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CENTRE FOR THE STUDY OF LIVING STANDARDS

PRODUCTIVITY DRIVERS IN BRITISH COLUMBIA: STRATEGIC AREAS FOR IMPROVEMENT

CSLS Research Report 2008-9
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Prepared for the BC Progress Board | By the Centre for the Study of Living Standards

Productivity Drivers in British Columbia: Strategic Areas for Improvement

Abstract

A brief analysis of British Columbia's productivity performance and the state of the drivers of this performance reveals that five areas merit additional focus. These areas could be the object of further research in the context of a productivity series produced for the British Columbia Progress Board by the Centre for the Study of living Standards. They are, in the proposed order of completion:

- Education and literacy, including professional qualifications and education for targeted groups such as aboriginals and recent immigrants, credentials recognition.
- Public and private investment, including public infrastructure, business investment and taxation structure.
- Research and innovation, including R&D investment, product and process innovation, knowledge diffusion and technology adoption.
- Resource reallocation, including competition policy, improving market mechanisms, product market regulation and foreign ownership rules.
- Trade and migration, including interprovincial and international movement of goods and services, skilled and unskilled immigration and emigration and interprovincial migration.

Productivity Drivers in British Columbia: Strategic Areas for Improvement

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Executive Summary

The British Columbia Progress Board (BCPB) has asked the Centre for the Study of Living Standards (CSLS) to consider producing a set of studies on productivity in British Columbia in five issues areas. Each report would provide recommendations for action by government, the private sector and individuals to improve productivity. In this paper, we provide a brief analysis of British Columbia's productivity performance and the state of the drivers of this performance. We then identify the five strategic areas that we believe should be the focus of the reports and that are most likely to result in recommendations that would help to improve BC's productivity performance.

They are, in the proposed order of completion:

- Public and private investment, including public infrastructure, business investment and taxation structure.
- Education and literacy, including professional qualifications and education for targeted groups such as aboriginals and recent immigrants, credentials recognition.
- Research and innovation, including R&D investment, product and process innovation, knowledge diffusion and technology adoption.
- Resource reallocation, including competition policy, improving market mechanisms, product market regulation and foreign ownership rules.
- Trade and migration, including interprovincial and international movement of goods and services, skilled and unskilled immigration and emigration and interprovincial migration.

Labour productivity in British Columbia grew on average 0.7 percent a year during the 1987-2006 period while Canada as a whole experienced average annual growth of labour productivity of 1.3 percent. In fact, labour productivity growth in British Columbia was below that of every other province over that period. British Columbia's total factor productivity growth, however, was above the national average. The report finds that from a growth accounting perspective declining capital intensity accounts for virtually all the labour productivity difference between Canada and British Columbia. With population aging and a soon stagnating labour force, labour productivity growth will become increasingly synonymous for GDP and income growth in British Columbia. Indeed, the CSLS estimates that 72 percent of GDP growth and 156 percent of GDP per capita growth will come from labour productivity growth in the 2006-2026 period in British Columbia. To increase its productivity growth, British Columbia will have to improve its performance in a number of key areas.

This report identifies a number of areas in which British Columbia underperforms compared to the rest of Canada. This underperformance may explain its lagging labour productivity growth and improvements in these lagging areas offers the possibility of stronger productivity growth in the future. First, despite having strong human capital in certain areas, British Columbia remains below the national average in terms of post-secondary and university completions. Moreover, its level of M&E investment as well as its growth in total investment have been below the national average and have translated into negative growth in capital intensity. Indeed, as previously noted, falling capital intensity appears to be a key factor in explaining the gap in labour productivity growth between British Columbia and Canada. In addition, although the percentage of firms in British Columbia reporting product and process innovation is similar to the national average, the province's R&D expenditure as a share of GDP is only about three quarters the national average. The industrial structure of British Columbia's economy was also found to be a drag on its productivity level and growth. Finally, British Columbia exhibits a lower share of exports as a share of GDP relative to other provinces in spite of its strategic geographic positioning.

This report identifies three key drivers of productivity: human capital, physical capital and technological progress. Clearly, to increase productivity in the future, British Columbians will need to invest more both in their people and in new technologies, as such investments are two of the key drivers of productivity growth. The first two proposed reports would assess in which specific sphere investments in human and physical capital are most needed and how they can be achieved. The third proposed report would focus on research and innovation, the third key driver of productivity. Innovation generally refers to both knowledge creation and technology adoption, which results in new or enhanced products or production processes. Innovation finds its source in both embodied capital, as is the case of ICT investment, and disembodied capital, as is the case for network capital acquired through technological clustering. In this context, this report will be able to efficiently harness the findings of the two previous reports.

In addition to the key drivers of productivity, there are a number of cross-cutting issues which affect productivity through more than one of the aforementioned drivers. In a fourth report, we propose to focus on microeconomic forces facilitating resource reallocation, and address the broad questions of market structure, market regulation and firm incentives, all of which directly affect productivity levels and growth. A fifth and final report would address the key questions of trade and migration, both macroeconomic factors which impact productivity growth. Trade plays an important role in ensuring an adequate level of competitive pressures and can open new markets and create new opportunities for firms located in British Columbia. Migration, on the other hand, can significantly alleviate current and future labour scarcity and dampen the effect of population aging, both of which are possible bottlenecks to productivity growth.

List of Charts, Tables and Exhibits

Productivity Drivers in British Columbia: Strategic Areas for Improvement[1]

Introduction

As noted in the BC Progress Board's 2007 Benchmark report, the province has performed consistently below the Canadian average in terms of productivity performance, both for levels and growth rates. Given the importance of productivity for living standards, productivity improvement represents a priority for the BC economy.

In this context, the British Columbia Progress Board (BCPB) is working with the Centre for the Study of Living Standards (CSLS) to consider a set of studies on productivity in British Columbia in five issue areas. Each report would provide recommendations for action by government, private sector organizations and individuals to improve productivity. The objective of this paper is twofold. First, it provides a brief overview of the productivity situation and the state of the drivers of productivity in British Columbia. Second, it identifies five specific strategic areas or topics of relevance for productivity that merit additional focus and research for the development of an effective strategy to improve BC productivity performance.

The first section reviews the productivity situation and performance of British Columbia relative to Canada. It first explains the importance of productivity and then focuses on measures of labour productivity, capital productivity, total factor productivity and capital intensity. In the second section, the state of the main drivers of productivity in BC is assessed. The main drivers are divided into six different categories: education and literacy; physical investment; research and innovation; the industrial structure and resource base; macroeconomic conditions; and microeconomic conditions. In the third section, a framework for choosing relevant areas for the productivity series is presented and five strategic areas are proposed.

[1] This report was also published on the website of the BC Progress Board (http://www.bcprogressboard.com) with small formatting differences.

I. Productivity Situation in British Columbia

Economists widely recognize that Canada faces an important productivity challenge. Indeed, productivity has been targeted as a key issue by the BC Progress Board and has already been the topic of one BCPB report (BC Progress Board, 2006) while issues of high relevance for productivity growth have been discussed in depth in other BCPB reports (BC Progress Board 2002, 2005 and 2007a). Yet, the general public often fails to recognize the issue and few governments or political parties are ready to address it (Sharpe, 2007). As noted by Watson (2008), explaining the importance of productivity for economic growth has become more challenging in the last four years as Canada enjoyed strong income growth (14.3 percent compared to 8.1 percent in the United States between 2002 and 2006) in spite of its lackluster productivity growth. The situation in British Columbia is similar and, in some respects, even worse because the province has significantly benefited from the increase in commodity prices and the ensuing resurgence of mining in the province (Stueck, 2008) but has generally been performing below the Canadian average in terms of labour productivity.

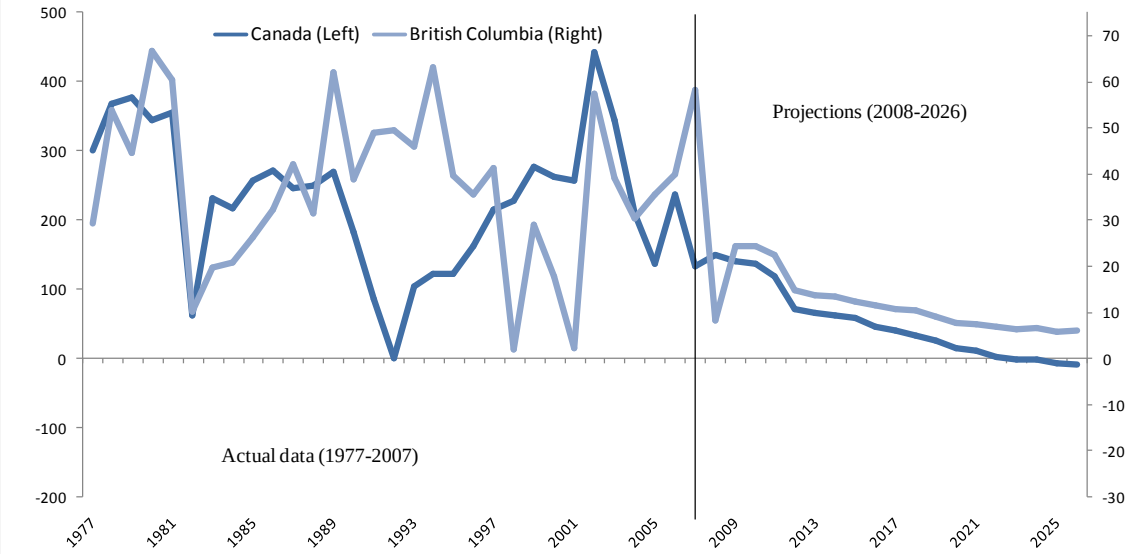
This section reviews the productivity performance of British Columbia during the last two decades. It compares the performance of the province with that of Canada, which itself has been losing ground to most OECD countries in the last 30 years. It first sets the context for discussion by highlighting the increasing importance of productivity for future living standards. The second section focuses on labour productivity, the third section looks at capital productivity, the fourth section discusses total factor productivity (TFP) and the final section examines capital intensity. Most of the data used in this section are from the CSLS productivity database, which provides detailed estimates of labour and capital productivity by province and industry.

A. Importance of Productivity

Economic growth, defined as real GDP growth or real output growth, can be decomposed into labour input growth measured by hours worked and labour productivity growth, defined as output per worker. The size of the working age population (15 to 64) is the primary driver of trends in hours of potential labour supply, which is in turn determined by employment trends. In theory, declines in the unemployment rate, higher labour force participation rates, and increases in average annual hours worked could offset the decline in the size of the working age population. But the magnitude of any changes from these sources is too small to offset demographic developments.

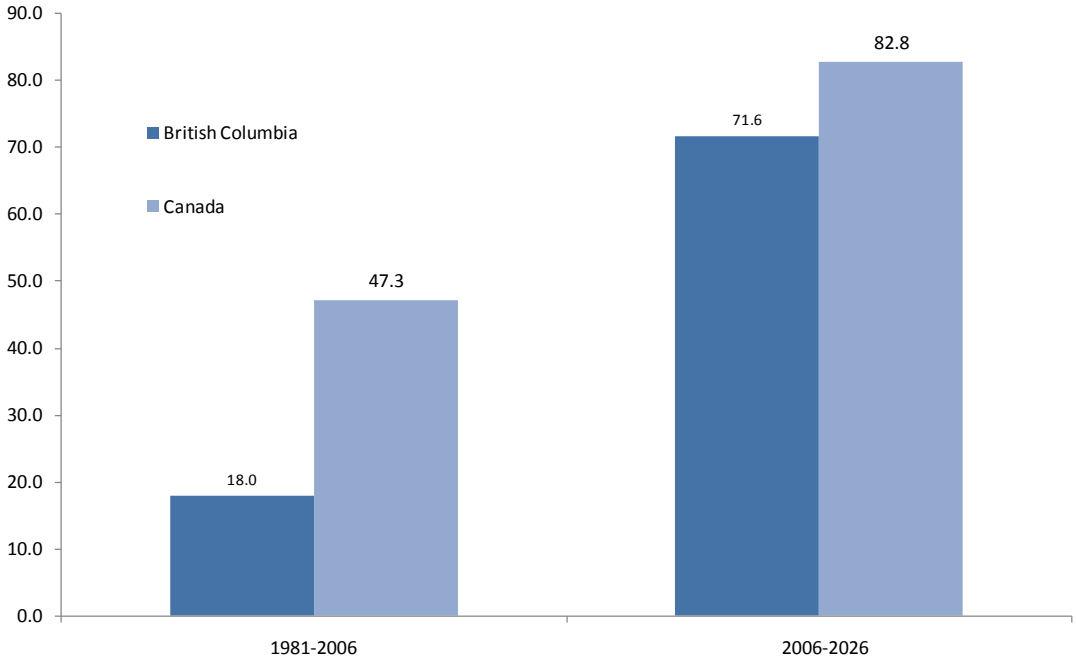
Consequently, with the ageing of the baby boom cohorts and their retirement from the workforce, which will start in a few years, labour force growth in Canada will fall significantly (Chart 1). Net labour force growth in Canada will turn negative around 2023 and immigrants will account for a much larger proportion of new entrants in the labour force. While British Columbia's labour force growth is also projected to decrease significantly, strong immigration is expected to prevent negative net labour force growth over the 2006-2026 period.

Chart 1: Net Labour Force Growth in Canada and British Columbia 1977-2026, persons aged 15-64



Source: Labour force estimates for 1976-2007 from Statistics Canada, Labour Force Survey; for 2008-2026 from Statistics Canada, Population Estimates and Projections.
Note: Projected labour force estimates are calculated by multiplying projected population with the 2007 labour force participation rates for the 15-44 age group and the 45-64 age group.

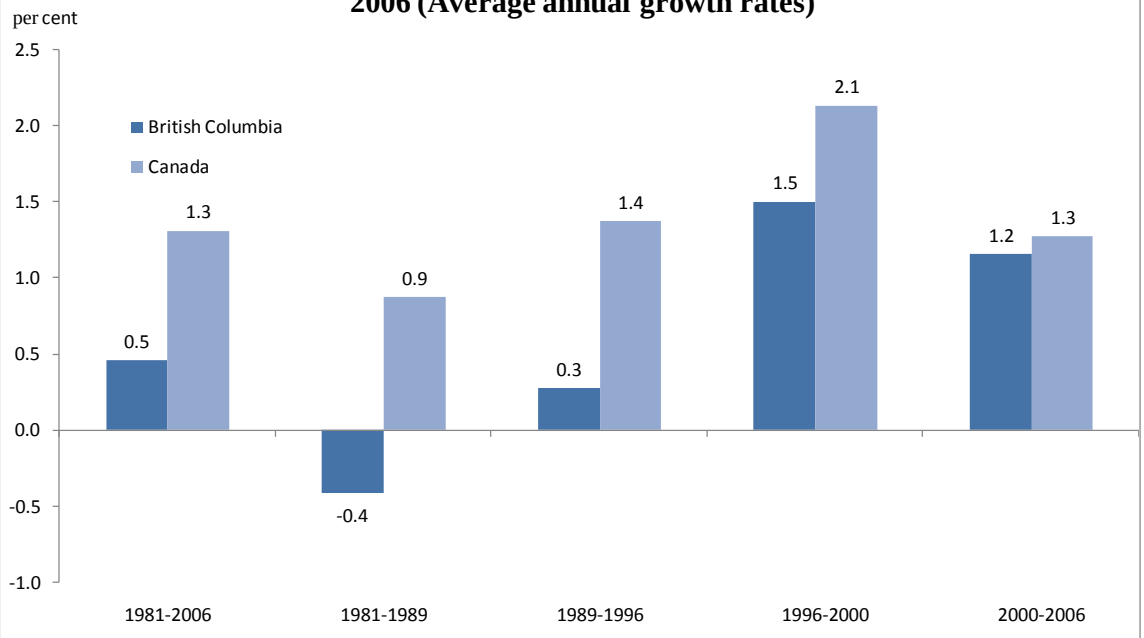
Chart 2: Contribution of Labour Productivity Growth to Economic (GDP) Growth in Canada and British Columbia, 1981-2026



Source: Table 1d

Declining labour force growth means that in both Canada and British Columbia the importance of hours worked as a source of economic growth will fall in the future. Productivity growth will hence assume a greater relative importance as a source of economic growth. It is estimated that from 2006 to 2026 productivity growth will account for 83 percent of economic growth in Canada and about 72 percent in British Columbia (Chart 2). In the future, if British Columbia wants to increase GDP, it will have to increase labour productivity.

Chart 3: Output per Hour Growth in British Columbia and Canada, 1981-2006 (Average annual growth rates)



Provincial Economic Accounts and Labour Force Survey, Statistics Canada.

Labour productivity is not only an engine of economic growth, it is also the main driver of living standards, defined as real Gross Domestic Product per capita. GDP per capita can be decomposed into the product of labour productivity, the average number of hours each employed person works, and the proportion of the entire population that is employed. Over the 1981-2006 period, labour productivity accounted for 56 percent of the increase in living standards in British Columbia. Over the 2006-2026 period, the rapid growth of the population aged 65 and over will cause the employment-population ratio to fall, putting downward pressure on growth in material living standards in British Columbia. With no expected increase in average weekly hours, productivity will be responsible for 156 percent of future living standards growth.

Economic growth in British Columbia has picked up considerably since 1996, with real GDP growing slightly faster than 3 per cent per year between 1996 and 2006 compared to an average of only 2.13 per cent per year in the 1981-1989 period. More rapid economic growth in the province was mostly the result of faster productivity growth over the last decade (Chart 3). The trend toward more rapid productivity growth

in British Columbia is encouraging, but its poor overall performance in the last 25 years suggest that efforts must continue if the province wishes to secure its future standards of living. The following sections review the productivity performance of British Columbia in more details.

B. Labour Productivity

Labour productivity in British Columbia in 2006, defined as GDP per hour worked in 1997 chained dollars, was below the level observed in Canada (Table 1). The gap, however, was only $1.6 per hour worked, or 4.5 per cent of the Canadian level. Even though British Columbia only displays a small productivity gap with the rest of Canada, recent trends suggest that this gap has widened. Indeed, in 1987, British Columbia was well ahead with a productivity level 5.6 per cent higher than the Canadian average. In the last 20 years, British Columbia consistently lost ground in terms of labour productivity (Chart 4).

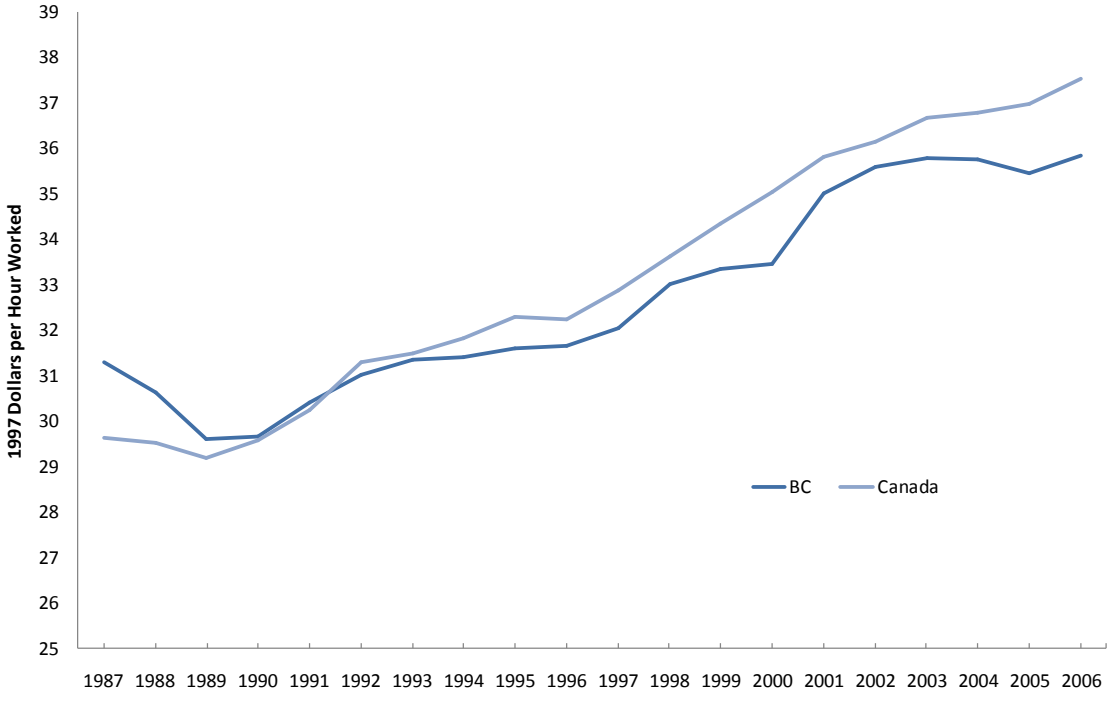
Table 1: Productivity in British Columbia and Canada in 1987 and 2006

	BC			Canada			BC as a Share of Canada	
	Levels		Growth*	Levels		Growth*		
	1987	2006	1987-2006	1987	2006	1987-2006	1987	2006
Labour Productivity (Real GDP per Hour Worked)	31.3	35.9	0.7	29.6	37.5	1.3	105.6	95.5
Capital Productivity (Real GDP per $1,000 of Capital)	786.0	1011.3	1.3	844.2	953.0	0.6	93.1	106.1
Total Factor Productivity (1997 = 100)	91.3	111.3	1.1	92.3	110.0	0.9	98.8	101.2
Capital Intensity (Capital per hours worked)	39.8	35.5	-0.6	35.1	39.4	0.6	113.4	90.0

Source: CSLS Productivity Database * Average Annual Growth Rates.

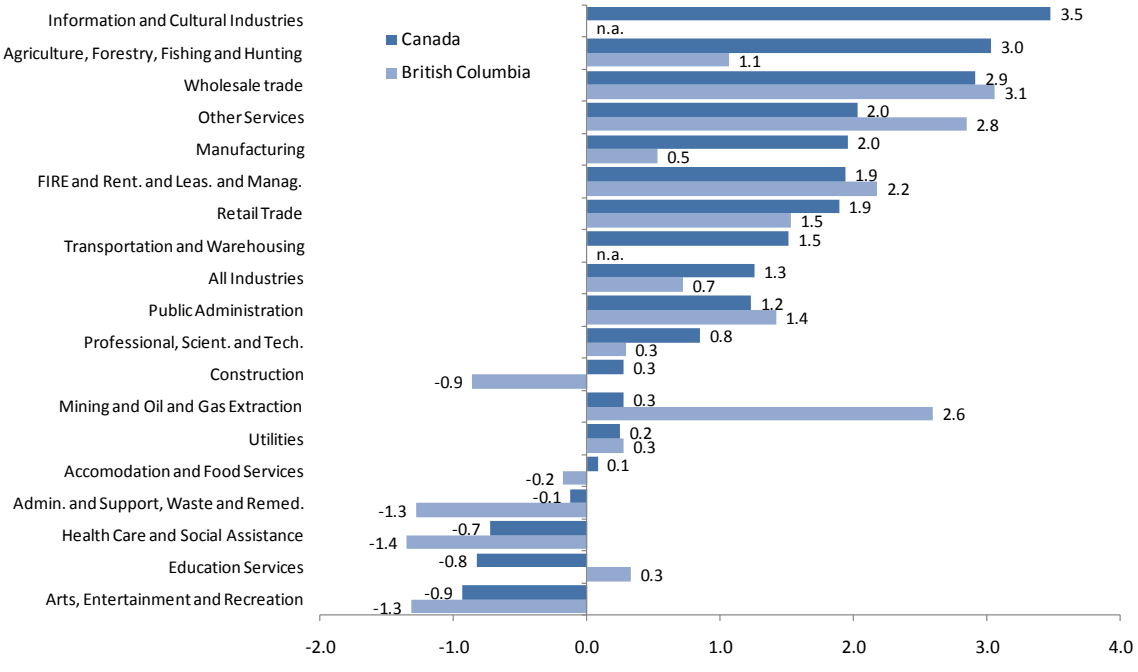
As a whole, labour productivity in British Columbia grew on average 0.7 per cent a year during the 1987-2006 period while Canada has a whole experienced average annual growth of 1.3 per cent. In fact, labour productivity growth in British Columbia was below that of every other province over that period. The poor performance of British Columbia compared to the rest of Canada can be attributed to many factors which are still poorly understood. One interesting element, though, is the fact that labour productivity growth in some industries, most notably agriculture, forestry, fishing and hunting and manufacturing, has been significantly lagging behind the national average for these industries (Chart 5). Yet, the opposite happened in a few other industries, with productivity in the mining, oil and gas extraction industry in British Columbia outpacing the national average by over 2 percentage point annually. The effect of British Columbia's industrial structure, with employment more concentrated in lower productivity industries than is the case in the rest of Canada, will the subject of discussion later in the paper.

Chart 4: Labour Productivity (GDP per Hour Worked) in British Columbia and Canada



Source: CSLS Productivity Database

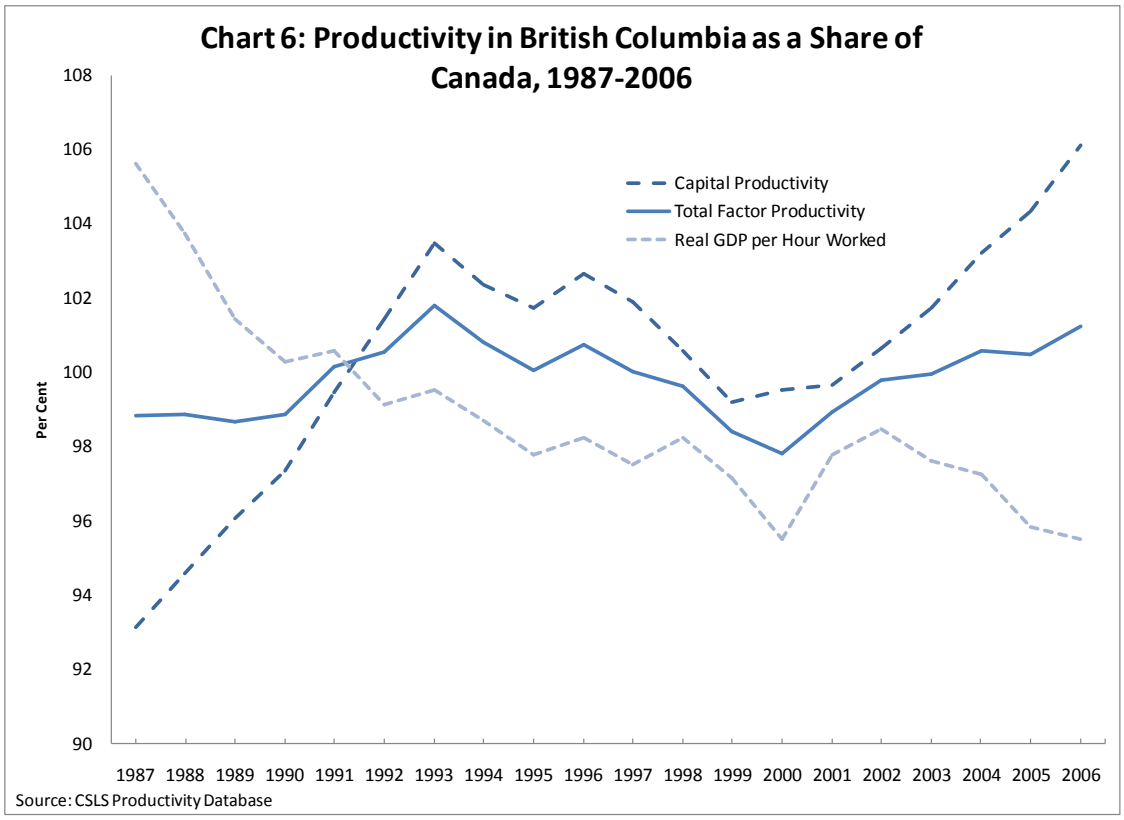
Chart 5: Average Annual Labour Productivity Growth by Industry, Canada and British Columbia, 1987-2006



Source: Statistics Canada, Innovation Survey 2003, Table 358-0032

C. Capital Productivity

From the point of view of the advance of living standards and warranted real wage growth, labour productivity is key. Yet, the productivity of other factors of production also plays an important role in economic growth. As is the case for labour productivity growth, capital productivity growth is a partial productivity measure and thus represents the growth in GDP that is not accounted by growth in the capital stock. In other words, it can be interpreted as the rate of change in the efficiency with which capital is utilized.



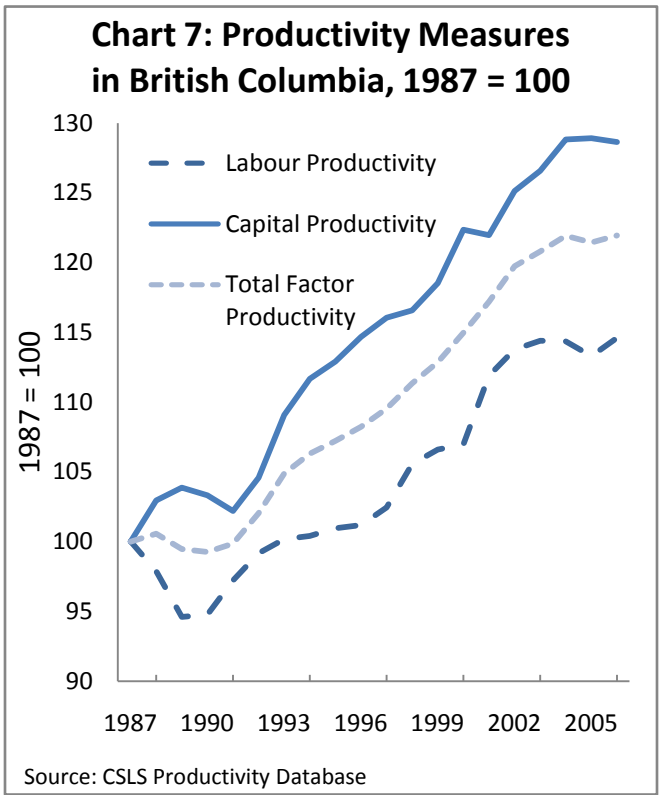
Capital productivity in British Columbia has performed relatively well when compared to Canada during the 1987-2006 period, growing on average at an annual rate of 1.3 per cent, about twice as fast as in Canada which grew 0.6 per cent per year on average (Chart 6 and Table 4). This suggest that investments in capital in British Columbia have provided increasingly high returns to investors and indicates that the prospects for future investment in the province have improved considerably over the period.

D. Total Factor Productivity

Total factor productivity (TFP) is often associated with innovation. In reality, it is better interpreted as the portion of economic growth that cannot be explained by increases in factors of production which, in our case, are labour and capital. Innovation is

often embodied in new physical capital, and will thus be captured by an increase in capital stock. There exist, however, many innovations which are the result of either intangible capital, such as the value to a firm of being located in a technological cluster, or investments in factors unaccounted for in the growth accounting methodology used to calculate TFP, such as investment in human capital.

TFP can thus be interpreted as the efficiency with which inputs are used. In contrast to slower productivity growth, TFP in British Columbia has been growing faster than in Canada over the 1987-2006 period. This suggests that there were developments in the province which led firms to use inputs, particularly capital inputs, more efficiently. In any case, because TFP accounted for an important part of economic growth in Canada and British Columbia over the last 20 years, further exploration of the drivers behind its growth is warranted.



E. Capital Intensity

Productivity in British Columbia has evolved in a different way than in Canada during the last twenty years (Chart 7 and Chart 8). Economic growth in the province has been healthy at about 3.1 percent annually over the 1987-2006 period, but a large part of this growth was directly attributable to an increase in the number of hours worked which increased at an average annual rate of 2.4 percent. By comparison, hours worked in Canada increased only 1.4 percent per year over the same period. This lead to a sharp decrease in the province's unemployment rate, especially over the last five years when it dropped from almost nine percent in 2002 to just above 4 percent in 2007. In fact, most

labour market indicators, from employment growth to the labour participation rate and the number of firms reporting skill shortages point to a buoyant labour market (Sharpe and Shaker, 2007). Moreover, the strong job growth occurred throughout the province and fuelled robust consumer spending (Business Council of British Columbia, 2007).

These strong labour market developments, however, were not matched by similar growth in capital stock. British Columbia's real capital stock increased 1.79 percent a year between 1987 and 2006, 0.25 percentage points slower than Canada's capital stock (2.04 percent). Slow growth in capital stock and strong labour input growth translated into a substantial decrease in British Columbia's capital intensity (declining 0.6 percent per year), i.e. capital stock per hour worked, all the while Canada experienced an average increase of 0.6 percent per year in capital intensity (Table 1). This decrease in capital intensity, fuelled by both a strong labour market and weaker investment in capital, can from a growth accounting perspective explain most of the labour productivity growth differential between British Columbia and Canada. In fact, with capital shares at about 40 percent of GDP, the 1.2 percentage point difference between the annual growth rate of capital intensity in British Columbia and Canada accounts for a 0.5 percentage point difference in labour productivity growth between the two jurisdictions. Since the average annual labour productivity growth gap was 0.52 percentage point over the 1987-2006 period, differences in capital intensity growth account for practically all of the labour productivity growth gap between British Columbia and Canada.

Moreover, the decline in capital intensity can also explain the strong capital productivity growth in the province and the above average TFP growth. The former experienced strong growth partly because each unit of capital was associated with an increasing amount of workers and was used for additional hours. While a strong labour market and robust employment growth is undeniably good for British Columbians, a sustained decrease in capital intensity might deepen the labour productivity challenge British Columbia will face in the long term.

II. State of the Drivers of Productivity in British Columbia

In order to develop policies to improve productivity performance, it is important to first identify the drivers of productivity growth. The standard starting point for the discussion of the dynamics of productivity growth is the simple neo-classical growth accounting model. In this model, there are three key factors determining labour productivity growth. The first is investment in human resources, which determines the quality of labour input. More human capital makes a worker more productive. The second is investment in capital goods, which determines the size of the capital stock and hence the amount of machinery and equipment and structures available to each worker and firm. Higher ratios of capital to labour, or capital intensity, boost labour productivity. The third is often referred to as the pace of technological progress, but in fact encompasses all factors not captured by the previous two measures. It is very roughly proxied by the rate of total factor productivity growth. In this paper, we look at technological progress through one of its main drivers – the development of new knowledge through R&D.

These three drivers are in turn affected by the industrial structure and resource base of the province as well as by both the macroeconomic and microeconomic environment and policies. Indeed, the differences in industrial structures between provinces and countries sometimes explains an important part of the differences in economic growth and thus begs the question of whether or not public policies are creating the right incentives to ensure the development of dynamic industries and the decline of least dynamic industries. Moreover, while some of the macroeconomic and microeconomic policies directly affect one or more of the three productivity drivers and can thus be addressed in the discussion of these drivers, many have indirect effects. In this context, after a brief review of the state of the three productivity drivers, we turn our attention to areas of importance for productivity which go beyond these three drivers, starting with the industrial structure, and followed by macroeconomic factors and microeconomic factors.

A. Human Capital

The concept of human capital is as old as economics. Indeed, Adam Smith (1776) already identified it as a key component of economic growth in the Wealth of Nations (Book II, Chapter 1, p.283):

> "The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expence, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise of that of the society to which he belongs. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labour, and which, though it costs a certain expence, repays that expence with a profit."

The literature linking human capital, for which educational attainment, literacy and experience are the key proxies, and economic growth is extensive. Because human capital reflects the quality of the labour input, it is no surprise that it has a direct positive effect on productivity.

The BC Progress Board has stressed the importance of building strong human capital to the future living standards of British Columbians, starting at a young age, through university and throughout an individual's life and career (BC Progress Board, 2007). British Columbia already enjoys a very educated labour force. Among individuals aged between 25 and 44, less than nine percent did not have a high school diploma in 2006 (Table 2). This was below the national average of 10.1 percent and represented a long-standing characteristic of the province's population as British Columbia has consistently been ahead in terms of high school completion since 1990.

Table 2: Educational Attainment in Canada and British Columbia in 1990 and 2006, Population Aged 25-44 unless otherwise noted

	BC			Canada			BC as a Share of Canada	
	Levels		Growth*	Levels		Growth*		
	1990	2006	1990-2006	1990	2006	1990-2006	1990	2006
Percentage Without a High School Diploma	16.4	8.9	-7.5	22.7	10.1	-12.5	72.2	87.6
Percentage Who Completed Post-Secondary Education	43.9	60.1	16.2	44.6	64.0	19.5	98.4	93.8
Percentage Who Completed University Education	15.4	26.9	11.5	16.2	27.5	11.4	95.3	97.7
Average Years of Schooling (25 and over)	12.4	13.4	8.1	11.6	13.1	12.7	106.5	102.2
Human Capital Stock per Capita - IEWB ($1997, 25 and over)	83,507	95,795**	14.7***	73,257	83,949**	14.6***	114.0	114.1

Source: Statistics Canada, Labour Force Survey and Index of Economic Well Being * Total Percentage Point Change except for Average Years of Schooling and IEWB capital stock for which it is Total Percent Change. **2002 ***1990-2002

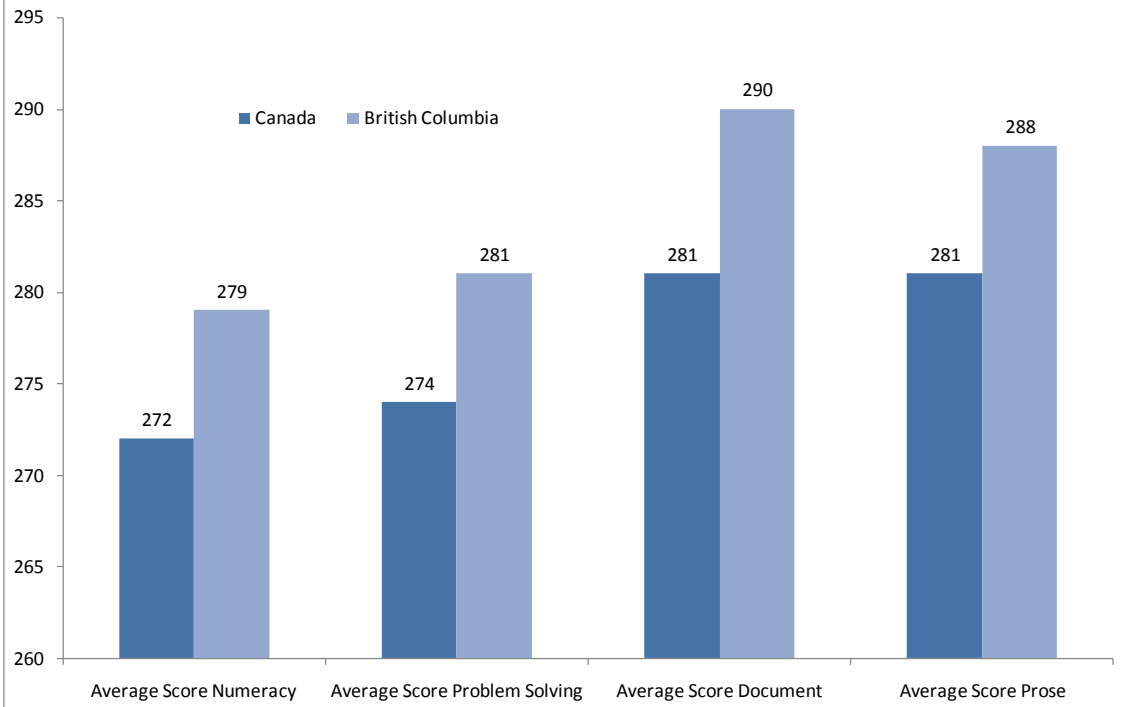
This strong performance in high school completion, however, does not translate into a better performance at higher levels of educational attainment. The number of persons completing post-secondary education, at 60.1 percent in 2006, was slightly below the 64.0 percent national average which, arguably, was inflated by the high levels in Quebec due to the system of CEGEPs. Nevertheless, this below average performance is also visible at the university level, where British Columbia does slightly worse than the Canadian average (97.7 percent of the national average in 2006), albeit its relative position has improved slightly over the 1990-2006 period (95.3 percent of the national average in 1990).

Yet, if we use other measures of educational attainment, we obtain slightly more optimistic results for British Columbia. For example, if we compute the average years of schooling of the population aged 25 years and over in British Columbia, we find that in

both 1990 and 2006 the province had a more educated labour force than the Canadian average. Similarly, using the human capital stock component of the Index of Economic Well Being (CSLS, 2003), a cost-based measure of human capital, we find that not only is British Columbia well above the national average, it is in fact first among the ten provinces since 1979. Over the 1990-2002 period, it remained stable relative to Canada at 14 percent above the national average.

While educational attainment is the most often used proxy to measure a population's human capital, it sometimes suffers from serious limitations. Most obvious is the inability to capture the quality of education that is provided. In more recent literature on human capital and skills, direct measures of literacy are used as a proxy for human capital (Coulombe and Tremblay, 2006). Unfortunately, the fact that there is limited time series for these direct measures is a major drawback. Still, in the most recent International Adult Literacy and Skills Survey (IALSS) in 2003 (the survey was also conducted in 1994), British Columbia systematically scored above the Canadian average (Chart 9). The province reported scores between 2.5 percent and 3.2 percent above the Canadian average depending on the domain (Numeracy, Problem Solving, Document and Prose). For each domain, average scores in British Columbia were significantly higher (statistically) than six or seven other provinces, with only Alberta and Saskatchewan scoring higher in all domains, albeit not in a significant way.

Chart 9: Average Score in Numeracy, Problem Solving, Document, and Prose for Canada and British Columbia, 2003



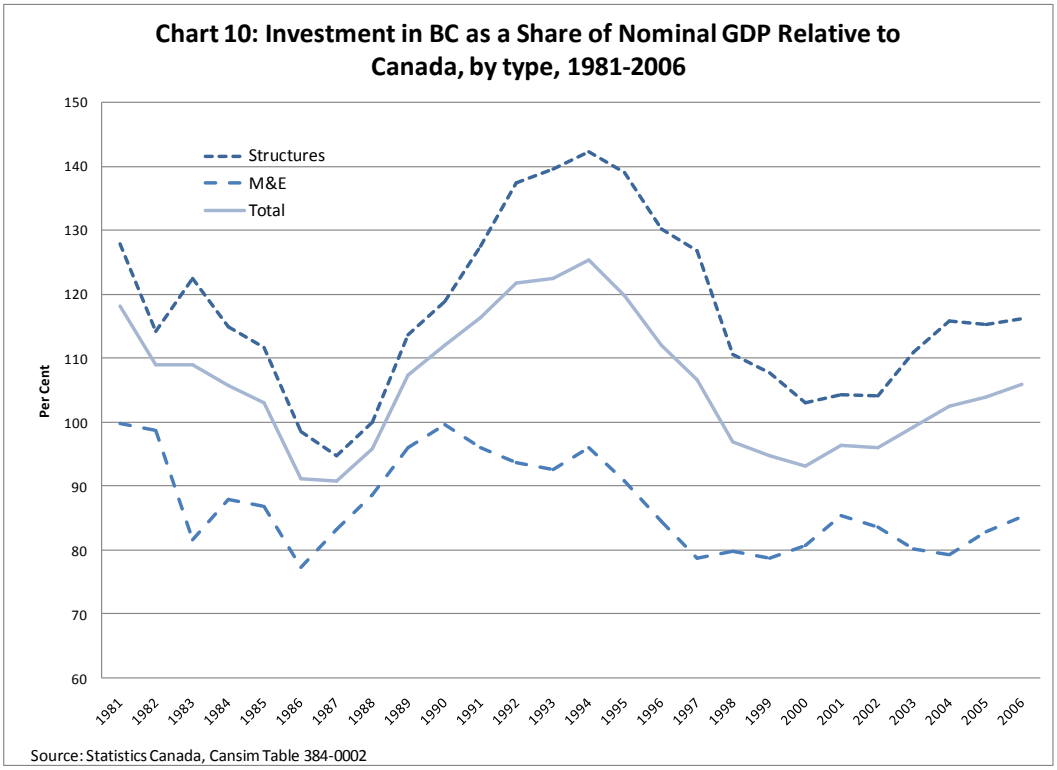
Source: Human Resources and Skills Development Canada, "Building on Our Competencies: Canadian Results of the International Adult Literacyand Skills Survey"

This relatively optimistic overview of British Columbia's educational and literacy levels does obscure important challenges facing the province. For example, the literacy of

recent immigrants and the aboriginal population is well behind that of the general population (Sharpe, Arsenault and Lapointe, 2007) and completion rates for apprenticeship programs are low (Sharpe, Arsenault and Lapointe, 2008). Moreover, a plethora of studies suggest that returns on human capital investment are high, suggesting that there is still great opportunity to reap strong benefits by investing in education (Lemieux and Card (2001) and Oreopoulos (2006)). In the context of increasing demand for skills in the labour market, education and literacy will play an even greater role in the future in ensuring increasing living standards. Hence, even though British Columbia does perform relatively well within Canada in terms of education and literacy, there remain important opportunities in this area which could have a significant impact on future productivity growth.

B. Investment and Capital Stock in British Columbia

At first glance, the past and current performance of British Columbia in terms of investment appears vigorous. In 2006, British Columbia invested 23.3 percent of its GDP, which is slightly more than Canada which invested 22.0 percent of its GDP in the same year (Table 3). Yet, this situation represented a significant decline from the early 1980s and 1990s when British Columbia consistently outperformed Canada by 15 to 20 percent (Chart 10). The fall in British Columbia investment relative to Canada since 1981 reflects a fall in both structures (from 127.8 percent of the national average to 116.2 percent) and M&E (from 99.7 percent to 85.3 percent). Still, total investment in British Columbia relative to Canada has increased since 2000 when it stood at only 17.8 percent of GDP, going from seven percent below the national average in 2000 to six percent above the national average in 2006.



British Columbia's investment is concentrated in structures, which account for almost three quarters of total investment in the province in 2006 compared to about two thirds in Canada. While strong investment in structures is desirable, productivity growth is generally most influenced by investments in machinery and equipment (M&E). On this count, British Columbia performs significantly worse than Canada with investment in M&E representing only 6.2 percent of GDP in 2006 compared to 7.3 percent for Canada.

Table 3: Total Investment as a Share of Nominal GDP in British Columbia and Canada

	Total Investment in British Columbia as a Share of Nominal GDP			Total Investment in Canada as a Share of Nominal GDP			Total Investment in BC as a Share of Nominal GDP, relative to Canada		
	Structures	M&E	Total	Structures	M&E	Total	Structures	M&E	Total
1981	20.6	8.4	29.0	16.1	8.5	24.5	127.8	99.7	118.1
1991	16.2	6.6	22.8	12.7	6.9	19.6	127.4	96.0	116.3
2000	10.9	6.9	17.8	10.6	8.6	19.2	103.1	80.7	93.1
2006	17.1	6.2	23.3	14.7	7.3	22.0	116.2	85.3	106.0

Source: Statistics Canada, Cansim Table 384-0002

In Canada, investment in ICT goods, a component of M&E investment which played a central role in fuelling very robust productivity growth in the United States in the late 1990s, is faring particularly badly (Centre for the Study of Living Standards, 2005).

Table 4: Public and Private Investment as a share of Canada, British Columbia relative to Canada

	Public Investment as a share of GDP in BC as a share of Canada			Private Investment as a share of GDP in BC as a share of Canada		
	Structures	M&E	Total	Structures	M&E	Total
1981	97.4	80.5	94.1	133.2	101.2	121.5
1991	109.2	84.7	102.5	131.2	97.5	118.8
2000	116.5	97.4	109.7	101.0	78.9	90.8
2006	105.0	91.5	101.1	118.0	84.5	106.7

Source: Statistics Canada, Cansim Table 384-0002

To begin assessing potential remedies, it is important to identify the source of under-investment in M&E. An important aspect of investment in both Canada and British Columbia is that it is mostly undertaken by private firms rather than by public entities. This holds for both structures and M&E. In British Columbia in 2006, the share of public investment in total investment was only 12.1 percent: 12.2 percent for structures and 11.8 percent for M&E. The shares of public investment for Canada were only slightly larger. This suggests that any relevant policy to increase investment will have to focus on the business sector. Yet, interestingly, both the level of public and private investment in M&E in British Columbia were below the national average in 2006 (Table 4).

While the level of investment in a given year is important, investment must also be sustained in order to maintain and build up a strong capital stock. Business investment in real terms has grown slower in British Columbia over the 1981-2006 period than in Canada, 2.89 percent compared to 3.29 percent. British Columbia lagged even more in terms of real business M&E investment (5.24 percent compared to 4.32 percent). Similarly, as noted in a previous section on capital intensity, British Columbia's capital stock has been growing slower over the last two decades than Canada's capital stock (1.79 percent per year in British Columbia and 2.04 percent per year in Canada). As noted earlier in the report, the slower growth in capital growth and the lower proportion of M&E investment relative to the Canadian average both have contributed to BC's slower labour productivity growth and should be of concern to policymakers in British Columbia.

C. Research and Development and Innovation

We have already established that increases in productivity can be the result of increases in the amount of physical and human capital. Similarly, technological progress can be either embodied in physical capital or disembodied in the form of, for example, organizational change. Productivity can also be significantly raised if appropriate management practices are exploited, if firms learn how to better exploit existing technologies or if new and enhanced processes are developed.

Table 5: Total Expenditure On Research and Development by Performing Sector, British Columbia and Canada, Percentage of GDP, 1981- 2005

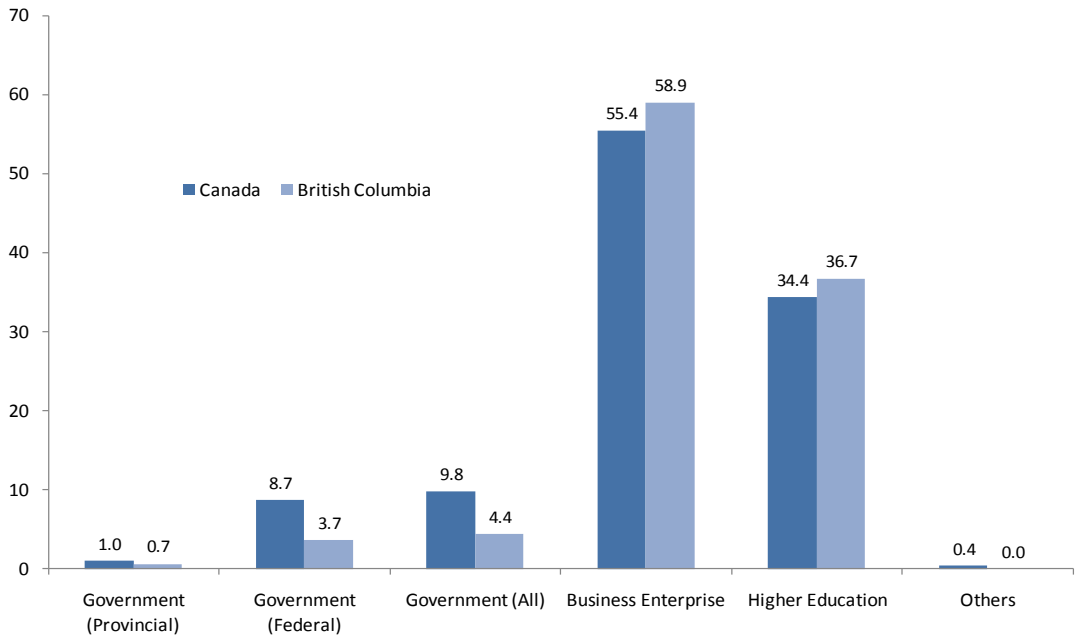
	British Columbia				Canada			
	Total Expenditure	Governments	Business Enterprise	Higher Education	Total Expenditure	Governments	Business Enterprise	Higher Education
1981	0.59	0.15	0.27	0.18	1.22	0.30	0.59	0.33
1991	0.96	0.15	0.43	0.37	1.57	0.29	0.78	0.48
2000	1.22	0.10	0.74	0.38	1.91	0.22	1.15	0.54
2005	1.45	0.06	0.86	0.53	2.01	0.20	1.12	0.69

Source: Statistics Canada, Table 358-0001

The question then becomes how firms, governments and individuals can develop higher quality physical capital and how knowledge can be created and diffused, thus improving the quality of human capital and creating intangible value in the form of better management practices and production processes. The innovative process is complex and necessitates a suitable incentive structure, the appropriate a priori knowledge and considerable investment in knowledge creation and knowledge diffusion. It is this latter element, expenditures on research and development (R&D), on which we first focus our attention. We then look briefly at direct measure of innovation by firms in British Columbia. Expenditures on research and development in British Columbia as a percentage of GDP are about 72 percent that of Canada. Indeed, as a share of GDP, total expenditures on R&D in Canada were 2.01 percent in 2005 compared to only 1.45

percent in British Columbia (Table 5). The relative importance of the different performing sectors of R&D in British Columbia is very similar to that in Canada, with the notable exception that the federal government performs significantly less R&D in the province than in other parts of Canada (Chart 11).

Chart 11: Percentage Share of Total Expenditure on Research and Development By Performing Sector, Canada and British Columbia, 2005

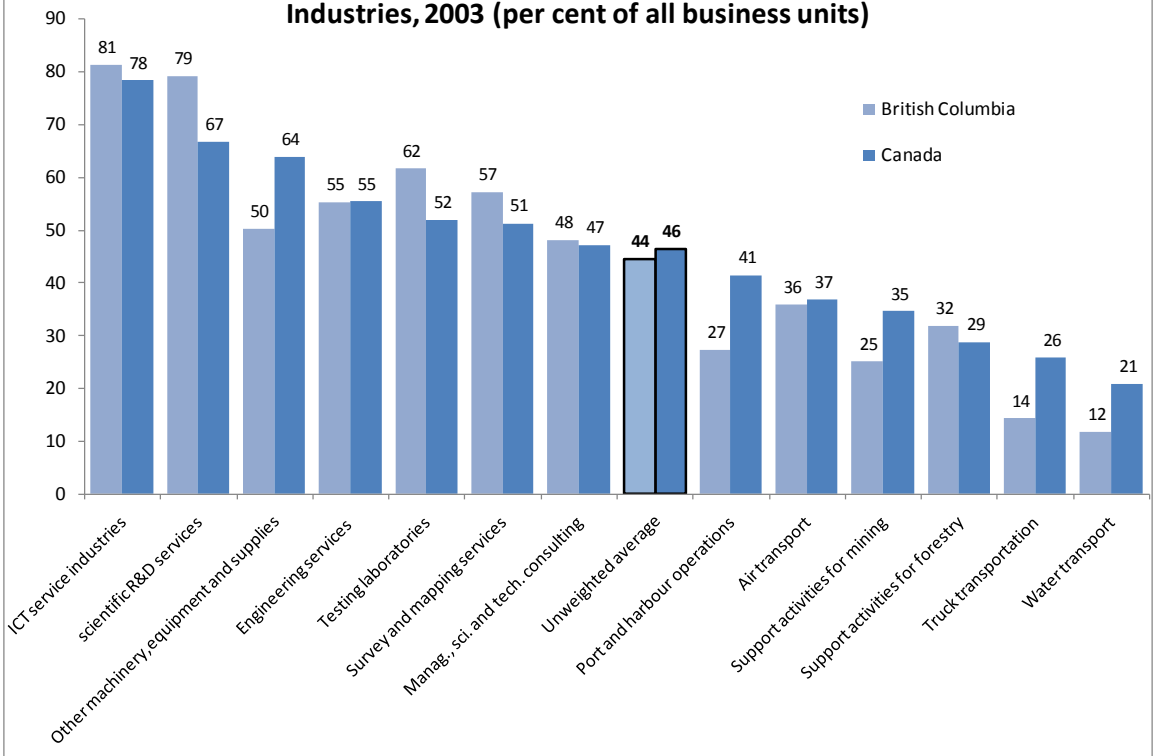


Source: Statistics Canada, Table 384-0002

Every performing sector in BC lagged the Canadian average. That was particularly the case of R&D performed by governments which represented only 0.06 percent of GDP in 2005, less than a third the level in Canada. The business sector and higher education both lagged the levels in Canada by about 25 percent in 2005. Over the 1981-2005 period, however, British Columbia improved its relative position significantly, from less than half the national R&D intensity in 1981 to about three quarters in 2005. Moreover, this took place over a period where national expenditures on R&D as a share of GDP increased 65 percent. British Columbia went from the eighth place among the ten provinces in 1981 to the fifth place in 2005. Yet, despite an encouraging performance over the last 25 years, British Columbia remains behind half the provinces.

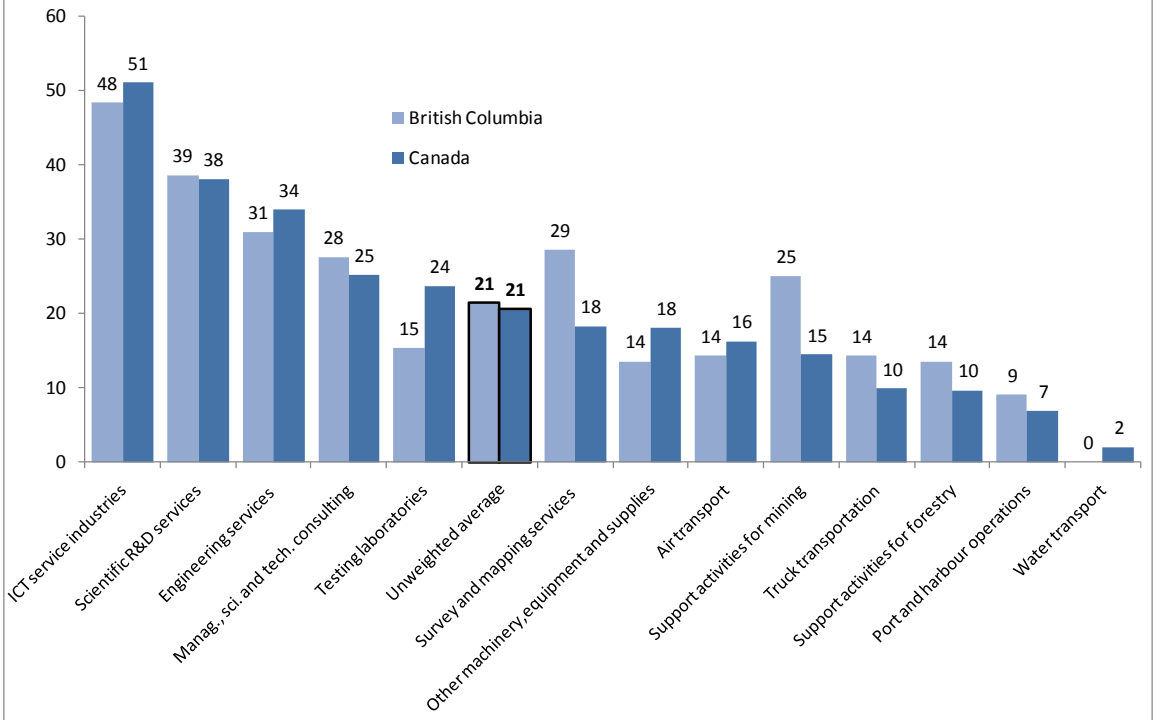
Direct measures of innovation, which are only available occasionally and for selected industries, do suggest that British Columbia is performing better than R&D estimates suggest. For example, the 2003 Statistics Canada survey of innovation found that over the 2001-2003 period, a larger proportion of business units in British Columbia innovated in terms of either product or processes than was the case in Canada as a whole for six of thirteen selected service industries (Chart 12). On average, about 44 percent of business units in British Columbia among the surveyed service industries were innovators, only slightly less than the Canadian average (46 percent).

Chart 12: Innovation in Canada and British Columbia, Selected Service Industries, 2003 (per cent of all business units)



Source: Statistics Canada, Innovation Survey 2003, Table 358-0032

Chart 13: Firms that Develop New or Significantly Improved Products, Canada and British Columbia, 2003 (per cent of all business units)



Source: Statistics Canada, Innovation Survey 2003, Table 358-0032

If we only focus on product innovation, the performance of British Columbia is slightly above the national average with 21.5 percent of business units considered product innovators compared to 20.6 percent nationally (Chart 13). British Columbia outperforms Canada in seven of the thirteen service industries. A number of other indicators are provided in the survey of innovation and a more involved analysis will be required to better understand the apparent disconnect between the input indicators (R&D expenditures) and the innovation output indicators (percentage of innovative firms). A key factor might be the process of technology or best practices adoption, which does not necessarily rely heavily on R&D but can lead to substantial innovation.

D. Industrial Structure and Resource Base

The industrial structure and resource base can have a direct impact on productivity levels and productivity growth. Clearly, aggregate productivity is simply a weighted average of industry-level productivity. Thus if British Columbia's industrial structure is more concentrated in low productivity level or low productivity growth industries, a below average productivity performance is to be expected. In turn, the resource base is one of the strongest determinants of a jurisdiction's industrial base, especially when resources are plentiful. Moreover, the resource base and the external evolution in prices of these resources can significantly affect both productivity levels and productivity growth.

Most obvious in Canada at this time is the effect that higher oil prices have had on aggregate productivity. On the one hand, high oil prices tend to displace labour and investment from low productivity sectors to the high productivity oil sector, increasing productivity growth and levels in Canada through a composition effect. On the other hand, high prices encourage the exploitation of marginal oil fields which necessitate more inputs (machines or labour) per barrel, which tends to lower productivity growth and productivity levels in the oil sector and, as a result, in the whole economy. While these effects were most obvious with the recent large swing in oil prices, the argument remains valid for changes in prices of other resources.

In British Columbia, the industrial structure tends to be more concentrated in below average productivity growth industries (Table 6). For example, while construction had an average productivity growth of about 1.6 percentage points per year below average during the 1987-2006 period in British Columbia, the average share of hours worked in that industry was about one percentage point higher in British Columbia than in Canada over the period. In mining, oil and gas extraction, an above average productivity growth industry, the share of hours worked was 1.0 percent in British Columbia compared to 1.6 percent in Canada as a whole. If British Columbia had had the same share of employment in each two-digit industry as Canada in both 1987 and 2006, its average annual productivity growth would have been 0.89 percent instead of 0.72 percent, accounting for about 31 percent of the annual 0.51 percentage point productivity growth difference over the 1987-2006 period.

Table 6: Industrial Structure in British Columbia

	Productivity Growth Differential*	Productivity Level Differential**	Share of Total Hours Worked Differential***
Agriculture, forestry, fishing and hunting	0.3	13.2	-0.4
Mining and oil and gas extraction	1.9	178.4	-0.5
Utilities	-0.4	285.1	-0.3
Construction	-1.6	-16.2	1.0
Manufacturing	-0.2	3.9	-4.6
Wholesale trade	2.3	20.4	0.2
Retail trade	0.8	-50.8	0.5
Transportation and warehousing	1.1	6.1	0.9
Information and cultural industries	2.6	52.9	0.2
FIRE, leasing and management of companies	1.5	233.0	0.3
Professional, scientific and technical services	-0.4	-44.7	1.0
Admin. and support, waste man. and remediation	-2.0	-39.1	0.0
Educational services	-0.4	-17.6	0.0
Health care and social assistance	-2.1	-23.3	0.0
Arts, entertainment and recreation	-2.0	-42.2	0.3
Accommodation and food services	-0.9	-53.8	1.6
Other services	2.1	-46.5	0.2
Public administration	0.7	10.3	-0.5

Source: Table 15

* Represents the difference, in percentage point, between the percentage point growth of a given industry in British Columbia minus the average productivity growth in British Columbia over the 1987-2006 period.

** Represents the difference in per cent between the average level of productivity of a given industry in British Columbia minus the average productivity level in British Columbia over the 1987-2006 period.

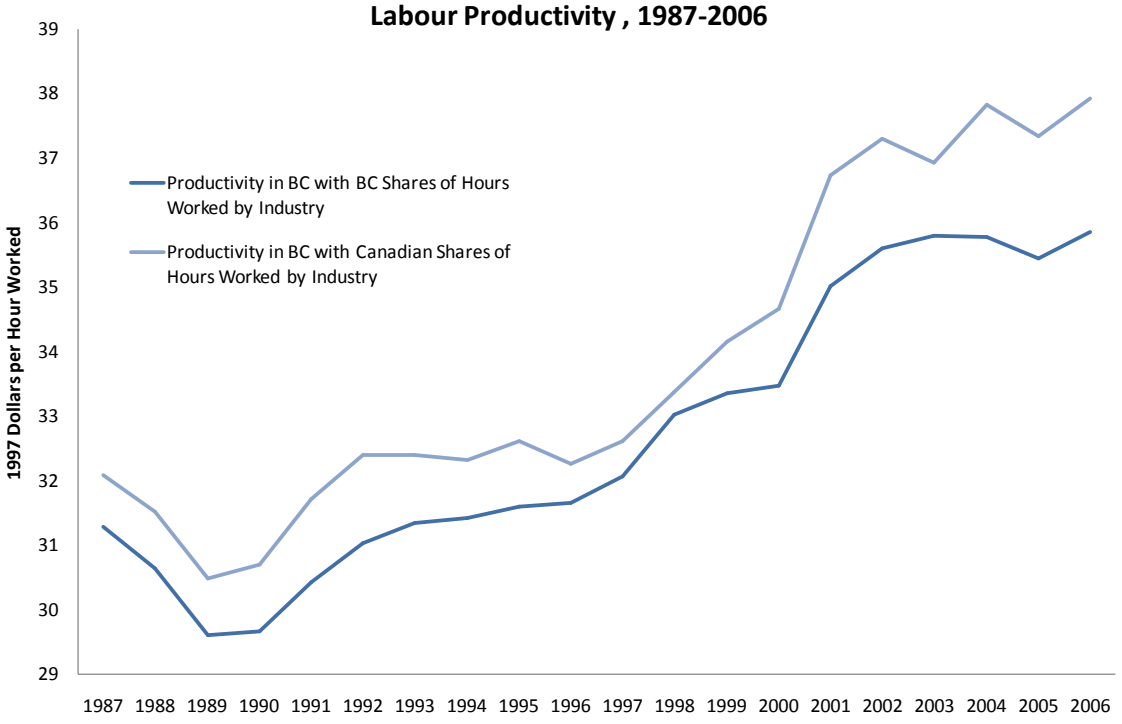
*** Represents the difference, in percentage point, between the average share of hours worked over the 1987-2006 period for the industry in British Columbia and that of the same industry in Canada.

The story is similar, and even clearer, if we focus on productivity levels. British Columbia tends to have larger shares of employment than Canada in industries with below average productivity levels and lower employment shares in above average productivity industries. In fact, this holds true for 14 of the 18 two-digit industries (Table 6). For example, British Columbia's share of employment in the mining, oil and gas extraction industries was 0.5 percentage point lower than in Canada, and the productivity level of this industry was about three times above the BC average. Similarly, the share of employment in British Columbia in accommodation and food services, which records productivity levels equivalent to only about half the province average, was 1.6 percentage points higher than the national average.

By applying the shares of employment in each industry to the productivity levels of these industries in British Columbia, we can estimate the effect of the industrial structure on British Columbia productivity. In 1987, productivity in British Columbia was above that in Canada (31.3 dollars per hour compared to 29.6 dollars per hour in 1997 dollars), but its industrial structure was already dragging it down about 1 dollar per hour (Chart 14).

Over time, the effect of the industrial structure on productivity growth amplified the gap between productivity in British Columbia and the productivity level that would obtain if the province had the same employment structure has the rest of Canada. In 2006, the difference between the productivity level in British Columbia (35.9 dollars per hour) and that that would obtain if it had the same employment structure as Canada (37.9 dollars per hour) reached two 1997 dollars per hour. In the same year, the productivity level differential between Canada and British Columbia was 1.4 dollars per hour.

Chart 14: Impact of the Industrial Structure of British Columbia on Labour Productivity , 1987-2006



Source: CSLS Productivity Database. Two industries did not have GDP estimates for British Columbia for the 1987-1996 period. Growth rates in Canada for these industries were used to extend the GDP series for British Columbia.

The fact that British Columbia's industrial structure accounts for both lower productivity growth and lower productivity levels raises important questions. First, is the industrial structure in the province more or less fixed because of the resource base or are structural shifts hampered by other factors that are the result of or can be affected by policies? More importantly, can anything be done to facilitate the transfer of resources from low productivity growth industries to more dynamic ones? In this context, it is relevant to examine both policies currently in place which may dampen resource reallocation and future policies which could potentially facilitate such shifts.

E. Macroeconomic Conditions

Macroeconomic conditions encompass both fiscal and monetary policy. Often, they also refer to issues related to trade and demographic trends. In this section, we briefly review the current macroeconomic conditions in British Columbia and the likely challenges it will face in the future.

In the next few years, economic growth is expected to be above the national average in British Columbia, fuelled in part by strong construction in the run-up to the 2010 Olympics (BC Progress Board (2007) and British Columbia Ministry of Finance (2007)). The recent and continued economic performance, of which the mining sector has been an important contributor (Stueck, 2008), provides a foundation and has driven a number of positive macroeconomic developments in the province.

The government of British Columbia recorded a healthy surplus in fiscal year 2005/06 and again in 2006/07, $3.06 billion and $2.85 billion respectively. These surpluses, in addition to insuring a continued decrease in the weight of the debt/GDP ratio (about 15 percent in 2005-2006, the lowest of any jurisdiction in Canada except Alberta), have allowed for substantial increases in spending for infrastructure, education and health, including a $14 billion investment for public transit which was hailed as the largest public-transit announcement in B.C. history (Bailey, 2008). Given that monetary policy is controlled by the Bank of Canada, and given that it focuses on the economic situation in Canada as a whole, interest rates can be expected to be slightly below the optimal level for the province in terms of ensuring low inflation levels. Still, the Bank of Canada's record has been very good in the last decade and inflationary expectations seem to be well anchored at low levels. In other words, the fiscal and monetary positions of British Columbia do not appear to be harming its productivity performance in any significant way.

International and interprovincial trade affects productivity indirectly. By facilitating competitive pressure and lowering barriers to investment, trade can act as a strong engine for productivity growth. As noted by the BC Progress Board (2007), British Columbia's international export levels as a share of GDP are below the Canadian average. Yet, British Columbia enjoys a unique position in the Canadian federation by being the province most likely to develop and benefit from strong trade links with the rapidly expanding Asia-Pacific region.

It should be noted, however, that exports estimates include the value of intermediate goods, which can themselves be produced locally or imported. For example, the auto industry, one of the main drivers of exports in Ontario and Quebec, has a large share of imported intermediate inputs. In contrast, resource industries have much lower levels of imported intermediate inputs. Thus, it would not be surprising if a more complete analysis of the value added of exports, as opposed to gross exports, reveals that British Columbia's performance is not as dire as current estimates suggest.

British Columbia has been a leader in terms of reducing barriers to interprovincial trade and migration with the development of a framework agreement with Alberta in 2006 (Trade, Investment and Labour Mobility Agreement or TILMA). Because both international and interprovincial trade have the potential to be driving forces for productivity, and because British Columbia performance appears to be below the Canadian average, an assessment of the reasons behind such a lacklustre performance, especially in terms of international trade, is needed.

Migration, the counterpart of trade in goods and services, can also affect productivity, albeit in a slightly different way. First, large migration flows often result in workers being reallocated from low productivity occupations towards higher productivity occupations. In other words, facilitating intra and inter-provincial migration ensures that individuals take employment in the most productive industries and areas. Between 2001 and 2006, British Columbia attracted an average of about 7,500 interprovincial migrants each year, and has been the only net recipient of such migrants along with Alberta (Sharpe, Arsenault and Ershov, 2007). For the 1987-2006 period, it is estimated that $349 million ($1997) was added to British Columbia's GDP as a direct consequence of interprovincial migration.

International migration can also generate a large increase in both the stock of technical skills and intangible knowledge, and can facilitate the adoption of international innovation and best practices. The issue of migration is doubly important for the province of British Columbia and Canada as a whole as the labour force is expected to grow much slower in the next decade and the BC economy is already believed to be at full employment (BC Progress Board, 2007). In this context, attracting skilled workers can be a way to ensure sustained economic growth. Of course, in such conditions, the successful integration of immigrants in the Canadian labour market becomes at least as important as attracting them.

F. Microeconomic Framework

The microeconomic environment encompasses all policies that influence individual persons or firms' behaviour. It includes, for example, product market regulations, which influence both consumers and firms' behaviour, competition policies, which regulate firms' behaviour, and taxation policies, which can potentially affect individuals, firms and government behaviour. Microeconomic conditions also include market realities which affect behaviour, such as the level of competition or the efficiency of existing market mechanisms for example.

Microeconomic conditions affect productivity in many ways and British Columbia certainly has potential for improving its approach to specific issues. In this part, it suffices to say that certain key microeconomic factors, such as product regulation, competition policy, taxation and market entry regulations, must not be overlooked when trying to find ways to improve the productivity performance of a given jurisdiction.

In the following section we propose five areas on which to focus and narrow down the microeconomic areas that should be of interest to British Columbia..

III. Strategic Areas of Importance for Improving Productivity in British Columbia

A. Decision Framework

The previous section identified and reviewed the main key drivers of productivity as well as other factors which affect these drivers. When deciding upon which areas should be the focus of further policy analysis and how these areas should be organized, the following questions should be posed. How important is this factor for productivity growth? Does it constitute a binding constraint for future productivity improvements, i.e. is it a factor limiting productivity growth. Finally, we aim to have a logical progression, both in the order of the reports to be produced and in the content of each report.

B. Five Topics of Importance

Exhibit A summarizes some of the issues that are of importance for productivity. This exhibit identifies the key role played by the three productivity drivers that are physical capital, human capital and research and innovation. For each of these drivers, a number of more precise and relevant issues are identified. Each of the three drivers encompasses a large number of issues which do not overlap between drivers, or driver-specific issues, and each are important to any explanation of productivity growth.

Taxation, depending on the issue at hand, can be both a powerful tool and a binding constraint. These two facts make taxation an unavoidable subject of analysis of productivity. Yet, taxation is complex in that it affects individual decisions to acquire human capital and those of firms to acquire physical capital, and can shape incentives of both individuals and firms to be innovative. Taxation, would overlap many policy suggestions on productivty.

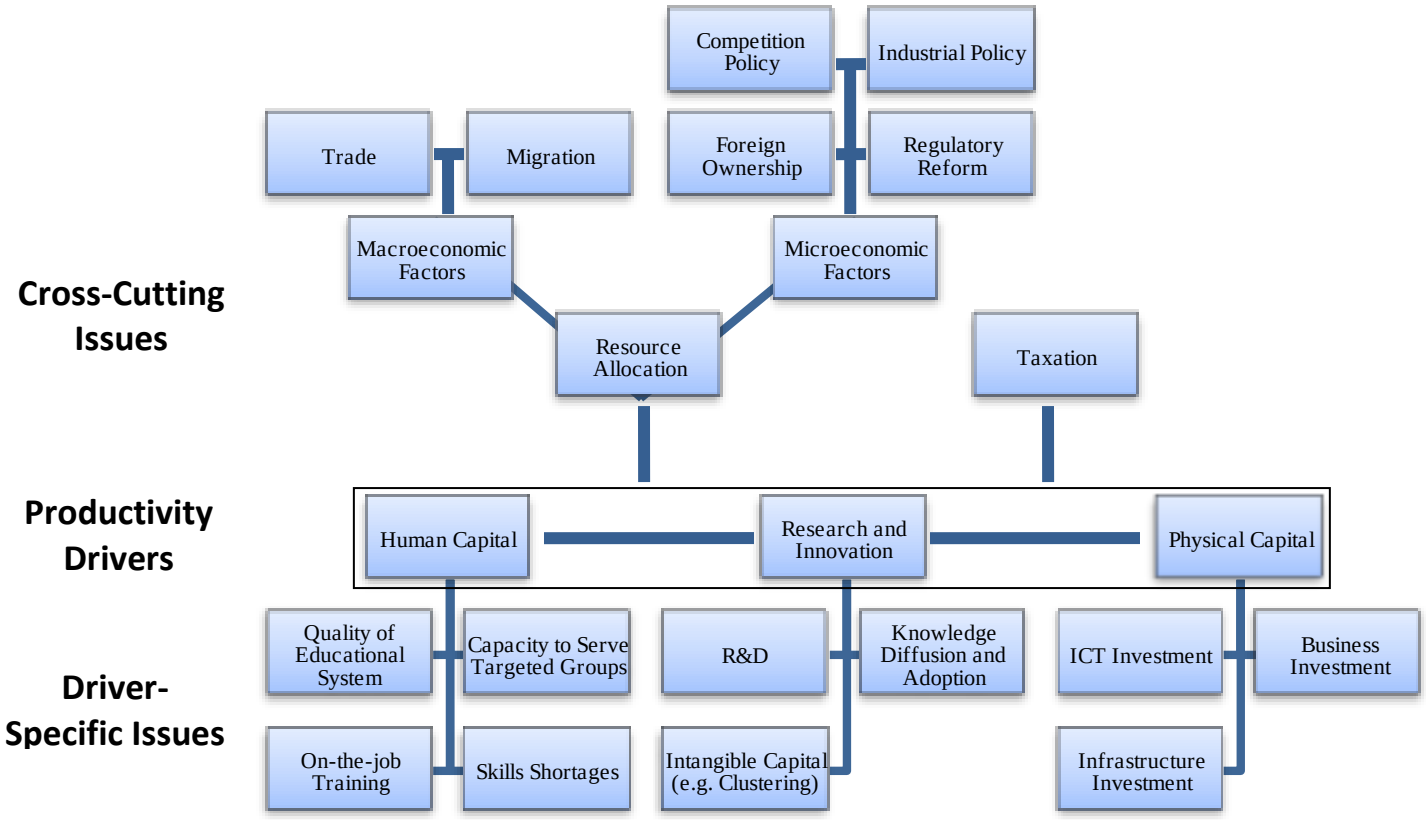
This leaves us with the cross-cutting issues, those which affect more than one of the productivity drivers through the general lens of resource allocation. As noted earlier, the capacity of the British Columbia economy to adapt and allocate resources efficiently is a central issue for productivity growth. Issues related to resource allocation can be divided, roughly and conveniently, between microeconomic and macroeconomic issues. We recognize that the differentiation between micro and macro factors in this fashion is somewhat artificial, but we believe that to deal with such an extensive issue as resource allocation, it is necessary to organize the issues in two distinct parts.

Microeconomic factors include issues such as competition policy, industrial policy, and market regulation and could be the subject of a report. Regulatory reform is also of paramount importance in this process, but has been the subject of research by the BC Progress Board (2005) and is already firmly on the BC government agenda, appearing prominently in the latest BC Ministry of Finance budget (2007). In this context, we do not believe it would require singular focus.

Macroeconomic issues, mostly trade and migration, are rich territory in the context of productivity. They benefit from some commonality as trade relates to the movement of goods and services while migration relates to the movement of individuals.

We believe such a division to be both optimal and logical as it covers all the key areas for productivity analysis and ensures a sufficient level of specificity and narrowness to guarantee meaningful policy recommendations. We also believe it will allow the CSLS to focus on the sub-areas which are of particular relevance to British Columbia and that have been less explored in previous research.

Exhibit A: CSLS Framework for Analyzing Productivity



Conclusion

Productivity is the key to improve future living standards and with the imminent decline in labour force growth, the importance of productivity to economic growth in British Columbia will grow. Indeed, the CSLS estimates that labour productivity growth will account for 72 percent of GDP growth in the 2006-2026 period in British Columbia, up from 18 percent over the 1981-2006 period. Yet, this issues paper established that British Columbia's productivity performance has been lackluster in the last twenty years, performing consistently below the Canadian average in terms of both labour productivity levels and growth rates. In this context, improving the productivity performance of British Columbia is imperative if its citizens are to enjoy a continual increase in living standards.

This report identifies a number of areas in which British Columbia underperforms compared to the rest of Canada. This underperformance may explain its lagging labour productivity growth and improvement in these lagging areas offers the possibility of stronger productivity growth in the future. First, despite having strong human capital in certain areas, British Columbia remains below the national average in terms of post-secondary and university completions. Moreover, its level of M&E investment as well as its growth in total investment have been below the national average and have translated into negative growth in capital intensity. Indeed, falling capital intensity appears to be a key factor in explaining the gap in labour productivity growth between British Columbia and Canada. In addition, although the percentage of firms in British Columbia reporting product and process innovation is similar to the national average, the province's R&D expenditure as a share of GDP is only about three quarters of the national average. The industrial structure of British Columbia's economy was also found to be a drag on its productivity level and growth. Finally, British Columbia is suffering from a lower share of exports as a share of GDP relative to other provinces in spite of its strategic geographic positioning.

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