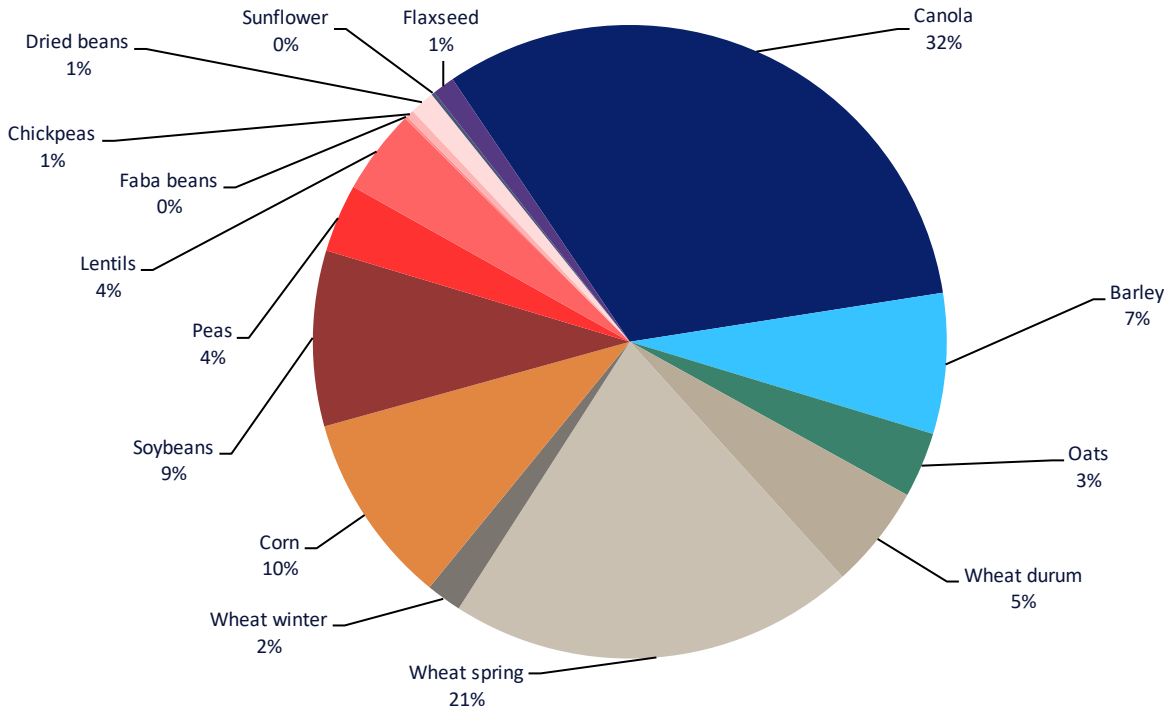
Farming is the foundation of the crop value chains in our analysis and typically accounts for the largest share of the economic impact and employment in Canada.

- The combined total farming economic impact of our featured crops in Canada averaged $83 billion between 2020/21 and 2022/23.
- An estimated 289,000 full-time equivalent jobs are generated by farming for our featured crops.

Table 5: Economic and employment impact in farming sector, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	12,969	2,911	1,354	11,298	3,978	3,634	3,894	69	460	**40,568**
Total economic impact	26,560	5,961	2,774	23,139	8,148	7,443	7,975	141	942	**83,083**
Direct employment impact	34,759	12,485	6,178	39,996	5,995	8,273	14,250	146	1459	**123,540**
Total employment impact	81,406	29,239	14,470	93,670	14,041	19,375	33,373	341	3416	**289,332**

Diagram 6: Share of total economic impact in Canadian crop farming, average 2020/21–2022/23



We determine the economic impact of farming by considering the ***crop revenues*** earned by farmers; i.e. volumes produced multiplied by prices received.

It is important to note that, unlike the other sectors in our analysis, *this calculation does not estimate the value added by the sector*: to do this, we would have to subtract the farming *costs* from farming revenues for the crop in question. However, if we did that, we would fail to capture the economic impact of the wide array of inputs used in arable farming, such as seed, fertilizers and crop protection. To include these would necessitate a multitude of value-added calculations for each arable farming input.

The best way to view the ***farming impact*** in this report, therefore, is to view this as ***a summation of all the value added by all the sectors up to and including the farming stage***.

The value of farming for each crop is determined by two main factors:

- ***Crop prices:*** The trajectory of Canadian crop prices demonstrates the recent pricing peak, encompassing the years of this report. We use farmgate price series from Statistics Canada where available, which are weighted for feed and food grades where appropriate according to production volumes of each.

- ***Crop output:*** the high volumes of wheat and canola help explain the high values generated in many sectors for these crops.

Diagram 7: Selected Canadian crop prices

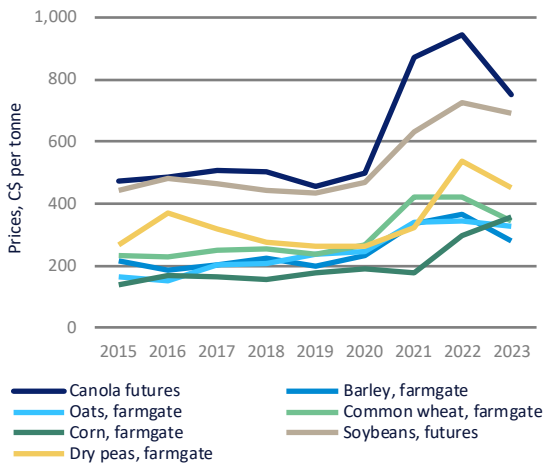
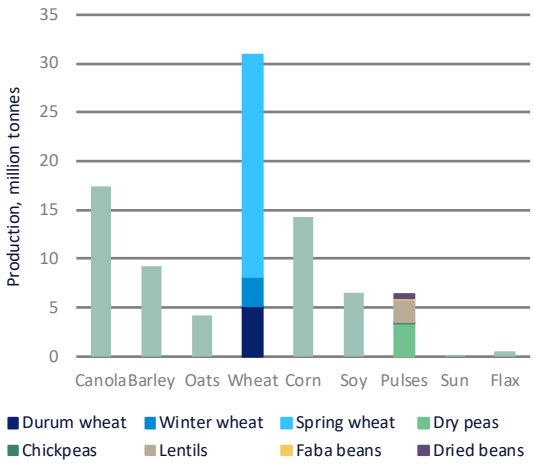


Diagram 8: Selected Canadian crop output



The analysis takes paid farm employment as a combination of growers and paid labor. While many growers may hire an immediate family member (such as a son or daughter), we assumed that hired labor was primarily found outside the immediate family.

Estimating ***grower employment*** in farming was done on the basis of the crop area as a proportion of the total field crop area in Canada. This percentage was then applied to the total number of field crop farms in Canada, *assuming that there is one full time farmer per farm*. This data series is constructed every five years, with the last data from 2021/22.

Estimates for ***hired labor*** were based on crop budgets developed by agricultural ministry extension specialists from across the prairie provinces. While there was some variability in these budgets in terms of labor requirements, the data were fairly tightly clustered at around 1.6 man-hours per acre. By multiplying the number of acres by 1.6 and dividing by 2,000 (50 weeks x 40 hours/week), we estimated the number of hired hands working on each crop on a full-time basis annually, adjusted for the labor intensity of each crop.

Primary elevation

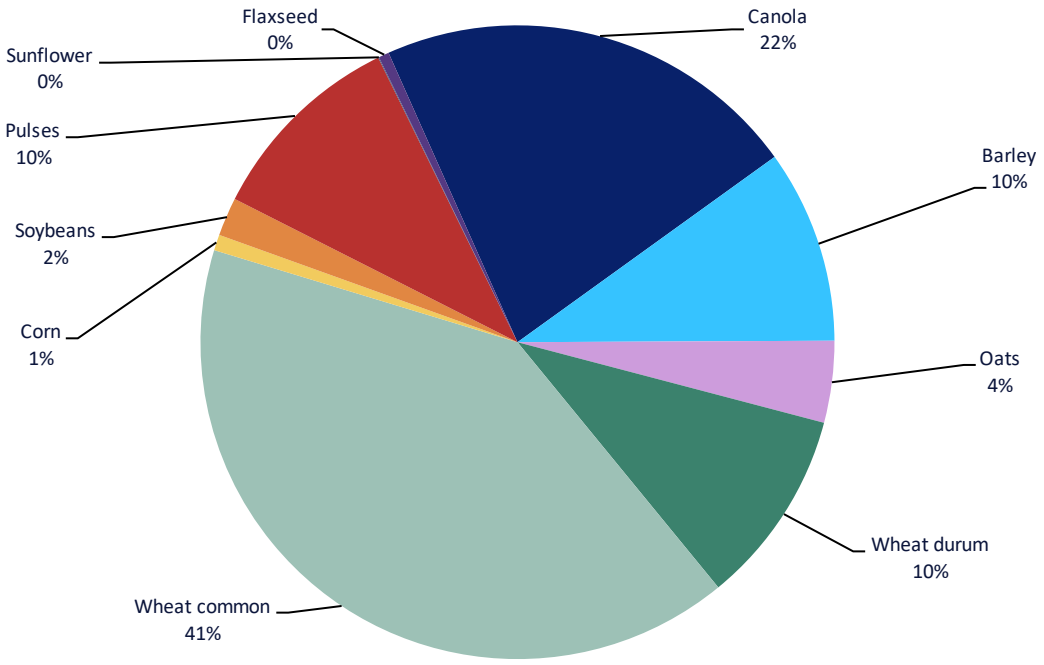
According to Canadian Grain Commission data, most of the large-scale crops in the prairie provinces are delivered to primary elevators, the balance being delivered directly to processors. This makes elevation an important sector in economic value added and job creation. At the elevators, crops are gathered and co-mingled before being transported 1) to domestic processors and end users 2) overland for export to the US or Mexico, or 3) to Canadian ports for overseas export.

- The total economic impact of elevation of our featured crops in Canada averaged $1.9 billion between 2020/21 and 2022/23.
- Over 9,400 FTE jobs are related to elevation of these crops.

Table 6: Economic and employment impact in elevation sector, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	233	106	45	542	9	21	110	0	6	1,071
Total economic impact	413	187	79	961	15	37	195	1	10	1,900
Direct employment impact	1,368	315	254	3,385	211	178	426	2	45	6,184
Total employment impact	2,087	480	388	5,163	321	271	649	3	68	9,431

Diagram 9: Share of total employment in elevation sector, average 2020/21–2022/23



The economic impact of elevation is determined by the product of volumes of each crop being elevated and fees incurred for primary elevation. Elevated crop volumes were determined by data available through the *Canadian Grain Commission*, with the numbers modified slightly to reconcile with information on internal trade flows within the country. CGC data estimates only small volumes of elevation outside of the prairies.

Primary elevation fees were also obtained from the *Canadian Grain Commission* based on annual surveys conducted on the costs of moving grain to point of export. Total fees, for receiving, removal of dockage and storage, typically range from $20-$25 per tonne over the period.

To understand the employment impact of primary elevation, we began with a *"Working in Canada"* report developed by the Canadian government. This identifies 6,250 individuals employed in the elevation of all agricultural commodities in Canada. Each crop's share of this total is calculated by multiplying the total jobs figure by the ratio of the crop's commercial positions over all crops in commercial positions.

Crop and product delivery

The transport analysis is the most complex of our categories. This is because of the number of products involved, the intricate web of transport routes and the alternative modes of transport available. We estimate economic values and jobs for:

- ***Crop delivery:*** transporting the crop from the farm 1). To elevators, or 2). direct to primary processors (e.g. flour millers, feed processors, oilseed crushes, ethanol facilities, etc.) or 3). to overseas export ports and overland to the US.

- ***Product delivery:*** this involves transporting the products after processing, e.g. flour, vegetable oil, semolina, pea protein, malted barley, etc. either to end users, to the US border or to port export facilities. This category includes transporting feed (after the feed mill) and other primary processing by-products (such as wheat mids, corn DDGs, etc.) to feed processors.

We assume that:

- Crops and products are transported predominantly by rail if moving between Canadian provinces (i.e. inter-provincial transfers) and internationally.

- The crop delivered from farms directly to elevators and processing facilities is transported by truck.
- Small volumes of certain crops are delivered by barge/laker vessels.

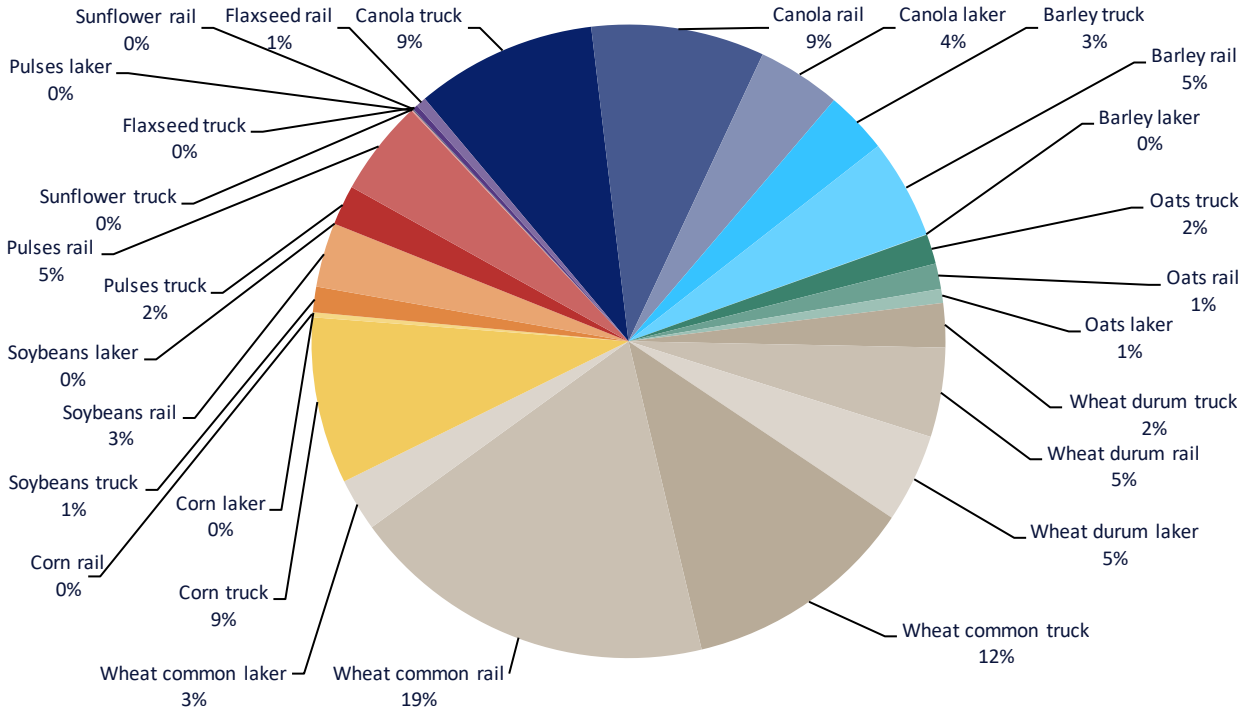
Crop delivery

- The combined economic impact of crop delivery for our featured crops in Canada averaged over $9.5 billion a year.
- 24,200 jobs are related to transporting these crops.
- The largest share of jobs is in rail, followed quite closely by trucking.

Table 7: Economic and employment impact in crop delivery, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	942	401	146	2,028	296	234	354	2	26	4,428
Total economic impact	2,131	792	337	4,260	836	438	668	5	74	9,541
Direct employment impact	2,023	961	303	4,577	973	536	674	8	35	10,090
Total employment impact	4,880	2,284	731	11,019	2,289	1,277	1,609	20	82	24,190

Diagram 10: Share of total economic impact in crop delivery, average 2020/21–2022/23



Product delivery

For product transportation, we cover transport of primary processed products, by-products and feed (after the feed mill), by rail and truck for domestic use and for export.

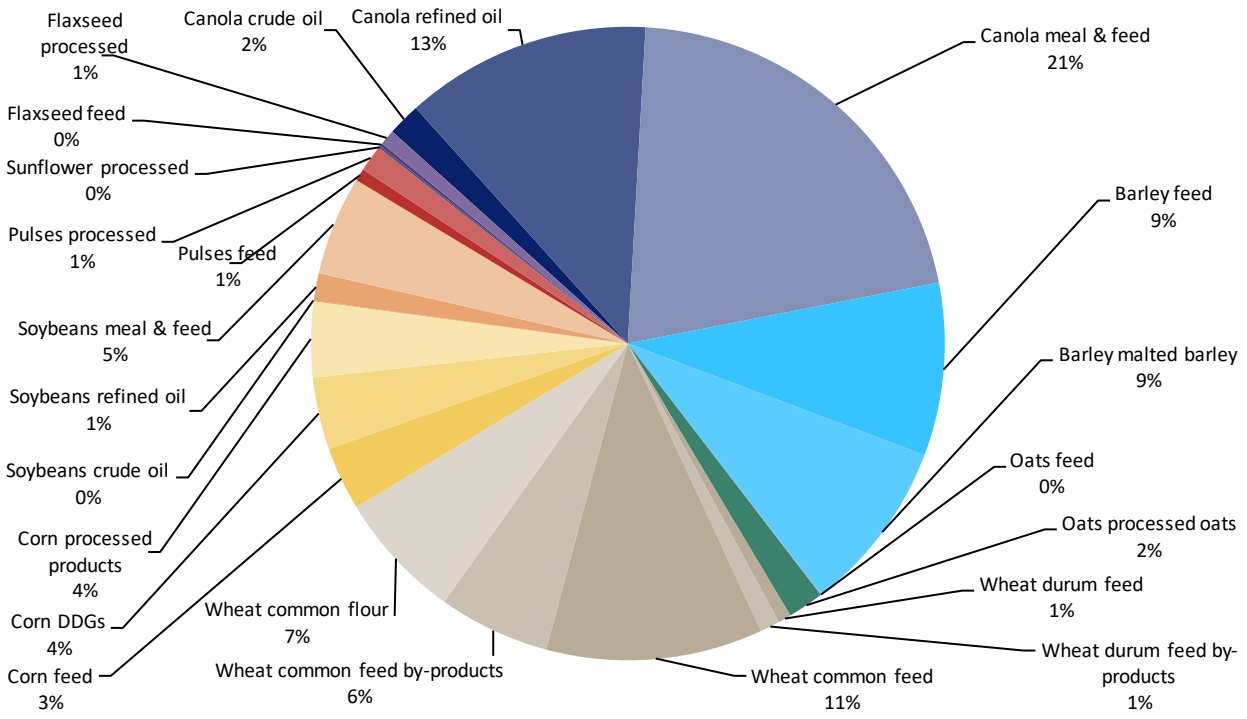
Livestock feed (post feed milling) is assumed to have negligible exports. We also assume negligible quantities of processed products are transported by laker and therefore exclude lakers from this category: *note that this makes no difference to the aggregate total, because if we did allocate some products to laker transport, we would have to simultaneously reduce the figure for rail or trucks.*

- The economic impact of transportation of crop products in Canada is limited by the size of the domestic market compared with international exports. Nonetheless, the combined average economic impact of product delivery for our featured crops in Canada approached $1.8 billion between 2020/21 and 2022/23.
- Over 5,800 FTE jobs are related to transporting these crop products.
- The largest share of jobs is in rail, with many jobs linked to the feed sector.

Table 8: Economic and employment impact in product delivery, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	219	93	35	174	177	40	12	1	12	764
Total economic impact	382	230	59	480	510	69	13	2	22	1,767
Direct employment impact	920	292	49	660	591	169	52	3	25	2,761
Total employment impact	2,197	689	117	1,554	672	404	124	7	59	5,824

Diagram 11: Share of total employment impact in product delivery, average 2020/21–2022/23



With an enormous number of combinations of farm origins, processing facilities and end-use destinations, determining the economic impact of transportation of Canadian crops and their products is the most complicated aspect of our economic impact model.

For rail and trucking transport:

- The first step is to determine the domestic and international trade flows of each crop and product. To do this, we locate processing facilities and the average distance crops, products and feed are transported to elevators and livestock units (which we assume are always within province) and processing facilities.
- The next step is to compile a distance matrix between the centers of farm production, processing, markets and points of export (port facilities).

Trucking

Trucking crops and their products were dealt with as follows:

- ***Crop volumes trucked from farm to elevator*** are based on the volumes passing through elevators. These data were obtained from the Canadian Grain Commission.
- Crops that do not pass through a primary elevator were accounted for in ***volumes trucked directly to primary processing and commercial feed facilities***.
- All livestock feed and feed by-products were assumed to be trucked *within* a province over an average distance derived from industry interviews.

For the prairie provinces, the average distance trucked from farm to elevator was determined by dividing the number of square miles of crop planted by the volume of crop harvested. Elsewhere, where production is smaller and more isolated, the average distance to elevators was determined in conversations with individuals with local expertise.

Distances trucked directly from farm to processing facilities were determined using the average distance between the geographic centers of production and processing facilities.

Volumes were multiplied by distances to arrive at a figure in tonne-miles. This, in turn, was multiplied by a tonne-mile trucking rate sourced from StatCan to derive a final trucking expenditures number.

The direct ***employment*** impact of trucking was calculated from the tonne-miles of each crop delivered by truck. This was converted to a full-time employment impact by assuming that a typical truck (with one driver):

- Transports 18 tonnes of cargo
- Averages 40 miles per hour
- A full-time trucker drives 2,000 hours per year
- Trucking wages were obtained from StatCan data

Rail

Our calculations on rail expenditures incorporate estimates of the trade flows for each crop within Canada and internationally to the US and export ports. The intra-Canadian trade estimates provide us with an estimate for tonne-miles of crops and products transported. The tonne-mile figure is then multiplied by a range of rail freight rates (which tend to be higher for shorter distances and lower for longer distances) to arrive at an estimate of rail freight expenditures.

For ***employment***, according to the *Railway Association of Canada*, roughly 35,000 individuals are employed in freight rail in Canada. Using the *Association* estimate of tonne-miles of cargo transported in Canada annually, to estimate the number of individuals directly employed in the rail transportation of each featured crop, we multiply total freight rail employment by the ratio of each crop's estimated tonne-miles to total freight tonne-miles.

Primary processing: adding value to the crop

This important step in the value chain differs for each crop. Essentially, our definition of primary processing is the *processing of the crop itself* into a food or fuel/industrial product. However, feed milling — which *can* include processing of the crop itself, such as for corn or feed wheat — is not included in primary processing. Feed milling is dealt with as a separate category (see below) for each crop. This is because for some crops it involves the further processing of a crop product, such as the meal from soybeans and canola. In this study, we include the following sectors as primary processing:

- Wheat: Milling for flour and semolina, ethanol processing and starch processing.

- Canola: crushing.
- Barley: malting.
- Soybeans: crushing.
- Oats: processing for oat milk.
- Pulses: processing for manufactured food products, e.g. soups and hummus and tinning, plus processing of protein concentrates, isolates and starches.
- Corn: fuel ethanol processing, starch processing and distilling.
- Sunflower: roasting for human food and birdseed and dehulling for baking.
- Flaxseed: crushing for oil and milling flaxseed for food uses.

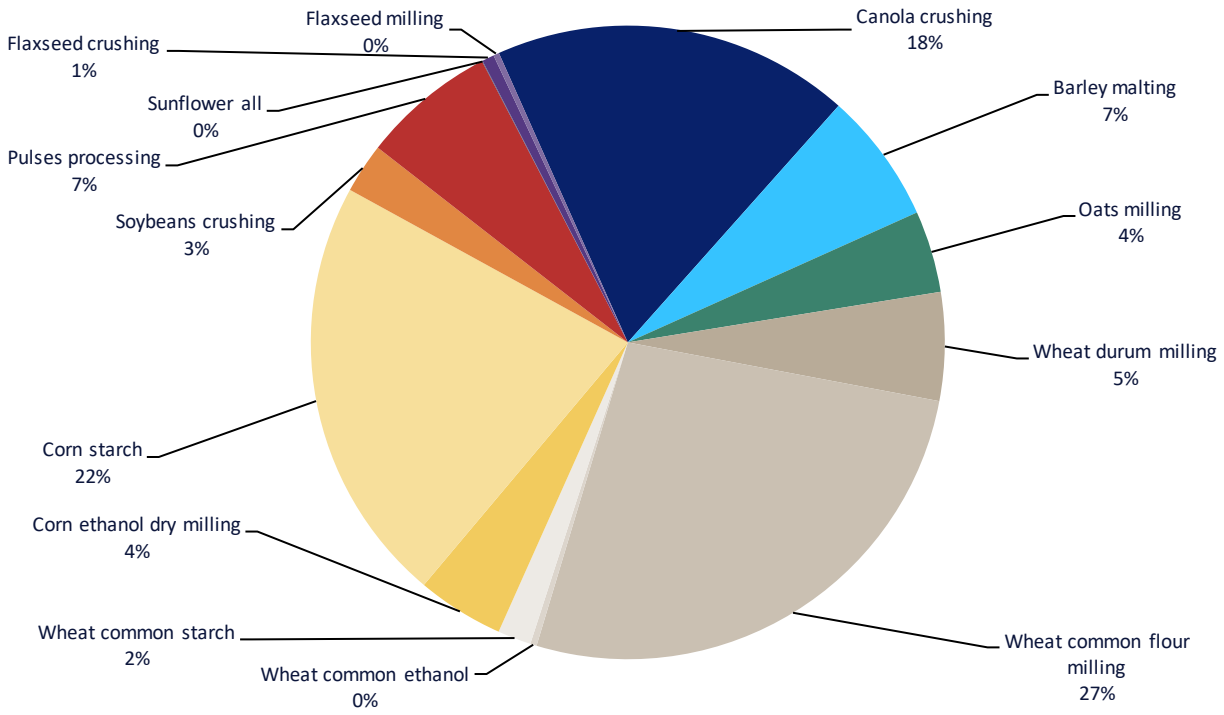
Primary processing generates a significant economic impact. The combined economic impact from processing our featured crops in the Canadian economy is over $31 billion. As well as the breadth of activities involved, this is also due in part to the high multiplier applied in capital-intensive processing sectors.

Over 41,000 FTE jobs are related to primary processing of these crops. As a capital-intensive sector that relies heavily on contracted workers, total employment is much higher than the direct numbers employed.

Table 9: Economic and employment impact in primary processing, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	921	338	211	1,865	2,078	128	346	2	46	5,936
Total economic impact	5,526	2,030	1,263	10,371	8,829	770	2,078	10	276	31,152
Direct employment impact	450	660	116	1,899	437	90	38	13	226	3,930
Total employment impact	5,061	7,424	1,305	20,996	2,519	1,014	428	143	2547	41,436

Diagram 12: Share of total economic impact in primary processing, average 2020/21–2022/23



The economic impact of the important primary processing sectors is based on the value they add from processing the crops into products. This is done by estimating the volumes processed at primary processing facilities across Canada, then multiplying by representative crop and product prices in order to derive the processing value added. We use public sources for domestic prices if available, supplemented by export unit values (EUVs) in order to provide a basis for the gross margin. The ***economic impact*** of primary processing is, therefore, the product of the volume of crop processed and the value added per unit of crop.

Biofuels represent a relatively modern and increasingly significant element of the value chains for several key crops, especially in Canada. Biofuel uses supplement the established industrial uses of crops, which we cover in this section for wheat and corn ethanol (biodiesel from canola and soybean oil is covered in the *Further Processing* category).

The ***employment*** impact of primary processing is determined via discussions with processing facilities in Canada as well as through press releases citing the number of individuals employed in a given facility.

Feed milling: adding value to the crop and products

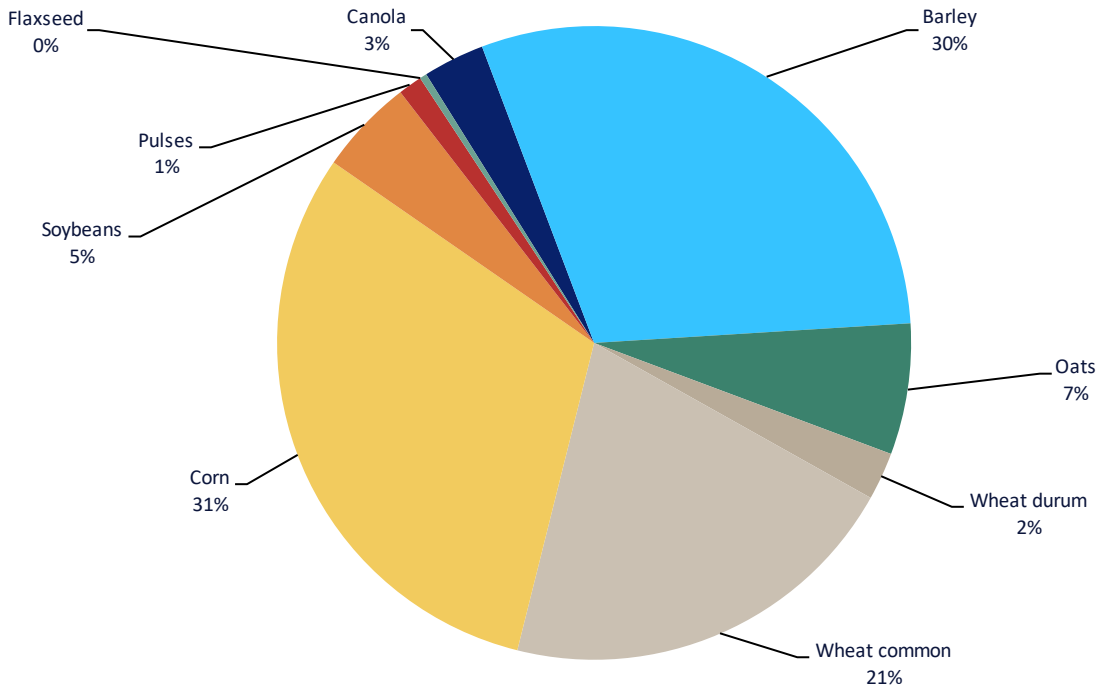
Feed milling is a processing sector that is difficult to categorise as primary or secondary processing. This is because in some cases the crop itself is milled into feed as a primary process (e.g. corn and feed wheat), whereas in other cases the by-products from primary processing are milled into feed (e.g. soybean and canola meal, corn DDGs and wheat bran and middlings). In this report, we present feed milling as a separate category covering all of these elements. Feed milling is a significant element of the value chain for many major crops in Canada. In this study, ***for the feed milling sector***, we cover feed milling of:

- Feed wheat and wheat by-products
- Feed barley
- Oats
- Canola meal
- Soybean meal
- Corn and corn by-products
- Pulses, notably faba beans and dry peas
- Flaxseed meal.

Table 10: Economic and employment impact in feed milling, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	51	432	9	333	441	79	21	0	10	1,376
Total economic impact	252	2,143	44	1,652	2,191	392	106	0	49	6,830
Direct employment impact	323	3,062	688	2,387	3,164	503	125	0	37	10,287
Total employment impact	1,829	17,365	3,900	13,534	17,940	2,851	709	0	210	58,338

Diagram 13: Share of total employment impact in feed milling, average 2020/21–2022/23



- The aggregated total economic impact of feed milling using our featured crops and their processed by-products on the Canadian economy is estimated at over $6.8 billion.

- We estimate that the crops' combined feed milling FTE employment accounts for over 58,000 individuals, including on-farm job creation. Corn, barley and wheat account for the vast majority of this employment.

ANAC data give the number of commercial feed mills in Canada at 471 mills, producing an aggregated 19.5 billion metric tonnes of prepared feed in 2023. In terms of transportation, major feed mill clusters are found for poultry, dairy and hogs around the urban conglomerations of Toronto, Montreal and Edmonton respectively.

In addition, there are large concentrations of on-farm feed production, with as many as 25,000 on-farm mills. Although the number of on-farm feed mills that process each particular crop is unknown, we allow for some volumes of crops, notably barely, corn and wheat, to be processed on-farm and then adjust this in terms of jobs created per tonne of feed processed to account for the lower intensity of output compared with commercial feed mills. On average, a feedlot mill will require less than one full-time worker to run the mill — typically, they would simply temper the wheat, for example, and roll it into flakes or run it through a hammer mill in order to increase the digestibility and nutritional value of the raw grain. The largest concentration is "*Feedlot Alley*" in southern Alberta, where much of the large-scale beef cattle production is located.

The dairy industry also has some on-farm feed production. These operations are included in our estimates as the on-farm feed and feed lot operations would otherwise have to purchase feed from feed millers. However, in terms of jobs, we again assume that on-farm feed mills generate fewer jobs than commercial feed mills per tonne of feed processed.

The economic impact of the feed milling sector is based on the value it adds from processing each crop/by-product into processed feed. As it is extremely difficult to ascertain how much of each crop is processed in each feed mill individually, we calculate the share for each crop simply as a proportion of the total feed processed.

The processed feed volume for each crop is then multiplied by the gross margin per tonne of raw material, which was itself estimated in conjunction with industry participants in interviews.

Similarly for jobs created, we estimate the total jobs at all feed mills combined and then apportion jobs to each crop by the crop/product quantity as a proportion of total feed crops. The average jobs per mill was estimated via discussions with employees of feed mills in Canada.

Further processing and downstream activities

Many of the outputs from primary processing are further processed before they enter the marketplace. This complex category includes all subsequent processing of any outputs from earlier in the crop value chain. In our analysis, we also include some end use sectors where the crop itself is used directly for retail, for example, porridge oats, lentils, chickpeas and flaxseed. In effect, this category includes all processing and product manufacturing *except* the primary processing of the crop itself, plus retail end uses where the product is overwhelmingly reliant on the crop itself. As we have already noted, the processing of corn or wheat into ethanol is included as primary processing, whereas processing of canola and soybean *oil* into FAME or renewable diesel is included as secondary, or further, processing.

This is the most difficult sector of the value chain to quantify accurately. Further processing is difficult to quantify because:

- Ingredient use and product formulations of processed goods are sensitive information from the perspective of food manufacturers.
- Branding and marketing can add significant value to consumer products, even products as simple as bread. This is the difference between consumer products at this stage of the chain and the commodity products at earlier stages. Branding and marketing make it very difficult to quantify the value that a crop can claim to add in the further processing and retailing chain. The difficulty lies in stripping out the part of the value-added that is attributable to the crop rather than any branding and marketing.
- It becomes more and more difficult to claim that the jobs and value added in end-use sectors are directly attributable to the crop. For example, should restaurant jobs be included because they serve bread, or use canola oil for their frying? Most would agree the restaurant job is not *dependent upon* the Canadian canola or wheat crop. By contrast, most would agree that *producing* bread or canola oil for sale on the supermarket shelf *does* represent part of the wheat and canola value chain.

As a guiding principle for the hundreds of potential retail food and industrial end uses of these products, *we include only large end use sectors where the crop itself or crop product form an overwhelming element of the end use product*.

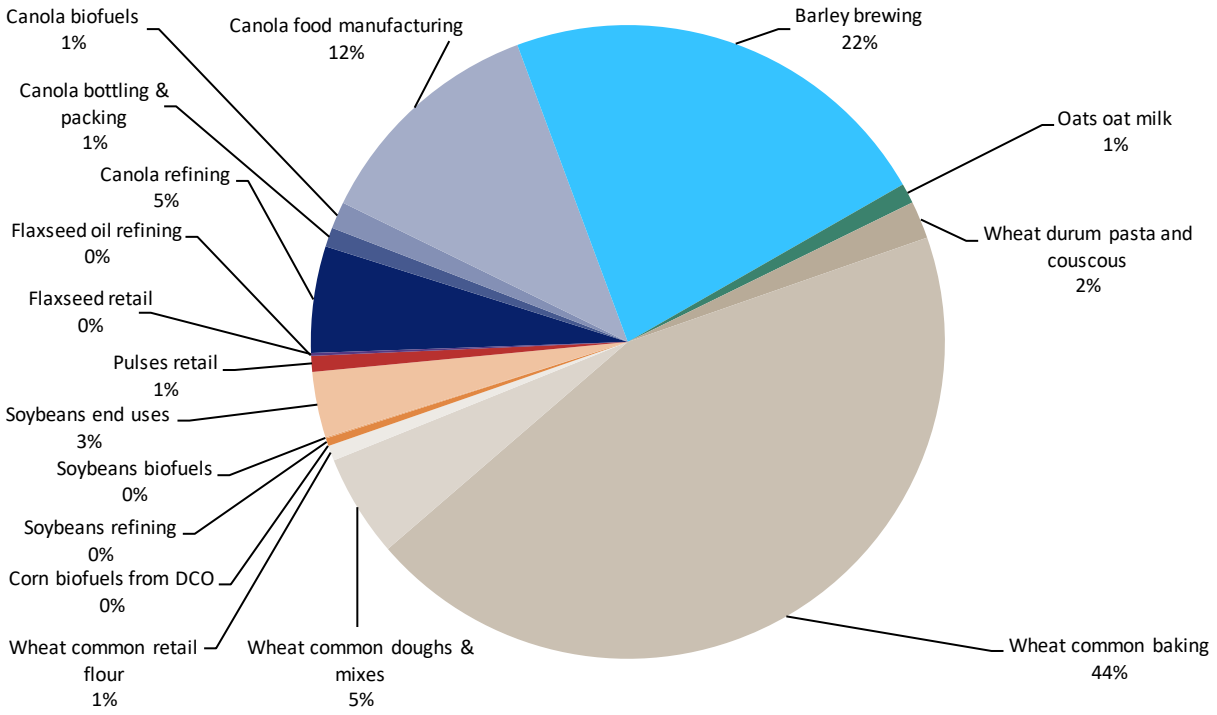
In this report, we cover the following in our further processing and downstream activities category:

- Wheat: processing flour and baking it into bread, pastries, snacks, etc, plus doughs and mixes, plus the direct retailing of flour, plus processing semolina from durum wheat into pasta and couscous.
- Barley: brewing and distilling of malted barley.
- Canola: refining canola oil, processing canola oil into biofuels, bottling and packing canola oil, margarine.
- Soybean: refining soybean oil, processing soybean oil into biofuels, bottling and packing soybean oil, margarine.
- Corn: distillers' corn oil for biofuels, corn oil for food.
- Pulses: direct retail of lentils and chickpeas.
- Oats: oat milk and oats for direct retail.
- Flaxseed: refining of flaxseed oil and direct retail of flaxseed.

Table 11: Economic and employment impact of further processing and downstream activities, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	2,911	4,313	145	7,411	27	564	149	0	26	15,547
Total economic impact	7,248	8,159	372	18,926	69	1,390	296	0	52	36,513
Direct employment impact	3,509	19,899	500	44,496	6	2,283	517	0	173	71,383
Total employment impact	9,462	53,469	1,072	94,697	41	6,151	691	0	232	165,814

Diagram 14: Share of total economic impact of further processing and downstream activities, average 2020/21–2022/23



- The economic impact of this sector is very high because of the significant value added by turning basic products into important consumer goods. We estimate that the combined economic impact from our featured crops on the Canadian economy from further processing and downstream activities averaged over $36.5 billion annually between 2020/21 and 2022/23.
- Almost 166,000 FTE jobs are related to this category in Canada.
- The largest sectors include baking products for wheat, brewing barley and food manufacturing from canola oil.

The value added to the Canadian economy by further processing and key downstream activities is calculated by taking StatCan's sales revenue estimates, net of any production presumed to use imported raw materials. We subtract from these estimated input costs (raw material input volumes multiplied by representative prices), with the raw material estimated to account for an indicative percentage of the returns to each sector, as discussed with industry participants. For retail sales where included, such as for retail flour and vegetable oils, we derive revenue from estimated volumes sold multiplied by the difference between input EUVs and retail prices from StatCan.

The total number of people employed in this wide-ranging category is based on many industry interview estimates. The numbers of jobs estimated in each facility were apportioned according to the percentage of those jobs that were estimated to be attributable to the crop input.

One problem with including this analysis in the main value-added calculations is that the quantification methodology employed here is necessarily less robust than in the rest of the analysis in this study. Firm data from food processing is typically regarded as proprietary. Also, many ingredients other than just the crop raw material are used in the processes, making allocation difficult for the value attributable to a single crop input. Taking these caveats into consideration, the analysis presented here should be taken as indicative for many sectors.

Impact at ports

A portion of the featured crops and their products leave Canada via its international ports. These overseas shipments leave Canada via ports in British Columbia, Ontario and Quebec, plus very small volumes from Churchill, Manitoba. The sectors covered for the impact at ports for each crop were:

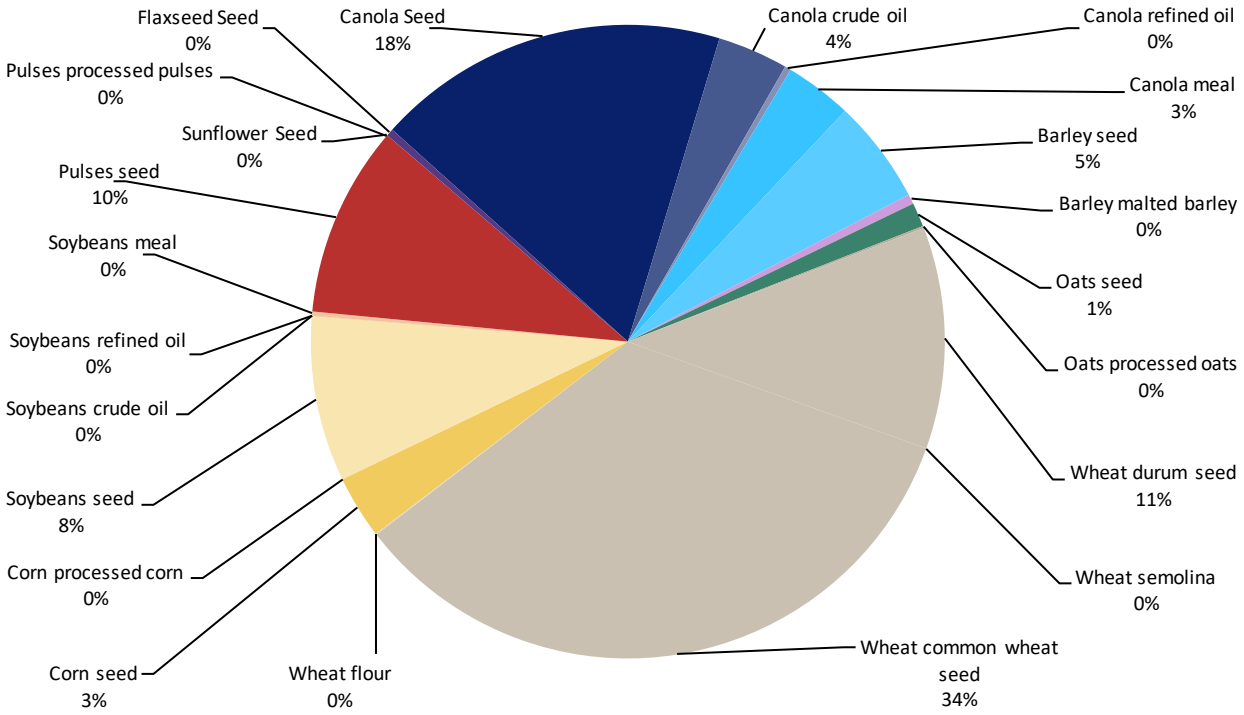
- Wheat: grain/seed and flour for common wheat, and grain/seed and semolina for durum wheat
- Canola: seed, crude oil, refined oil and meal
- Barley: grain/seed and malted barley
- Soybeans: seed/beans, crude oil, refined oil and meal
- Oats grain/seed and processed oats (oat milk)
- Pulses: grain/seed and processed peas, faba beans, dried beans, lentils and chickpeas (protein concentrates/isolates and food processing, e.g. soups and hummus)
- Corn: grain/seed and starches
- Sunflower seed
- Flaxseed and oil

The total aggregate impact of exports from Canadian ports for our featured crops is $1.2 billion, with a combined total employment impact approaching 5,700 jobs.

Table 12: Economic and employment at impact ports for export, average 2020/21-2022/23, (C$ million and FTE jobs)

	Canola	Barley	Oats	Wheat	Corn	Soybeans	Pulses	Sunflower	Flaxseed	**Total**
Direct economic impact	191	40	9	253	28	75	80	0	3	680
Total economic impact	339	70	16	450	50	134	148	0	6	1,212
Direct employment impact	941	216	50	1,688	120	321	364	0	14	3,714
Total employment impact	1,436	329	76	2,575	183	490	554	0	21	5,664

Diagram 15: Share of total employment impact at ports for export, average 2020/21–2022/23



The economic impact at Canadian ports is calculated as the product of volumes multiplied by port fees.

- Canadian export volumes by port and direct prairie exports (overland) were obtained from data provided by the Canadian Grain Commission.
- Export volumes by port for products were obtained from Canadian trade data.

Port fees were also obtained from the Canadian Grain Commission.

The employment impact at the ports was based on each crop's share of total port movements, combined with an understanding of the total number of individuals, gleaned from interviews, employed at Canadian ports.

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