
Business Indicators ♦ December 2002

High Technology Input Indicators

This article is based on information presented in the 2002 edition of *Input Indicators of the British Columbia High Technology Sector*.¹

Introduction

There is clear value in monitoring the output of the high technology sector, but informed policy-making requires knowledge about the processes that give rise to that output as well. The high technology sector is a complex system with many players and interactions. Understanding this system is a matter of identifying the various parts, and collecting information that shows how these parts behave and interact over time.

The input indicators cover key aspects of the educational, business, government, external, and labour sectors from the point of view of their impact on high technology firms. The position of British Columbia in relation to the other major high technology provinces remains below average, despite strong relative growth in some indicators over the past two or three years.

Interprovincial Comparisons

The indicators have, where possible, been presented for the provinces of Alberta, Ontario, and Quebec as well as British Columbia. Comparisons to other provinces are useful as they show the range of experience in comparative and competitive jurisdictions. These four provinces have the largest general economies, and they have the most extensive high technology sectors. Based on 2001 data, the share of high tech employment for these provinces ranges from 2.9% to 4.6% of total employment with the BC share being the lowest.

The Education Sector

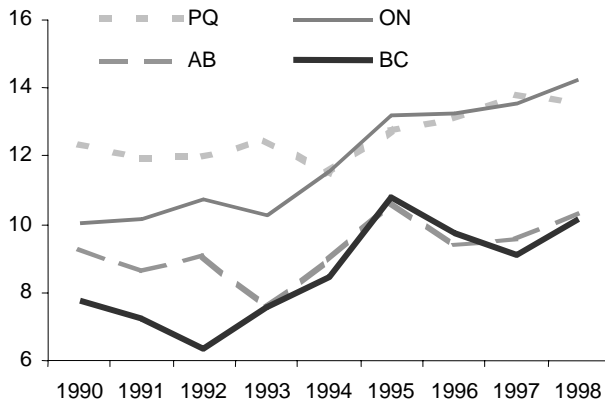
A high level of education suggests a more knowledgeable population base that would be sufficiently proficient to work in the high technology market. Also, higher levels of educational attainment enable high technology firms to draw from a broader, more highly developed skill base.

The percentage of the population aged 15 and older with a high school diploma and the percentage with post-secondary credentials both showed steady increase across Canada during the 1990s and in the most recent reporting year. Each year the number of people completing high school and the number of people continuing into post-secondary education facilities increases. While BC leads the high technology provinces in the largest portion of its population with a high school diploma, it falls short of the other three provinces in the percentage of its population with post-secondary credentials.

The number of BC graduates with a bachelor's degree in Computer Science per 100,000 persons was low compared to the Canadian average during most of the 1990s, despite increasing over most of this period. In 1997, the number of computer science graduates increased in all provinces except BC, but then rebounded in 1998 to bring BC much closer to Alberta.

¹ Available on the BC STATS web site at www.bcstats.gov.bc.ca/data/bus_stat/hi_tech.htm

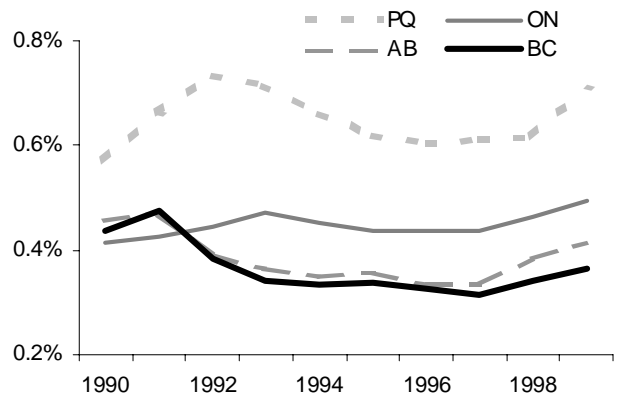
BC has the lowest number of computer science bachelor degrees awarded per 100,000 persons aged 15 years and older



Source: Statistics Canada

Research and development (R&D) at universities contributes to the high technology sector's impact on the economy. Universities are increasing partnerships with industry to bring the products and processes of R&D to market. The ratio of R&D performed by the higher education sector to GDP is an indicator of the proportional investment in R&D by this sector relative to the size of the overall economy. A higher proportion of investment is likely to lead to higher rates of discovery. The higher education sector, which does not include the private non-profit sector, performed \$5.2 billion worth of R&D in 1999. This accounted for over 0.5% of Canada's GDP that year. The ratio of R&D performed by the higher education sector to provincial GDP was highest in Quebec at just over 0.7% in 1999. Alberta (0.41%) and BC (0.37%) were lower than the Canadian average (0.53%).

The ratio of higher education performance of R&D to GDP is weakest in BC



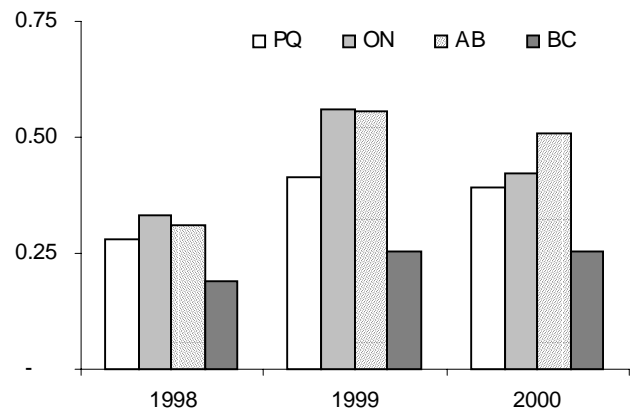
Source: BC STATS

The Business Sector

British Columbia returns average or below average ratings in all of the business stimulus indicators compared to other Canadian provinces. However, BC has experienced upward trends in some of these indicators over the past few years where other provinces have been fairly constant.

The granting of patents indicates the success of R&D. Through the 1990s, BC fell behind other high technology provinces in both patent applications and patents awarded per 10,000 persons. Patents awarded per 10,000 decreased from 1999 to 2000 in the nation, after showing strong growth between 1998 and 1999.

BC has the fewest patents awarded per 10,000 persons

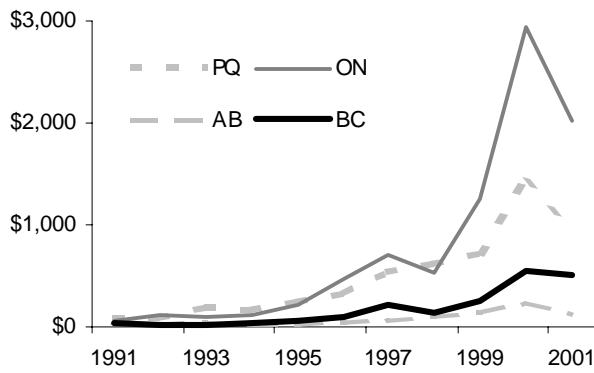


Source: Canadian Intellectual Property Office

Venture capitalists provide the funds for projects that are more often than not involved in the development of a new untested product or process. Venture capital investment by province is therefore a good proxy for both the quality of ventures in a given province as well as the venture capitalists' assessment of the business climate.

Venture capital investment in BC more than tripled between 1998 and 2000 but in 2001, it fell by 7.6%. Ontario had the highest venture capital investment in the last reporting year. However, BC managed to increase its share of the national total from 10.2% to 13.5% last year despite investments falling dramatically at the national level.

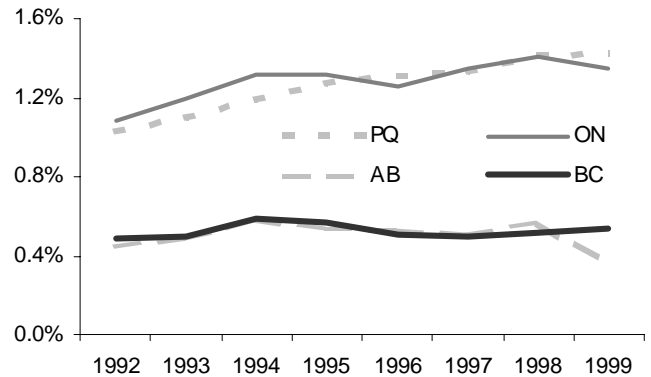
BC gains more of the national share of venture capital investment by investee province (\$ millions)



Source: Canadian Venture Capital Association

The ratio of R&D performed by business to GDP is an indicator of the proportional investment in R&D by the business sector relative to the size of the overall economy. It is assumed that a higher proportion is likely to lead to higher rates of discovery. The business sector in Canada performed \$9.8 billion worth of R&D in 1999. During the 1990s, the ratio of business R&D to provincial GDP was much higher in Quebec and Ontario and much lower in BC and Alberta than the Canadian average. In the most recent year, the ratio increased in BC.

The ratio of business performance of R&D to GDP rises in BC

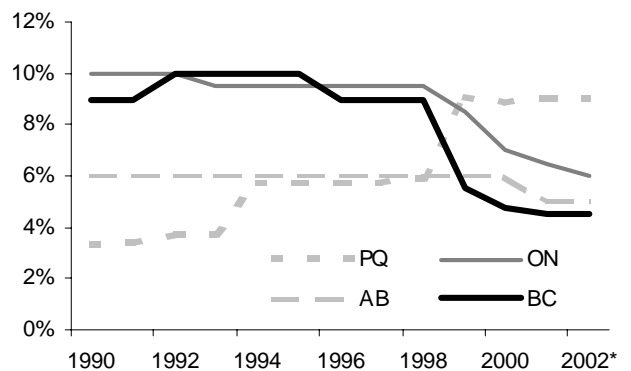


Source: BC STATS

The Government Sector

The government sector affects high technology firms by providing a regulatory, tax, and infrastructure environment for the private sector to operate within by funding and directly performing R&D. Lower levels of taxation attract investment and a skilled workforce, which are both essential to the high technology sector.

The small business tax rate in BC remains the lowest amongst the high tech provinces

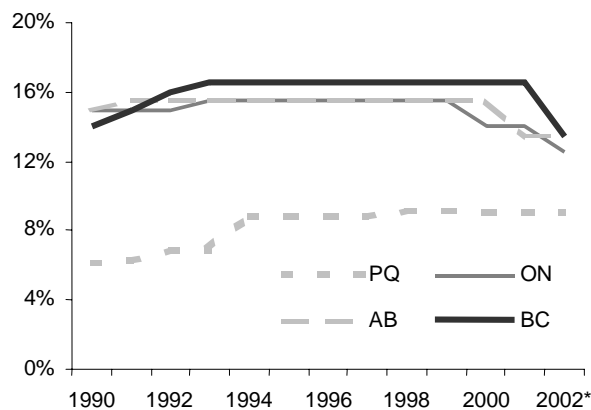


Source: BC Ministry of Finance (*2002 rates are projected)

British Columbia's small business tax rate declined in 1996 and 1999 through 2001 becoming the lowest small business tax rate of the high technology provinces. Quebec's tax rate increased in 1999 and is now the highest among the four provinces.

British Columbia's corporate tax rate rose in the early 1990s, then in 2001 BC initiated corporate tax cuts similar to the recent cuts in Alberta and Ontario. Quebec has the lowest rate of the four provinces although it has been rising over the past ten years.

BC has the highest general corporate tax rate of the four provinces

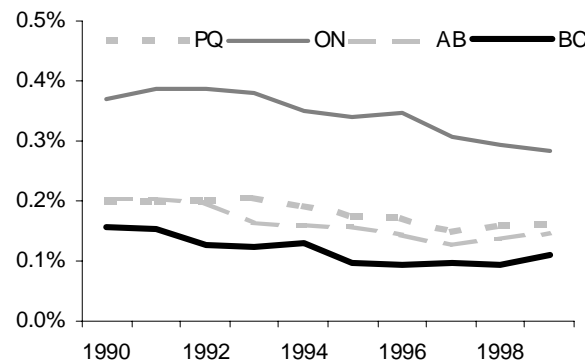


Source: BC Ministry of Finance (*2002 rates projected)

Government tends to fund much more R&D than it actually performs. However, in some fields, governments do maintain research personnel in order to provide independent testing of products, processes and practices. The purpose of most internal government research is not necessarily focused on innovation, but serves a peer review function. Significant innovations developed by government researchers are often spun-off to the private sector. The ratio of government R&D to GDP is an indicator of the proportional investment in R&D by the government sector relative to the size of the overall economy.

Ontario has maintained the highest ratio of government R&D to GDP during the 1990s. BC's ratio has been the lowest of the provinces, at less than half the Canadian average between 1992 and 1999. The ratios for Quebec and Alberta increased slightly in 1998.

The ratio of combined federal and provincial performance of R&D to GDP in BC remains lower than average



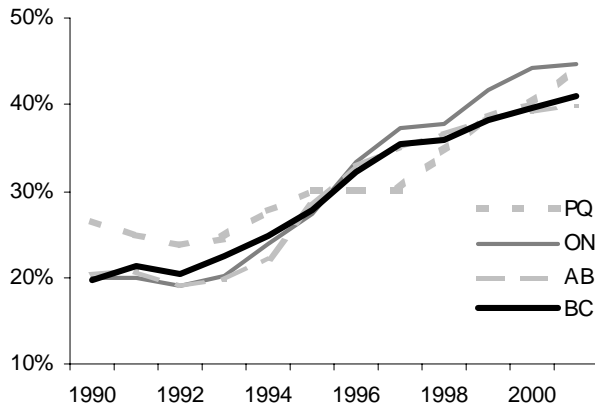
Source: Statistics Canada

The External Sector

The British Columbia economy benefits from being part of a world system that provides information, skilled labour, machinery and equipment, and other material inputs, as well as markets for locally-produced products. BC is also a provider of these resources to foreign countries and to other provinces.

Educational attainment of immigrants measures the flow of educated, skilled workers into British Columbia. These workers often bring knowledge of other business practices and business opportunities, as well as languages. Immigrants also offset the loss of skilled workers who move to other provinces or out of Canada. The percentage of educated immigrants grew dramatically in the last 10 years in Canada. Ontario had the highest percentage of immigrants with 16 or more years of education (45%), while the other provinces had between 40% and 44% in 2001.

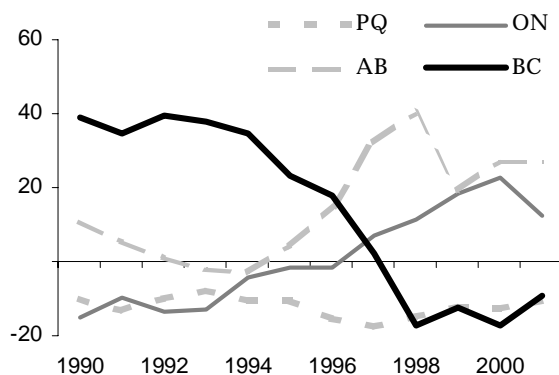
The percentage of immigrants aged 25 years and older with 16 or more years of education grows steadily in all four provinces



Source: Citizenship and Immigration Canada

Workers in Canada are much more free to move within the borders of the country than they are internationally. In aggregate, the movements of skilled and educated workers between provinces is a general indicator of both real and perceived economic opportunity. This indicator points to the overall perception of the strength of provincial economies. In the early 1990s, there was a general westward flow of migrants that benefited both BC and Alberta. In recent years however, people began moving east, mostly to Alberta and Ontario, but also to the Atlantic provinces.

Net inter-provincial migration (thousands)

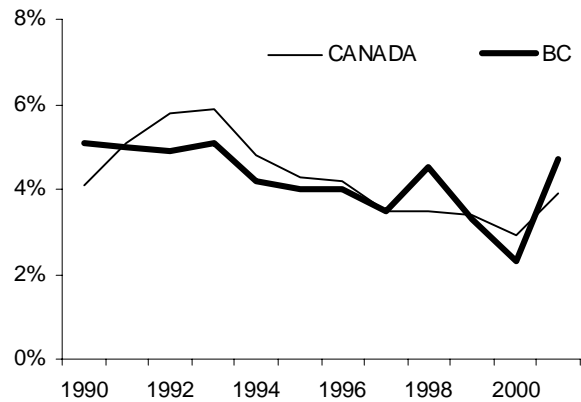


Source: BC STATS

The Labour Sector

This section contains a set of indicators that are specific to the labour market but represent a combined impact of the source sectors. A low level of unemployment in natural and applied sciences occupations is desirable because some components of this group (e.g. computer scientists) are the engines of innovation in the high technology economy. Higher levels of unemployment in this group indicate idle intellectual capital, which has the effect of slowing the overall rate of innovation.

BC's unemployment rate for natural and applied sciences rises above the national average



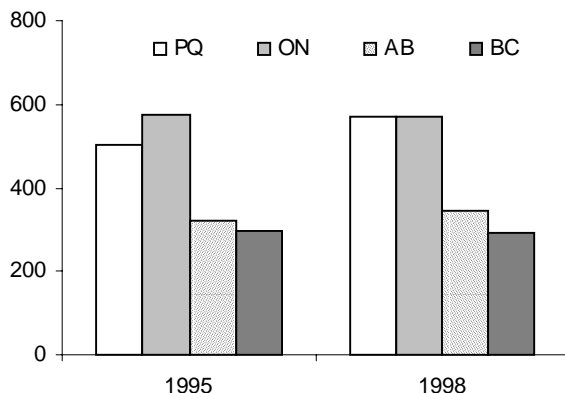
Source: Statistics Canada

During the 1990s, BC usually had a lower rate of unemployment for natural and applied science occupations than the Canadian average. In 2000, the BC unemployment rate for natural and applied sciences reached a decade low of 2.3%, the lowest rate in the nation. However, the unemployment rate rose above the national level the following year.

The absolute number of researchers and technicians engaged in research is an important determinant to the volume of scientific and technical discoveries that may result in patent applications, and later, in the birth of new firms or the growth of existing firms. British Columbia's workforce of researchers and technicians was the fourth largest per 100,000 persons across

Canada in 1998, up from an eighth place rank in 1995. While the number of researchers in BC increased only slightly in 1998, several other provinces' total number of researchers decreased.

BC lags behind the high tech provinces in the total research workforce per 100,000 persons



Source: Statistics Canada

Summary

The picture of British Columbia that emerges from the input indicators is varied. In some areas, British Columbia is strong when compared to other provinces, and has shown strong growth over the past decade. In other areas, performance has lagged. In this way, the detailed indicators offer concrete guidance about potential government policies and industry growth strategies.

BC STATS recognises the importance of providing the latest information available. We are working to improve the frequency of release on our statistics on the high technology sector. Watch our web site², or future editions of *Business Indicators*, for progress in these areas.

² www.bcstats.gov.bc.ca