

Ottawa's Hardware and Semiconductor Cluster

Economic Impacts



Doyletech Corporation



DT EconWin

Economic Impact
Industrial Analysis
Regional Science

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Disclaimer: The information and observations contained in this report are based on our present knowledge of the components of development, and of the current socioeconomic and fiscal conditions of the affected areas. Estimates made in this analysis are based on assumptions, current tax policies, and the current economic structure of the region. Even if the assumptions outlined in this report were to occur, there will usually be differences between the estimates and the actual results because events and circumstances frequently do not occur as expected. This analysis is based on the best available information and is intended to aid decision-makers in quantifying the impacts of Ottawa's Hardware and Semiconductor Industry Cluster on the Canadian economy. In no way will Doyletech Corporation be held responsible or have any liability or be subject to damages as a result of this analysis. Additionally, the findings and opinions expressed in the presentation constitute judgments as of the date of the presentation and are subject to change without notice. We are under no obligation to advise of any change brought to its attention which would alter those findings or opinions.

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Project Team: Doyletech project team included Jeffrey Doyle and Glenn McDougall.

Executive Summary: Economic Impacts of Ottawa’s Hardware and Semiconductor Industry Cluster, 2024

Ottawa’s **Hardware and Semiconductor Industry Cluster** is a vital component of the Canadian economy, not solely for the role it plays in technological innovation, productivity enhancement, national security, cluster development, and economic independence, but also because its influence spans hundreds of sectors and thousands of suppliers.

Ottawa’s Hardware and Semiconductor Industry Cluster generated C\$12.65 billion in output across Canada in 2024, contributed C\$6.54 billion to national GDP, supported 48,453 jobs, paid C\$3.82 billion in income, and generated C\$2.69 billion in gross operating surplus.¹ These are total impacts (that is, they include direct plus indirect plus induced effects).

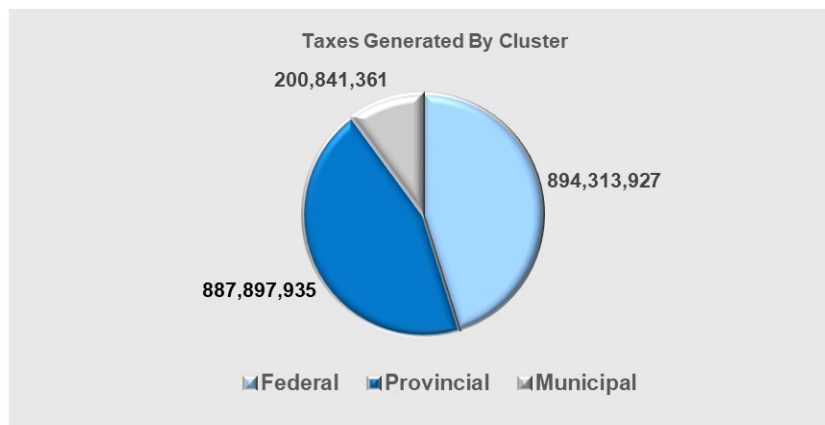
FIGURE ES-1 ECONOMIC IMPACTS GENERATED BY CLUSTER

Impact	Gross Output	Value-Add	Jobs	Labour Income	Gross Operating Surplus
Unit	(C\$)	(C\$)	(FTEs)	(C\$)	(C\$)
Direct	7,123,098,668	3,509,538,388	23,718	2,176,035,049	1,367,984,327
Indirect	3,103,071,016	1,619,830,988	13,334	989,736,739	626,137,584
Induced	2,425,396,123	1,411,990,363	11,400	651,247,022	695,052,645
Cluster Total:	12,651,565,806	6,541,359,739	48,453	3,817,018,810	2,689,174,556

Source: DT ECONWIN.

In addition, the cluster generated C\$1.98 billion in taxes to all three levels of government in 2024; C\$894 million to the federal government, C\$888 million to provincial governments, and C\$201 million to municipal governments.

FIGURE ES-2 TAX IMPACTS GENERATED BY CLUSTER



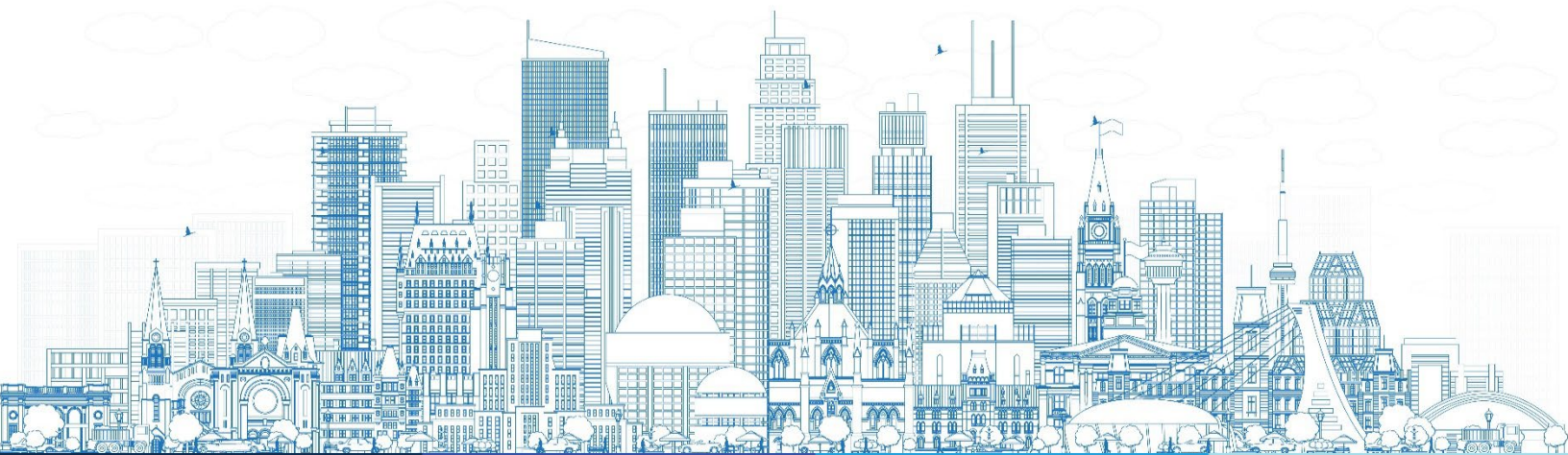
Source: DT ECONWIN.

Please note that the economic impacts being measured in this case are for the entire Canadian economy. While these impacts are likely to be heavily concentrated in the greater Ottawa region, it would be incorrect to assume that all of the impact would be felt locally.

¹ Source: DT ECONWIN, using the latest Statistics Canada data and Input-Output (IO) tables.

Part I:

About this
Evaluation



Part 1: About this Evaluation

Part 1 herein describes the mandate, methodologies, and assumptions underlying this evaluation.

1.1 Mandate

The Kanata North Business Association (“KNBA”) retained the services of Doyletech Corporation (“Doyletech”) to perform a third-party economic evaluation of Ottawa’s [Hardware and Semiconductor Industrial Cluster](#).² The evaluation was based on information available as of November 2024. Several sources were used including employment data from KNBA and Invest Ottawa, supplemented by Doyletech’s proprietary databases and datasets.

The economic impact assessment consisted of two phases. The first phase involved defining Ottawa’s hardware and semiconductor cluster and collecting various data on the cluster, and its firms. The second involved conducting the economic impact analysis based on the insight and data from the first phase.

1.2 Impact Methodology

[DT EconWin](#) (Doyletech’s proprietary computer-based impact model)³ was used to quantify the macroeconomic benefits Ottawa’s Hardware and Semiconductor Cluster brings to the Canadian economy through its activities and purchases. Over the last twenty years, it has become a widely-used and accepted software tool that models Canadian economic relationships between government, industry, and household sectors for a specific region so that when there is a change in any of these sectors, one can measure the impacts that will happen to the others.

1.3 Basic Assumptions Underlying the Evaluation

The evaluation of the economic benefits was based on several assumptions, the most important being:⁴

- All results are denominated in 2024 Canadian Dollars (\$C).
- US Dollar (\$US) data were converted to Canadian Dollar (\$C) at an exchange rate of \$US = \$C1.38.
- Alternative use of funds was not considered.
- While assumptions and estimates were applied, this was complemented by extensive primary and secondary research, along with Doyletech’s intelligence of Canada’s technology sectors gained since 1982.

² Established in 1982, Doyletech is a Canadian-based economic consulting firm that has no connection with KNBA beyond service contract. It has no financial interests in KNBA.

³ [DT EconWin](#) has been developed inhouse, from the ground up. It is based on advanced econometric modeling techniques and includes regional science and industrial analysis modules, as well as impact assessment.

⁴ [DT EconWin](#), being based in part on Statistics Canada’s input-output model, is built on the assumption that there is no social safety net (i.e., those that do not earn wages have no income from social assistance or unemployment programs, and therefore all induced spending is new spending in the economy). Economic impacts estimated with a social safety net assumption would be slightly lower.

1.4 Definition of Ottawa's Hardware and Semiconductor Industrial Cluster

With input and approval from the Kanata North Business Association, a special definition was developed for Ottawa's Hardware and Semiconductor Industrial Cluster. After significant research, analysis, and discussion, the local cluster was defined as having 156 firms, with a total output of \$C 7.12B, and employment of 23,718.⁵

The data in Figure 1.1 serves as key inputs into Doyletech's **DT EconWin** Economic Impact Model.

This industrial cluster includes more than just firms in the Telecommunications and Semiconductor industries; it also includes firms in sectors such as Computer and Peripheral Equipment Manufacturing, Computer Systems Design and Related Services, Communications Equipment Manufacturing, Aerospace Product and Parts Manufacturing, among others.

FIGURE 1.1 DIRECT GROSS OUTPUT OF OTTAWA'S HARDWARE AND SEMICONDUCTOR INDUSTRIAL CLUSTER, 2024

Industry (Input-Output Industrial Classification Code-IOIC)	Sales / Gross Direct Output
Telecommunications [BS517000]	1,494,574,431
Semiconductor and other electronic component manufacturing [BS334400]	1,466,509,020
Computer systems design and related services [BS541500]	895,820,333
Other electronic product manufacturing [BS334A00]	866,640,924
Aerospace product and parts manufacturing [BS336400]	527,454,719
Printing and related support activities [BS323000]	420,272,727
Computer and peripheral equipment manufacturing [BS334100]	344,060,000
Communications equipment manufacturing [BS334200]	279,235,192
Medical equipment and supplies manufacturing [BS339100]	210,000,000
Software publishers [BS511200]	158,610,297
Architectural, engineering and related services [BS541300]	132,113,943
Other transportation equipment manufacturing [BS336900]	108,726,808
Pharmaceutical and medicine manufacturing [BS325400]	60,000,000
Machinery, equipment and supplies merchant wholesalers [BS417000]	56,619,355
Other electrical equipment and component manufacturing [BS335900]	43,426,600
Industrial machinery manufacturing [BS333200]	21,086,200
Electrical equipment manufacturing [BS335300]	12,000,000
Data processing, hosting, and related services [BS518000]	10,350,000
Electric lighting equipment manufacturing [BS335100]	9,348,120
Support activities for transportation [BS488000]	6,250,000
Total for Ottawa's Hardware and Semiconductor Cluster:	7,123,098,668

Source: Doyletech Corporation, 2024.

⁵ Geographically, Ottawa is defined as the greater Ottawa region extending from Carp in the West to Orleans in the East. It does not include Gatineau.

Part II:

Economic Impacts Explained



Part 2: Economic Impacts Explained

The primary objective of this evaluation is to provide key evidence of how Ottawa's Hardware and Semiconductor Industrial Cluster impacts Canadian:

- [Gross Domestic Product \(GDP\)](#);
- [Output](#);
- [Labour Income](#);
- [Gross Operating Surplus \(GOS\)](#);
- [Jobs](#); and
- [Taxes](#).

These measures of impact provide different perspectives on new spending introduced into an economy (that is, an 'economic shock'). Economic shocks can be positive, negative, or a combination of the two.

Input-output (final-demand) multipliers are the primary means by which to assess these impacts. They predict the total impact (i.e., direct + indirect + induced) on all industries in an economy of changes in the demand for the output of any one industry. They identify the extent of the *multiplier effect*, often used as an argument for the efficacy of government spending or taxation relief to stimulate aggregate demand. As noted, these are *final-demand multipliers*, meaning:

they translate a one-dollar delivery to final demand by the sector into either gross output or earnings in all sectors — from that one-dollar delivery to final demand. In the case of the employment multiplier, it estimates the number of jobs generated for a \$1 million delivery to final demand.

Below, we address the benefits and limitations of each measure and how they apply to the industrial analysis in this evaluation.

2.1 Why Measure Gross Domestic Product?

The most common measure of production in the economy is *Gross Domestic Product (GDP)*. [GDP captures the value of goods and services produced for final domestic consumption, export, or investment \(called Final Demand or Final Use⁶\)](#). Specifically, it covers only the final, unduplicated output.

A new foreign order for the product of one of the sectors in the economy, or a decrease in consumer spending on a particular sector's product are examples of changes in Final Demand.

Since the value of intermediate inputs is excluded, this measure identifies the total 'value-added' by labour and capital services used to produce final goods and services. It is consequently smaller than Output but is a better measure of the true dollar impact on the economy.

⁶ Final Demand is the demand for goods and services not used up in the production process. [DT EconWin](#) is based on the latest (2021) provincial and national Input-Output (IO) Tables from Statistics Canada. Categories of Final Demand in these IO tables include Final Consumption Expenditure – Private (PCE), Final Consumption Expenditure – Government (GCE), Gross Fixed Capital Expenditure (GFCE) – Private Enterprises, Gross Fixed Capital Expenditure (GFCE) – Public Enterprises, Change in Stocks (CIS), and Net Exports (X-M). Since Final Demands are the driving force in this input-output framework, it is said to be a 'demand driven' impact model.

2.2 Why Measure Total Output?

A limitation of the GDP measure is that it does not capture goods and services consumed during the production process (i.e., *intermediate inputs*). While the GDP method ensures there is no duplication, useful information concerning the flow of goods and services among the various industries and consuming sectors in an economy is not revealed. To better reflect the flow of goods and services in the economy, it is necessary to use another valuation method called Total Output (also known as Total Spending, or Gross Output, or Economic Activity, or Total Gross Value of all Business Revenue).⁷

As the broadest measure of economic activity, total output captures the value of goods and services for final consumption or export, plus those that are consumed during the production process (referred to as *intermediate inputs*).⁸ Hence, it quantifies economic impact in terms of specific values of output needed from each Canadian/provincial sector to support delivery of new commodities, products, or services.

However, the output multiplier tells us nothing about employment or income formation.

2.3 Why Measure Labour Income?

Not only do industries make purchases from other sectors, they also make purchases from the labour force. Income multipliers, just like output multipliers, are sector-specific measures calculated from the interindustry transactions quadrant of an Input-Output Table.⁹ They indicate the total amount of wages and salaries that a sector must pay per dollars' worth of final demand.¹⁰

Industries that are highly linked with the rest of the economy have higher multipliers. So, in the case of income effects, if industry A and industry B are highly linked, then their indirect income effects are going to be large in comparison to the direct income effects — hence, their income multipliers will be larger.

2.4 Why Measure Jobs?

Jobs multipliers indicate how much employment (in terms of full-time equivalent, *FTE jobs*¹¹) is needed throughout the economy to supply one dollar's worth of final demand for that sector. One FTE is the equivalent of one person working full-time for a year. One FTE is the same as one 'person-year' of employment. [Most economists would agree that, from a public policy perspective, the most important impact measures are GDP and jobs.](#)¹²

While manufacturing activities tend to feature lower employment multipliers, their impact can be significant. Canadian suppliers with high efficiencies are much better positioned to be inserted into *Global Value Chains* (GVCs) leading to more sustainable business models. In

⁷ The relationship between GDP and Output is a useful analytical measure as it shows the extent to which industries rely on labour and capital as opposed to material and service inputs in production.

⁸ (Intermediate Goods) + (Final Demand) = (Total Output). That is, (aircraft components sold to other industries) + (aircraft components sold for final demand) = (all components produced).

⁹ Labour income is a subcomponent of value added.

¹⁰ In Canada, we see substantial differences in the purchases of labour by sector, owing to reasons such as process automation and technology adoption by Canadian-owned firms and SMEs.

¹¹ Full-Time Equivalent (FTE), also called person years of employment, accounts for part-time and seasonal employment. Because certain jobs may only be part time or seasonal, the number of jobs is typically greater than the number of FTEs.

¹² The jobs multipliers developed by [DT EconWin](#) do not distinguish between employee jobs and self-employed jobs.

such cases, the low value of the employment multiplier may mask high efficiency in using labour in the technology embedded in production (i.e., it masks high labour productivity).

All input-output multipliers are subject to misuse (and abuse) as authorities press for large multipliers to serve their lobby needs. This is especially true for income and employment multipliers. For instance, if the regional labour market is tight, the impact of a demand shock may materialize in an increase of local wages, instead of the job growth that is predicted by the IO employment multiplier.

2.5 Why Measure Gross Operating Surplus?

Gross Operating Surplus (GOS) is the excess of gross output over the costs incurred in production. These multipliers can be interpreted in the same way as the income multipliers except that '*income*' refers to wages and salaries earned by households whereas GOS is earned by businesses. GOS is a broad measure of profitability in the sense that it is surplus before deducting consumption of fixed capital, dividends, interest, royalties, land rent, and direct taxes payable.¹³

2.6 Why Measure Taxes?

The model identifies tax revenues generated for all three levels of government. This facilitates discussion on who benefits and who pays for alternative policy actions. However, it does not identify the relative efficiency of alternative actions.

2.7 Appropriate Use of Multipliers

The following notes and cautions on multipliers are provided:

- There is significant debate, even among economists, in terms of how multipliers should be interpreted. Over current view, like that of several leading economists such as Oosterhaven et al. (1986)¹⁴, is that the *simple multiplier* (i.e., *direct multiplier + indirect multiplier*) can be deemed as the lower limit of the effect following an increase in final demand. Likewise, the *total multiplier* (i.e., *direct multiplier + indirect multiplier + induced multiplier*) can be deemed the upper limit of the effect.¹⁵
- Our multipliers are developed from the latest Statistics Canada IO tables and methodologies, as well as proprietary subroutines in our model. They assess direct, indirect, and induced impacts for each of 186 industries in each province and territory in Canada (as well as for Canada overall).¹⁶ This makes for much more realistic

¹³ GOS is similar to the accounting concept of *Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA)*.

¹⁴ Oosterhaven, J., Piek, G. and Stedler, D., (1986). Theory and Practice of Updating Regional Versus Interregional Interindustry Tables. *Papers in Regional Science*, 59 (1), 57-72.

¹⁵ This statement is motivated by the view that simple multipliers underestimate economic impacts given that they omit household and factor income activities, and that total multipliers overestimate impacts due to rigid assumptions regarding the behaviour of household income-expenditure patterns.

¹⁶ **Direct impacts** are those first-level impacts resulting from a shock or change in demand, to either industry output or to final demand. It measures the *direct impact on industries* that must respond to satisfy the change in demand for commodities. **Indirect impacts** are secondary and are generated from the *linkages between industries*. They refer to the impacts on industries that supply intermediate inputs to the industries directly impacted by the shock. **Induced impacts** capture the *income effect* of the shock. They measure the impact of additional consumption from spending the wages generated by the shock. When there is an increase in final demand, industries must increase production. They hire additional people, who receive wages. **DT EconWin** utilizes provincial savings rates, disposal income ratios, and tax levels because not all this additional income is available to be spent locally, provincially, or even nationally within one year. In

- modeling of the final demand *shock*. It more realistically captures the inequity/diversity/differences between Canadian industries and geographies.
- Multipliers based on IO tables describe *average effects*, not *marginal effects*, and thus do not take account of economies of scale, unused capacity, or technological change.¹⁷ Generally, average effects are expected to be higher than the marginal effects.
 - Large multipliers are not the same as large multiplier impacts. The impacts depend on both the size of the multiplier and the magnitude of the *exogenous* stimulus by which the multiplier is multiplied. Thus, any given multiplier effect can be the result of a large multiplier associated with minimal change in initial spending or a small multiplier and substantial change in initial spending.
 - Local context and growth patterns need to be considered. A sector with the largest multiplier in the province may be so small that it takes an unrealistic rate of growth to generate the same region-wide growth of income as a very large sector with a very small multiplier.
 - Input-output relationships (quantified by the *technical coefficients* within **DT EconWin**) could change over time due to economic reasons. Therefore, multiplier coefficients calculated using supply-use tables of a particular year may not be appropriate to analyze another year since technical relationships might have been changed. However, it has become common practice to use multipliers calculated for one year for use in subsequent years.¹⁸ This is because of the significant cost and time required to develop multipliers every year (the most recent multipliers produced by Statistics Canada are for 2021).

essence, households must withdrawal a proportion for savings and taxes. Nevertheless, this income creates an additional multiplier effect on the economy.

¹⁷ Technological change does not occur very rapidly in most industries. The exceptions would be industries producing commodities susceptible to wide fluctuations in price, such as petroleum and agricultural products.

¹⁸ Under the assumption that there is not a significant structural change among industries during that period.

Part III:

The Economic
Impact of
Ottawa's
Hardware and
Semiconductor
Industry Cluster



Part 3: The Economic Impact of Ottawa’s Hardware and Semiconductor Industry Cluster

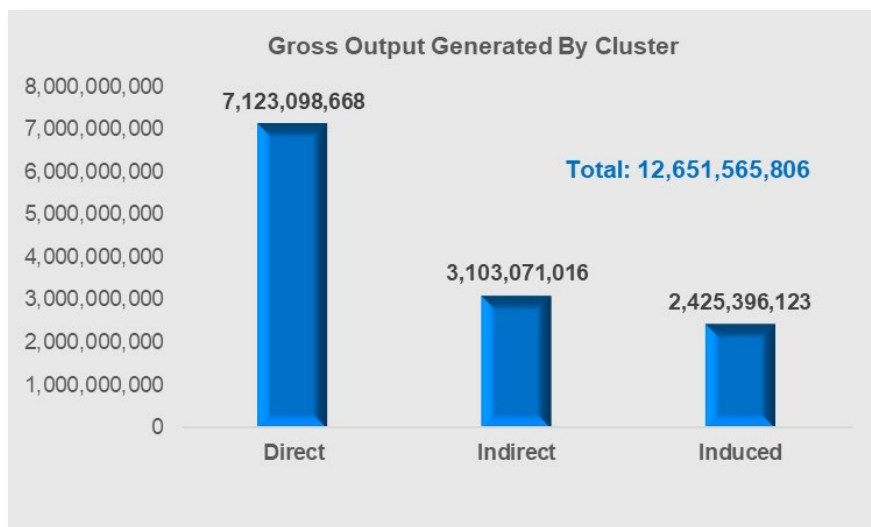
Part 3 herein provides an assessment of the cluster’s economic impact on the Canadian economy.

Please note that the economic impacts being measured in this case are on the entire Canadian economy. While these impacts are likely to be heavily concentrated in the greater Ottawa region, it would be incorrect to assume that all of the impact would be felt locally.

3.1 Gross Output

Figure 3.1, below, identifies the economic impact of the cluster in terms of **Gross Output**. As discussed in Part II, gross output is the broadest measure of economic activity as it captures the value of goods and services for final consumption or export, plus those that are consumed during the production process (referred to as intermediate inputs).

FIGURE 3.1: GROSS OUTPUT GENERATED

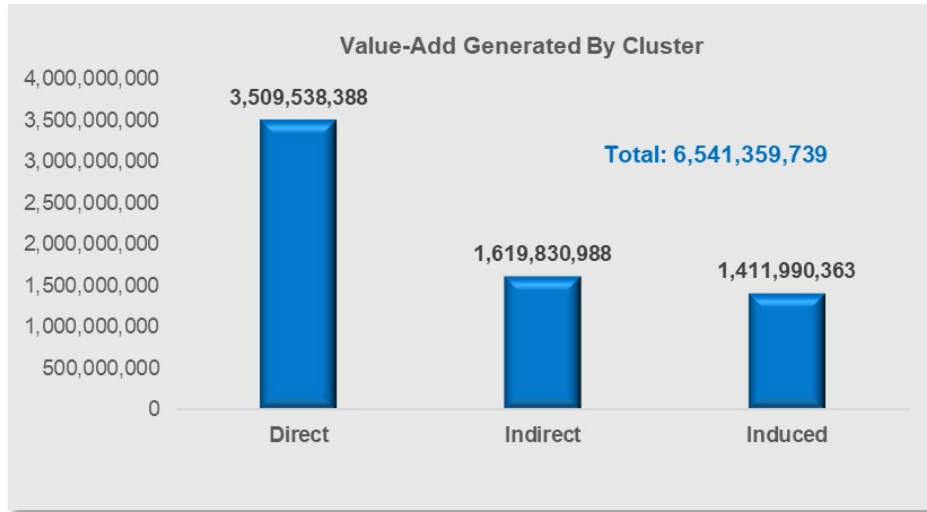


Source: DT EconWin.

3.2 Value-Add

Figure 3.2, below, identifies the economic impact of the cluster in terms of **Value-Add**. As discussed in Part II, this measure identifies the total ‘value-added’ by labour and capital services used to produce final goods and services. That is, the value of intermediate inputs is excluded. It is consequently smaller than Gross Output but is a better measure of the true dollar impact on the economy.

FIGURE 3.2: VALUE-ADD GENERATED

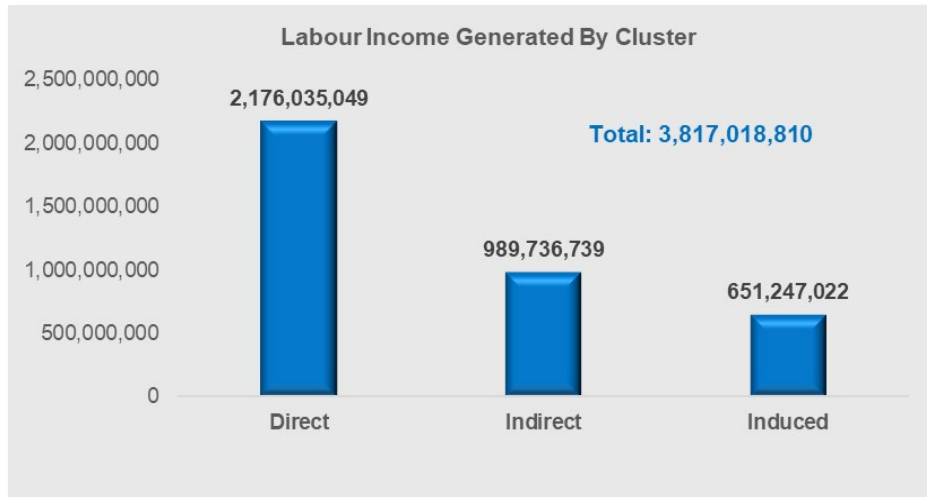


Source: DT ECONWIN.

3.3 Labour Income

Figure 3.3, below, identifies the economic impact of the cluster in terms of Labour Income. As discussed in Part II, this measure identifies the total amount of wages and salaries generated by the cluster.

FIGURE 3.3: LABOUR INCOME GENERATED

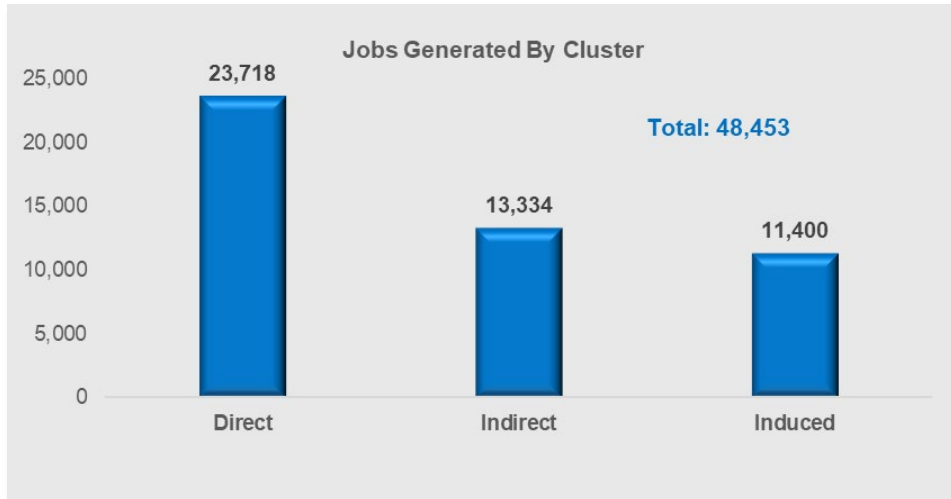


Source: DT ECONWIN.

3.4 Jobs

Figure 3.4, below, identifies the economic impact of the cluster in terms of Jobs. As discussed in Part II, jobs are measured in terms of full-time equivalents (FTEs). One FTE is the equivalent of one person working full-time for a year. One FTE is the same as one 'person-year' of employment.

FIGURE 3.4 JOBS GENERATED

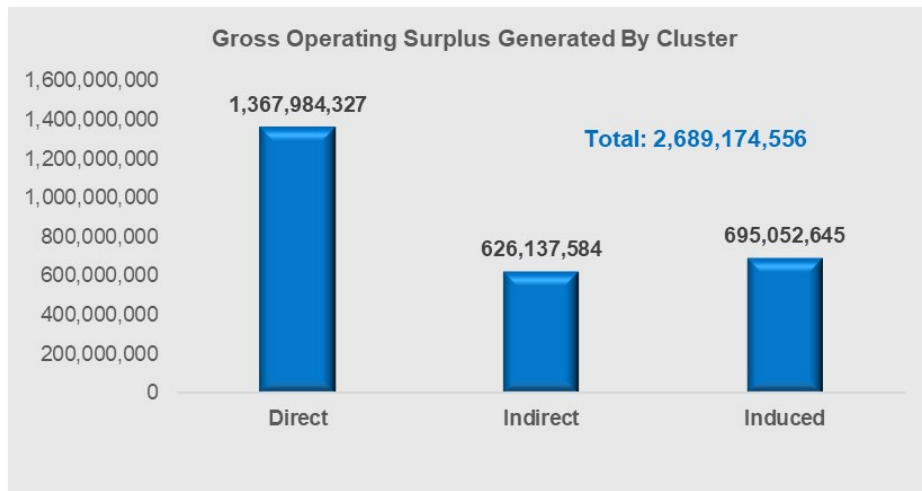


Source: DT EconWin.

3.5 Gross Operating Surplus

Figure 3.5, below, identifies the economic impact of the cluster in terms of **Gross Operating Surplus**. As discussed in Part II, gross operating surplus (GOS) is the excess of gross output over the costs incurred in production. GOS is a broad measure of profitability in the sense that it is surplus before deducting consumption of fixed capital, dividends, interest, royalties, land rent, and direct taxes payable.¹⁹

FIGURE 3.5 GROSS OPERATING SURPLUS GENERATED



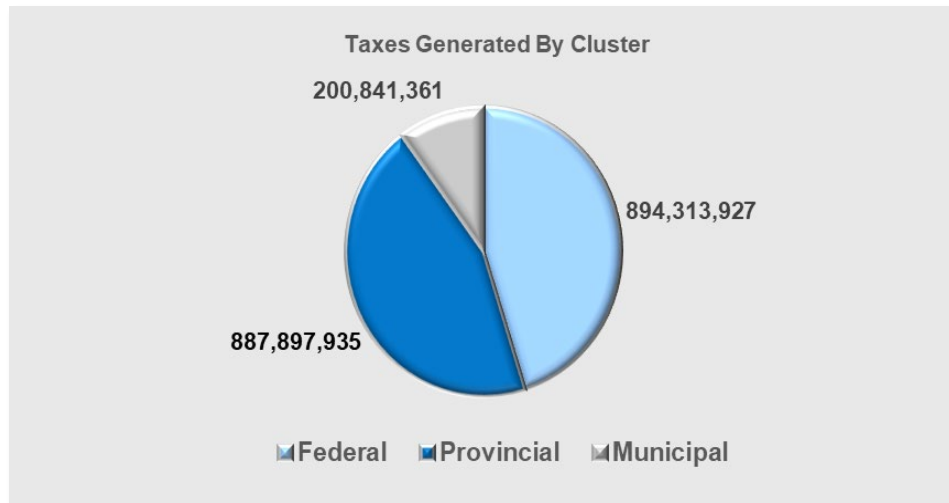
Source: DT EconWin.

3.6 Taxes

Figure 3.6, below, identifies the economic impact of the cluster in terms of **Taxes**.

¹⁹ GOS is similar to the accounting concept of *Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA)*.

FIGURE 3.6 TAXES GENERATED



Source: DT EconWin.

3.7 Summary of Impacts

Figure 3.7, below, provides a summary of the economic impact measures.

Ottawa’s Hardware and Semiconductor Industry Cluster generated \$12.65 billion in output across Canada in 2024, contributed \$6.54 billion to national GDP, supported 48,453 jobs, paid \$3.82 billion in income, and generated \$2.69 billion in gross operating surplus.²⁰ These impacts include direct plus indirect plus induced effects.

FIGURE 3.7 SUMMARY OF ECONOMIC IMPACTS GENERATED

Impact	Gross Output	Value-Add	Jobs	Labour Income	Gross Operating Surplus
Unit	(C\$)	(C\$)	(FTEs)	(C\$)	(C\$)
Direct	7,123,098,668	3,509,538,388	23,718	2,176,035,049	1,367,984,327
Indirect	3,103,071,016	1,619,830,988	13,334	989,736,739	626,137,584
Induced	2,425,396,123	1,411,990,363	11,400	651,247,022	695,052,645
Cluster Total:	12,651,565,806	6,541,359,739	48,453	3,817,018,810	2,689,174,556

Source: DT EconWin.

3.8 Segmentation of Gross Output by Industry

Figure 3.8, below, segments the total Gross Output impact by industry.

²⁰ Source: DT EconWin, using Statistics Canada data and Input-Output (IO) tables.

FIGURE 3.8 SEGMENTATION OF GROSS OUTPUT GENERATED

Segmentation of Gross Output By Industry	Total Canadian Impact (Direct + Indirect + Induced)
Semiconductor and other electronic component manufacturing	2,515,062,969
Telecommunications	2,437,650,897
Computer systems design and related services	1,845,389,885
Other electronic product manufacturing	1,455,090,111
Aerospace product and parts manufacturing	878,212,107
Printing and related support activities	877,529,455
Computer and peripheral equipment manufacturing	611,738,680
Communications equipment manufacturing	487,823,881
Medical equipment and supplies manufacturing	395,850,000
Software publishers	313,889,778
Architectural, engineering and related services	246,392,503
Other transportation equipment manufacturing	192,228,996
Machinery, equipment and supplies merchant wholesalers	108,142,968
Pharmaceutical and medicine manufacturing	101,640,000
Other electrical equipment and component manufacturing	72,478,995
Industrial machinery manufacturing	39,346,849
Electrical equipment manufacturing	22,512,000
Data processing, hosting, and related services	20,130,750
Electric lighting equipment manufacturing	16,742,483
Support activities for transportation	13,712,500

Source: [DT ECONWIN](#).

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