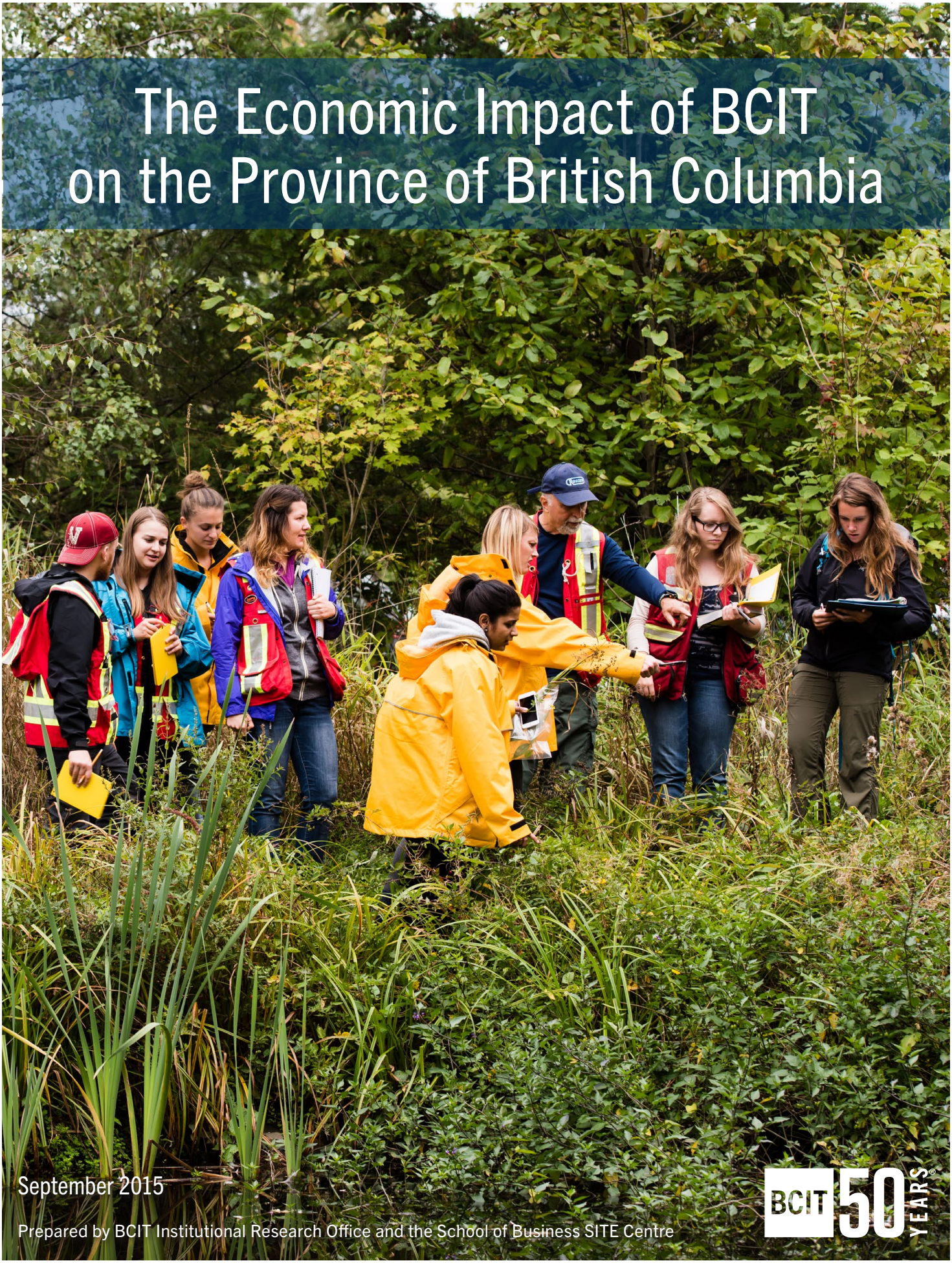
The Economic Impact of BCIT on the Province of British Columbia



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Prepared by BCIT Institutional Research Office and the School of Business SITE Centre

BCIT 50 YEARS

Cover: Jace Standish, instructor, with Forest and Natural Areas Management students at Guichon Creek, Burnaby.

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FOREWORD

This report is the fourth edition of the BCIT® Economic Impact Study. The first report was produced in 2004, the second edition was released in 2007, the third report was produced in 2010, and the fourth report was produced in 2014. All four editions were produced through the collaborative efforts of the BCIT Institutional Research Office and faculty from the BCIT School of Business SITE Centre.

New to the fourth edition:

- The value of international students is included in the Impact of BCIT on the British Columbia Economy section. Prior reports did not separate the impact of domestic and international students.
- An updated section is included that looks explicitly at key sectors of the British Columbia economy and calculates BCIT's relative contribution of skilled workers in each sector.
- An updated section that looks more in-depth at the applied research economic impact and activities at BCIT.

EXECUTIVE SUMMARY

The British Columbia Institute of Technology® (BCIT) is a significant contributor to the British Columbia economy. The impact that BCIT has on both the gross domestic product (GDP) and government tax revenues comes from a variety of sources, all of which have a multiplier – or spillover – effect that far exceeds its annual operating budget. The purpose of this report is to summarize and quantify the economic value of BCIT to the provincial economy.

In any economic impact study, the results are sensitive to the choice of multiplier. An impact multiplier can reasonably range from 1 to 4. A relatively conservative multiplier of 1.49 was selected for this study. A value in this range is supported by the independent studies of provincial and regional multipliers. The multiplier value also allows for comparisons to the University of British Columbia, Simon Fraser University, and the University of Victoria, as the multipliers used for their economic impact studies are within this range.

Sources of Economic Value

BCIT's economic value added to the GDP is derived from three sources:

- Direct purchases by BCIT within the local economy and the income of its employees.
- The economic value added by its graduates.
- The economic contribution of its applied research programs.

BCIT Operations

In 2014, $190 million was spent on salaries and compensation. Direct spending on goods and services by BCIT was $82 million which resulted in $41 million being considered as local value added. In addition, approximately $147 million was spent by full-time students and BCIT's visitors.

The direct spending by BCIT, its staff, students, and visitors generated a short-term impact of $447 million. As a result, 9,673 jobs were supported, directly or indirectly, by BCIT.

BCIT Education

Apprenticeship Completers

In 2013, apprenticeship last level completers of BCIT earned $53 million annually. When compared to the income of high school graduates, this added an additional $25 million in income and over $8 million in tax revenues for the province. A BCIT completer will earn $3,341 more annually than system completers. In comparison, the 1,067 apprentice completers of BCIT will earn a premium of close to $4 million or 7 percent more than the system average income.

Diploma and Certificate Graduates

In 2013, diploma and certificate graduates of BCIT earned $178 million annually. When compared to the income of high school graduates, this added an additional $43 million in income and $14 million in tax revenues for the province. A BCIT graduate will earn $4,070 more annually than system graduates. In comparison, the 5,859 diploma and certificate graduates of BCIT will earn a premium of $24 million or 14 percent more than the system average income.

Degree Graduates

In 2013, degree graduates of BCIT earned $46 million annually. When compared to the income of high school graduates, this added an additional $24 million in income and $8 million in tax revenues for the province. A BCIT degree graduate will earn $13,780 more annually than system graduates (excluding research universities). In comparison, the 787 graduates of BCIT will earn a premium of $11 million or 27 percent more than the system average income.

Return on Investment to the Province of BC

In terms of a return on government investment, there was $4.47 million in regional economic activity per $1 million tax dollars invested at BCIT. In addition, there were 71 jobs created per $1 million tax dollars invested.

An important measure in public sector expenditures is the Return on Investment or ROI. This study applied internal rate of return calculations on block funding converted to cost-per-graduate in the three categories of apprenticeship, diploma, and degree. The ROI for apprenticeships is 32 percent, the ROI for diploma programs is 20 percent, and the ROI for degree programs is 27 percent.

The additional taxes paid by BCIT apprenticeship completers translate into a 47 percent return on the government's education funding to BCIT. When compared to the post-secondary system equivalent return of 42 percent, the "BCIT Premium" is 5 percent. Given that apprenticeship programing tends to be similar across all delivering institutions, no vast difference is to be anticipated.

The additional taxes paid by diploma and certificate graduates translate into a 14 percent return on the government's education funding to BCIT. When compared to the post-secondary system equivalent return of 8 percent, the BCIT Premium is 6 percent.

The additional taxes paid by degree graduates translate into a 58 percent return on the government's education funding to BCIT. When compared to the post-secondary system, excluding the research universities' equivalent return of 35 percent, the BCIT Premium is 23 percent.

BCIT's Contribution to the BC Economy by Sector

BCIT is a major contributor of skilled workers to key sectors of the British Columbia economy. In the construction, manufacturing, finance, insurance, and real estate sectors, BCIT produces more than one-third of all post-secondary credentials[1]. Overall, BCIT supplies 18 percent of all sector related credentials. The value of new hires with a BCIT credential was forecasted at $347 million for 2014, and estimated to have a total value for the next five years of $1.9 billion.

[1] These findings exclude the major research universities in BC.

The Overall Economic Impact of BCIT

The overall impact of BCIT on the economy is nearly three-quarters of a billion dollars ($763 million gross, and $579 million net impact). The totals are summarized as follows:

Summary of BCIT's Value Added to Economy

	GROSS INCOME	NET INCOME (millions)	TAX REVENUE
Value Generated from BCIT Operations	$447	$447	$77
Valued Added by BCIT Graduates	$277	$93	$31
Value Added by Applied Research	$39	$39	$7.3

INTRODUCTION

What is an Economic Impact Study?

The purpose of an economic impact study is to attempt to measure the magnitude of the contribution an organization, initiative, or policy has on society and the economy. While similar in design to a cost-benefit analysis, an economic impact study is usually broader in scope. At the most basic level it answers a simple question: "How would the economy be impacted if an institute like BCIT did not exist?" It is a simple question, but finding the answer can be rather complex. It requires looking at all direct and indirect effects and incorporating all private and social costs and benefits. It is not meant to be a tool for evaluation of individual programs, departments, or schools.

The British Columbia Institute of Technology (BCIT) is an engine of economic growth in the province of British Columbia. The magnitude of BCIT's operations, combined with the contribution to industry from its applied programs and applied research, is a major contributor to the provincial economy. The impact can be measured through additions to the gross domestic product, government tax revenue, and increases in both human and physical capital stock.

BCIT's Contribution can be Measured in Three Broad Categories:

- The addition to GDP arising from the purchases of goods and services, employment income of faculty and staff, and the local spending contributions of students and visitors.
- The value of a BCIT education as measured by the increased income and taxes of graduates.
- The economic value to government and industry of BCIT's applied research initiatives.

The purpose of this report is to calculate the net impact of each category for 2014. This includes any multiplier effects that arise from indirect job creation and secondary rounds of spending in the local economy. Determination of the spending impact of BCIT on the economy is based on the guidelines established by the American Council on Education (ACE) in 1971.[2] The methodology used is identical to that employed by Simon Fraser University, University of British Columbia, University of Victoria, and other post-secondary institutions to determine the economic impact of their operations.

In any economic impact study, the results are inherently sensitive to the choice of multiplier. An impact multiplier can reasonably range from 1 to 4, depending upon the structural characteristics of the regional and local economy at the time of the study[3]. A relatively conservative multiplier of 1.49 was selected for this report. A multiplier in this range has strong empirical support by independent studies of regional multipliers for the province of BC, thus giving greater validity to the final results. Further, the multiplier value employed allows for meaningful comparisons to institutes such as the University of British Columbia, Simon Fraser University, and the University of Victoria in any discussion of relative impact.

All of the data used in this report is publicly available. The primary sources were the BCIT Fact and Figures reports, the Ministry of Advanced Education website, Ministry of Labour and Citizens' Services (BC Stats) reports, and Statistics Canada census reports.

Considerations Beyond the Scope of the Report

This type of study is limited by both the availability of the data and the complexity of the linkages with the data. As such, certain aspects of BCIT are not included in the actual calculation of BCIT's economic impact, but are worthy of mention since their omission places a downward bias on the overall results.

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[2] See Caffrey, J., Isaacs, H.H. "Estimating the Impact of a College or University on the Local Economy". American Council on Education, Washington, 1971.

[3] Impact multipliers are highly sensitive to such variables as: current unemployment rates, capacity utilization ratios, and the adaptability of industries to sudden economic change. All such variables tend to fluctuate over the normal business cycle, thereby changing the magnitude of the impact multiplier.

The Qualitative Aspects of Part-Time Studies

BCIT supplies a significant amount of part-time studies courses and industry training to people currently in the workforce. These people are integrating the additional skills they acquire into their current professions. This implies an ongoing increase in labour productivity which further enhances the gross domestic product. Gains in labour productivity are typically measured by differentials in wages. The current available data only captures wage differentials by educational credential. Therefore, the ongoing nature of productivity gain due to part-time studies – or lifelong learning – is not measured in the calculations done for this report.

BRITISH COLUMBIA ECONOMIC IMPACT ASSESSMENT

This section employs a standard economic expenditure model that determines the economic impact of BCIT on the entire British Columbia economy resulting from cash flows, which are directly and indirectly attributable to the operations of BCIT. Cash flows originate through faculty and staff income, Institute direct purchasing, and expenditures by students and visitors to campus. A regional "multiplier factor" is used to account for spin-off effects on business volume in other sectors of the economy as a direct result of Institute-related expenditures.

In summary, the following economic impacts may be attributed to the British Columbia Institute of Technology:

Table 1
Summary of BCIT Expenditures and Economic Impact

	CASH INJECTION (000'S)	FIRST ROUND INCOME GENERATED (000'S)	REGIONAL ECONOMIC IMPACT (000'S)
Salaries and Wages	$157,482	$157,482	$234,648
Benefits	$32,367	$25,894	$38,581
Direct Local Spending	$81,811	$40,906	$60,949
Subtotal	**$271,660**	**$224,281**	**$334,179**
INDUCED EXPENDITURES			
Total Student Spending	$144,608	$74,485	$110,983
Total Visitor Spending	$2,000	$1,000	$1,490
Subtotal	**$146,608**	**$75,485**	**$112,473**
TOTAL	**$418,268**	**$299,766**	**$446,652**

Compensation of BCIT Personnel

The BCIT payroll reflects the total compensation associated with full-time and part-time faculty and staff who were actively employed. According to BCIT Consolidated Financial Statements, the Institute's financial statements reflect a total salaries, wages, and benefits outlay of approximately $-190 million[4] for the fiscal period that ended on March 31, 2014.

Direct Local Spending by BCIT

BCIT's financial statements indicate that approximately $82 million[5] was dispersed for the purchase of capital and operating goods and services. Of this amount, one-half, or $41 million, is considered to fall into the category of "local value added".

[4] The information is based on BCIT's Consolidated Statement of Operations from the Consolidated Financial Statements prepared by Grant Thornton for BCIT's Financial Services, March 31, 2014. The number has been rounded to the nearest million.

[5] The information is based on BCIT's Consolidated Statement of Operations from the Consolidated Financial Statements prepared by Grant Thornton for BCIT's Financial Services, March 31, 2014. The number has been rounded to the nearest million.

Student Expenditures

The expenditures of students, excluding tuition, books, and residence fees, were estimated on the basis of government-recognized costs and information provided by BCIT's Office of Student Financial Aid Services. In order to present a conservative estimate, non-BCIT expenditures of students are calculated on the assumption that only full-time students have an impact on the local economy. Based on available data, BCIT's 17,981 full-time students spent approximately $144 million annually.[6]

Visitors-to-BCIT Expenditures

The Institute attracts an estimated 50,000 visitors annually to its campuses.[7] Based on Tourism Vancouver's estimate that each visitor spends an average daily total of $40 off campus, BCIT is credited with generating an additional $2 million in local spending.

Total Direct Local Spending by BCIT

Local value-added ratios were applied to account for the value of imported inputs. It is estimated that 72 percent[8] of the initial cash injections, or equivalently approximately $300 million, was realized as a result of direct local spending by BCIT.

Provincial Multiplier Effect

The economic ripple-effect associated with direct spending by BCIT, its students, and visitors is captured by a multiplier. Several independent economic studies have provided a multiplier ranging from 1.39 to 2.0 for the BC economy. For purposes of this study, a conservative multiplier value of 1.49[9] was used to estimate the re-spending of dollars injected into the BC economy by BCIT, its students, and visitors.

IMPACT OF BCIT ON THE BRITISH COLUMBIA ECONOMY

BCIT is a major contributor to the BC economy, specifically the local economies within the Metro Vancouver region, both in terms of dollars injected and circulated within the economy, and job creation.

Total BC Economic Impact

The short-term economic impact resulting from BCIT operations is approximately $447 million.

Jobs Created (Directly or Indirectly)

The Institute supported, directly or indirectly, 9,673 jobs during the year. This figure is calculated by dividing the Institute's total direct and spin-off expenditures by $46,000, the average annual income of British Columbians.[10]

Taxes Returned to Government

Assuming an average annual income of $46,000, and the Federal and Provincial tax rates applicable to this income, the 9,672 jobs created by BCIT operations resulted in $147 million total taxes returned to government in the form of personal income taxes. Of this total, the British Columbia government realized $49 million in tax revenues.

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[6] The information is based on Enrolments by Student Groupings Report, BCIT Facts and Figures, the BC government's 2004 Student Living Allowance, and information provided by BCIT's Financial Aid and Awards Office.

[7] It is not possible to accurately estimate the number of visitors to the campuses as BCIT does not track this information. The estimated number is similar to that reported in other economic impact studies.

[8] The percentage of initial expenditures attributed to the local economy is referred to as the "Export Factor". If BCIT ceased to exist, the export factor counts for the portion of the economic activity attributed to BCIT that would be replaced by another institute and that portion of BCIT expenditure that would disappear from the province.

[9] This value is based on the income multiplier derived by Davis, C.H. "Income and Employment Multipliers for Seven British Columbia Regions", Canadian Journal of Regional Science, vol. 9:1, 1986, p. 103-115.

[10] The income figures are based on the data from the Provincial Comparison – Average Weekly Wage Rate, http://www.bcstats.gov.bc.ca/Publications/PeriodicalsReleases.aspx

Income Generated (per $1M tax dollars invested)

In fiscal year 2014, BCIT received $134,584,000[11] in Provincial Government grants. Based on this figure, for every $1 million taxpayer dollars spent at BCIT, the Province benefits through $3.32 million in regional economic activity.[12]

Jobs Created (per $1M tax dollars invested)

For every $1 million dollars spent by the Province, the British Columbia economy benefits from the creation of 71 jobs.[13]

Value of International Students

In 2013, BCIT attracted 2,236 students from other countries to study at the Institute. The majority of students were from Asia, representing over 60 percent of all international students with China (48 percent) and South Korea (9 percent) leading all other countries. The median age for international students was 25 to 29 with 84 percent of the students in the range of 18 to 29.

International student enrollment was divided with 47 percent of students in part-time studies, 23 percent in international student entry program (ISEP), 22 percent in full-time programs, and 7 percent in international programs. For the purpose of this study, international students may be double counted, as full-time students have the option to enroll in additional part-time studies courses.

Table 2
BCIT International Student Impact 2013-2014

Full-time	1,362
Part-time	1,231
Total students	2,236

(note: some full-time are also in part-time classes)

Total Tuition Expense	$10,902,500
Other Education Expenses (books, etc.)	$4,472,000
Total Living Expenses	$56,883,840
Total Spending by International	$72,258,340
Economic Impact of International	**$107,664,927**

The calculation of the economic impact for international students is summarized in Table 2. It is assumed an international student spends 1.25 times more on tuition compared to a domestic student. The total tuition expense for international students is approximately $11 million[14]. In addition, international students' living expenses are considered to be a 100 percent net injection into the BC economy, whereas domestic students would buy food and pay rent regardless of attending BCIT. This equates to the living expenses for all international students being approximately $57 million annually.

The total expenditure for international students is approximately $72 million. As a result, the total BC economic impact generated by international students is $108 million annually.

[11] The information is based on BCIT's Consolidated Statement of Operations from the Consolidated Financial Statements prepared by Grant Thornton for BCIT's Financial Services, March 31, 2014. The number has been rounded to the nearest million.

[12] Income Generated per $1 million tax dollars invested is derived from the BCIT Regional Economic Impact of $447 million divided by the 2013/14 Provincial Government Grants in the amount of $135 million.

[13] Jobs Created per $1 million tax dollars invested is calculated from the Income Generated per $1 million tax dollars invested and divided by the average annual income of British Columbians.

[14] Based on the average annual domestic tuition cost of $5,000 for a diploma and $6,000 for a degree.

The Export Factor[15]

This model provides a conservative method for estimating BCIT's impact on the regional/local economy, and as such offers a means of substantiating the findings in the British Columbia Economic Impact Analysis model.

The approach involves measuring the increment (addition) to the total value resulting from Institute operations. BCIT revenues and related spending which would occur, irrespective of whether or not the Institute existed in the local economy, are identified and deducted from cash flows attributed either directly or indirectly to BC economy model.

For example, local tax revenue spent in support of the Institute is not included in the calculations, as similar economic impacts may arise from reallocating these funds to other sectors within the local economy or by simply reducing taxes. In other words, from the community's perspective, Provincial financing using regional tax dollars is viewed as a transfer of wealth rather than wealth creation, and therefore does not represent a true economic gain.

The "Export Factor" in the table below reflects the proportions of revenue and spending, by category, which are attributable to BCIT operations and which would/could not be reallocated in the event the Institute did not exist.

Sources of Revenue	Export Factor
Provincial Government Grants and Contracts	90%
Student Fees	
"Non-Local/Regional"	100%
"Local/Regional"	43%
Sales of Services and Products	80%
Federal Government	
Sponsored Research Grants and Contracts	100%
Non-Government Sponsored Research Grants	100%
Gifts, Grants, and Bequests	52%
Visitor Spending On Campus	60%
Accommodation at a BCIT Residence	100%
Conference Facilities	50%
Non-Institute Student Spending	
"Non-Local/Regional"	100%
"Local/Regional"	43%

VALUING A BCIT EDUCATION

This section of the report calculates the additional income and tax revenues resulting from a BCIT education relative to a high school diploma (or equivalent). Further, the increase in value associated with a BCIT education is directly compared to the additional income and tax revenues resulting from an education received from other such BC certification-granting institutions, excluding the research universities. The difference between a BCIT education and the system equivalent is referred to as the BCIT Premium. This section also calculates the return on investment, specifically the payback period, associated with the Provincial Grants currently received by the Institute.

BC Student Outcomes Survey

Each year, BC Stats, on behalf of the Ministry of Advanced Education and the Post-Secondary Institutions, contacts former students about their educational and labour market experiences. Three different annual surveys make up BC Student Outcomes: Apprentice Student Outcomes Survey (APPSO); Diploma, Associate Degree, and Certificate Student Outcomes (DACSO); and the Baccalaureate Graduate Survey (BGS). The information collected in the BC Student Outcomes surveys are used for evaluation and program improvement, accountability, and making knowledgeable choices.

[15] For a more detailed explanation and breakdown of the "Export Factor" please see the 2005 edition of the Economic Impact of BCIT. Found at: http://www.bcit.ca/files/ir/pdf/2005_economic_impact_study.pdf.

The following tables (Tables 3A, 3B, and 3C) were taken from the BC Student Outcomes Surveys for Diploma, Associate Degree, and Certificate Student Outcomes (DACSO), Apprenticeship Student Outcomes (APPSO), and Baccalaureate Graduate Student Outcomes (BGS). When reporting "All BC Institutes", this includes all colleges, teaching-intensive universities, institutions, and agencies (excluding BCIT and the research intensive universities) within BC, and is referred to as "System-Wide" below. Unfortunately, comparisons to the research universities are unavailable due to limitations in data access for those institutions.

Table 3A
Apprenticeship Employment Outcomes Indicators

	SURVEY YEAR		
	2011	2012	2013
Eligible Cohort	1,498	1,569	1,435
Response Rate	55%	53%	58%
Currently Employed	**85%**	**91%**	**93%**
System-Wide	84%	86%	86%
Median Hourly Wage (Main Job)	**$28**	**$29**	**$30**
System-Wide	$26	$27	$27
Employed in Training Related Job	**94%**	**93%**	**93%**
System-Wide	90%	90%	90%

[16] *See footnote below for an explanation of the Apprentice category.*

Table 3B
Diploma and Certificate Employment Outcomes Indicators

	SURVEY YEAR		
	2011	2012	2013
Eligible Cohort	4,988	5,136	5,496
Response Rate	60%	61%	63%
Currently Employed	**78%**	**80%**	**79%**
System-Wide	75%	76%	76%
Median Hourly Wage (Main Job)	**$20**	**$20**	**$21**
System-Wide	$18	$18	$18
Employed in Training Related Job	**78%**	**80%**	**81%**
System-Wide	66%	66%	67%

[17] *See footnote below for an explanation of the Diploma and Certificate category.*

[16] The Apprenticeship Student Outcomes (APPSO) Survey is conducted by BC Stats on behalf of the public and private post-secondary institutions to collect feedback from those apprentices who completed their last level of training at the institution. The feedback asked of the former students includes aspects of their in-school experience and workplace training, usefulness of the knowledge and skills gained, satisfaction of their training, and labour market information. The survey takes place one to two years after completion of their final course.

[17] The Diploma, Associate Degree, and Certificate Student Outcomes (DACSO) Survey is conducted by BC Stats on behalf of the public post-secondary institutions to collect feedback from those graduates who received a diploma, associate degree, or certificate credential at those institutions. The feedback asked of the former students includes aspects of their in school experience, usefulness of the knowledge and skills gained, satisfaction of their education, and labour market information. The survey takes place one to two years after graduation of their program.

Table 3C
Degree Employment Outcomes Indicators

	SURVEY YEAR		
	2011	2012	2013
Eligible Cohort	488	461	632
Response Rate	62%	55%	59%
Currently Employed	**94%**	**92%**	**95%**
System-Wide	88%	88%	88%
Median Gross Salary (Main Job)	**$60,000**	**$63,350**	**$61,995**
System-Wide	$48,000	$48,000	$50,000
Employed in Training Related Job	**91%**	**95%**	**94%**
System-Wide	78%	80%	81%

[18] *See footnote below for an explanation of the Degree category.*

From these survey results, a three year average was calculated. For the purposes of the calculations in this section, the variables extracted for use in the estimation of the economic value added from education are summarized in Table 4A, 4B, and 4C.

Table 4A
Apprenticeship Three-Year Average Employment Outcomes

	ELIGIBLE COHORT	RESPONDENTS	CURRENTLY EMPLOYED	MEDIAN HOURLY WAGE (MAIN JOB)
BCIT	4,502	2,483	90%	$29
System-Wide	19,429	10,786	87%	$28

Table 4B
Diploma and Certificate Three-Year Average Employment Outcomes

	ELIGIBLE COHORT	RESPONDENTS	CURRENTLY EMPLOYED	MEDIAN HOURLY WAGE (MAIN JOB)
BCIT	15,620	9,626	79%	$20
System-Wide	82,570	45,675	76%	$18

Table 4C
Degree Three-Year Average Employment Outcome

	ELIGIBLE COHORT	RESPONDENTS	CURRENTLY EMPLOYED	MEDIAN ANNUAL SALARY (MAIN JOB)
BCIT	632	373	94%	$62,000
System-Wide	9,181	5,244	89%	$50,000

[19] *See footnote below for data source.*

Economic Value of a BCIT Education

To determine the economic value of education at BCIT, the following calculations were carried out, using both the BCIT and System-Wide median salary and the percentage of graduates who were currently employed at the time of the survey (Column 1, Tables 5A, 5B, 5C) which is one to two years after graduation.

[18] The Baccalaureate Graduate Survey (BGS) is conducted by BC Stats on behalf of the public post-secondary institutions to collect feedback from those graduates who received a degree credential at those institutions. The feedback asked of the former students includes aspects of their in school experience, usefulness of the knowledge and skills gained, satisfaction of their education, and labour market information. The survey takes place two years after graduation of their program. It is important to note that the Degree System-Wide results do not include the research universities (UBC, UBC-O, SFU, UVIC, UNBC).

[19] The information was taken from BC Stats Student Outcomes Reporting (SORS) database.

The additional income added as a result of high-school graduates obtaining an applied program credential (Column 2, Tables 5A, 5B, 5C) was calculated taking the difference between the average income of a high-school graduate (or equivalent) from the Statistics Canada (2000 Census, adjusted) and the BCIT and System-Wide rates (Tables 4A, 4B, 4C) and applying this differential to the BCIT graduate population.

Table 5A
Apprenticeship Value Added Income and Tax Revenue from 2013 BCIT Graduates[20]

	TOTAL INCOME	ADDITIONAL INCOME ADDED	ADDITIONAL TAXES
BCIT	$53,469,504	$25,496,611	$8,413,882
System-Wide	$49,904,870	$22,864,407	$7,545,254
Difference	**$3,564,634**	**$2,632,204**	**$868,627**
BCIT Premium (%)	7%	11%	11%
Per BCIT Graduate	**$3,341**	**$2,467**	**$814**

In 2013, 1,067 apprenticeship students completed the last level of their program.[21] These last level completers will earn $53 million annually. This amount is $3.6 million, or 7 percent, more than that earned by students elsewhere in the system. On a per-apprentice completer basis, a BCIT apprenticeship student will earn $3,341 more annually than a completer from elsewhere.

When compared to the earnings of 1,067 high-school graduates, BCIT apprenticeship completers will earn close to $27 million more annually as a result of having completed their training at BCIT. If these high-school graduates had received their post-secondary education elsewhere, the additional income would have been $23 million. The employment income advantage is $2.6 million. This equates to $2,467 per BCIT student annually relative to earnings of apprentices from other institutions offering similar program offerings.

Table 5B
Diploma and Certificate Value Added Income and Tax Revenue from 2013 BCIT Graduates[22]

	TOTAL INCOME	ADDITIONAL INCOME ADDED	ADDITIONAL TAXES
BCIT	$177,738,624	$42,910,327	$14,160,408
System-Wide	$153,890,150	$24,181,916	$7,980,032
Difference	**$23,848,474**	**$18,728,412**	**$6,180,376**
BCIT Premium (%)	14%	56%	56%
Per BCIT Graduate	**$4,070**	**$3,197**	**$1,055**

In 2013, BCIT graduated 5,859 students from its diploma and certificate programs.[23] These graduates will earn $177 million annually. This amount is $24 million, or 18 percent, more than that earned by students elsewhere in the system. On a per-graduate basis, a BCIT diploma or certificate holder will earn $4,070 more annually than a graduate from other public post-secondary teaching universities, colleges, or institutions.

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[20] Apprenticeship Programs: Values in each case for BCIT and System-Wide were calculated by using 1,067 apprentice last level completers multiplied by the appropriate average wage and weighted by the percentage of apprentices that were "currently employed" at the time of the survey.
Additional Income Added: Earnings per credential were compared to the average income of British Columbians with a high-school diploma and some post-secondary education, as reported by Statistics Canada 2000 (and adjusted to current dollars).

[21] The information is based on Overall Credentials Awarded Report, BCIT Facts and Figures.

[22] Diploma and Certificate Programs: Values in each case for BCIT and System-Wide were calculated by using 5,859 diploma and certificate graduates multiplied by the appropriate average wage and weighted by the percentage of graduates that were "currently employed" at the time of the survey.
Additional Income Added: Earnings per credential were compared to the average income of British Columbians with a high-school diploma and some post-secondary education, as reported by Statistics Canada 2000 (and adjusted to current dollars).

[23] The information is based on Overall Credentials Awarded Report, BCIT Facts and Figures.

When compared to the earnings of 5,859 high-school graduates, BCIT diploma and certificate graduates will earn $43 million more annually as a result of having earned this type of credential from BCIT. If these high-school graduates had received their post-secondary education elsewhere, the additional income would have been $24 million. The employment income advantage is $19 million. This equates to $3,197 per BCIT student annually relative to earnings of graduates from other public post-secondary institutions offering credentials.

Table 5C
Degree Value Added Income and Tax Revenue from 2013 BCIT Graduates[24]

	TOTAL INCOME	ADDITIONAL INCOME ADDED	ADDITIONAL TAXES
BCIT	$45,866,360	$24,317,066	$8,024,632
System-Wide	**$35,021,500**	**$14,618,445**	**$4,824,087**
Difference	$10,844,860	$9,698,621	$3,200,545
BCIT Premium (%)	27%	50%	50%
Per BCIT Graduate	**$13,780**	**$12,324**	**$4,067**

In 2013, BCIT graduated 787 students from its degree programs.[25] These graduates will earn $46 million annually. This amount is close to $11 million, or 27 percent, more than that earned by students elsewhere in the system excluding the research universities, as that data is unavailable for comparison. On a per-graduate basis, a BCIT degree holder will earn $13,780 more annually than a graduate from a different public BC post-secondary institution.

When compared to the earnings of 787 high-school graduates, BCIT degree graduates will earn $24 million more annually as a result of having earned a degree from BCIT. If these high-school graduates had received their post-secondary education elsewhere, the additional income would have been close to $15 million. The employment income advantage of attending BCIT is $10 million. This equates to $12,324 per BCIT graduate annually relative to earnings of graduates from other public institutions offering degree program credentials.

The Tax Revenue Advantage Associated with a BCIT Education

Using both the 2013 Federal and Provincial income tax rates, the increase in tax revenues due to the education received by BCIT and system graduates is calculated on the additional income earned by graduates (Tables 5A, 5B, 5C).

The 1,067 BCIT apprenticeship completers paid an additional $900,000, or 11 percent, more in personal income taxes than an equivalent number of apprenticeship completers from other educational institutions. On a per-completer basis, the differential is $814 annually.

The 5,859 BCIT diploma and certificate graduates paid an additional $6.2 million, or 56 percent, more in personal income taxes than an equivalent number of diploma and certificate graduates from other public post-secondary institutions. On a per-graduate basis, the differential is $1,055 annually.

The 787 BCIT degree graduates paid an additional $3.2 million, or 50 percent, more in personal income taxes than an equivalent number of degree graduates from other post-secondary institutions excluding the research universities. On a per-graduate basis, the differential is $4,067 annually.

Returns Associated with a BCIT Education

The tables below calculate the additional tax revenue which the two levels of government realize on BCIT graduates from apprenticeship, diploma, certificate, and degree programs. For comparison purposes, equivalent tax revenues have been provided for other credential granting institutions (with the exception of the research universities).

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[24] Degree Programs: Values in each case, BCIT and System-Wide, were calculated by using 787 degree graduates multiplied by the appropriate average wage and weighted by the percentage of graduates that were "currently employed" at the time of the survey.
Additional Income Added: Earnings per credential were compared to the average income of British Columbians with a high-school diploma and some post-secondary education, as reported by Statistics Canada 2000 (and adjusted to current dollars).

[25] The information is based on Overall Credentials Awarded Report, BCIT Facts and Figures.

Table 6A
Apprenticeship Annual Tax Revenue from BCIT and System Equivalent Education (2013 Completers)[26]

	BCIT ADDITIONAL TAX REVENUE/YEAR	SYSTEM-WIDE ADDITIONAL TAX REVENUE/YEAR	BCIT PREMIUM
Provincial Tax	$2,804,627	$2,515,085	$289,542
Federal Tax	$5,609,254	$5,030,170	$579,085
Total Government Return	**$8,413,882**	**$7,545,254**	**$868,627**

Table 6B
Diploma and Certificate Annual Tax Revenue from BCIT and System Equivalent Education (2013 Graduates)[27]

	BCIT ADDITIONAL TAX REVENUE/YEAR	SYSTEM –WIDE ADDITIONAL TAX REVENUE/YEAR	BCIT PREMIUM
Provincial Tax	$4,720,136	$2,660,011	$2,060,125
Federal Tax	$9,440,272	$5,320,021	$4,120,251
Total Government Return	**$14,160,408**	**$7,980,032**	**$6,180,376**

Table 6C
Degree Annual Tax Revenue from BCIT and System Equivalent Education (2013 Graduates)[28]

	BCIT ADDITIONAL TAX REVENUE/YEAR	SYSTEM-WIDE ADDITIONAL TAX REVENUE/YEAR	BCIT PREMIUM
Provincial Tax	$2,674,877	$1,608,029	$1,066,848
Federal Tax	$5,349,755	$3,216,058	$2,133,697
Total Government Return	**$8,024,632**	**$4,824,087**	**$3,200,545**

Tables 6A, 6B, and 6C indicate that BCIT provides the Provincial and Federal government with a tax premium of $10 million annually, relative to other credential granting institutions, with the Provincial share of this total being $3.4 million.

Table 7A
Apprenticeship Programs Returns as a Percentage of Block Funding (Tax Revenues)[29]

	BCIT ADDITIONAL TAX REVENUE/YEAR	SYSTEM-WIDE ADDITIONAL TAX REVENUE/YEAR	BCIT PREMIUM
Provincial Tax	16%	14%	2%
Federal Tax	32%	28%	4%
Total Government Return	**48%**	**42%**	**6%**

[26] Apprenticeship Additional Tax Revenue per Year: Values for BCIT and System-Wide were calculated using the 1,067 apprentice completers Additional Income Generated multiplied by the appropriate tax rates.

[27] Diploma and Certificate Additional Tax Revenue per Year: Values for BCIT and System-Wide were calculated using the 5,859 diploma and certificate graduates Additional Income Generated multiplied by the appropriate tax rates.

[28] Degree Additional Tax Revenue per Year: Values for BCIT and System-Wide were calculated using the 787 degree graduates Additional Income Generated multiplied by the appropriate tax rates.
BCIT Premium: The difference between BCIT and System-Wide in Additional Tax Revenues provided to the governments.

[29] Apprentice Programs Rates of Return on Block Funding (Tax Revenues): Values for BCIT and System-Wide were calculated using 1,067 apprentice completers Additional Tax Revenue for Federal and Provincial amounts divided by the Institute's Industry Training Authority (ITA) Block Funding.

Table 7B
Diploma and Certificate Programs Returns as a Percentage of Block Funding (Tax Revenues)[30]

	BCIT ADDITIONAL TAX REVENUE/YEAR	SYSTEM-WIDE ADDITIONAL TAX REVENUE/YEAR	BCIT PREMIUM
Provincial Tax	5%	3%	2%
Federal Tax	9%	5%	4%
Total Government Return	**14%**	**8%**	**6%**

Table 7C
Degree Programs Returns as a Percentage of Block Funding (Tax Revenues)[31]

	BCIT ADDITIONAL TAX REVENUE/YEAR	SYSTEM-WIDE ADDITIONAL TAX REVENUE/YEAR	BCIT PREMIUM
Provincial Tax	19%	12%	7%
Federal Tax	39%	23%	16%
Total Government Return	**58%**	**35%**	**23%**

[32] *See footnote below for explanation of return on investment.*

The return on investment by government, in terms of tax revenues from BCIT graduates from apprenticeship, diploma, certificate, and degree programs, is 48 percent, 14 percent, and 58 percent, respectively. Other post-secondary institutions (excluding the research universities) provide a rate of return of 42 percent, 8 percent, and 35 percent, respectively. The BCIT Premium earned by the British Columbia taxpayers, by investing public dollars in BCIT, is as high as 34 percent greater than that realized from an investment in alternate public post-secondary institutions.

Present Value Calculation of Educational Benefits of BCIT

Present value calculations were undertaken to determine the additional income earned attributed to a BCIT program five, ten, and twenty years following graduation. From this earnings profile, the additional Provincial and Federal tax revenues generated by BCIT graduates were determined.

For comparative purposes, the additional income and tax revenues attributed to graduates from post-secondary sector institutions were determined, and the BCIT Premium calculated.

This analysis yielded the following results.

Table 8A
BCIT Apprenticeship Present Value Calculations[33]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	9	$120,380,590	$26,483,730	$13,241,865	$39,725,595
10	14	$235,136,926	$51,730,124	$25,865,062	$77,595,185
20	24	$448,815,628	$98,739,438	$49,369,719	$148,109,157

[30] Diploma and Certificate Programs Rates of Return on Block Funding (Tax Revenues): Values for BCIT and System-Wide were calculated using 5,859 diploma and certificate graduates' Additional Tax Revenue for Federal and Provincial amounts divided by the Institute's Ministry of Advanced Education (AVED) Block Funding that was proportionally related to these programs.

[31] Degree Programs Rates of Return on Block Funding (Tax Revenues): Values for BCIT and System-Wide were calculated using 787 degree graduates' Additional Tax Revenue for Federal and Provincial amounts divided by the Institute's Ministry of Advanced Education (AVED) Block Funding that was proportionally related to these programs.

[32] Calculations are based on 2 years' FTE (full-time equivalent) funding being provided for 5,371 students.

[33] BCIT Apprentice Present Value Calculations: Values for BCIT were calculated using 1,067 apprentice completers' Additional Income Generated and Tax Revenue for Federal and Provincial amounts over the specified number of years. The cumulative Additional Income Generated includes Growth Rate for Wages and Discount Factor in its calculation.

Table 8B
System-Wide Apprenticeship Present Value Calculations[34]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	9	$107,952,811	$23,749,618	$11,874,809	$35,624,428
10	14	$210,862,001	$46,389,640	$23,194,820	$69,584,460
20	24	$402,481,069	$88,545,835	$44,272,918	$132,818,753

The present value differential for apprentice completers – BCIT versus System-Wide – is as follows:

Table 8C
BCIT Premium – Present Value Differential for BCIT vs System-Wide[35]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	9	$12,427,779	$2,734,111	$1,367,056	$4,101,167
10	14	$24,274,925	$5,340,484	$2,670,242	$8,010,725
20	24	$46,334,559	$10,193,603	$5,096,801	$15,290,404

Over a five year period, BCIT apprenticeship last level completers will earn an additional $120 million over that earned by individuals with only grade 12 and some post-secondary education. This will result in an additional $26 million in Federal tax and $13 million in Provincial tax revenues.

In comparison, the equivalent number of System-Wide completers will earn an additional $108 million over the five year period, and contribute an additional $24 million in Federal and $12 million in Provincial tax revenues.

In comparing the BCIT and System-Wide apprentice completers, the BCIT students will earn, over the first five year period, an additional $12 million in additional income, and contribute $2.7 million more in Federal and $1.4 million more in Provincial taxes.

Table 8D
BCIT Diploma and Certificate Present Value Calculations[36]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	7	$206,513,174	$45,432,898	$22,716,449	$68,149,347
10	12	$403,377,925	$88,743,143	$44,371,572	$133,114,715
20	22	$769,944,220	$169,387,728	$84,693,864	$254,081,593

[34] System-Wide Apprentice Present Value Calculations: Values System-Wide were calculated using 1,067 apprentice completers' Additional Income Generated and Tax Revenue for Federal and Provincial amounts over the specified number of years. The cumulative Additional Income Generated includes Growth Rate for Wages and Discount Factor in its calculation.

[35] BCIT Premium: The difference between BCIT and System-Wide in Additional Income Generated and Federal and Provincial Tax Revenues over the specified number of years.

[36] BCIT Diploma and Certificate Present Value Calculations: Values for BCIT were calculated using 5,859 diploma and certificate graduates' Additional Income Generated and Tax Revenue for Federal and Provincial amounts over the specified number of years. The cumulative Additional Income Generated includes Growth Rate for Wages and Discount Factor in its calculation.

Table 8E
System-Wide Diploma and Certificate Present Value Calculations[37]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	7	$116,379,540	$25,603,499	$12,801,749	$38,405,248
10	12	$227,321,755	$50,010,786	$25,005,393	$75,016,179
20	22	$433,898,488	$95,457,667	$47,728,834	$143,186,501

The present value differential for diploma and certificate graduates – BCIT versus the System-Wide – is as follows:

Table 8F
BCIT Premium – Present Value Differential for BCIT vs System-Wide[38]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	7	$90,133,634	$19,829,400	$9,914,700	$29,744,099
10	12	$176,056,170	$38,732,357	$19,366,179	$58,098,536
20	22	$336,045,732	$73,930,061	$36,965,031	$110,895,092

Over a five year period, BCIT diploma and certificate credential graduates will earn an additional $207 million over that earned by individuals with only grade 12 and some post-secondary education. This will result in an additional $45 million in Federal tax and $23 million in Provincial tax revenues.

In comparison, the equivalent number of System-Wide diploma and certificate graduates will earn an additional $116 million over the five year period, and contribute an additional $26 million in Federal and $13 million in Provincial tax revenues.

In comparing the BCIT and System-Wide diploma and certificate credentials, the BCIT graduates will earn, over the first five year period, an additional $90 million in additional income, and contribute $20 million more in Federal and $10 million more in Provincial taxes.

Table 8G
BCIT Degree Present Value Calculations[39]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	7	$117,029,974	$25,746,594	$12,873,297	$38,619,892
10	12	$228,592,236	$50,290,292	$25,145,146	$75,435,438
20	22	$436,323,507	$95,991,172	$47,995,586	$143,986,757

[37] System-Wide Diploma and Certificate Present Value Calculations: Values for System-Wide were calculated using 5,859 diploma and certificate graduates' Additional Income Generated and Tax Revenue for Federal and Provincial amounts over the specified number of years. The cumulative Additional Income Generated includes Growth Rate for Wages and Discount Factor in its calculation.

[38] BCIT Premium: The difference between BCIT and System-Wide in Additional Income Generated and Federal and Provincial Tax Revenues over the specified number of years.

[39] BCIT Degree Present Value Calculations: Values for BCIT were calculated using 787 degree graduates' Additional Income Generated and Tax Revenue for Federal and Provincial amounts over the specified number of years. The cumulative Additional Income Generated includes Growth Rate for Wages and Discount Factor in its calculation.

Table 8H
System-Wide Degree Present Value Calculations[40]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	7	$70,353,728	$15,477,820	$7,738,910	$23,216,730
10	12	$137,420,487	$30,232,507	$15,116,254	$45,348,761
20	22	$262,300,198	$57,706,043	$28,853,022	$86,559,065

The present value differential for diploma and certificate graduates – BCIT versus System-Wide – is as follows:

Table 8I
BCIT Premium – Present Value Differential for BCIT vs System-Wide[41]

YEARS IN WORK FORCE	YEARS SINCE ADMISSION	ADDITIONAL INCOME	FEDERAL TAX	PROVINCIAL TAX	TOTAL TAX
5	7	$46,676,246	$10,268,774	$5,134,387	$15,403,161
10	12	$91,171,749	$20,057,785	$10,028,892	$30,086,677
20	22	$174,023,309	$38,285,128	$19,142,564	$57,427,692

Over a five year period, BCIT degree graduates will earn an additional $117 million over that earned by individuals with only grade 12 and some post-secondary education. This will result in an additional $26 million in Federal tax and $13 million in Provincial tax revenues.

In comparison, the equivalent number of System-Wide degree graduates will earn an additional $70 million over the five year period, and contribute an additional $15 million in Federal and $8 million in Provincial tax revenues.

In comparing the BCIT and System-Wide degree credentials, the BCIT graduates will earn, over the first five year period, an additional $47 million in additional income, and contribute $10 million more in Federal and $5 million more in Provincial taxes.

The Return on Investment (ROI)

While the focus of this report is the overall impact of BCIT on the provincial economy both directly and indirectly, this section evaluates the direct return on investment to both society (in GDP) and to the government in terms of tax dollars. In this case, the direct benefit is the increased GDP and tax revenue that results from the higher incomes earned by BCIT graduates.

To do this, the annual grants (ITA and AVED) are converted to dollars per graduating student. This is combined with annual tuition to derive the overall annual cost per graduate. The per-student investment is then compared to both the stream of additional income and the additional tax dollars that graduate will generate over his or her career. Using an internal rate of return approach (IRR) generates the returns on investment for society and the tax base from BCIT programs.

To calculate the benefit stream, we take the difference in annual income due to education and weight it by the employment rate for the education category to derive the expected annual value. We assume an average post-graduation career of 20 years and an annual average productivity gain of 1 percent. All values are adjusted for inflation, thereby generating all values in real (constant 2013 dollar) terms. The following table shows the ROI for apprenticeships, diploma programs and degree programs. The overall rates of return (far right column) are determined by the weighted average of the three categories.

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[40] System-Wide Degree Present Value Calculations: Values for System-Wide were calculated using 787 degree graduates' Additional Income Generated and Tax Revenue for Federal and Provincial amounts over the specified number of years. The cumulative Additional Income Generated includes Growth Rate for Wages and Discount Factor in its calculation.

[41] BCIT Premium: The difference between BCIT and System-Wide in Additional Income Generated and Federal and Provincial Tax Revenues over the specified number of years.

BCIT 2013 VALUES	APPRENTICESHIP	DIPLOMA	DEGREE	
Share of BCIT Grads	14%	76%	10%	
Annual Funding per Graduate	$4,169	$8,793	$8,793	
Annual Tuition	$900	$5,200	$5,800	
Annual Cost per Graduate	$5,069	$13,993	$14,593	
Program Length (Years)	4	2	4	
Wage Differential	$28,471	$15,031	$17,840	
Employment Rate After Grad	90%	79%	94%	
Expected Value per Student	$25,624	$11,874	$16,770	
Federal Tax Revenue	$5,637	$2,612	$3,689	
Provincial Tax Revenue	$2,819	$1,306	$1,845	
Total Tax Revenue	**$8,456**	**$3,918**	**$5,534**	**Overall**
ROI in Terms of GDP	**57%**	**37%**	**47%**	**41%**
ROI in Terms of Tax Revenue	**33%**	**21%**	**28%**	**23%**

For both apprenticeships and diplomas, the graduate income is compared to the baseline income of those with a high school diploma (grade 12) with an average income of $29,129. For degree programs at BCIT the baseline for calculating the income differential is the diploma program. Even though the degree program is four years, only the additional investment above the diploma (two years) is included in the calculation.

The ITA annual grant translates into $4,169 per year for each actual graduate. The AVED grant equates to $8,793 per year for each diploma or degree graduate. Each apprenticeship grad will contribute an average of $8,456 per year in additional tax dollars. This equates to an ROI of 33 percent on apprenticeship programs. Diploma graduates will contribute an average of $3,918 in additional tax revenue for an ROI of 21 percent. Degree graduates will contribute $5,534 in additional tax dollars (above a diploma graduate) for an ROI of 27 percent.

Apprenticeships account for 14 percent of graduates, diploma programs account for 76 percent of graduates, and degree programs produce 10 percent of graduates. Using a weighted average of the three categories of ROIs, the overall ROI for society is 41 percent and to government funding is 23 percent.

BCIT Education and Key Sectors of the Economy

BCIT: Integral to the economic, social, and environmental prosperity of British Columbia.[42]

BCIT is known for its applied education and it has long held a reputation for close ties to industry. In many cases, BCIT is the only institute in the province that supplies training for specific skills and occupations. The purpose of this section is to quantify the linkages between BCIT and key sectors of the economy. It also measures BCIT's market concentration[43] within each of these sectors.

BCIT, like most post-secondary institutes, groups programs and fields of study by faculty, school, and department. The broadest and oldest groupings are typically the Faculty of Arts, Faculty of Science, and Faculty of Applied Science. Within these groupings there will be schools such as Business, Construction, Health Science, and Computing which, in turn, contain departments (or programs) such as Marketing, Economics, and Nursing. The academic groupings are based on subject matter expertise of the instructors and operational concerns of the Institute (i.e. types of capital requirements like labs and equipment). However, BCIT, with its focus on applied education and job-ready skills, has strong linkages to most, if not all, sectors of the Provincial economy. This section is an overview of BCIT's contribution and relative impact on key sectors of the BC economy. While BCIT makes up close to 15 percent[44] of the post-secondary FTEs, it is often the dominant, if not the only, supplier of skilled workers for a wide range of industries and professions. This section provides an overview of this contribution at the sector level in British Columbia.

[42] BCIT Strategic Plan 2014-2019 is available on the BCIT website http://www.bcit.ca/files/about/pdf/bcit_strategic_plan_2014-19.pdf.

[43] "Market Concentration" is a term used in industrial organization which refers to the percentage of a market which is supplied by a single provider.

[44] This percentage is derived from those institutions that submit to the Central Data Warehouse (CDW) and exclude the research universities' FTE activity in the calculation.

Gross Domestic Product by Sector

In 2013, the gross domestic product (GDP) of British Columbia was $229 billion (according to Statistics Canada). For reporting purposes, Statistics Canada and BC Stats divide the economy into eight sectors[45]. Those sectors and their share of GDP are listed in Table 9.

Table 9 British Columbia Economy

MAJOR SECTORS BC ECONOMY	GDP (thousands)	SHARE OF GDP
Services (Public and Private) and Professions	$109,093	47%
Trade (Retail/Wholesale)	$37,653	16%
Construction	$19,437	8%
Manufacturing	$16,893	7%
Finance, Insurance, Real Estate, and Leasing	$14,451	6%
Transportation and Warehousing	$12,110	5%
Primary Industries	$7,429	3%
Utilities	$1,425	1%
Total	**$229,685**	**100%**

One method of calculating GDP used by Statistics Canada is the sum of payments to factors of production, or the "value added" approach. Using this approach to calculating GDP, it was determined that 64 percent of net GDP was recorded as wages, salaries, and benefits. Further, from the latest federal census data, we estimate that 86 percent of payments to labour is paid to skilled workers; those with certificates, diplomas, or degrees.

Post-Secondary Credentials Awarded by Sector

Table 10 presents all public post-secondary credentials awarded, excluding the credentials awarded by the research universities and pre-workforce training, in British Columbia for fiscal year 2013[46]. Credentials have been categorized by sector by aligning the program credential Classification of Instructional Program code (CIP) to the various sectors in the economy. Table 10 also shows BCIT's share of credentials awarded by sector. In the areas of construction and manufacturing, BCIT is responsible for more than 18 percent of all post-secondary credentials, which is the largest portion of any post-secondary institute (excluding the research universities).

The categories "Finance, Insurance, Real Estate, and Leasing" and "Services and Professions" are programs primarily from the Schools of Health Science and Business. In the financial industries, one in every four credential is from BCIT. For the category "Services and Professions", BCIT only supplies 10 percent of credentials. However, since this is by far the largest sector of the provincial economy, it is BCIT's second largest category in terms of the number of graduates produced at BCIT.

Table 10
Credentials Awarded for Public Post-Secondary Institutions by Sector

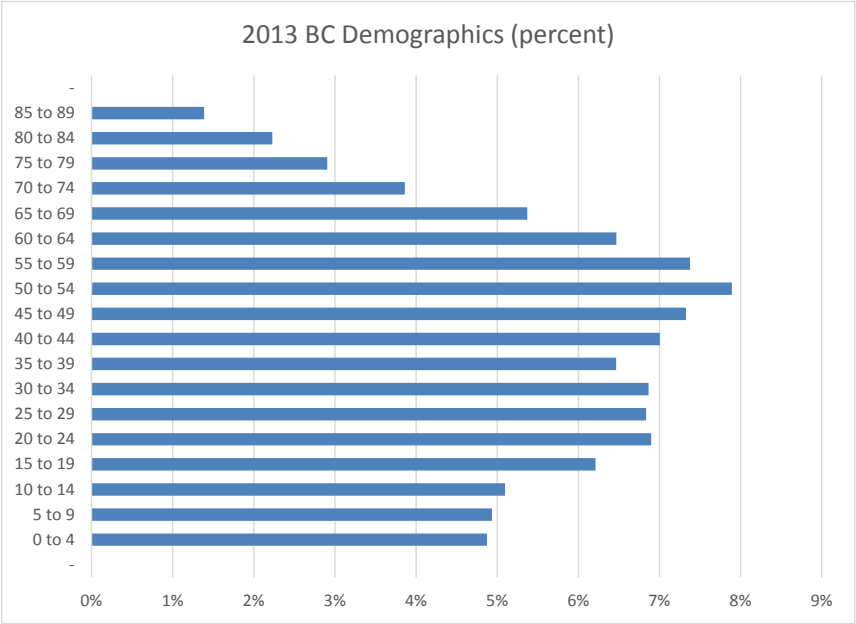
MAJOR SECTORS OF BC ECONOMY	BCIT	SYSTEM TOTAL	BCIT %
Primary Industries	85	1,357	6%
Manufacturing	2,074	6,528	32%
Construction	1,177	3,621	33%
Transportation and Warehousing	48	1,334	4%
Trade (Retail/Wholesale)	898	5,891	15%
Finance, Insurance, Real Estate, and Leasing	554	1,655	33%
Services (Public and Private) and Professions	1,809	17,586	10%
Grand Total	**6,646**	**37,971**	**18%**

[45] This number can vary depending on the focus of individual reports developed by Statistics Canada (i.e. employment rates, capital investment, demographics).

[46] Data from the Ministry of Advanced Education's Central Data Warehouse (CDW).

Demographics for British Columbia in 2013

Figure 1
British Columbia Population by Age Grouping



The population of British Columbia in 2013 was 4.54 million. Figure 1 shows British Columbia's population by age grouping in 2013 (according to BC Stats). The distribution by age implies some future challenges in the labour market and supports the concern of a skills shortage in many sectors. The two largest groupings are the 50-54 and 55-59 year olds. The 45 to 74 year olds represent 38 percent of the population and 53 percent of the workforce, whereas the 15 to 40 demographic is only 27 percent of the population and 37 percent of the workforce. Given that only 12 percent of those measured as retired work up to age of 65 before retiring (average being 62 years; Canadian Census), there will be significant demand for skilled labour and middle management in the next ten years. Given the current age distribution, education, and skills training will have a greater premium and there will be an increasing reliance on immigration.

Table 11
2012 Employment Openings for Skilled Labour from Attrition and Economic Growth[47]

MAJOR SECTORS OF BC ECONOMY	OPENINGS	FILLED BY BCIT GRAD
TOTAL	**45,140**	**6,815**
Services (Public and Private) and Professions	21,440	2,206
Construction	3,820	1,242
Trade (Retail/Wholesale)	7,400	1,129
Manufacturing	3,320	1,055
Finance, Insurance, Real Estate, and Leasing	2,840	951
Primary Industries	1,460	91
Transportation and Warehousing	2,380	86
Utilities	280	56

Table 11 shows the number of expected job openings in 2012 for skilled workers by sector due to attrition and economic growth. This estimate is the net effect since many positions, especially at the senior or middle management level, will be filled by internal candidates. It is assumed that openings for skilled workers will have a credential requirement as a condition of employment. Using the percentage of credentials in British Columbia that were awarded by BCIT, an estimate for the number of positions to be filled by BCIT graduates is reported in the last column of Table 11.

[47] Results are estimated using aggregate attrition forecasts based on turnover, demographics, and average retirement age of workforce.

Economic Value of New Hires of Skilled Labour (Share of GDP)

This section calculates the value of new hires of skilled labour as a share of Provincial GDP. We report the forecast for 2014 and the cumulative value for the next five years (2014-2019). For this forecast, an annual attrition rate of 2 percent and an economic growth rate of 3 percent (Canada's long-run trend) were assumed[48]. The results are summarized in Table 12.

Table 12
Forecasted Value of New Hires of Skilled Labour

	2014 FORECAST (millions)		2014-2019 CUMULATIVE VALUE (millions)	
MAJOR SECTORS BC ECONOMY		BCIT GRADS	OVERALL	BCIT GRADS
Services (Public and Private) and Professions	$1,091	$112	$5,966	$614
Trade (Retail/Wholesale)	$377	$57	$2,059	$314
Construction	$194	$63	$1,063	$346
Manufacturing	$169	$54	$924	$294
Finance, Insurance, Real Estate, and Leasing	$145	$48	$790	$265
Transportation and Warehousing	$121	$4	$662	$24
Primary Industries	$74	$5	$406	$25
Utilities	$14	$3	$78	$16
Total	**$2,297**	**$347**	**$12,560**	**$1,896**

The forecast suggests that BCIT graduates will account for $347 million of new hires in 2014 and almost $1.9 billion over the next five years. The largest contributions are to Construction ($346M), Manufacturing ($294M), Retail and Wholesale Trade ($314M) and Public and Private sector services ($614M).

Although it is beyond the scope of this report, it is worth noting that within each sector there are a significant number of skill sets that are either solely taught by BCIT or BCIT is the only large scale provider of the skills training. As a result, without BCIT, many industries will have to rely on out-of-province recruiting or immigration to fill the need for skilled workers in their sector.

RESEARCH AND DEVELOPMENT ACTIVITY IMPACT ANALYSIS[49]

As BC's premier polytechnic institute, BCIT and its faculty are engaged in a wide range of research and development activities on behalf of, and with, industry clients, including applied research, technology transfer, commercialization, technical and business consulting, and associated training.

The local economy is a direct beneficiary of BCIT's applied research services, expertise, and graduate labour pool, in that high-technology firms are induced, in part, to locate within proximity of the Burnaby Campus.

For example, Technology Place, built on the BCIT Burnaby Campus by Discovery Parks Inc., makes available office and laboratory space to hi-tech firms. A number of high-profile employers, such as eBay, Electronic Arts, and Creo Inc., who regularly employ BCIT graduates, are also located nearby.

When evaluating the economic impact of applied research, it is important to recognize that the benefits tend to diffuse throughout the economy over a longer time horizon. Unlike the impact calculated in the previous two sections, the economic benefits of applied research will not necessarily be realized in the same year that the investments were made.

[48] Two percent attrition is considered a conservative estimate. Given the current age distribution of the province, the attrition rate could be as high as 6 percent, depending on the numbers who opt for early retirement (55 to 65 age bracket).

[49] Accurate data was only available up to 2005. Results in this section are based on extrapolations from that year.

BCIT Technology Centre

Whereas considerable research and development activity occurs across the various technology programs at BCIT, and independently by faculty, the Institute's principal research and development facility is its Technology Centre.

The Technology Centre's mission[50] is to support economic development in British Columbia through applied research, technology transfer, and enterprise development. It achieves its mission by:

- Providing solutions to technical and business problems
- Developing prototypes and systems
- Organizing industry-specific conferences and workshops
- Providing advice and training for people who want to start new business ventures

The key differentiator between university and BCIT research is that the research conducted at the BCIT Technology Centre focuses on activities with short-term/immediate industrial and commercial relevance, whereas university research is undertaken principally to develop new knowledge.

BCIT's applied research Technology Centre reached its 25th year in operation in 2014. The Technology Centre of Excellence has several departments conducting research in various fields with businesses and industry clients.

The Smart Microgrid Applied Research Team (SMART) conducts applied research and development in emerging and next generation technologies and helps stimulate BC's IT industry through joint, collaborative industry, academic, and government research. SMART has partnered with BC Hydro to construct and design Canada's first Smart Power Microgrid at BCIT's Burnaby Campus. The Smart Microgrid Initiative at BCIT advances the state of Smart Grid on a global scale, working to chart a path from lab to field for cost-effective technologies and solutions for Canada's evolving Smart Electricity Grid.

BCIT's Make+ is a twelve person multi-disciplinary team of researchers that conducts applied research and development services and education in emerging and next generation product development in health technologies, energy, consumer electronics, and industrial products for clients in industry, academia, government, and the community. Make+ is involved in 17 applied research projects including a baby Medical Tubing Manager, skating performance technical data analysis, longboard deck tester, and a GPS-enabled device for realtors and house buyers.

BCIT's Make+ also provides a broad range of evaluation services specializing in aging and disability, health and safety, and evolving technology. Through funding from National Research Council, the BCIT Technology and Product Evaluation Group created the e-health Accelerator, an initiative aimed at providing expertise in the area of e-health usability.

BCIT's Natural Health and Food Products Research Group (NRG) addresses issues of product quality, process improvement, and human health using basic and applied science along with state-of-the-art technology. Projects undertaken by the department include provenance, authentication, and product quality analysis for BC Agri-Food and Agri-Products to develop and validate applied methods that support the authenticity and quality of agricultural products, in order for BC industry to be competitive in domestic and foreign markets.

Other BCIT Research Projects

BCIT achieves its research mission through a number of unique research facilities that have been established in the Technology Centre and Schools, as a result of partnerships with industry and with the help of Federal and Provincial programs:

[50] Source: BCIT Technology Centre Annual Review 2000-2001, p.4.

Advanced Prototyping Hub

The Advanced Prototyping Hub is a new facility that serves a broad range of research disciplines, and is equipped to allow researchers to develop prototypes not only at the lab mock-up level, but at an advanced level equivalent to that of commercial products that are released into the marketplace. It comprises two key platforms: (1) an integrated design/machining platform and (2) a performance evaluation platform for life-sciences products, with emphasis on safety, efficacy, and environmental impact.

Integrated Molecular Biology Laboratory (IMBL)

This new facility focuses on the study of the biological activity and safety of natural health products (NHPs), with the overall objective of providing molecular and biological evidence-based data on a NHP's mechanism of action and safety profile. IMBL's research strategy is to apply molecular biology and drug-discovery based techniques to the study of NHPs. Its core facilities include infrastructure for cell culture and imaging, assay development, and activity screening, as well as for genetic manipulation and analysis of expression changes.

Centre for the Advancement of Green Roof Technologies (CAGRT)

Green roofs are specialized roofing systems that support vegetation growth on rooftops. Green roof technology offers multiple benefits to urban areas – they can reduce site level storm water runoff, lower a building's cooling/heating energy demand, and, when widely adopted, they can reduce impact on the regional watershed, mitigate urban heat island effects, and improve air and water quality of the local community. The Centre's principal functions are to develop the regional infrastructure network; to inventory performance of green roofs; develop a system performance evaluation module; provide a testing and verification facility for the local green roof industry; and improve public awareness of the technology through education and demonstration.

Building Science Centre of Excellence

This Centre has been developed through national and international partnerships and it focuses on themes related to building envelopes and rain control. Research facilities have been established in three areas: (1) a Building Science Materials Laboratory for instrumentation and testing of construction materials, (2) a Water Penetration Test Chamber for special purpose testing of window and wall assemblies, and (3) a Building Envelope Test Hut, which is a real-time, real-weather exposure facility for field tests on wall panels.

BCIT Centre for Biomechanics Research

To improve police dog performance as partners in the law enforcement field, BCIT has launched the world-class BCIT Centre for Biomechanics Research. This unique research centre will develop best practices in health screening, fitness training, and rehabilitation care for police dogs.

Centre for Rehabilitation Engineering and Technology that Enables (CREATE)

CREATE, developed in partnership with the Neil Squire Foundation, is a research facility devoted to development of devices, technologies, and products for people with disabilities. Equipped with a state-of-the-art Rapid Prototyping Machine, CREATE is the first research facility of its kind in BC.

Herbal Analysis and Evaluation Lab (HEAL)

The Herbal Analysis and Evaluation Lab is fully equipped for research-oriented investigations into a variety of areas concerning herbal medicines including the determination of toxic components and contaminants, the quantification of active and marker compounds, and the identification of constituents in medicinal preparations to assist in clinical studies.

Industrial Instrumentation Process Lab

The BCIT Industrial Instrumentation Process Laboratory is capable of simulating a wide variety of complex control process for research testing of industrial control systems. The lab houses a fully operational distillation column, evaporator and power boiler, and extensive process control equipment.

Internet Engineering Lab (IEL)

One of only four research centres of its kind in North America, BCIT's Internet Engineering Lab (IEL) is capable of emulating and testing any network configuration, from small plant floor networks to complex sets of interconnected backbone nodes of the Internet. Research conducted within the IEL focuses on the design and management of advanced networks involving layer 3/4 (TCP/IP) issues including: network security and critical infrastructure protection, conformance to standards, and network performance testing and evaluation.

Dr. Tong Louie Living Laboratory

The Living Laboratory is a joint venture between BCIT and Simon Fraser University. Designed for research and development of age and disability sensitive environments and products, the lab occupies 1,500 square feet on the 7th floor of the BCIT Downtown Campus and contains an experimental studio, a viewing theatre, and a data acquisition and analysis centre.

Photovoltaic Energy Applied Research Lab (PEARL)

A novel facility for applied research and development in alternative energy, this lab is equipped with state-of-the-art instruments for flash testing and custom prototyping of solar modules. Currently, we intend to fold the PEARL facility into a new BCIT Centre for Advancement of the Adoption of Renewable Energy Technologies, which will focus on applied research on a range of alternative energy technologies, including wind power, solar thermal as well as solar electric, biodiesel, mini-hydro and so on, strategies for improving the integration of such technologies into the grid, as well as increasing the efficient use of energy in the built environment.

Food Analysis Lab and Pilot Plant

This food pilot plant and food analysis laboratory has a broad range of equipment for use in food processing simulation; drying; packaging; chemical, physical, and microbiological analysis; texture and colour measurement; and shelf life studies.

Forensic Science Centre

The Forensic Science Centre conducts investigative research in the analysis of forensic, physical, and biological samples.

Research and Development Economic Impact Analylsis

Compared to the impact multiplier used in the above sections, research and development (R&D) can have a larger multiplier effect in the local economy due to the commercial nature of the expenditures, technological spillovers, and network externalities.

Of the more than 20 studies surveyed, only two organizations reported multipliers specifically for applied R&D. Most expressed their impacts in terms of anecdotal evidence of the relationship between their research institution and industry. This is likely due to the need for confidentiality concerning client firms' production costs and profits, and the labour resources required to collect relevant information for purposes of determining the multiplier effect.

A Michigan State University study estimated their R&D multiplier effect to be 4.04. Alternatively, a 2001 report by the Science Council of BC estimated the multiplier effect associated with the Technology BC Program to be 18. NASA's officially stated multiplier is 23. In other words, depending upon the multiplier factor used, one dollar of applied research and development expenditure will return $4.04 or $18.00 to the economy. Selection of an appropriate multiplier factor is therefore critical in estimating the economic "ripple-effect" associated with applied research and development.

In 2013, BCIT received $15.2 million of research funding to support applied research conducted by students, faculty, and institute mandated projects. The funding for BCIT's research projects increased 193 percent within the last year, significantly more than any other Canadian college. As a result of the increase in funding, BCIT was ranked the top research college on Canada's Top 50 Research Colleges annual report for 2013.

Research has shown that direct post-secondary funding for applied research will, on average, produce 60 percent more indirect funding by private corporations working in collaboration with the PSI. Therefore, the BCIT funding of $15.2 million will generate an additional $9.1 million for a total injection of $24.3 million.

Unlike other sections of this report, the economic impact of applied research presents some additional challenges. All other activities cited (spending, wages, graduates, etc.) are recorded in annual values which means they are considered flow variables producing a stream of benefits. Applied research does not lend itself well to a simple annual flow analysis. Rather, it is a stock variable that produces a stream of benefits over time. This is analogous to a consumer durable (i.e. a refrigerator or automobile) that is a one-time purchase that produces benefits over a time horizon. The impact multipliers for applied research referenced above reflect the cumulative impact of investment in applied research. To be consistent with other sections of this report, it is required that we convert the total impact to an annual average over a specific time horizon. For the purpose of this study we chose a five year horizon (2013-2018). Using the 2013 direct and indirect injection of $24.3 million, we produce both a cumulative and annual impact for a range of impact multipliers. The results are listed in the table below. For the summary and calculation of BCIT's impact from all sources, we use the realistic value of the forecast.

Applied R&D at BCIT likely has a larger economic multiplier than that associated with university research since a large percentage of research undertaken at universities is for the sake of knowledge only and usually does not translate into efficiency enhancing or commercially valuable applications – at least not in the short term, or with any direct localized effects. For example, research in philosophy, pure mathematics, and the like are funded but not expected to have any real short-term economic impact.

This differs markedly from applied R&D where the sole objective is efficiency enhancement and the development of commercially viable applications. Given the commercial nature of applied R&D, the tax revenues received by the Provincial government from spin-off economic activity are likely much higher for a dollar spent on applied research, compared to the same expenditure made in a traditional R&D environment where the funding is allocated to both pure and applied research.

Furthermore, applied R&D develops not only new products and processes offered for sale, but often also results in operating cost reductions, which are reflected on financial statements in the form of higher profitability. Such productivity gains benefit the Province through increased corporate tax revenues.

A conservative approach to measuring the tax revenues generated by applied research is to determine the additional income tax which results from the economic impact, indicated above. The following assumptions are used in calculating tax revenues:

- 65 percent of economic activity reported above is labour income.
- Per CCRA's 2011 tax table, 22 percent Federal tax, and 11 percent Provincial tax.

Based on these assumptions, the following impact (GDP) plus Federal and Provincial tax revenues are generated for each multiplier:

MULTIPLIERS		CUMULATIVE (millions)	ANNUAL (millions)	FED TAX (millions)	PROV TAX (millions)	TOTAL TAX (millions)
Conservative	4	$97.3	$19.5	$2.8	$0.9	$3.7
Realistic	**8**	**$194.6**	**$38.9**	**$5.6**	**$1.8**	**$7.3**
Optimistic	12	$291.8	$58.4	$8.3	$2.7	$11.0
BC Tech	18	$437.8	$87.6	$12.5	$4.0	$16.5
NASA	23	$559.4	$111.9	$16.0	$5.1	$21.1

NON-QUANTIFIED RESEARCH AND DEVELOPMENT ECONOMIC IMPACTS

As mentioned earlier, the various Schools of BCIT, and faculty independent of BCIT, also undertake research and development activities which generate positive economic impacts for the Province and, in some cases, internationally.

The following examples are intended to illustrate the broad range of applied research activities in which the various BCIT Schools and faculty have been engaged:

Several School of Business faculty members have authored technical and business textbooks. These texts are being marketed nationally, and in at least one instance, the distribution is international in scope.

One School of Business faculty member has been instrumental in facilitating negotiations for overseas oil and gas leases, and chairing several meetings with a foreign Deputy Oil Minister and his staff to discuss/negotiate the construction of a 300,000 bpd refinery.

A faculty member on professional development leave led a collaborative National Research Council, UBC, and BCIT project that developed techniques for manufacturing a new generational of platinum nanostructured catalysts which accelerate the chemical reaction and thus boosts the current generated.

A Mechanical Engineering Technology faculty member developed a new numerical technique for predicting the flow of incompressible fluids, such as water. The findings were presented to scientists at a conference at the Massachusetts Institute of Technology (MIT) and at the National Aeronautical Space Agency (NASA).

BCIT's Centre for Wood Science and Applied Technology conducts activities that enhance the development of forest-based communities. The focus is on the development of practical solutions, innovative technologies, and products to keep BC's economic sector competitive and sustainable. A particular research emphasis is the production of value-added products from local forest resources, the use of underutilized species, beetle-killed timber, and woody residues.

School of Construction and Environment faculty members have been engaged in investigating the feasibility of constructing specialized roofing systems that support vegetation growth on rooftops, such a vegetative roof system provides numerous environmental and economic benefits, including the decrease of the urban "heat island" effect.

BCIT's Building Science Centre of Excellence is undertaking research in the area of building performance, notably rain penetration damage and mitigation.

The Fish, Wildlife, and Recreation program of BCIT is involved in supporting environmental initiatives concerned with the management, protection and/or restoration of rivers and streams. Current research encompasses the monitoring of rivers and streams to determine how the ecosystem is responding to the return of natural flow regimes.

The BCIT Canadian Housing and Construction Centre has been working with government and industry partners to assist in the development of new technologies and/or the adaptation of existing technologies to create more sustainable, energy efficient, functional, and environmentally-friendly housing. As an example, Home 2000, located on the Burnaby Campus, is a demonstration project which showcases some of the most innovative, yet practical, housing ideas.

Considerable work is being carried out by BCIT faculty in the area of Geographic Information System Technology (GIS); notably, the development of Open GIS solutions, Indoor GIS location and routing, GIS data updates via the internet, and the development of a prototype wireless GIS service which delivers location-based information to cell-phone or PDA mobile users.

The Civil Engineering Technology department is conducting structural and earthquake engineering research, with particular focus on the seismic performance of wood frame, concrete and masonry structures, performance-based seismic design, and passive seismic control devices.

The School of Computing and Academic Studies faculty members are engaged in a variety of research projects, including applications of science-based attributes in enterprise information systems, pattern discovery of computer systems for intrusion detection, modeling genome sequences using Markov models, firewall and perimeter designs, covert channels and steganography, and ultra-wideband antenna design.

CONCLUSION

BCIT, as an economic entity with 2,391 employees operating in the province of British Columbia, generated a short-term impact of $447 million and 9,673 jobs were supported, directly or indirectly, by the Institute.

In 2013, the 7,713 graduates of BCIT earned $277 million annually in gross income, which is $93 million more than they would have earned if they had not pursued higher education. Further, because they chose BCIT, they will earn a premium of $31 million, or 39 percent, more than the system average (excluding the research universities) income.

The overall impact of BCIT on the economy is close to three-quarters of a billion dollars ($763 million gross income and $579 million in net income). The totals are summarized as follows:

Table 13
Summary of BCIT's Value Added to the Economy

	GROSS INCOME	NET INCOME (millions)	TAX REVENUE
Value Generated from BCIT Operations	$447	$447	$77
Valued Added by BCIT Graduates	$227	$93	$31
Value Added by Applied Research	$39	$39	$7.3

The investment in education, as measured by the increased tax revenues associated with a BCIT education, is 16 percent and the payback period is six years after graduation. The overall annual tax contribution related to BCIT's various activities is $121.3 million.

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