THE IMPACT OF BIO-FOOD INDUSTRY ACTIVITIES IN CANADA

Raymond Dupuis, Agriculture and Agri-Food Canada
and Maurice Doyon, Laval University

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Canada

PREFACE

This document is intended for all bio-food industry stakeholders in Canada. We hope it will contribute to a better understanding of the economic impact that the industry and its activity have at the national and international levels.

We would like to thank Agriculture and Agri-Food Canada for supporting this project, Andréanne Léger for her writing assistance, Jean Nolet for his work on the primary data, David Beaulieu of the Manufacturing, Construction and Energy Division, Statistics Canada, for kindly providing all the special output statistics needed for this study and, especially, Ronald Rioux of the Input–Output Division of Statistics Canada for his invaluable co-operation.

Raymond Dupuis
Economist and Senior Analyst
Agriculture and Agri-Food Canada

and

Maurice Doyon
Professor
Laval University

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EXECUTIVE SUMMARY

Using an innovative definition of the bio-food industry that encompasses the products of the modern bioeconomy, this study assesses the industry's economic impact on Canada as a whole and on its five major regions (the Atlantic provinces, Quebec, Ontario, the Prairies and Northwest Territories, and British Columbia and Yukon). We have moved beyond the term agriculture industry to agri-food industry to include food and beverage processing and marine products, while the boundaries are broadened even further with the use of the term bio-food industry to reflect all of the new bioproducts being produced, such as nutraceuticals and functional foods.

The first part of the study is aimed at measuring the impact of the newly defined bio-food industry on employment and economic activity (GDP). This impact is the result or the contribution of final demand for bio-food products, based on the aforementioned definition, with respect to the economy as a whole. In 2002, the bio-food industry represented $170 billion in expenditures for Canada as a whole, resulting in a $113 billion contribution to GDP (12% of Canada's total GDP) and 2.8 million jobs annually (16% of all Canadian jobs).

The second part of the study looks at the commercial impact of bio-food industry activity in terms of GDP alone (value-added of exports to GDP), rather than the measurement commonly used (nominal value of exports to GDP), which creates bias. The technique developed in the course of the study measures the proportion of jobs and economic activity directly related to external trade (international and interprovincial sales). It was found that for Canada as a whole (international sales only), bio-food exports account for 20% of bio-food GDP and 18% of jobs in the industry.

Based on the study's findings, it can be concluded that the bio-food industry plays a key role in the Canadian economy as a whole and in the country's regions, in terms of both value-added or GDP and jobs. Interestingly, the bio-food industry is proportionally more labour intensive than the rest of the economy as its percentage of jobs is always above that of the GDP.

The study's findings also demonstrate the importance of external trade (interprovincial and international) for the Canadian bio-food economy. In some regions, over half of the bio-food industry's vitality depends on exports outside those regions. Accordingly, efforts made by the private and public sector in this regard must be maintained, or even increased.

I. DEFINITION OF THE BIO-FOOD INDUSTRY

As a result of significant progress made in the biotechnology field in the last two decades, the lines between the agri-food sector and the pharmaceutical and biochemical sectors, among others, have become blurred. For instance, some agricultural inputs are now genetically modified for use in pharmaceuticals, such as the semen of genetically modified pigs, which contains a recombinant protein and is used to treat diseases. There are also functional foods and nutraceuticals, which have more than just dietary characteristics.

In this context, traditional methods cannot adequately measure the agriculture industry's economic contribution to the gross domestic product (GDP). The term "agriculture industry" has been replaced by "agri-food industry" to reflect the broader integration of agriculture into the rest of industry. Recent developments, particularly in the biotechnology field, require a broader definition of the agri-food industry to take this new reality into account.

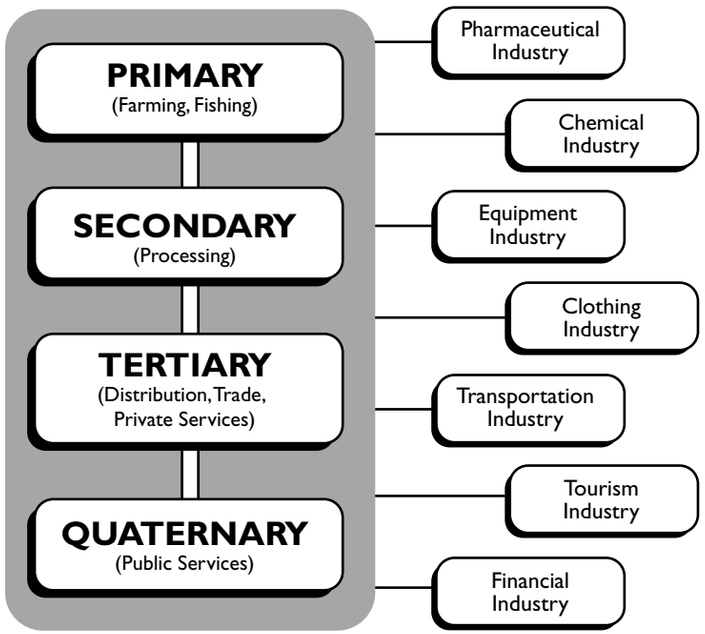
We would therefore like to propose the following definition of the **bio-food industry**:

A life sciences industry that includes all products of plant or animal (non-human) origin that have been cultivated, grown or harvested, and all foods and beverages of non-living origin that have been processed only once, and the services related to this industry, excluding the forest industry.

This paper is divided into two sections. The first section measures the economic impact that this newly defined bio-food industry has on jobs and economic activity (GDP). This impact is the result or the contribution of final demand for bio-food products, as described above, with respect to the economy as a whole and will be evaluated for all of Canada and for the country's five major regions: the Atlantic provinces, Quebec, Ontario, the Prairies and Northwest Territories, and British Columbia and Yukon.

In the second section, the impact of exports on bio-food industry activity is measured in an effort to evaluate the proportion of jobs and economic activity directly related to exports. A new method is used to measure this contribution more accurately. This method is also used to evaluate the impact of interprovincial trade.

Bio-Food Industry



II. MEASURING THE SIZE OF THE INDUSTRY

The approach we have taken is not perfect. Rather, it is a first attempt to develop a broader measurement of the agriculture and agri-food industry, renamed the bio-food industry, in order to take the circumstances of the early 21st century into account.

Since the data gathered did not take the new "bio-food industry" concept into account, figures had to be taken from a number of sources and certain simplifications and assumptions had to be made. Below is a description of the methodology used.

We used Statistics Canada's input–output (I–O) model, which establishes interindustrial linkages among all sectors of the economy through surveys, national accounts and other means. It simulates a demand shock by targeting a very specific sector and then assessing the impact on jobs and economic activity for the entire economy. That was the main purpose of this analysis, namely to determine total demand in the bio-food industry or for all of the industry's goods and services that are sold in domestic and foreign markets, and then to assess their direct and indirect impact on the economy.

To do this, we developed a "hybrid" demand consisting of all elements of the final demand that are fully contained in the newly defined bio-food industry, as well as other elements of the final bio-food industry demand. For the other elements of the final demand, we defined the elements of the bio-food industry's intermediate demand. For example, the total final demand of the food processing industry was used, whereas the intermediate demand of the bio-food industry is not linked to the entire pharmaceutical industry.

We then established a correlation between a complete list of bio-food industry commodities and those used by the I–O model by creating a correlation file between matrix 14 of the I–O model and Harmonized System (HS) codes[1]. Each of the goods was classified in one of the categories included in our definition of the bio-food industry. There was also a category for data excluded from the bio-food sector and another for uncertain cases.

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After the classification was completed, specialists and various sources of information were consulted to classify the uncertain cases more precisely. On this basis, we decided to include chemical and pharmaceutical compounds of animal origin (eg, dye pigments of animal origin) and to exclude products that had been processed more than once since they belonged to another industry. Thus, raw cotton and cotton bales were considered to be part of our group, but not cotton fabrics or clothing, which belong to another industry.

A large number of components in our simulations were intermediate elements. This meant that they were used as final demand inputs by an industry. However, to grasp the economic impact of a sector across its industry network, we had to simulate an expenditure characterized by a final demand. The next section provides a more detailed explanation of how input–output models work.

As previously mentioned, we used a hybrid model consisting of final demands (13 full final demands were used) and intermediate products (116 were used) that were found up to a certain point in the final demands. All of the 116 intermediate products were found in 9 other final demands. However, these nine demands also contained products other than bio-food industry products. In order to separate out the impact of bio-food industry products from that of other products included in the nine final demands, the latter were disaggregated until they contained only bio-food elements. As a result, the shock simulated for these demands after disaggregation allowed us to capture all the upstream effects of the demand. This approach is based on the assumption that input–output relationships that apply to a final demand can also be applied to a subset of that demand, that is, the disaggregated demand[2].

The model cannot be used to simulate a shock on inventory leakages or imports (negative in the matrix), so these elements were omitted. Simulations on exports were handled as followed:

- For the 116 intermediate products, we took 100% export data;
- For nine goods that came from special Industry Division simulations, the rule of three was used: the relative weight of the goods was multiplied by the full value of exports in the I–O matrix code.

Bio-food industry I–O simulations were generated for five regions of Canada and for Canada as a whole. When data had to be weighted because of provincial aggregations, the weightings used were based on their use (final demand) and not their production (intermediate demand). Thus, Industry Division data on the Atlantic provinces were compiled on the basis of use rather than production.

Classification Examples

- Seaweed harvested for food or industrial uses are included
- Blood, proteins and human hormones are excluded
- Salt (non-living, food) is included

Single-processed products

- Wool is included, but not garment manufacturing
- Ethanol is included, except when it is added to gasoline

Related Services

- Agriculture-related services
- Transportation, distribution (of these products only)

Other

- The forestry industry (excluded)
- Wood pulp (excluded)
- Christmas trees (ornamental sector, included)
- Maple syrup production (food, included)

III. BRIEF LITERATURE REVIEW OF ECONOMIC IMPACTS

The measurement of the economic spinoffs or economic impact of investments in a given sector has given rise to many works on the subject since the development of input–output models and mathematical programming in the 1960s[3].

The literature divides the economic impacts into three elements[4]:

1. **Direct effects**: when part of the sector's initial demand directly contributes to the use of factors of production, such as labour and capital.
2. **Indirect effects**: the economic effects or impact on input suppliers.
3. **Induced effects**: the growth in economic activity resulting from increased income (eg, salaries and wages). In other words, the effects of income respending by those who receive it.

Simply put, direct effects are the result of investment expenditures in a target sector, indirect effects are associated with the economic impact of investment expenditures upstream of the sector, and induced effects are associated with new spending or the economic impact of investment expenditures downstream of the sector.

The I–O models developed by Statistics Canada and the Quebec statistics institute can be used to simulate the impact of various investment projects on economic activity in terms of production, jobs, income, taxes and imports. These models are based on the structure of interindustrial linkages. Input–output models work with expenditures, so the downstream impact of various sectors cannot be evaluated. For instance, simulating an increase in bio-food production at the primary level (that is, at the level of intermediate demand) makes it possible to measure the impact on input suppliers (eg, capital goods suppliers), but not the downstream impact on the processing and distribution of processed products. In other words, I–O models allow us to measure direct and indirect effects, but not induced effects[5]. In the case of this study, simulating a shock on final demand allowed us to measure all the direct and indirect economic impacts of the bio-food industry.

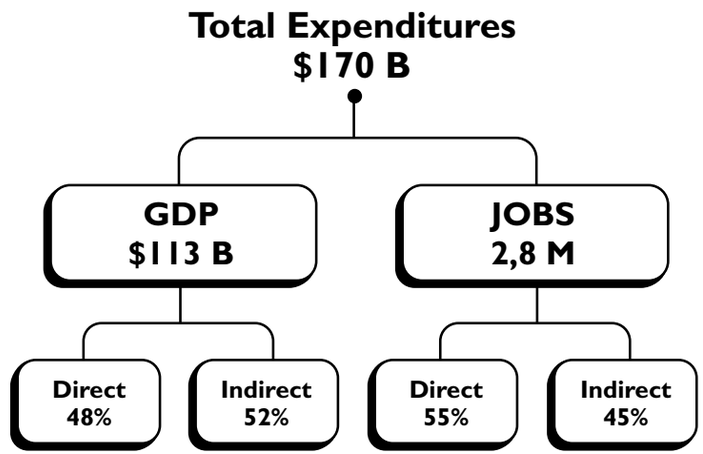
IV. ECONOMIC IMPACT

This section presents the economic impact of bio-food expenditures in terms of jobs and value-added (GDP)[6]. This impact is provided for Canada as a whole and then for each of the five major regions using 1996 input–output linkages, the most recent data available at the time of the study, and 2001 taxation and incidental taxation. To update the data, estimates for 2002 were made using recent GDP data from the Conference Board of Canada. These data include the agri-food GDP compiled by Agriculture and Agri-Food Canada. The bio-food results presented are thus an estimate for 2002 based on 1996 results and 2002 agri-food GDP.

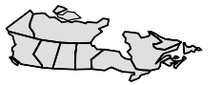
CANADA

In 2002, Canada's bio-food industry represents:

- $170 billion in total final expenditures,
- $113 billion in value-added (GDP), or 12% of the entire economy
- 2.3 million jobs (person-years), or 16% of the entire economy (see Table 1).



Canada's Bio-Food Industry, 2002



Economic impact can be measured in terms of many components, the main ones being **wages and gross income before taxes** (eg, the employer's profit in terms of return on capital, employer costs and benefits) paid by businesses and organizations operating in the bio-food industry, suppliers to businesses and organizations operating in the bio-food industry, and by these suppliers' suppliers. The addition of wages and other income constitutes what we call the **GDP** of bio-food industry activity at factor cost, or the value-added at factor cost, which equals $113 billion. The **GDP at market prices**, which totals $128 billion, was obtained by adding indirect taxes and subtracting subsidies (see Table 2).

The measurement of economic impact takes into account goods and services imported by businesses and organizations operating in the bio-food sector, and the chain of suppliers. **Total expenditures**, which include subsidies and imports, equal $173 billion. **Net total expenditures** are $170 billion and correspond to total expenditures less subsidies.

This impact ($113 billion and 2.8 million jobs) comprises **direct effects**, which correspond to expenditures attributable to bio-food companies themselves, and **indirect effects**, which correspond to expenditures incurred by bio-food companies' suppliers and these suppliers' suppliers. The total impact is thus the sum of the **total effects** (direct and indirect).

Direct effects account for 48% of the total effects on expenditures, which means that the effects produced by other sectors of the economy that supply bio-food companies equal 52% of bio-food industry GDP. Of the total number of jobs generated (direct and indirect) by the bio-food industry, the majority (55%) are direct jobs, while 45% (1.3 million) are indirect.

The main leverage effects (multipliers) of the Canadian bio-food industry are as follows:

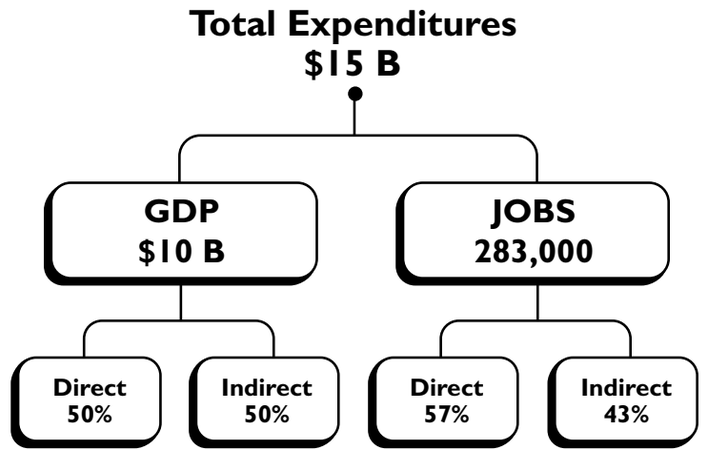
- $170 billion in total expenditures produces a GDP at factor cost of $113 billion, or a Keynesian income multiplier of 0.7;
- a value-added of $100 in bio-food industry activity results in a value-added of $108 in other sectors of the economy (all suppliers);
- 100 jobs in the bio-food sector generate a further 81 jobs in businesses in other sectors of the economy (all suppliers).

ATLANTIC PROVINCES

The Atlantic provinces' bio-food industry represents:

- $14.9 billion in total final expenditures,
- $10.2 billion in value-added (GDP), or 19% of the entire economy
- 283,000 jobs (person-years), or 22% of the entire economy

This impact ($10.2 billion and 283,000 jobs) includes **direct effects**, which consist of expenditures attributable to bio-food companies themselves, and **indirect effects**, which correspond to the expenditures incurred by bio-food companies' suppliers and these suppliers' suppliers. The total impact is thus the sum of the **total effects** (direct and indirect).



Atlantic Provinces' Bio-Food Industry, 2002

Direct effects account for 50% of the total effects on GDP, which means that the effects of other sectors of the economy that supply bio-food companies are also equivalent to 50% of bio-food industry GDP. Of the total number of jobs generated (direct and indirect) by the bio-food industry, more than half (57%) are direct jobs, while 43% (122,000) are indirect.

The main leverage effects (multipliers) of the Atlantic provinces' bio-food industry are as follows:

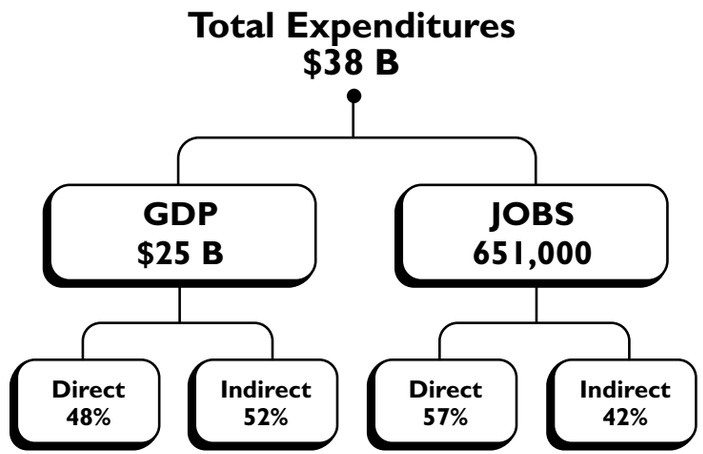
- $14.9 billion in total expenditures results in a GDP at factor cost of $10.2 billion, or a Keynesian income multiplier of 0.7;
- a value-added of $100 in bio-food industry activity results in a value-added of $100 in other sectors of the economy (all suppliers);
- 100 jobs in the bio-food sector generate 76 additional jobs in businesses in other sectors of the economy (all suppliers).

QUEBEC

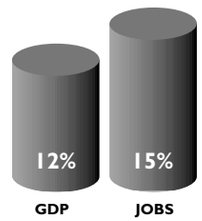
The Quebec bio-food industry represents:

- $37.6 billion in total final expenditures,
- $24.9 billion in value-added (GDP), or 12% of the entire economy
- 651,000 jobs (person-years), or 15% of the entire economy

The **direct effects** of this impact ($25 billion and 651,000 jobs) consist of expenditures attributable to bio-food companies themselves; the **indirect effects** correspond to the expenditures incurred by bio-food companies' suppliers and these suppliers' suppliers. The total impact is thus the sum of the **total effects** (the direct and indirect effects).



Quebec Bio-Food Industry, 2002



Direct effects account for 48% of the total effects on GDP, which means that those produced by other sectors of the economy that supply bio-food companies are equivalent to 52% of bio-food industry GDP. Of the total number of jobs (direct and indirect) generated by the bio-food industry, over half (57%) are direct jobs, while 43% (297,000) are indirect.

The main leverage effects (multipliers) of the Quebec bio-food industry are as follows:

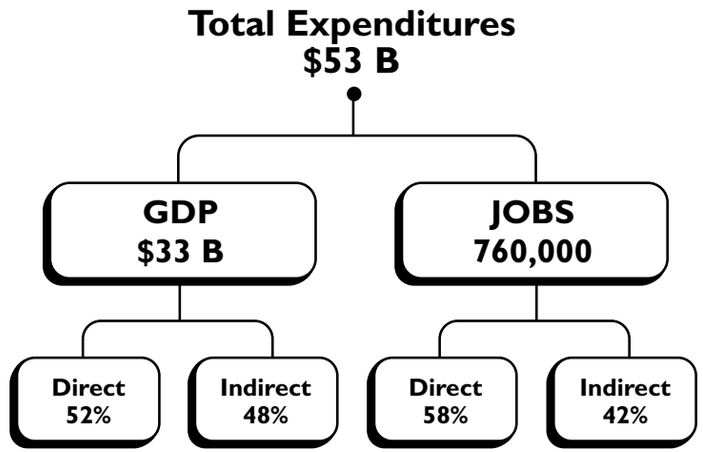
- $38 billion in total expenditures produces a GDP at factor cost of $25 billion, or a Keynesian income multiplier of 0.7;
- a value-added of $100 in bio-food sector activity results in a value-added of $109 in other sectors of the economy (all suppliers);
- 100 jobs in the bio-food sector generate a further 84 jobs in businesses in other sectors of the economy (all suppliers).

ONTARIO

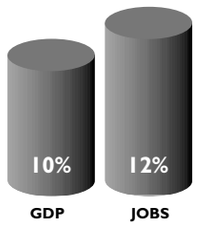
The Ontario bio-food industry represents:

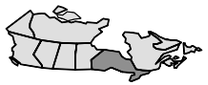
- $53.3 billion in total final expenditures,
- $32.9 billion in value-added (GDP), or 10% of the entire economy
- 760,000 jobs (person-years), or 12% of the entire economy

The industry's impact ($33 billion and 760,000 jobs) consists of **direct effects**, that is, expenditures attributable to bio-food companies themselves, and **indirect effects**, which correspond to the expenditures incurred by bio-food companies' suppliers and these suppliers' suppliers. The total impact is thus the sum of the **total effects** (direct and indirect).



Ontario Bio-Food Industry, 2002





Direct effects account for 52% of the total effects on GDP, which means that the effects produced by other sectors of the economy that supply bio-food companies contribute 48% of bio-food industry GDP. Of the total number of jobs (direct and indirect) generated by the bio-food industry, the majority (58%) are direct jobs, while 42% (320,000) are indirect.

The main leverage effects (multipliers) of the Ontario bio-food industry are as follows:

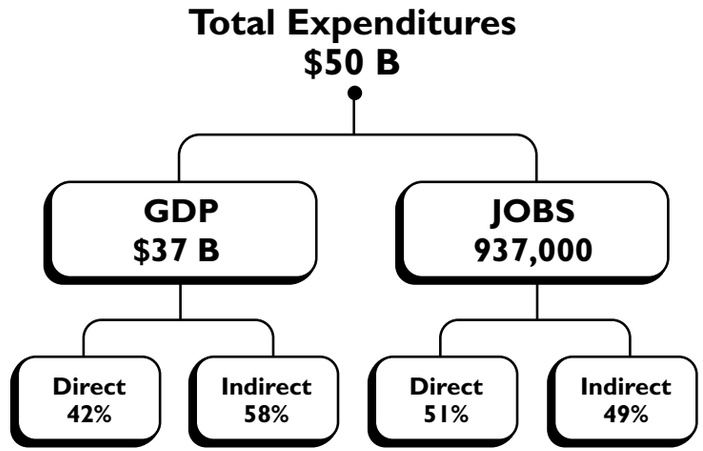
- $53 billion in total expenditures produces a GDP at factor cost of $33 billion, or a Keynesian income multiplier of 0.6;
- a value-added of $100 in the bio-food sector results in a value-added of $194 in other sectors of the economy (all suppliers);
- 100 jobs in the bio-food sector generate 73 additional jobs in businesses in other sectors of the economy (all suppliers)

PRAIRIES AND NORTHWEST TERRITORIES

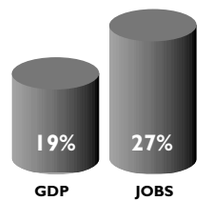
The bio-food industry in the Prairies and Northwest Territories represents:

- $50.4 billion in total final expenditures,
- $36.9 billion in value-added (GDP), or 19% of the economy as a whole
- 937,000 jobs (person-years) or 27% of the entire economy

The industry's impact ($37 billion and 937,000 jobs) includes **direct effects**, that is, expenditures attributable to bio-food companies themselves, and **indirect effects**, which correspond to the expenditures incurred by bio-food companies' suppliers and these suppliers' suppliers. The total impact is thus the sum of the **total effects** (direct and indirect).



Prairies and Northwest Territories Bio-Food Industry, 2002



Direct effects account for 42% of the total effects on GDP, which means that the effects produced by other sectors of the economy that supply bio-food companies are also equivalent to 58% of the bio-food sector GDP. Direct jobs account for over half (51%) of all jobs generated by the bio-food industry, while the 459,000 indirect jobs represent 49% of the total.

The main leverage effects (multipliers) of the Prairies and Northwest Territories bio-food industry are as follows:

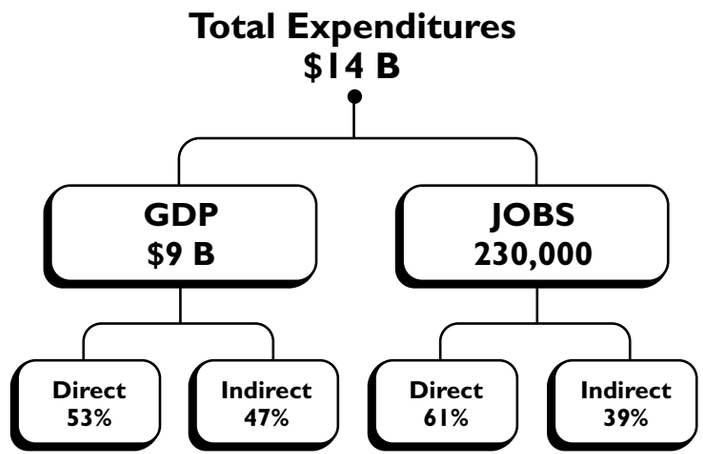
- $50 billion in total expenditures results in a GDP at factor cost of $37 billion, or a Keynesian income multiplier of 0.73;
- a value-added of $100 in the bio-food industry produces a value-added of $163 in other sectors of the economy (all suppliers);
- 100 jobs in the bio-food sector generate 96 additional jobs in businesses in other sectors of the economy (all suppliers).

BRITISH COLUMBIA AND YUKON

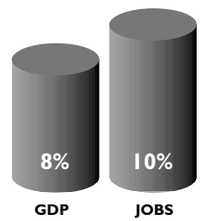
The bio-food industry in British Columbia and Yukon represents:

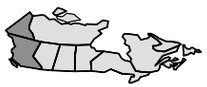
- $14.2 billion in total final expenditures,
- $9.1 billion in value-added (GDP), or 8% of the entire economy
- 230,000 jobs (person-years), or 10% of the entire economy

The impact of this industry ($9 billion and 230,000 jobs) can be broken down into **direct effects**, that is, expenditures attributable to bio-food companies themselves, and **indirect effects**, which correspond to the expenditures incurred by bio-food companies' suppliers and these suppliers' suppliers. The total impact is thus the sum of the **total effects** (direct and indirect).



British Columbia and Yukon Bio-Food Industry, 2002





Direct effects account for 53% of the total effects on GDP, which means that those produced by other sectors of the economy that supply bio-food companies are equivalent to 47% of the bio-food sector's GDP. Of the total number of jobs generated (direct and indirect) generated by the sector, the majority (61%) are direct jobs, while 90,000 (39%) are indirect.

The main leverage effects (multipliers) of the bio-food industry in British Columbia and Yukon are as follows:

- $14 billion in total expenditures results in a GDP at factor cost of $9 billion, a Keynesian income multiplier of 0.6;
- a value-added of $100 in the bio-food sector produces a value-added of $187 in other sectors of the economy (all suppliers);
- 100 jobs in the bio-food sector generate 64 additional jobs in other sectors of the economy (all suppliers).

V. THE ECONOMIC IMPACT OF EXPORTS

Which Measurement System Should be Used?

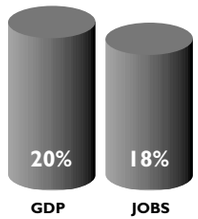
For an exporting country like Canada, economic impact data unfo- reign trade are very important. The ratio most frequently used to describe the impact of exports on economic activity is exports to GDP. This ratio, which relates the value of exports to the value of all economic activity, could be described as an ***indicator of openness to foreign markets***[7]. However, it is important to understand that the degree of openness to foreign markets is not a precise measurement of the economic impact of exports on the economy. Rather, it has a tendency to overestimate the importance of exports since each gross export dollar has a smaller value in terms of value-added (GDP)[8].

An Indicator of the Impact of Bio-Food Industry Exports

Rather than using a ratio in nominal dollars for exports and GDP dollars for economic activity, we used an indicator that expresses the value of exports as a percentage of GDP. This involved measuring the value-added or GDP of all bio-food exports and establishing the precise ratio in relation to the GDP of total bio-food industry economic activity for both jobs and the industry's value-added component.

We were thus able to directly simulate the shock on exports in the Canadian bio-food industry using the Canadian input–output model. The results demonstrate that exports are particularly important for jobs and GDP in the bio-food industry. As the figure above shows, 18% of jobs and 20% of economic activity in Canada's bio-food industry are directly related to bio-food exports.

Impact of External Trade on Canadian Bio-Food Industry Activity, 2002



The Regional Impact of External Trade

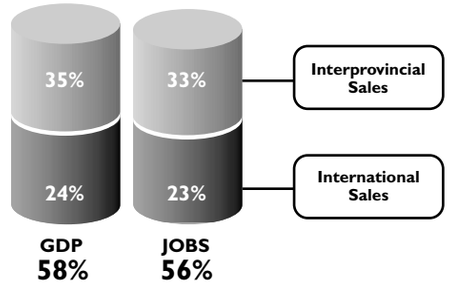
Indicators of the national impact of exports take only international exports into account. However, each province exports commodities both abroad and to the other provinces. To fully grasp the importance of foreign trade at the regional level, we developed a measure of the economic impact of a province's total foreign sales, both international and interprovincial.

It seemed reasonable to assume that the impact of interprovincial exports on a region or province would be comparable to that of exports to other countries in terms of GDP and jobs. So, for example, whether Ontario exports are being sent to Japan or British Columbia, the results should not be affected. Using the input–output model, we compiled data on interprovincial exports for each province and applied the same ratio to those exports as to international exports. The outcome of this assumption and method was a table estimating the impact of total exports (both interprovincial and international) for each region.

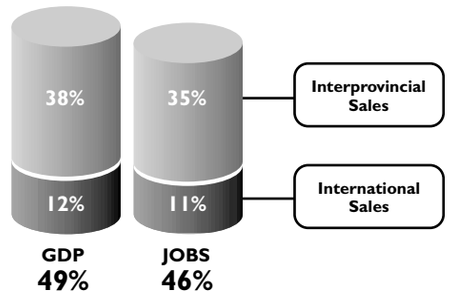
Comparing the figures in this section, we can see that the largest proportion of interprovincial bio-food exports was in Quebec, followed by Ontario. The proportion of export-related GDP and jobs was multiplied by more than four in Quebec and by nearly three in Ontario when interprovincial exports were added to the equation. The Prairies and British Columbia were the least affected by this calculation. This is due to the fact that the bio-food sector in the two regions is highly geared towards international, rather than interprovincial, exports.

This calculation also showed how highly dependent the Atlantic provinces and Quebec are on total exports. Nearly half of the GDP and jobs in Quebec's bio-food sector, and more than half in the Atlantic provinces, were created by their bio-food export activities.

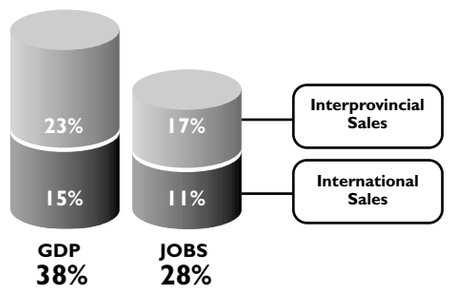
*Impact of External Trade on the **Atlantic Provinces'** Bio-Food Industry Activity, 2002*



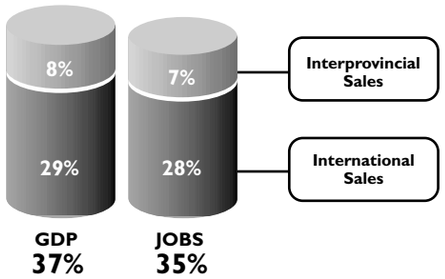
*Impact of External Trade on **Quebec** Bio-Food Industry Activity, 2002*

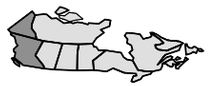


*Impact of External Trade on **Ontario** Bio-Food Industry Activity, 2002*

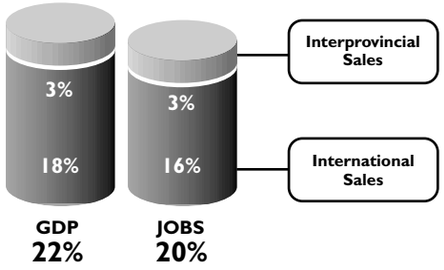


*Impact of External Trade on **Prairie** and **Northwest Territories** Bio-Food Industry Activity, 2002*





*Impact of External Trade on **British Columbia** and **Yukon** Bio-Food Industry Activity, 2002*



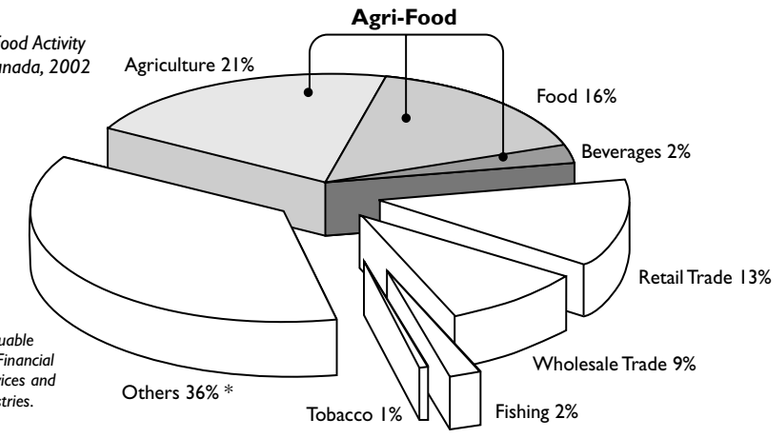
VI. CONCLUSION

After defining and measuring the size of the bio-food industry, this analysis helped to identify the effect of trade on regional activity in the industry. The results show that the bio-food industry, as defined in this study, plays a key role in the Canadian economy as a whole and in its regions, in terms of both employment and value-added or GDP. Interestingly, the bio-food industry is proportionally more labour intensive than the rest of the economy as its percentage of employment is always above that of the GDP.

Not that long ago, we talked only about agriculture, then changed to agri-food to include food and beverage processing, and now the industry has expanded its own borders to encompass all bio-food activity.

This innovative approach was useful for correctly assessing the contribution of external trade (international and interprovincial sales) in total bio-food industry activity. The findings suggest that, given the enormous importance of external trade (interprovincial and international) for the Canadian bio-food economy, efforts made by the private and public sectors in this regard must be maintained, or even increased.

Breakdown of Bio-Food Activity by Sector (GDP) Canada, 2002



* *Half of which is attribuable to the Transportation, Financial Services, Business Services and Communications Industries.*

Source: Table 3

Table 1 THE ECONOMIC AND TRADE IMPORTANCE OF THE BIO-FOOD INDUSTRY, 2002*

	BC-YUK	PRA-NWT	ONT	QUE	ATL	CAN
The Importance of the Bio-Food Industry for the Economy as a Whole*						
Jobs	10%	27%	12%	15%	22%	16%
Value-added	8%	19%	10%	12%	19%	12%
Impact of the bio-food industry*						
Final demand ($B)	14.2	50.4	53.3	37.6	14.9	170.0
Final demand ($B) 1996	*11.6*	*37.1*	*47.1*	*28.7*	*12.4*	*137.0*
Ripple effect on gross domestic product (GDP)						
Direct (%)	53%	42%	52%	48%	50%	48%
Indirect (%)	47%	58%	48%	52%	50%	52%
Total effects ($B)	9.1	36.9	32.9	24.9	10.2	113.2
Total effects ($B) 1996	*7.5*	*27.2*	*29.0*	*19.0*	*8.5*	*91.2*
Effect on jobs						
Direct (%)	61%	51%	58%	54%	57%	55%
Indirect (%)	39%	49%	42%	46%	43%	45%
Total effects (000's)	230	937	760	651	283	2,833
Total effects (000's) 1996	*188*	*691*	*670*	*497*	*236*	*2,283*
Multiplier effects						
Keynesian (GDP on demand)	0.6	0.7	0.6	0.7	0.7	0.7
GDP (total on direct)	1.9	2.4	1.9	2.1	2.0	2.1
Jobs (total on direct)	1.6	2.0	1.7	1.8	1.8	1.8
Impact of External Trade on the Bio-Food Industry**						
Jobs						
International sales	16%	28%	11%	11%	23%	18%
Interprovincial sales	3%	7%	17%	35%	33%	
Total external sales	20%	35%	28%	46%	56%	
Value-added						
International sales	18%	29%	15%	12%	24%	20%
Interprovincial sales	3%	8%	23%	38%	35%	
Total external sales	22%	37%	38%	49%	58%	

*Based on 1996 economic linkages, 2001 and 2002 taxation and incidental taxation based on current agri-food GDP (AAFC).

**Ratio of jobs or value-added of the bio-food industry in relation to jobs or value-added of the economy as a whole.

***Ratio of jobs or value-added in exports in relation to jobs or value-added of the total bio-food industry.

Table 2 THE DETAILED ECONOMIC IMPACT OF THE BIO-FOOD INDUSTRY FINAL DEMAND, 2002[I]

Components ($B and 000's)	BC-YUK	PRA-NWT	ONT	QUE	ATL	CAN
1. Salaries and wages before taxes	5.5	17.4	18.4	13.8	5.7	60.6
2. Other gross revenue before taxes	3.6	19.5	14.5	11.1	4.5	52.6
3. GDP at factor cost[II]	9.1	36.9	32.9	24.9	10.2	113.2
4. Indirect taxes	1.4	4.5	5.8	5.0	1.3	18.0
5. Subsidies	-0.1	-1.0	-0.7	-1.1	-0.2	-3.1
6. GDP at market prices[III]	10.4	40.4	38.0	28.7	11.3	128.0
7. Imports, inventories and other leakages	-3.8	-9.9	-15.4	-8.9	-3.6	-42.0
8. Total expenditures net of subsidies[IV]	14.2	50.4	53.3	37.6	14.9	170.0
Ripple effect on GDP						
Direct	4.9	15.7	16.9	11.9	5.1	54.4
Indirect	4.3	21.2	15.9	13.0	5.1	58.8
Total	9.1	36.9	32.9	24.9	10.2	113.2
Ripple effect on jobs						
Direct	140	479	440	354	161	1,565
Indirect	90	459	320	297	122	1,268
Total	230	937	760	651	283	2,833

I Based on 1996 economic linkages, 2001 taxation & incidental taxation & 2002 estimates based on agri-food GDP (AAFC).
II Gross domestic productat factor cost = (1 + 2).
III Gross domestic product at market prices = (3 + 4 - 5).
IV Final demand = (6 - 7).

Table 3 **BREAKDOWN OF BIO-FOOD ECONOMIC ACTIVITY BY SECTOR (GDP) CANADA, 2002**

	BC-YUK	PRA-NWT	ONT	QUE	ATL	CAN
Agriculture	13.2%	28.5%	17.8%	20.4%	11.9%	20.6%
Food	17.7%	10.5%	18.6%	17.0%	18.8%	15.8%
Beverages	2.2%	0.8%	3.3%	3.1%	1.4%	2.2%
Retail trade	17.4%	8.6%	14.9%	13.5%	12.5%	12.7%
Wholesale trade	9.2%	10.2%	8.7%	8.9%	9.2%	9.3%
Fishing	3.6%	0.1%	0.3%	0.8%	13.4%	1.8%
Tobacco	0.3%	0.2%	1.1%	1.2%	0.2%	0.7%
Other	36.4%	41.1%	35.3%	35.1%	32.5%	36.8%
Bio-Food GDP	100%	100%	100%	100%	100%	100%

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[1] This file is a decomposition of the majority of the 679 intermediate demands in matrix 14 into 21,250 product groups. We then used the codes of the Industry Division's Standard Classification of Goods (SCG) and Standard Industrial Classification (SIC) to correlate our HS codes and the codes used by the Industry Division. However, the level of aggregation of the data available proved to be higher than that of the HS codes. As a result, a number of commodities could not be used for lack of data. Such was the case of sodium benzoate, a common food additive. The Standard Classification of Goods (SCG) is the standard used to classify goods at Statistics Canada. It is based on the Harmonized Commodity Description and Coding System (HS), an international standard for designating and classifying goods. SCG codes are an extension of the six-digit HS codes, with up to three digits added to represent the statistical requirements for import, export and production statistics. After our data output request was submitted to the Industry Division, we obtained a crossed matrix from the input–output model displaying final demand elements by column and intermediate demand elements by row (matrix 14).

[2] Special outputs provided by the Industry Division posed another problem. It was possible that some elements of our special outputs were already compiled in our 13 initial final demands, which were used in full. Since these data were confidential, and thus transmitted in aggregates by product group, it was impossible to determine the specific portion of a product obtained by a special output from among the various final demands. To avoid double-counting impacts, we proceeded as follows: for a given product group, such as code 65, we knew the total value (e.g., $150 million). We asked the Industry Division for an output for a subset of this group (e.g., $10 million) and we knew that our 13 fully used final demands contributed $100 million to product group 65. This meant that the other final demands in this product group accounted for the remaining $50 million. We then applied the ratio 50/150=0.33 to our special output for this product group. Accordingly, $10M*0.33=$3.3 million, which was distributed evenly among the other final demands affected (excluding the 13 fully used final demands).

[3] Thompson and Thore, 1992.

[4] Baillargeon and Hamel, 1993; Juneau, 1998; Doyon et al, 2001; Charron and Doyon, 2002.

[5] Poole, 1999.

[6] Presentation proposed by Juneau 1998.

[7] This discussion refers to a joint study conducted in 1997 by the Quebec department of industry and commerce (Jules Dufort and Bruno Villeneuve) and the Quebec institute of statistics (Nguyen Van Phu).

[8] For example, if exports include a significant number of imports in the form of inputs, the inputs do not have a direct economic spinoff. The study mentioned in the previous note showed that for some exporting economies where little production activity taked place in the countries themselves, such as Hong Kong and Singapore, this ratio can even exceed 100%.

For more information:
AGRICULTURE AND AGRI-FOOD CANADA
Québec regional office
2001, University Street, Room 746-M
Montreal (Quebec) H3A 3N2
Phone: (514) 283-8888
Fax: (514) 496-3966
E-mail: FaxBack-Mtl@agr.gc.ca