Economic Impact Assessment
Nova Scotia Highway Construction Program

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Prepared for:
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Executive Summary

This report provides an economic impact assessment of the proposed $1.889 billion (2015$) Nova Scotia highways twinning project. A construction project of this size has significant economic importance to the provincial economy. The report measures the direct and total contribution of the twinning project to provincial household income, employment and provincial output (Gross Domestic Product).

The approach used in this report is an input-output impact assessment of expenditure flows. First the direct impact of the sector is documented. This is followed by simulations with the input-output model to estimate total impacts.

Based on simulations with the Nova Scotia input-output model, the economic impact of the project construction phase is significant. The project creates:

- Direct household income of $414.8 million and total household income of $674.0 million.
- Direct employment of 8,361 and total employment of 13,856.
- Direct gross domestic product of $453.7 million and total gross domestic product of $933.3 million.

The operations phase for the project provides, on an annual basis the following key economic impacts:

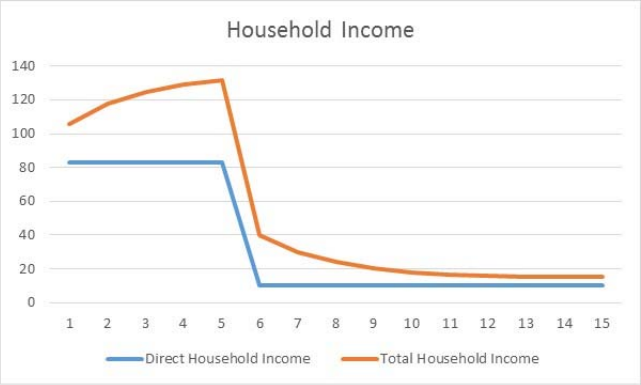
- Direct household income of $10.4 million and $15.6 million total household income.
- Direct employment of 211 and total employment of 340.
- Direct Gross Domestic Product of $12.3 million and total Gross Domestic Product of $22.1 million.

The proposed Highway Twinning Program represents a significant project for the Nova Scotia economy. For illustrative purposes, we assume a five-year construction period and a ten-year operation period. The total economic impact over the first fifteen years is as follows:

- Direct GDP of $576.7 million and total GDP of $1,142.20 million.
- Direct household income of $515.8 million and total household income of $820.6 million.
- Direct employment of 10,471 and total employment of 17,096.

On an annual basis, the average over the 15-year period is as follows:

- Total GDP: $76.1 million
- Total household income: $54.71 million
- Total employment (full time equivalents): 1,140



Chapter One – Introduction

1.1 Study Purpose

This report provides an economic impact assessment of the proposed $1.889 billion (2015$) Nova Scotia highways twinning project. A construction project of this size has significant economic importance to the provincial economy. The report measures the direct and total contribution of the twinning project to provincial household income, employment and provincial output (Gross Domestic Product).

The economic impact of the twinning project is provided for the construction phase of the project and the operations phase. Total economic impacts are provided on a 15-year time profile of the provincial economy.

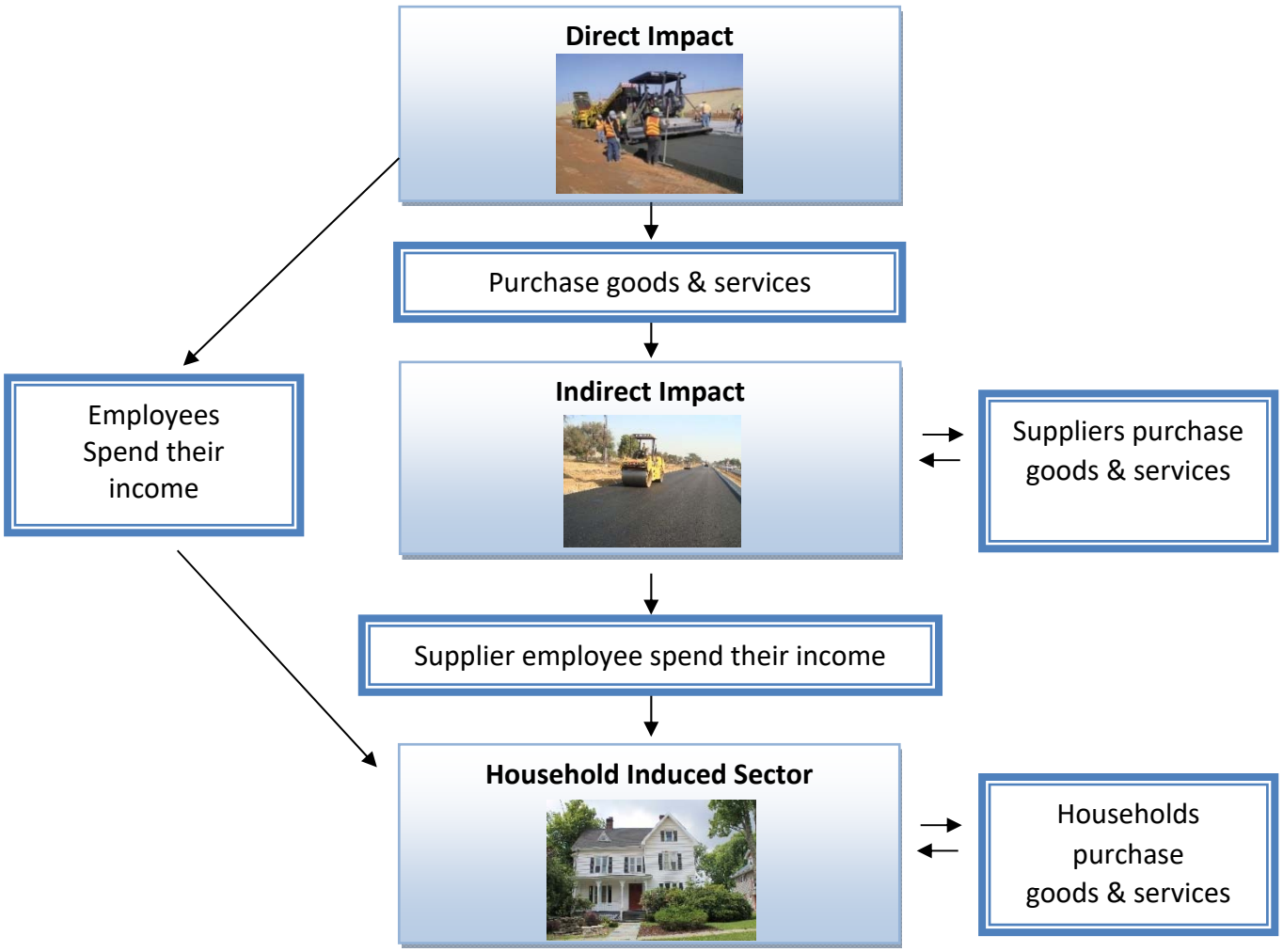
1.2 Methodology Overview

The approach used in this report is an input-output impact assessment of expenditure flows. First the direct impact importance of the sector is documented. This is followed by simulations with the input-output model to estimate total impacts.

The direct sector impact is specified by key performance indicators for each component. These are –household income, Gross Domestic Product (consistent with I-O definitions) and direct employment (full time equivalent).

The total economic impact consists of the direct, indirect and induced impacts. Indirect and induced impacts are obtained from simulations with the latest Statistics Canada data. Figure 1.1 illustrates the process. The first step is to convert the direct sector data into the social accounting framework used by the I-O system. The next step is to structure the simulation appropriately to ensure that double counting of forward and backward linkages are avoided. The final step is simulation with the latest Statistics Canada I-I Model.

Figure 1.1: I-O Model Process



Canmac's advanced modelling capability provides more accurate impact measurements than a traditional stand-alone I-O approach. Canmac provides dynamic impacts – showing how the traditional impacts change overtime. An appendix provides a sensitivity analysis of the report's impact.

1.3 Report Outline

The report consists of three chapters (including the present one) and supporting appendices. Chapter Two is the main analytical chapter. It presents the total economic and fiscal impacts that result from the economic model simulations. Chapter Three provides concluding comments on the impact results. Appendices provide 1) a discussion of the Nova Scotia Input-Output Model strengths and limitations, 2) definition of terms, and 3) more detailed results.

Chapter Two – Highway Twinning Economic Impact Analysis

2.1 Introduction

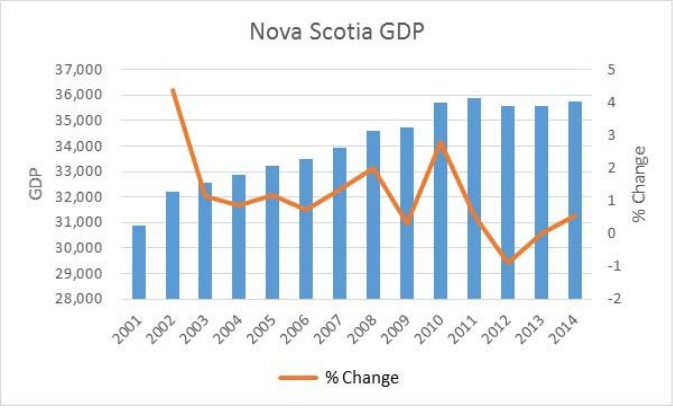
This chapter sets out the economic impact results. Section 2.2 provides an overview of the industry sector in the Nova Scotia economy. Section 2.3 presents the economic model simulation results for the economic impact of the project. Section 2.4 provides an industry impact. Section 2.5 presents the fiscal impact measurement.

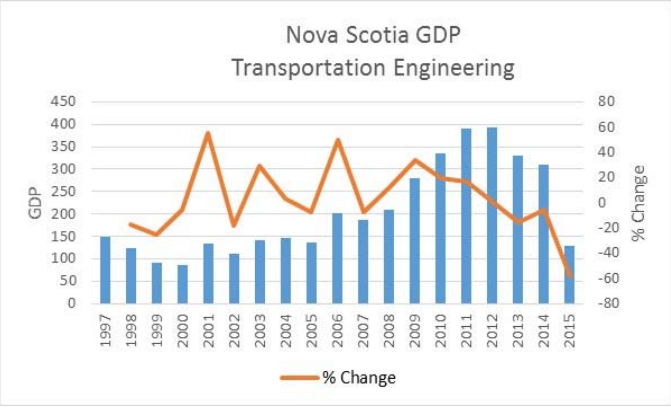
2.2 Sector Overview

Construction of Nova Scotia's highways and bridges is defined by Statistics Canada within the Nova Scotia transportation engineering construction sector. As show in Chart 2.1, this sector has shown average growth of 3.20% over the 1997 – 2015 period. Over the 2001-2014 period Nova Scotia GDP has had average growth of 1.15.

Chart 2.1: Nova Scotia Transportation Engineering Construction

Gross Domestic Product (Millions $) and Percent Change

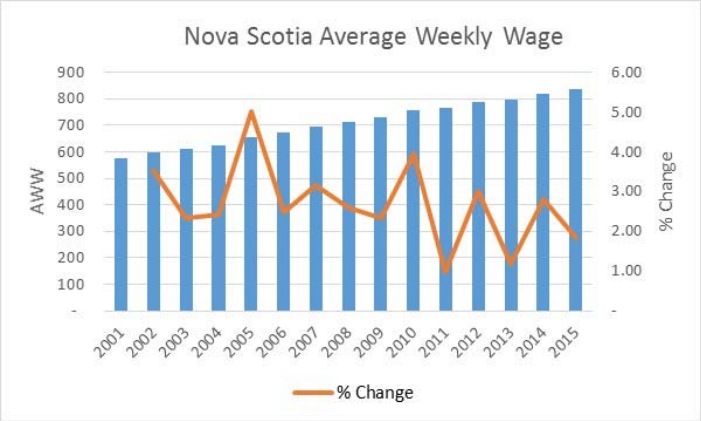


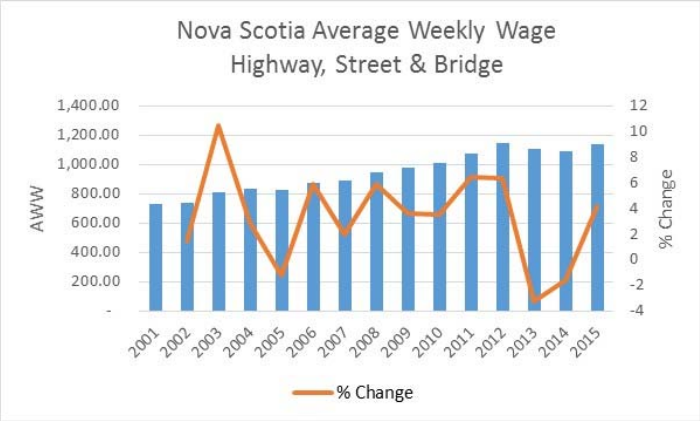


Source: Statistics Canada, Canmac Economics Ltd.

The highway, street and bridge sector average weekly wage was $725.58 in 2001 and reach $1,135 in 2015. Average annual sector wage growth was 3.31% with Nova Scotia's growth at 2.69%. The Nova Scotia highway, street and bridge construction sector's wage rate was 36% above the corresponding Nova Scotia figure in 2015.

Chart 2.2: Nova Scotia Average Weekly Wage and Percent Change

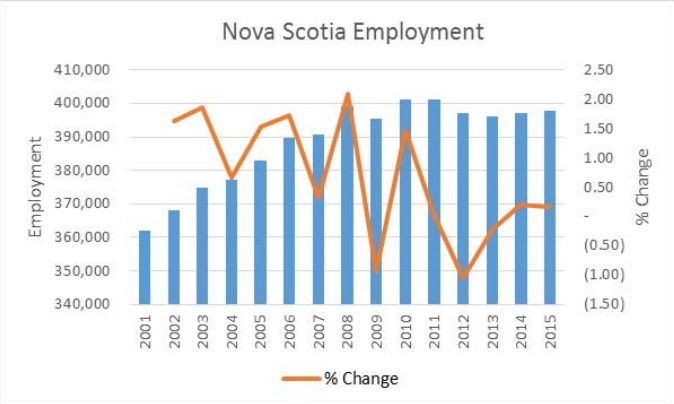


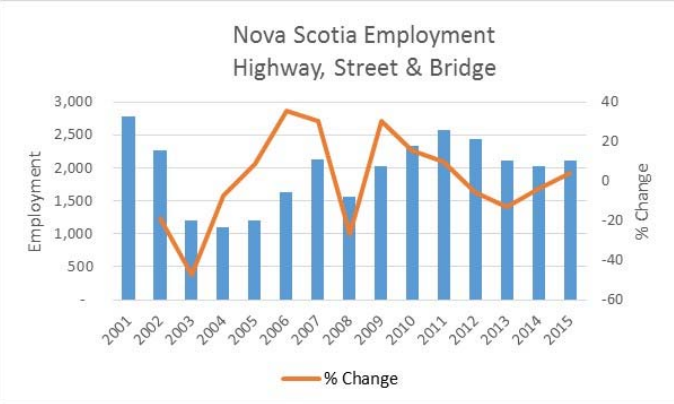


Source: Statistics Canada, Canmac Economics Ltd.

Average annual employment for the sector was 2,788 in 2001 and 2,116 by 2015. Employment average annual growth was .83% with the corresponding figure for Nova Scotia was .68%. Statistics Canada provides estimates of employees for the Highway, Street and Bridge sector. This estimate excludes owners of businesses who are working. This is a substantial component of total employment for the construction sector. For 2015 using the construction sector ratio of total employment to employees, the total employment for the Highway, Street and Bridge construction subsector would be 3,187. (The Nova Scotia Road Builders Association has total employment at an estimated 5,000 – the difference with the Statistics Canada number is likely due to different definitions of which firms are included in the sector.)

Chart 2.3: Nova Scotia Employment and Percent Change





Source: Statistics Canada, Canmac Economics Ltd.

Whereas average annual growth in the Nova Scotia highway, street and bridge sector is on a par with the Nova Scotia economy volatility in growth is much stronger. The Nova Scotia transportation engineering sector – *stronger growth but more volatile!*

Nova Scotia - Annual

GDP Smallest Growth Rate

-.88%

GDP Largest Growth Rate

+5.28%

Wage Smallest Growth Rate

+.96%

Wage Largest Growth Rate

+5.03%

Employment Smallest Growth Rate

-1.05%

Employment Largest Growth Rate

+1.86%

Nova Scotia Transportation Engineering

GDP Smallest Growth Rate

-41.60%

GDP Largest Growth Rate

+43.44%

Wage Smallest Growth Rate

-3.22%

Wage Largest Growth Rate

+10.50%

Employment Smallest Growth Rate

-47.15%

Employment Largest Growth Rate

+30.10%

2.3 Economic Impact

The economic impact of the Nova Scotia proposed highway twinning project is presented in two phases – phase 1 is the construction activity impact; phase 2 is the operations phase impact. The project costing are D class estimates and accordingly should be treated as an approximate order of magnitude. Costs are provided in 2015 dollars and include a 30% contingency. The project costs, provided by Nova Scotia's Transportation, Infrastructure and Renewal Department are as follows:

- The construction phase cost is $1.8892 billion dollars. Canmac estimates that the project construction activity will last five (5) years.
- The operations phase will see estimated annual expenditures of $31.5 million dollars over a 30-year period for repair and maintenance.

Canmac's input-output model computes the direct impact of the highway twinning project and then simulates the transmission of the direct expenditures within the Nova Scotia economy to measure the total economic impact. The economic impact of the 1.8892 billion construction phase is significant. The project creates:

- Direct household income of $414.8 million and total household income of $674.0 million.
- Direct employment of 8,361 and total employment of 13,856.
- Direct gross domestic product of $453.7 million and total gross domestic product of $933.3 million.

The operations phase for the project provides, on an annual basis the following key economic impacts:

- Direct household income of $10.4 million and $15.6 million total household income.
- Direct employment of 211 and total employment of 340.
- Direct Gross Domestic Product of $12.3 million and total Gross Domestic Product of $22.1 million.

2.4 Industry Impact

The economic impact of the project impacts significantly on various industries in Nova Scotia. The impact on increases in industry Gross Domestic Product for the top six industries are as follows:

	GDP (Millions $)
Construction	$489.26
Finance, insurance, real estate and rental leasing	$131.08
Retail trade	$49.68
Professional, scientific and technical services	$34.20
Wholesale trade	$32.58
Miscellaneous manufacturing	$27.80
Total	$764.6

The top six industries account for 80% of the total Nova Scotia GDP impact.

2.5 Fiscal Impact

Table 2.3 shows the estimated fiscal impact of the Highway Twinning Program for the construction phase and a one year annual operations phase. Estimates of fiscal impact use effective tax rates. Overall, the construction phase creates $197.6 million in government revenues. Each year of operations (repair and maintenance) provides $4.6 million in government revenue.

Table 2.3 – Government Fiscal Impact Revenues by Main Source

Construction and Annual Operations

	Federal	Provincial
Construction		
Income Tax	$66,298,684	$42,724,186
Other Tax	$32,246,182	$56,355,162
Total Tax	$98,544,866	$99,079,348
Operations		
Income Tax	$1,534,510	$988,868
Other Tax	$746,351	$1,304,362
Total Tax	$2,280,861	$2,293,230

**Totals may not sum due to rounding*

Chapter 3 – Summary and Conclusions

3.1 Summary

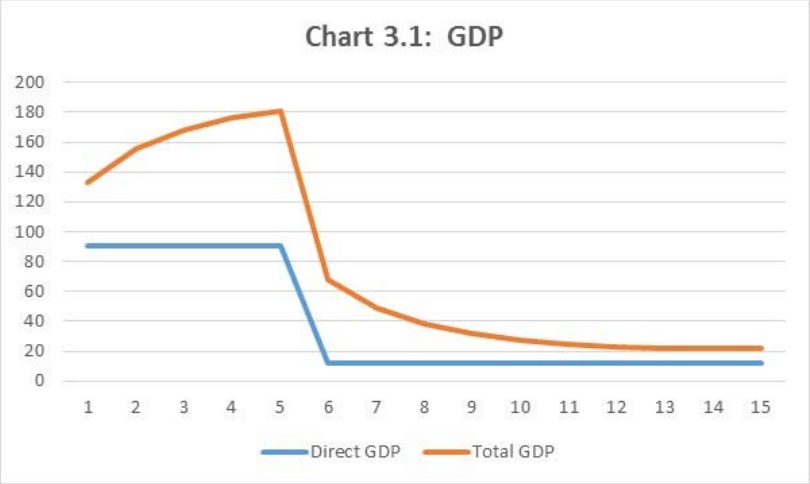
The proposed Highway Twinning Program represents a significant project for the Nova Scotia economy. Charts 3.1 to 3.3 show the expenditure impacts for the first 15 years. For illustrative purposes, we assume a five-year construction period and a ten-year operation period. Chart 3.1 presents GDP output, Chart 3.2 presents household income and Chart 3.3 presents employment (full time equivalents). The total economic impact over the first fifteen years is as follows:

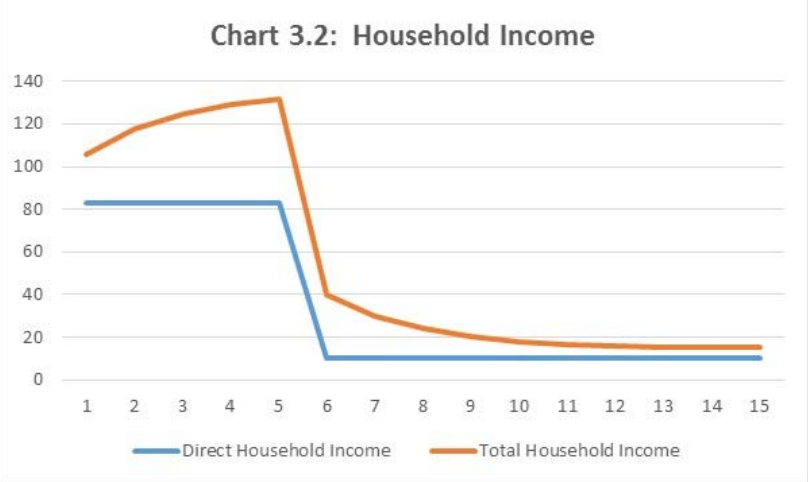
- Direct GDP of $576.7 million and total GDP of $1,142.20 million.
- Direct household income of $515.8 million and total household income of $820.6 million.
- Direct employment of 10,471 and total employment of 17,096.

On an annual basis, the average over the 15-year period is as follows:

- Total GDP: $76.1 million
- Total household income: $54.71 million
- Total employment (full time equivalents): 1,140

Nova Scotia Twinning Project
Economic Impact
Time Profile





3.2 Conclusion

This report provides what is known as an expenditure based impact assessment. It provides an estimate of the economic importance of the project to the Nova Scotia economy. As shown above, the project represents a significant injection into the provincial economy. Recent Nova Scotia GDP growth has been stagnant and exhibiting one of the poorest growth rates of any Canadian province. This project represents an important fiscal stimulus to the provincial economy at a time when such a stimulus is sorely needed.

There is one qualification to the impact estimates that should be noted for policy purposes. The impact metrics presented are total impacts. The size of the net benefits of the impact to the Nova Scotia economy depends on the type of financing for the project. The extent the project is financed from external sources such as the federal government or private industry then the greater the net benefits. The extent the project is funded from internal sources (taxes, provincial debt financing) lowers the impact. For example, if the project is financed by raising personal income taxes then this income would have been spent by households in the local economy and depending on the size of the multiplier would have created GDP, income and employment at any rate.

Another important aspect of the impacts is their distributional benefits. The proposed projects have a wide distribution across the province. In particular, rural areas have less economic options than urban areas. Hence the project provides important rural economic benefits.

Finally, as noted above, we have provided an expenditure based impact. There are also important output benefits from the project; namely, safety benefits and travel time savings. These benefits will be documented when the more detailed engineering estimates are developed.

Appendix A – Limitations to I-O Models

An input-output model, like any model, is an approximation to reality. It is built on assumptions that are never fully realized in the real world. While most analysts are well aware of the limitations of any I-O model it may be helpful to the general reader to review these limitations.

INPUT-OUTPUT LACKS AN EXPLICIT TIME DIMENSION

An input-output system provides a snapshot of an economy for a period of time (usually a one-year period). If the economy is in disequilibrium, all future uses of the tables and the related impact models will reflect the structural implications of the atypical year.

Multiplier effects do occur over time. However, the impact models associated with input-output systems imply that the multiplier effects are virtually instantaneous. There is some evidence to show that the multiplier effects take from two or three years to move through an economy.

SENSITIVITY TO RELATIVE PRICE CHANGES

Relative prices between commodities will change from the base year of model construction to the period in which the model is used. Therefore, the analysis of projects via input-output analysis in the future will reflect one set of relative prices, while the direct requirements coefficients in the tables reflect the relative prices of the base year. If the relative price changes are not accounted for, future data supplied to the impact model will produce "incorrect" impact results.

For example, say, in 1984 an industry required $100 of lumber for every $1,000 of output (i.e. 10 percent of inputs). If an analysis of the same industry were conducted in 2011, prices for the same volume of lumber may have increased to $150 while inflation on all other inputs was only 10 percent. Therefore, the total output value (for the same amount of production) is now $1,140, of which lumber is 13.2 percent of inputs. The relative price change in lumber has caused an increase in the size of its technical coefficient. Using unadjusted data in the 2011 model would produce incorrect impact results to the extent that relative prices change.

CONSTANT TECHNOLOGY

As mentioned earlier, the input-output system is a static model. However, times change and so do the technologies used. To mitigate this limitation, most input-output systems are updated on a periodic basis. The PEI Input-Output system has been updated over the years. Such an update picks up any technology changes in the economy. Between updates no changes in technology are assumed.

CONSTANT RETURNS TO SCALE

Input-output systems assume constant returns to scale; that is, all inputs change in the same proportion as any change in an industry's output. This assumption implies that even for one-dollar increase in sales, the model will show impacts on wages, salaries and employment associated with the multiplier effects. However, common sense tells us that this is not true. Such a small increase would not necessarily cause, especially in the short run, generation of a commensurate increase in wages or employment. However, in the long run, it can be assumed that even a small increase in final demand will produce the multiplier effects estimated by an input-output system.

In the short run, industries can draw on inventories, use their labor more efficiently, etc. to increase output with limited impact effects. However, if the new level of final demand is maintained, then firms in the long run will move back to their historical steady-state level of the utilization of factors of production. In the long run, increases in, say, household income due to increases in final demand will reflect the technical coefficients' relationship between income and output modeled in the input-output system.

NO SUPPLY CONSTRAINTS

Input-output systems assume that whatever is demanded by industries as inputs can be supplied. They assume no productive capability constraints. This problem is not significant when there is excess capacity in an economy. However, when economies are operating at or near capacity, this limitation is important. The multipliers for an economy near capacity will be underestimated. This is because increased final demand will require new capital investment whose own direct and multiplier effects are not captured within the standard input-output system.

FIXED CONSUMPTION PATTERNS

The consumption patterns that result in household re-spending multipliers are assumed to be fixed and linear. As Canadians become "better off" they redirect real growth in income to savings and luxury consumption. Because the input-output system is static, it does not model the effect of non-linear patterns in household consumption (as real incomes increase) within its multiplier estimates. This problem is partially overcome by regularly updating input-output systems.

CONCLUSION

Although the list of limitations may appear long, a similar or longer list is associated with almost any form of economic analysis. The limitations occur in different areas in other analytical tools. No one economic model is expected to provide the comprehensive "answer". Economic analysis techniques should be used in a complementary fashion to appreciate the full scope of a problem. In a very real sense, then, quantitative economic models should be used to examine the structural implications of changes in an economy and should not be treated as providing "the" answer.

Appendix B – Glossary of Terms

Glossary of Terms

Direct Impact

All 'first round' economic activities which contribute to GDP, employment, household income. These can vary from investment in a new or expanded facility to wages paid to employees directly involved in production of the operation for which an impact statement is required.

Gross Domestic Product (GDP)

The measure of economic activity in an economy, in this case the Nova Scotia economy. GDP measured on an expenditure basis is expressed as:

GDP = C + G + I + X - M

where:

C = Personal consumption (expenditure) of goods and services.
G = Government expenditures on goods and services.
I = Investment in capital, machinery equipment and inventories.
X = Exports of goods and services.
M = Imports of goods and services.

GDP is also measured on an income basis and consists of :

- labour income
- corporate profits before taxes
- interest and investment income
- net farm income
- unincorporated business income
- inventory valuation adjustment
- indirect taxes less subsidies
- capital consumption allowance

Gross domestic product of an industry is the value added by labour and capital in transforming inputs purchased from other producers into outputs.

Indirect Impact

All 'subsequent rounds' of economic activities which contribute to GDP, employment, household income. These activities are not directly associated with the production activity but are a result of direct production activities. These indirect contributions also include 'induced contributions' which measure the economic activity associated with the respending of wages paid in the direct, indirect, and to a lesser extent earlier rounds of induced activity.

Input-Output (I-O)

The input-output model measures the wide economic impact of a direct economic event by the known inter-industry dependency in the given economy. Different sectors of an economy depend on other sectors of the economy to supply its inputs or purchase its output to varying degrees. The imbalance in this supply/demand relationship is made up by imports (supply) and exports (demand).

The input-output model measures total economic activity defined as direct + indirect + induced activities. For an explanation on direct, indirect and induced activity see preceding GDP definition.

Input-Output Multipliers

Relate the indirect and induced impact by industry to the direct increase or reduction of the output of a given industry. The sum of all industries indirect and induced impacts plus the direct industry impact equals the total impact.

Multipliers are produced for output, income, GDP, and employment.

Appendix C – Interval Estimates of Results

Input-output multipliers use average multipliers for a given industry sector as the estimate of the industry's economic impact. The averages represent best point estimates of the impacts.

An estimate of lower and upper bounds on the construction impact multipliers used in the text is provided in Table C1. Using the standard deviation of the 205 firm multipliers provided by Statistics Canada as an estimate of the range for individual firm multiplier, then we estimate that 95% of the time the impact multipliers will fall between the lower and upper bounds provided in Table C1.

Table C1 – Interval Estimates

	Lower Band	Upper Band
Total Gross Domestic Product	.689	.751
Total Household Income	.489	.551
Total Employment	9.61	11.77
Note 1: variances used to calculate the intervals are estimated as the variance of multipliers relative to the global average.		