

INDIGENOUS CONTRIBUTIONS TO
THE MANITOBA ECONOMY

Technical Brief

Details about Data and Calculations Used in the
Input-Output Model Macroeconomic Analysis

JANUARY 2019



Stephen Johnson, *SJ Research Services Inc.*
Wm. (Bill) Ashton, *Rural Development Institute*
Aimee Coueslan, *Rural Development Institute*

Copyright © 2018 by MKO Inc., SCO Inc., & RDI

All rights reserved. This report or any portion thereof may not be reproduced without the express written permission of the copyright holders except for non-commercial uses permitted by copyright law and the First Nations principles of OCAP®.

Table of Contents

Introduction	1
Key Terms	2
Concepts of the Input-Output Model	3
Data Sources for Spending	4
Input-Output Model Calculations	7
Weaknesses of the Input-Output Model	13
References	14
Appendix A: Tribal Council Financial Statements for Spending	16
Appendix B: Definitions and Model Description	24
Appendix C: Mixed Endogenous-Exogenous Input-Output Impacts	27
Appendix D: Developing North- and South-Level Input-Output Models	29

Introduction

This technical brief describes the calculation and estimation methods used in the research report “Indigenous Contributions to the Manitoba Economy.” This description has been undertaken in order to enable other researcher to repeat these calculations at a later date, either in Manitoba or in another jurisdiction. As a result, this report is intended for readers interested in and experienced with economic analysis. For others, this report may fall short of providing a full explanation of all aspects of the input-output model. In addition, while this technical brief focuses on First Nations spending and impacts (Chapter 3), a similar approach was used for Indigenous spending and impacts in Chapter 2 of the main report.

This report presents key terms, outlines the input-output model, lists data sources, and details related calculations of impacts.

The analyses are based on standard methods for estimating economic contributions for sub-national geographies. In this report, First Nations data are used to help illustrate the calculations, and these calculations were repeated for Indigenous people, including Métis and Inuit. Results are the sum of direct, indirect, and induced impacts for First Nations and Tribal Council spending, spending on infrastructure investment, household spending, and business spending.

Economic outputs include gross domestic product (GDP)¹, labour income, employment, and government revenues.

Key Terms

The Base Case is a hypothetical scenario representing no First Nation economy.

Direct impact is the total initial expenditure, usually construction or operating outlays.

Indirect impact is the secondary impact that includes inter-industry transactions: purchases of inputs from supporting industries.

Induced impact is the additional impact from changes in household spending as additional labor is hired.

¹ In this project, gross output is not included, see explanation below.

Gross domestic product² (GDP) is a generally accepted measure of net economic activity within a prescribed geographic area over a specified period of time. It represents the payments made to final factors of production: labour, unincorporated business profits, and other operating surplus (corporate profits, interest income, inventory valuation adjustments, and capital consumption allowances). GDP excludes the value of intermediate goods and services used in production and measures net economic activity within a prescribed geographic area—in this case, Manitoba.

Labour income includes wages, salaries, and employer contributions to pensions and benefit packages.

Value added is the difference between gross output and intermediate inputs. It represents the value of labour and capital used in producing gross output. The sum of value added across all industries is equal to GDP for the economy.

Employment is measured by number of positions and is a mix of full- and part-time jobs. It is not to be confused with the number of First Nations people working. Employment results are rounded to the nearest whole number, and as such, column sums may not necessarily add to the table total.

Leakage occurs when income is removed from the specified geographic area (in this case, Manitoba) by taxes, savings, and imports. When consumers choose to spend money on goods and services outside of Manitoba, leakages occurs. Examples of leakages are purchasing goods online from the USA or spending money while traveling outside of the province.

The North in Manitoba is defined as Statistics Canada Census Divisions 21, 22, and 23, roughly corresponding to the area north of the 53rd parallel.

Off reserve refers to people, households, or businesses located on or living in a place that is not designated as on reserve.

2 GDP is often presented with gross output. Gross output is the total expenditures on local goods and services as well as business profits and payments to labour. To put it another way, gross output is the total value of goods and services produced by an industry and includes intermediate inputs, which are foreign and domestically-produced goods and services used by an industry in the production of its gross output. Gross output adds additional details and could be included in subsequent research. A simple example illustrates how gross output is different from GDP. A baker buys water, eggs, and flour to make bread. The baker sells the bread to households, and the baker's gross output is the revenue earned from the sale of the bread. Intermediate inputs are the cost of water, eggs, and flour for the baker. Value added is the difference between revenue earned and the cost of intermediate inputs. Because gross output can include sales to other industries, it can be duplicative in nature. As an example, the value of the eggs is counted twice—first when the eggs are sold by the supplier and second when the bread is sold by the baker. An industry's value added is defined as the total value of an industry's production less the cost of inputs purchased from other industries and eliminates this duplication.

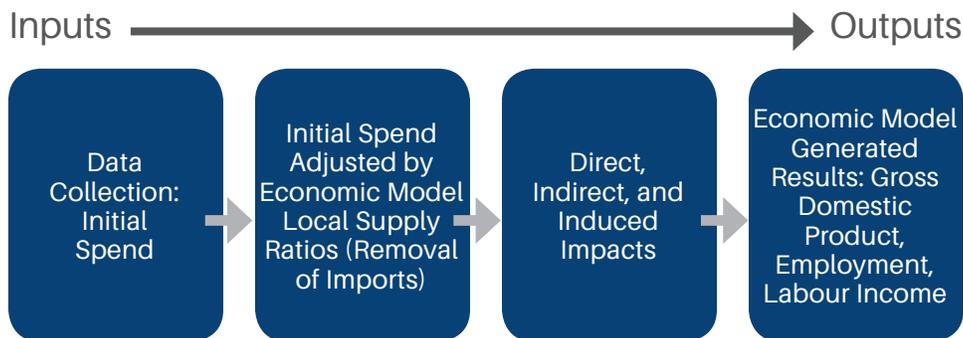
On reserve refers to people, households, or businesses located on or living in a census subdivision that is legally affiliated with First Nations or Indian bands, namely a First Nation reserve or Indian settlement. First Nations reserves are tracts of federally owned land with specific boundaries that are set apart for the use and benefit of a First Nation band. Indian settlements are places where self-contained groups of at least 10 First Nations people reside more or less permanently. They are usually located on Crown lands under federal or provincial jurisdiction. Indian settlements have no official limits and have not been set apart for the use and benefit of a First Nation band as is the case with reserves.

The South in Manitoba is defined as Statistics Canada Census Divisions 1 through 20, roughly corresponding with the area south of the 53rd parallel.

Concept of the Input-Output Model

As noted in Figure 1, data on spending is collected and adjustments are made for leakages (largely imports), resulting in the input-output model inputs. The economic model, in turn, calculates direct, indirect, and induced impacts, reported in terms of GDP, employment, and new labour income. The import adjustment is made because an imported input (a car, for example) does not count towards current regional production.

FIGURE 1. MODEL OF INPUTS AND OUTPUTS



Data Sources For Spending

In most cases, the latest publically available financial information was from 2015–2016. This information was assumed to correspond closely with the 2016 calendar year for consistency with Statistics Canada data sources. In cases where 2016 data was not available, the latest financial information was always utilized.

Spending by First Nations and Tribal Councils

First Nation band and Tribal Council spending data was retrieved from Aboriginal Affairs and Northern Development Canada's First Nation profiles. For this project, First Nation and Tribal Council spending includes wages, benefits, and amortization, so industry detail was expanded to include these elements. (See Appendix A.). The First Nations Financial Transparency Act requires each First Nation to which the Act applies to publish on its internet site, or cause to be published on an internet site, the following documents within 120 days after the end of each financial year: its audited consolidated financial statements, the Schedule of Remuneration and Expenses, the auditor's written report respecting the consolidated financial statements, and the auditor's report or the review engagement report, as the case may be, respecting the Schedule of Remuneration and Expenses.

Infrastructure Spending

The bulk of infrastructure spending data was accessed through Aboriginal Affairs and Northern Development Canada's National First Nations Infrastructure Investment Plan 2015–2016.

The Infrastructure Investment Plan is intended to assist First Nations in the planning, construction and/or acquisition, operation, and maintenance of community infrastructure and facilities in the following categories:

- Water supply, treatment, and distribution systems;
- Wastewater collection, treatment, and disposal systems;
- Solid waste collection and disposal;
- Elementary and secondary educational facilities;
- Housing;
- Roads and bridges;
- Fire protection including fire halls, fire vehicles, and firefighting equipment;

- Electrical power generation and distribution;
- Community buildings such as community/recreation halls and band offices;
- Bulk fuel storage and distribution (non-commercial use);
- Structural mitigation;
- Waste management;
- Energy systems;
- Remediation of contaminated sites;
- Land acquisition for approved community expansion; and
- Connectivity.

Added to this data was data from the Province of Manitoba's Aboriginal and Northern Affairs (now known as Indigenous and Northern Relations) Capital Grants and Community Capital Support Programs for 2015-2016. For this report, this First Nations capital spending data was allocated to the North or South based on First Nation location.

Business Spending

Business spending for the North and South was extrapolated using the 2016 Business Register and data from the 2016 Census.

The Business Register (BR) is Statistics Canada's continuously maintained central repository of baseline information on businesses and institutions operating in Canada. The Business Register maintains a complete and unduplicated list of all businesses in Canada that have a corporate income tax account, an employer payroll deduction remittance account, a GST/HST account, a T5013 partnership account, and/or a registered charities account. Persons reporting any of the various types of business income on personal tax forms (T1) are also included on the Register (regardless of whether they have GST/HST or PD7 remittances).

The major sources of information for the Business Register are updates from the Statistics Canada survey program and from the Canada Revenue Agency (CRA) Business Number account files. Included in the Business Register are all Canadian businesses which meet at least one of the three following criteria:

- Have an employee workforce for which they submit payroll remittances to CRA; or
- Have a minimum of \$30,000 in annual revenue; or

- Are incorporated under a federal or provincial act and have filed a federal corporate income tax form within the past three years.

The data in this report reflects counts of businesses by industrial activity (North American Industry Classification System),³ location (geography codes), and number of employees as of December 31, 2016.

In the Business Register, businesses are categorized by their number of employees using a range: 10 to 19 employees or 20 to 49 employees, for example. The number of businesses with each employee range multiplied by the mid-point number of employees in each range (e.g. for range 10-19, the midpoint is 14.5) results in estimates for employment by industry.

By associating business counts by geographic locations (from the 2016 Business Register) and the numbers employed per location (Manitoba Census Subdivisions), coupled with estimates of expenditures per employee, it is possible to derive annual total gross business expenditures (excluding capital). These expenditures were then totalled for spending on and off reserve. These can further be broken down by expenditures by type using the Summary-level provincial input-output (IO) “Use tables,”⁴ assuming a relatively consistent level of expenditures by category per employee between the region and the province.

Off-reserve business spending was estimated using the ratio of off-reserve population to on-reserve population in both the North and South multiplied by on-reserve business spending for both the North and South. Off-reserve business counts were likewise estimated.

Household Spending

On-reserve household spending is based on 2016 Census household income data by First Nation. While household income data was readily available at the community level, household spending had to be estimated.

On-reserve household spending was estimated using the percentage of household income spent on consumer goods and services.⁵ In southern Manitoba, which is the base case, 75.9% of household income from all sources goes toward personal expenditures on goods and services. In

³ The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the business economy.

⁴ S-level provincial IO tables are explained at <https://www150.statcan.gc.ca/n1/en/catalogue/15-211-X>

⁵ Cansim Table 384-0012: Sources and disposition of personal income

the North, reliable public data on total cost of living was elusive, but anecdotal data shows a significant difference in food costs between the North and the South. For example, the *Thompson Citizen*⁶ reported that in Manitoba's urban centres, a family of four spends an average of \$8,000 on food every year; the same groceries cost \$14,300 in Fox Lake Cree Nation (a remote community with road and rail access) and \$23,296 in Shamattawa, a fly-in community. For Northern communities without all-season road access, the average of \$14,300 and \$23,296 was calculated and then divided by \$8,000 yielding a scalar (or coefficient) of 2.35. This number was then applied to the Manitoba average amount of household income spent on food (14.6%)⁷ in order to reflect the higher cost of living. For Shamattawa itself, \$23,296 was used instead of the average, and the scalar was 2.912 (\$23,296 divided by \$8,000). For Northern communities with all-season road access, a scalar was developed using the ratio of a fixed basket of goods for Thompson as compared to Winnipeg (\$1,339.05 divided by \$978.98 or a scalar of 1.36). This scalar was applied to the food portion of household spending for these communities. For non-food expenditures, the Thompson scalar of 1.36⁸ was applied to each community's estimated non-food spending. Using this method, in many communities, slightly more was spent on consumer goods and services than household income would allow. In this case, it is assumed that the household is tapping into savings and/or supplementing with traditional hunting and fishing or simply going without.

Input-Output Model Calculations

To estimate the economic impact of the Manitoba First Nations Economy, separate economic models were employed for Manitoba's North and South using the latest provincial input-output tables.⁹ An input-output table is a means of presenting a detailed analysis of the process of production, the use of goods and services (products), and the income generated in that production. The Manitoba model includes 35 industries and 66 commodities and is based on a Statistics Canada's standardized method. It yields results similar to Statistics Canada's inter-

6 Epp-Koop, S. (2016).

7 Statistics Canada. (2017).

8 Jarosiewicz, S. (2013, November). Calculation Guide for the 2013 Family Living Wage for Manitoba [PDF]. Retrieved from https://www.policyalternatives.ca/sites/default/files/uploads/publications/Manitoba%20Office/2013/11/CCPA_MB_Calculation_Guide_.pdf

9 Cansim Table 381-0035.

provincial model and the Conference Board of Canada’s Sport Tourism Economic Assessment Model (STEAM).¹⁰ A model description and definitions used in this project are in Appendix B.

Rationale for use of Input-Output Analysis

In this project, every attempt was made to mimic the method used in the *\$1.14 Billion Strong: Indigenous Economic Performance in Atlantic Canada* study.¹¹ They too relied heavily on input-output analysis, which is a recognized standard model used by economists and which explicitly recognizes the inter-dependencies between industries in a set geographic area.

Input-Output Analysis

Input-output tables illustrate inter-industry relationships within an economy and show how output from one industrial sector may become an input to another industrial sector. In the inter-industry matrix, column entries typically represent inputs to an industrial sector, while row entries represent outputs from a given sector. Each column of the input–output matrix shows the monetary value of inputs to each sector, and each row represents the value of each sector’s outputs. A two-industry economy is represented below:

		Processing Sectors		Final Demand	Total Output
		1	2		
Processing Sectors	1	Z_{11}	Z_{12}	X_1	X_1
	2	Z_{21}	Z_{22}	Y_2	X_2
Payments Sector		W_1	W_2		
Total Output		X_1	X_2		

¹⁰ For more information about the Sport Tourism Economic Assessment Model (STEAM) see <https://canadiansporttourism.com/steam.html> or <https://www.conferenceboard.ca/topics/economics/custom.aspx>

¹¹ Group ATN Consulting Inc. (2016, March 31).

In an economy with n industry, each industry produces x_i units of a single homogeneous good. For the j th sector, in order to produce X_j , it must use z_{ij} units from sector i , z_{jj} from itself (industry j), and W_j from the payments sector.

In addition, each sector sells some of its output to other industries (intermediate output) and some of its output to consumers and other end users (final demand). Final demand in the i th sector is Y_i .

A two-industry economy can be expressed as a system of equations:

$$X_1 = a_{11}X_1 + a_{12}X_2 + Y_1$$

$$X_2 = a_{22}X_1 + a_{21}X_2 + Y_2$$

Where:

$$a_{ij} = \frac{z_{ij}}{X_j}$$

Expressed in matrix terms:

$$X = AX + Y$$

Solving for X yields:

$$X = (I - A)^{-1}Y$$

Where $(I - A)^{-1}$ is known as the Leontief inverse.¹²

While the ability to solve industry output in terms of final demand is useful, the above simplified example does not take into account leakages. For example, if an increase in final demand can be satisfied through imports or inventory withdrawals, no increase in industry output can be expected.

¹² For more about the Leontief inverse, see https://en.wikipedia.org/wiki/Input%E2%80%93output_model

Leakage Calculation

The input-output model utilized in this study explicitly recognizes leakages:

$$(I - (I - \mu - \alpha - \beta)A)^{-1}((I - \mu - \alpha - \beta)e^* + (I - \mu - \beta)X_d + (I - \mu)X_r) = X$$

Where:

I = an identity matrix of industry by industry dimension

A = a matrix of technical coefficients representing inter-industry purchases (z_{ij}) divided by own industry gross output X_i .

μ = a diagonal matrix whose elements represent the ratio of imports to use

α = a diagonal matrix whose elements represent the ratio of government production to use

β = a diagonal matrix whose elements represent the ratio of inventory withdrawals to use

e^* = final demand categories of consumption, government purchases of goods and services, business and government investment, and inventory additions.

X_d = final demand category of domestic exports

X_r = final demand category of re-exports.

Sub-Provincial Input-Output Tables

Impacts were calculated by creating a mixed endogenous–exogenous model.¹³ This approach allows for the modification of the input structure of an expanding industry to reflect the output and input structure of a new development or event. The impacted industry in this study was the input-output category of “Other Aboriginal Government” (comparable to North American Industrial Classification System code 914),¹⁴ part of the wider “Government Sector.” In this study, the labour

¹³ For a short explanation of the endogenous-exogenous model, see <https://www.youtube.com/watch?v=qjQhAyuH2P4>

¹⁴ In the North American Industry Classification System (NAICS), Code 914 “Aboriginal Public Administration” is comprised of “establishments of Aboriginal governments primarily engaged in providing to their constituents a wide variety of government services that would otherwise be provided by federal, provincial, or municipal levels of governments.”

income and employment coefficient in the model was adjusted to reflect actual employment and income paid to labour. A detailed account of the mixed endogenous–exogenous model methodology is available in Appendix C. With this approach, gross expenditures are treated as industry gross output and expenses are either inter-industry purchases or final value added (wages, amortization, and profits).

Key to this analysis is the estimation of impacts at the regional level for Manitoba’s North and South. Regional level impacts were estimated by constructing separate economic impact models for the regions using regional employment by industry to estimate regional output. Also, a community hierarchy model was used to assess regional trade flows and leakages, and re-balancing was completed to ensure model cohesiveness. The regional models are square models with 25 industries. A more detailed discussion of the regional input-output models is available in Appendix B.

Detailed Impacts by Industry

Total impacts (direct, indirect, and induced) of spending—First Nations and Tribal Council, household, and business spending, as well as infrastructure investment—on the provincial economy are provided at the 25-industry level of detail. The bulk of total and direct activity occurs within the government sector for First Nation band and Tribal Council spending and within the construction sector for spending on infrastructure. Indirect impacts are concentrated in industries supplying inputs to directly impacted industries. Induced impacts, which represent the impacts caused by consumer spending of additional wages earned, is concentrated heavily within the retail trade and service industries. Induced impacts are third-round impacts from the spending of incremental labour income in the economy after removing a portion for taxes and savings.

Government Fiscal Impacts

An expansion in economic activity is expected to generate incremental government revenues.

These government revenues are estimated for direct, indirect, and induced impacts. In brief, the process is as follows: the economic model outputs direct, indirect, and induced impacts, reported as GDP and labour income. The GDP and labour income are then used as inputs for the tax model (or fiscal module). Using these inputs, the fiscal module then outputs personal income tax, corporate tax, unincorporated business taxes, and sales and excise taxes. Estimates are not adjusted for

any changes to equalization entitlements.

The economic impact model's fiscal module is based on the 2016 provincial and federal budgets and estimates government revenues as follows:

- Provincial personal income tax is calculated by using the provincial personal income tax rate that would apply to average industry annual income. This rate is applied to model-generated labour income.
- Federal personal income tax is calculated by taking the federal personal income tax rate that would apply to average industry annual income and applying it to model-generated labour income.
- Corporate income tax is calculated by applying the respective provincial and federal corporate tax rate to incremental corporate profits before taxes calculated by the model.
- Unincorporated business income taxes are calculated by applying the small business tax rate to incremental unincorporated business profits calculated by the model.
- Federal and provincial sales taxes collected on goods are calculated by applying an estimated ratio of federal and provincial taxes to model-generated indirect taxes on products. All model-generated indirect taxes on services are considered federal sales and excise tax revenues.
- According to Section 87 of the *Indian Act*, property situated on a reserve is immune from taxation, and income counts as property. Therefore, labour income assumed to have been earned on reserve is excluded from all personal income tax calculations above. This labour income includes direct-impact labour income earned by employees of First Nation bands, Tribal Councils, and on-reserve businesses. Labour income calculated as a part of indirect and induced impacts was assumed to be taxable as it was beyond the scope of this macroeconomic analysis to determine whether it had been earned on or off reserve.

Weaknesses of the Input-Output Model

Economic impacts are subject to the usual constraints and limitations of input-output analysis: the framework rests on the assumption that input coefficients of production are constant. The assumption of fixed coefficients of production ignores the possibility of factor substitution. The input-output model cannot reflect such phenomena as bottlenecks or increasing input costs. The analysis operates on the assumption that a fixed quantity of an input is needed per unit of output produced. It also assumes that there are constant returns to scale, in which an increase in outputs is expected to be in proportion to an increase in inputs. This project begins by assuming a fully operational marketplace across all of Manitoba; however, this assumption is modified to accommodate locations, such as fly-in communities, that may not have fully functional economies.

In the construction of sub-provincial economic estimates, it is generally assumed that labour productivity across most industries will be the provincial average. In some industries, such as mining, forestry, hunting, fishing, and trapping, where the North is the centre of that industry's economic activity, this assumption will likely be accurate. For other industries in Manitoba's North—notably construction, manufacturing, and services—it remains difficult to quantify regional disparities in labour productivity. As such, it was necessary to assume that the provincial average can be applied in all regions.

GDP as a measure of economic activity has a number of limitations. For example, GDP does not take into account leisure time or how hard people work to produce output. Barter and cash transactions are not included in GDP statistics. Harmful side effects, such as pollution, are not included in GDP statistics. While GDP is not reduced to take into account these harmful effects, market transactions undertaken in an effort to correct the bad effects are added to GDP. Goods and services produced but not exchanged for money, known as “nonmarket production,” are not measured, even though they have value. Good examples are unpaid household labour and subsistence hunting and fishing. However, in this report, subsistence hunting and fishing are accounted for in household spending estimates as they are valuable in offsetting higher food costs in remote communities, especially evident in the North.

References

- Epp-Koop, S. (2016, January 22). Rising food prices nothing new for Manitobans living in the North. *Thompson Citizen*. Retrieved from <http://www.thompsoncitizen.net/opinion/columnists/rising-food-prices-nothing-new-for-manitobans-living-in-the-north-1.2155695>
- Group ATN Consulting Inc. (2016, March 31). *\$1.14 Billion Strong: Indigenous Economic Performance in Atlantic Canada*. Halifax, NS: Atlantic Policy Congress of First Nations Chiefs Secretariat.
- Jarosiewicz, S. (2013, November). Calculation Guide for the 2013 Family Living Wage for Manitoba [PDF]. Retrieved from https://www.policyalternatives.ca/sites/default/files/uploads/publications/Manitoba%20Office/2013/11/CCPA_MB_Calculation_Guide_.pdf

Data Sets

- Statistics Canada. (1998). Sources and disposition of personal income, provincial economic accounts. (CANSIM Table 384-0012). Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3840012&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=>
- Statistics Canada. (2007). 2006 Census of Population: Experienced labour force 15 years and over by class of worker, by province and territory. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2006/index-eng.cfm>
- Statistics Canada. (2012). 2011 Census Profile. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/details/download-telecharger/comprehensive/comp-csv-tab-dwnld-tlchrgr.cfm?Lang=E#tabs2011>
- Statistics Canada. (2013). Labour statistics by business sector industry and by non-commercial activity consistent with the industry accounts, provinces and territories, annual. (CANSIM Table 383-0030). Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=3830033>

Statistics Canada. (2013). 2011 National Household Survey: National Household Survey Profile. Retrieved from <http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/dt-td/index-eng.cfm>

Statistics Canada. (2015). Supply and use tables, summary level, provincial and territorial (CANSIM Table 381-0035). Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=3810035>

Statistics Canada. (2017). Aboriginal peoples in Canada. Retrieved from <http://www.statcan.gc.ca/daily-quotidien/171025/dq171025a-eng.pdf>

Statistics Canada. (2017). Interprovincial and international trade flow, basic prices, detailed level. (CANSIM Table 386-0005). Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=3860005#F1>

Statistics Canada. (2017). 2016 Census Profile. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E>

Statistics Canada. (2018). Special tabulation, based on Canadian Business Counts, with employees, by Manitoba CSDs, December 2016.

Appendix A: Tribal Council Financial Statements for Spending

TABLE A.1: DAKOTA OJIBWAY TRIBAL COUNCIL SPENDING 2012

A.A.N.D.C	
Education	
Guidance and Counselling	35,679
Guidance and Counselling	56,251
PSE - Student Support	759,082
PSE - Administration	104,388
Yellowquill College	404,997
Social Development	
Social Development	135,998
Indian Government Support	
Advisory Services - IGS	567,040
Tribal Council Funding	375,107
Band Employee Benefits	154,740
Community Development	
Fire Prevention	54,733
Housing - O&M	61,545
Housing - Advisory	57,217
Schools - O&M (SMTP)	322,135
Land Management	
Aboriginal Environmental Stewardship	15,000
Spending	Spending

TABLE A.2: INTERLAKE RESERVE TRIBAL COUNCIL SPENDING STATEMENT 2013

A.A.N.D.C.	
Community	
Infrastructure	54,028
Housing Service Delivery	50,336
Other (Fire Protection)	52,208
Economic Development	
Community Economic Development Program	35,801
Environmental Stewardship	8,800
Education	
Elementary/Secondary Schools	936,324
Post - Secondary Education	1,363,082
Other (Service Delivery)	124,880
Indian Government Support	
Tribal Council Funding	654,761
Other	
Skills Link Program	62,549
CMHC	
Non-Profit On Reserve Housing	
RRAP Homeowner and Persons with Disabilities Programs	74,205
Health Canada	
Children and Youth	
Mental Health and Addictions	210,926
Primary Care	358,523
Health Governance and infrastructure	463,992
Total	4,450,415

TABLE A.3: ISLAND LAKE TRIBAL COUNCIL SPENDING 2013

AANDC	
Administration	893,548
Social Development	128,207
Maintenance Mgmt.	54,460
Housing Inspection	74,598
Fire Inspection	57,460
Education	70,194
Employee Pension	62,093
Housing Infrastructure	6,158,192
Water and Sewer Retro	4,200,044
Water and Sewer Retro	299,966
Service Canada	
Day Care Initiative	1,136,612
Health Canada	
Board and Lodging	616,809
Medical Transportation	650,159
Total	14,402,342

TABLE A.4: KEEWATIN TRIBAL COUNCIL SPENDING 2013

A.A.N.D.C.	
Community Development	
Community Based on Research	
Housing	61,788
Infrastructure	1,342,127
Education	
Elementary/Post Secondary	4,176,354
Other Education	2,156,089
Indian Government Support	
Indian Government Support	2,711,517
Land Management	
Land Management	11,138
Social Development	
Active Measures	351,057
Income Assistance	374,188
Governance and Institutions of Government	
Governance Activities	113,731
Health Canada	
Children and Youth	497,581
Mental Health and Addictions	207,454
Chronic Diseases and Injury Prevention	27,640
Communicable Disease Control	199,190
Environmental Health and Research	35,647
Primary Care	1,068,661
NHHB	1,490,645
Health Governance and Infrastructure	1,559,266
HRDC	3,367,177
Industry Canada	266,156
Total	20,017,406

**TABLE A.5: SOUTHEAST RESOURCE DEV. COUNCIL SPENDING
2013**

AANDC	
CPP/QPP and private pension plans	204,447
Tuition agreements	2,250,836
Business development	12,000
Provincial schools	61,774
Aboriginal environmental stewardship	61,000
Wastewater O&M	285,000
Asset conditioning reporting system (ACRS)	469,175
Pension plan administration costs	20,182
Tribal Council funding	894,475
First Nation and Inuit professional standards and best practices	21,186
Ancillary support	44,658
Student accommodation services band operated	208,838
Student accommodation services band operated	39,520
Financial assistance allowances	77,220
Guidance and counselling	41,513
Student accommodation services provincial	2,095,335
Post secondary student support program	1,952,978
Administration post secondary	169,696
Service delivery	102,407
Community economic development program	470,704
Inspections	53,972
Development of maintenance management	58,188
Fire protection	52,208
FNIH	
Canada Prenatal Nutrition Program	50,694
Fetal Alcohol Spectrum Disorder	10,000
Fetal Alcohol Spectrum Disorder	558,368
Brighter Futures	44,862
National Aboriginal Youth Suicide Prevention Strategy	100,647
National Native Alcohol and Drug Abuse Program	76,365
Aboriginal Diabetes Initiative	51,605
Nutrition North	

Drinking Water	35,000
Environmental Health	242,700
Home & Community Care	46,240
Home & Community Care Strategy	371,622
Health Consultation and Liaison	93,526
Health Consultation and Liaison	11,546
Nursing	
Capital	1,476,477
First People's Development Inc. (HRSDC)	
Day Care Funding	56,601
Total	12,873,565

TABLE A.6: SWAMPY CREE TRIBAL COUNCIL INC. SPENDING 2013

AANDC	
Facilities O&M	128,055
Capital	440,438
Elementary/Secondary	67,162
Post Secondary Education	71,035
Housing	71,176
Income Assistance	171,903
Skills Link Program	754,940
Environmental Reviews	23,000
Governance Support	62,000
Block Funding - IGS	1,066,268
Band Employee Benefit Plans	123,874
Community Economic Development	222,591
IAP Project	138,294
Prevention Projects	337,272
Active Measures	321,563
Total	3,999,571

TABLE A.7: WEST REGION TRIBAL COUNCIL SPENDING 2013

AANDC -Fixed Contribution	
Management and Administration	1,036,189
Housing Inspector	180,521
Social Services	123,506
Fire Protection	62,387
Education Student Services	86,188
-Set Contribution	
Band Employee Benefits	43,234
Training - Operators	527,909
Environmental Site Assessment	618,642
Inspections and Water Monitoring	54,574
Circuit Rider Training Program	1,011,133
Development and Maintenance of Management Systems	56,540
Health Canada	
Children and Youth Forum	40,423
ADI	212,341
Brighter Futures	85,919
IRS - Health Support Program	221,657
Drinking Water Quality	127,217
eHealth	22,872
Environmental Health	134,971
Foot Care	43,357
Health Administration	354,355
Health Board	145,947
Health Careers	5,000
Health Director	140,504
Home Care	85,129
AHHRI Program	194,356
Imagination Library	2,013
HD-CHR Gathering	134,740
National Aids Program	37,965
NNADAP Flexible	91,083
NNADAP Post-Secondary	356,000
Psychological Services	299,436

T/A Insurance/Audit	21,020
Tribal Nursing	643,622
Mental Wellness Team	215,246
Interchange Canada Program	14,796
NAYSPS	109,820
TB Conference	142,711
Policy Analyst	49,256
Total	7,732,579

Appendix B: Definitions and Model Description

After-tax income: Total income less income taxes of the statistical unit during a specified reference period. “Income taxes” refers to the sum of federal, provincial, and territorial income taxes, less abatement where applicable. Provincial and territorial income taxes include health care premiums in certain jurisdictions.¹⁵

Direct Impact: total project expenditure, usually construction or operating outlays.

Employment: Employed persons are those who, during the reference week, did any work for pay or profit or had a job and were absent from work.

Employment income: All income received as wages, salaries, and commissions from paid employment, as well as net self-employment income from farm or non-farm unincorporated business and/or professional practice during the reference period.¹⁶

Final Demand: the sum of personal expenditure, government purchases of goods and services, business and government investment, and net exports.

GDP at factor cost: a measure of net economic activity within a prescribed geographic area. It represents the payments made to final factors of production: labour, unincorporated business profits, and other operating surplus (corporate profits, interest income, inventory valuation adjustments, and capital consumption allowances). GDP at factor cost excludes the value of intermediate goods and services used in production.

GDP at market prices: GDP at factor cost plus indirect taxes less subsidies.

Gross Output: total expenditures on local goods and services as well as payments to labour and business profits. Gross output includes double counting because it includes the value of inputs used in production rather than net value added alone.

Indirect Impact: the secondary impact that includes inter-industry transactions (purchases of inputs from supporting industries).

¹⁵ Statistics Canada. 2016 Census of Population.

¹⁶ Statistics Canada. 2016 Census of Population.

Induced Impact: the additional impact from changes in household spending as industries modify labour input requirements in response to altered levels of demand for output.

Labour force: Civilian non-institutional population 15 years of age and over who, during the survey reference week, were employed or unemployed (see “unemployment” below).

Market Income: The sum of employment income (wages, salaries, and commissions and net self-employment income from farm or non-farm unincorporated business and/or professional practice), investment income, private retirement income (retirement pensions, superannuation, and annuities, including those from registered retirement savings plans [RRSPs] and registered retirement income funds [RRIFs]), and other money income from market sources during the reference period. It is equivalent to total income minus government transfers. It is also referred to as income before transfers and taxes. For the 2016 Census, the reference period is the calendar year 2015 for all income variables.¹⁷

Participation rate: Total labour force expressed as a percentage of the population aged 15 years and over. The participation rate for a particular group (for example, women aged 25 years and over) is the labour force in that group expressed as a percentage of the population for that group.

Total Income: The sum of certain incomes (in cash and, in some circumstances, in kind) of the statistical unit during a specified reference period.¹⁸

Unemployment: Unemployed persons are those who, during the reference week, were available for work and were either on temporary layoff, had looked for work in the past four weeks, or had a job to start within the next four weeks.

Unemployment rate: Number of unemployed persons expressed as a percentage of the labour force. The unemployment rate for a particular group (for example, age, sex, marital status) is the number of unemployed in that group expressed as a percentage of the labour force for that group.

Wages, salaries and commissions: Gross wages and salaries before deductions for such items as income taxes, pension plan contributions, and employment insurance premiums during the reference period. While other employee remuneration such as security options benefits, board and lodging, and other taxable allowances and benefits are included in this source, employers’ contributions to pension plans and employment

¹⁷ Statistics Canada. 2016 Census of Population.

¹⁸ Statistics Canada. 2016 Census of Population.

insurance plans are excluded. Other receipts included in this source are military pay and allowances, tips, commissions and cash bonuses associated with paid employment, benefits from wage-loss replacement plans or income-maintenance insurance plans, supplementary unemployment benefits from an employer or union, research grants, royalties from a work or invention with no associated expenses, and all types of casual earnings during the reference period.¹⁹

Model Description

Industry outputs (X) are calculated as $(I-D(I-\mu-\alpha-\beta)B)^{-1}D((I-\mu-\alpha-\beta)e^*+(I-\mu-\beta)X_d+(I-\mu)X_r)=X$

Where:

I = an identity matrix of industry by industry dimension

D = a matrix of coefficients representing commodity output proportions

B = a matrix of coefficients representing commodity input proportions (technical coefficients) by industry

μ = a diagonal matrix whose elements represent the ratio of imports to use

α = a diagonal matrix whose elements represent the ratio of government production to use

β = a diagonal matrix whose elements represent the ratio of inventory withdrawals to use

e^* = final demand categories of consumption, government purchases of goods and services, business and government investment, and inventory additions.

X_d = final demand category of domestic exports

X_r = final demand category of re-exports.

¹⁹ Statistics Canada. 2016 Census of Population.

Appendix C: Mixed Endogenous-Exogenous Input-Output Impacts

In a three-industry by three-industry input-output model with industry 3 exogenized, endogenous industry output, and final demand X^M ,

$$\begin{pmatrix} X_1 \\ X_2 \\ Y_L \\ 3 \end{pmatrix}$$

is calculated as follows:

$$X^M = M^{-1} Y^M$$

Where $M =$

$$\begin{pmatrix} (1-a^{L11}) & -a^{L12} & 0 \\ -a^{L21} & (1-a^{L22}) & 0 \\ -a^{L31} & -a^{L32} & -1 \end{pmatrix}$$

$$a^L = (D(I-\mu-\alpha-\beta)B)$$

$Y^M =$

$$\begin{pmatrix} Y_1^L + a_{13}^L X_3 \\ Y_2^L + a_{23}^L X_3 \\ -(1-a_{33}^L) X_3 \end{pmatrix}$$

$$Y^L = D((I-\mu-\alpha-\beta)e^* + (I-\mu-\beta)X_d + (I-\mu)X_r)$$

Where:

I = an identity matrix of industry by industry dimension

D = a matrix of coefficients representing commodity output proportions

B = a matrix of coefficients representing commodity input proportions (technical coefficients) by industry

μ = a diagonal matrix whose elements represent the ratio of imports to use

α = a diagonal matrix whose elements represent the ratio of government production to use

β = a diagonal matrix whose elements represent the ratio of inventory withdrawals to use

e^* = final demand categories of consumption, government purchases of goods and services, business and government investment, and inventory additions.

X_d = final demand category of domestic exports

X_r = final demand category of re-exports.

Appendix D: Developing North- and South- Level Input-Output Models

This project used the latest available provincial input-output tables at the S-level from Statistics Canada as a starting point. The table represents 25 industries and 18 components of final demand (based on the 2014 S-level aggregation). The tables were converted into industry-by-industry space.

In a square input-output table, each industry in the table can be represented as a column. For example, industry 1 can be represented as follows:

$$\begin{pmatrix} z_{11} \\ z_{12} \\ \cdot \\ \cdot \\ \cdot \\ z_{125} \\ W_1 \\ X_1 \end{pmatrix}$$

z_{ij} = purchases by industry i of products from industry j . The transactions matrix consists of z_{11} to z_{2525} , comprising a transactions matrix of 625 (25 x 25) elements.

W_1 = value added or gross domestic product component of industry 1's output, which includes wages, salaries, supplementary labour income, unincorporated business profits, incorporate income profits, other income, and depreciation.

X_1 = industry 1's total output, which equals W_1 plus the sum of z_{11} to z_{125} .

To create sub-provincial models, four challenges must be overcome:

- 1) Allocating provincial gross output by community/region
- 2) Estimating technical coefficients by industry at a community/regional level
- 1) Estimating components of GDP by industry at a community/regional level
- 2) Allocating provincial final-demand output by community/region.

Census data on labour force by industry is used to allocate gross output by industry for the region/community. Regional gross output for industry i is estimated:

$$X_i^R = \text{Labour Force}_i^R / \text{Labour Force}_i^{\text{Mb}} \times X_i^{\text{Mb}}$$

Where:

X_i^R = regional gross output for industry i

Labour Force_i^R = regional labour force for industry i

$\text{Labour Force}_i^{\text{Mb}}$ = provincial labour force for industry i

X_i^{Mb} = provincial gross output for industry i

To estimate items in each regional transaction matrix (z_{ij}^R), it is assumed in all cases that the provincial input structure applies to regional industries.

The components of the regional transaction matrix are estimated:

$$z_{ij}^R = z_{ij}^{\text{Mb}} / X_i^{\text{Mb}} \times X_i^R$$

Where:

z_{ij}^R = an element of the regional transactions matrix.

z_{ij}^{Mb} = the corresponding element of the provincial transactions matrix.

The same methodology is used for estimating the components of GDP.

$$W_i^R = W_i^{\text{Mb}} / X_i^{\text{Mb}} \times X_i^R$$

Where:

W_i^R = regional value added or gross domestic product component of industry i 's output

W_i^{Mb} = provincial value added or gross domestic product component of industry i 's output

The components of final demand are estimated as follows:

$$PE_i^R = PE_i^{Mb} / \text{Pop}^{Mb} \times \text{Pop}^R$$

Where:

PE_i^R = Regional personal expenditure on industry i 's output

PE_i^{Mb} = Provincial personal expenditure on industry i 's output

Pop^{Mb} = Provincial population

Pop^R = Regional population

Personal expenditures are based on a per-capita allocation of provincial spending.

Gross fixed capital formation (GFCF) or investment by industry is estimated applying the regional share of industry to total provincial gross capital formation for each industry. The same approach is used to estimate exports (Xd), imports (M), and inventory changes by industry (VPC):

$$GFCF_i^R = X_i^R / X_i^{Mb} \times GFCF_i^{Mb}$$

$$Xd_i^R = X_i^R / X_i^{Mb} \times Xd_i^{Mb}$$

$$M_i^R = X_i^R / X_i^{Mb} \times M_i^{Mb}$$

$$VPC_i^R = X_i^R / X_i^{Mb} \times VPC_i^{Mb}$$

Where:

$GFCF_i^R$ = Regional investment spending on industry i 's output.

$GFCF_i^{Mb}$ = Provincial investment spending on industry i 's output

Xd_i^R = Regional exports of industry i 's output

Xd_i^{Mb} = Provincial exports of industry i 's output

M_i^R = Regional imports of industry i 's output

M_i^{Mb} = Provincial imports of industry i 's output

VPC_i^R = Regional inventory changes of industry i 's output

VPC_i^{Mb} = Provincial inventory changes of industry i 's output

Regional public administration employment is used to allocate provincial government current expenditures by region.

$$GCE_i^R = PAE^R / PAE^{Mb} \times GCE_i^{Mb}$$

Where:

GCE_i^R = Regional government current expenditures on industry i's output

PAE^R = Regional public administration labour force

PAE^{Mb} = Provincial public administration labour force

GCE_i^{Mb} = Provincial government current expenditures on industry i's output

It is also necessary to adjust for leakages for intra-provincial imported factors of production.

These are estimated residually: If the sum of the use (both final demand and inter-industry sales) of industry i's output is less than X_i , then intra-provincial exports are used to balance. Similarly, if use is greater than X_i , then intra-provincial imports are used to balance.

Intra-provincial exports/imports and exports due to out-shopping are estimated by calculating the marginal propensity to out-shop (the ratio of major community per capita retail sales to provincial per capita retail sales) and multiplying by planned expenditure (PE). Imports and exports are adjusted by this amount.

The estimation of intra-provincial imports into a region/community and the incorporation of intra-provincial imports into the region/community model's leakages will constrain local multipliers to values not exceeding provincial-level multipliers.

Developing Community/Regional Impact Models

Industry outputs (X) in response to a shock in final demand are calculated as $(I-(I-\mu-\alpha-\beta)A)^{-1}((I-\mu-\alpha-\beta)e^*+(I-\mu-\beta)X_d+(I-\mu)X_r)=X$

Where:

I = an identity matrix of industry by industry dimension

A = a matrix of technical coefficients representing inter-industry purchases (z_{ij}) divided by own industry gross output X_i .

μ = a diagonal matrix whose elements represent the ratio of imports to use

α = a diagonal matrix whose elements represent the ratio of government production to use

β = a diagonal matrix whose elements represent the ratio of inventory withdrawals to use

e^* = final demand categories of consumption, government purchases of goods and services, business and government investment, and inventory additions.

X_d = final demand category of domestic exports

X_r = final demand category of re-exports.

Employment is calculated as a fixed number of positions per dollar of industry output.

GDP components are calculated based on a fixed ratio of W_i to industry output.



Full report available:
www.indigenouststrong.ca
www.brandonu.ca/rdi/projects/indigenous-economy