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Innovation in British Columbia and Canada:
The Role of Urban and Regional Triple-Helix Innovation Strategies and Policies

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I. The Global, Canadian and British Columbia Contexts

Canada's poor economic performance (Chart 1) led it to launch parallel human capacity building (HCB) and innovation initiatives early in 2002. The federal HCB and innovation initiatives fund urban and regional infrastructure, university-based research, fellowships, and research infrastructure (buildings, equipment, etc.) among others.

This is a major departure for the Canadian government. Education and cities are the exclusive constitutional purview of provinces. The federal government has been loath to antagonize provinces by funding universities and cities until now. It has been spurred on by the unavoidable need to boost innovation and productivity as Charts 2, 3 and 4 show. Weak provincial fiscal capacity means under investment in R&D, universities, training of highly qualified people (HQP) and urban infrastructure. Provinces are happy to see federal programs in areas they once guarded jealously.
Thus, this paper reviews the context for recent federal efforts to build bridges among universities, governments and the private sector. It focuses on the Vancouver region and its efforts to use the federal policies to craft a regional innovation-based economy.

A. Agglomeration economies and diversity: Core Strategic Assets

Technological change, deregulation of international trade and financial flows, and the growing connectedness of markets result in enormous pressure on urban and regional economies to compete globally. Firms can seek out superior and separate places to: conduct R&D; obtain capital; organize production; produce goods-services; market them; and offer after sales service. Global organization of production allows business to put find optimal location mixes to maximize cost effectiveness and/or revenue generation. The result is increasing competition and low margins, which are increasingly a function of economic rent earning innovation, not merely cost cutting.

Commodity producing nations and regions face harsh markets as price takers and have but one strategic option open: get costs down and hope these costs are below world prices to earn profits. Canadian productivity exceeds that in the US only in resource extraction and processing, its core exports (Chart 4) as we would expect. *Commodity* is used broadly to describe any undifferentiated and largely homogeneous good or service. Thus, in addition to traditional natural resource and agricultural products, the term *commodity* also covers DRAM and SDRAM computer chips, VCRs, televisions and any good or service that is readily available and hard to distinguish from competing goods or services. Mass produced beer, toothpaste, and consumer banking and insurance services are commodities in this sense: as producers have little ability to set price and focus on lower production costs to earn normal profits.

Canada's economy is closely linked to commodity goods and services as used above. In addition to mineral, energy and forest products, Canada is a huge producer of automobiles (owned by US Big Three, Toyota and Honda). Canada's large brewers, banks, insurers, and retailers also offer commodity goods and services: markets largely set prices, the goods or services are hard to differentiate and price is a big determinant in purchase decisions. Making profits in such competitive settings demands innovation: new products, services or processes to provide higher profits and competitive advantage. Canada generally and BC specifically, have been slow to innovate and had slower growth in the 1990s compared to the US and innovative European and Asian economies. Chart 2 sets out this poor productivity growth in the past two decades, and Chart 5 shows the lag in R&D, patents and innovation.

B. Recent Initiatives to Boost Innovation and Productivity

The government issued its *Innovation Initiative* (Human Resource Development Canada (2002); *Achieving Excellence* (Industry Canada (2002a,b)) by noting:

> *Governments, academia and the private sector have made significant investments in innovation in recent years. As a result, Canada's innovation performance is improving at a quick pace, and we enjoy the fastest rate of growth in some areas. However, a number of other countries moved earlier. Consequently, we lag behind many developed countries in terms of our overall innovation performance. There is no time to waste. (*Page 12).

C. The Triple Helix is the model for Canada's innovation efforts

Canadian government, business and academia have historically been quite separate. Canadian universities have seen themselves often as monasteries, isolated from society to think great thoughts and avoid undue influence from commercializing ideas (Goldberg (1997)). Business with resource extraction or primary manufacturing roots, and the financial institutions that supplied capital to these resource-based activities, by-and-large distrusted academics as not being practical or useful, and saw government as a source tax, regulatory, and licensing costs. Lastly, government largely saw business as paying fees and taxes, and universities as necessary costs of a civil society, but not as aids in policy analysis and implementation or as sources of ideas for managing government better. This distrust, or at best indifference to what each might offer the other is part of the poor Canadian innovation record, and must be changed now. Thus, building

strong bridges among academic, business and government sectors is at the core heart of Canada's innovation effort.

> *The innovation message needs to be taken further than simply between levels of government. Many in the academic and business communities are already well aware of Canada's innovation challenges. The Government of Canada will reach out to these stakeholders and actively participate with them in the development of a national innovation strategy. (Industry Canada (2002b) page 82)*

D. The Place of "Place"

Canada's innovation strategy recognizes that innovation occurs in specific places, largely in cities big and small. The innovation strategy explicitly acknowledges that cities need infrastructure to function as hotbeds or clusters of innovation. For the first time in nearly thirty years the federal government is aggressively seeking a strong role in financing urban transportation and university research infrastructure. This funding is critical to the success or failure of Canada's innovation given its urban bias:

> *A paradox of the global, knowledge-based economy is that sources of competitive advantage tend to be localized. Communities and regions across Canada use their knowledge resources to create economic value, and it is in communities that the elements of the national innovation system come together. (Industry Canada (2002b) page 72)*

Thus innovation policy is manifest and realized locally and paradoxically: for national innovation policies to work there must be local areas where national efforts elicit the local conditions and innovations that are being sought. Conversely, for local innovation efforts to succeed there need to be appropriate national tax, regulatory, and funding programs in place to support local innovation. This often ignored link between macro national and provincial policies and local and firm-based efforts is vital. This macro-micro two-way interaction is difficult to identify or manage. The current federal effort is among the first making macro-micro links explicit. Its consultation processes offer a reasonable chance for these links to be identified and managed to the benefit of national policies and local development efforts.

The Canadian triple-helix innovation strategy does not focus solely on major urban areas. It is equally trying to build innovation cultures in smaller more remote centres, especially those that are losing their resource and primary manufacturing base and have been losing people and jobs in the past decade. Innovation is critical in these smaller centres if they are to reinvent themselves, as they must to survive.

E. The focus and overview of the current paper

This paper discusses Canada's innovation initiative in two contexts. The first is the triple-helix model; the second is placing the model in the context of Vancouver, now facing a rapidly changing economic base and competitive global economy.

Accordingly, the discussion continues with a brief review of Canadian innovation initiatives and their spotlight on place. The paper then looks at Vancouver and its

innovation efforts as the major innovation centre in Western Canada, where there are major efforts to implement a triple-helix cooperative innovation model.

II. The Role of Place in Canadian Innovation Policy

A significant economic literature supports focusing on place in Canada's innovation policy. Likely the most researched urban asset is agglomeration our start.

A. Agglomeration economies and diversity: Core Strategic Assets

There are many reasons for the rise and persistence of cities. Agglomeration economies are perhaps the most powerful, and lie at the heart of the ability of urban regions to be flexible and adaptive and home to new economic activities. In a classic study of the New York region, Haig (1927) showed the centrality of core cities allowed them to overcome the "costs of friction" that space imposes. Three decades later, Hoover and Vernon (1959) also in New York, extended Haig's idea to the external (agglomeration) economies cities confer by their spatial arrangement and diversity. These economies are vital for small firms in uncertain settings, letting them innovate and compete beyond what their small size would usually allow.

The reduced costs of uncertainty are general and manageable in urban regions given their diverse skills, businesses, capital investments, and services. Later studies by Jacobs (1969; 1984) and Quigley (1998) also see diversity as a key to creating external economies of scale and scope. Jacobs' work is especially relevant as she asserts that cities are innovation "cauldrons", where new ideas spring up and develop.

From an innovation policy perspective agglomeration economies can arise by providing settings for external economies to thrive: solid education, transportation and communication infrastructure, cost effective public services and reasonable taxes and regulations, and flexible urban development controls. Public investment in education and research, especially in universities is critical to create the labour force and knowledge base needed to innovate and compete globally as evidenced by the Silicon Valley, Route 128 (Boston) and Austin and Seattle technology-based economies.

B. Infrastructure and Efficient Urban Form

Providing good urban infrastructure is needed to compete globally. Hong Kong possesses what is likely the world's most diverse and efficient transportation system giving cost advantages to firms in Hong Kong as well as to people coming to Hong Kong to do business. Bangkok in contrast is disadvantaged because of the enormous difficulty in travelling around the urban area.[1]

While good infrastructure seems an unquestioned advantage, the related issue of compact and efficient urban form is much debated. The debate has focused on internal efficiencies and costs not on global competitiveness, which should benefit from compact urban form and excellent transport infrastructure. Higher housing and office costs due to

[1] A problem in auto intensive cities is the uncertainty due to traffic congestion. One simply cannot be sure that traffic jams will cause being late or missing meetings altogether.

compact development might weaken global competitiveness, as office and housing costs are important locational elements for mobile businesses and households in the knowledge-economy.[2] Some of the most expensive real estate markets though, are also among the most successful (e.g., Boston and Silicon Valley in the US or London, and Frankfurt globally). It is thus an open question whether real estate markets capitalize external economies (e.g., amenities or agglomeration) where high property prices reflect competitiveness, or if they are pricing themselves out of competition by growth controls and resulting high property prices.[3]

C. Quality of Life and The Biophysical Environment

In a world where human resources drive innovation, the ability to attract highly qualified people is key.[4] It is argued that the Silicon Valley, Route 128, Austin and Seattle did not just arise from their universities, but also their liveability. Also, as populations age and retirees increase the ability to attract retirees will be important since they only bring savings and income to urban regions, and also experience and knowledge with many continuing to work at reduced levels.[5] Thus public policy that enhances quality of life can attract innovative people and continuous innovation.

III. Vancouver: A Case Study of Canadian Triple Helix Innovation

A. *Getting Vancouver's Triple Helix Cooperation in Place: Finally*

In keeping with our thesis that place matters, here we examine the challenges of moving from a rent seeking to a rent-creating innovation economy using Vancouver as a case study. Vancouver is a good laboratory for exploring the evolution of triple helix innovation. Historically, there was little interaction among universities, businesses and government. The natural resource focus valued natural, not human resources. In the last half-decade with the technology boom have both government and business seen universities as useful partners and contributors to economic prosperity, not just costly.

The government strand of the triple helix is changing dramatically across Canada, as elsewhere, having faced significant fiscal stress and come to realize that the private sector must be relied upon as the fundamental engine of economic growth. Governments at all levels are trying to reinvent themselves to provide the appropriate environment within which innovation and growth can occur, including being fiscally responsible,

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[2]The debate on costs and benefits of compact urban form are reviewed in the Transportation Research Board ***Costs of Sprawl--Revisited*** (1998). Compactness has been championed by the "new urbanists" such as Duany and Plater-Zyberk (1991) and by economists like Downs (1994) who argue the significant costs of sprawl exceed benefits. Urban economists like Mills (1999) in turn note benefits are unsubstantiated but the higher housing prices and reduced housing access are significant. Adding global competitiveness to the debate should provide another important dimension for discussion.

[3]Duncan Maclennan (1995) explicitly stresses the need to see housing and housing policy in a global competitive setting both as elements of infrastructure and quality of life.

[4]The Transportation Research Board's ***Costs of Sprawl--Revisited*** (1998), Chapters 6 and 12, address quality of life issues and offer a superb literature review. The broader and design-based area of urban livability is reviewed in Transportation Research Board, ***The Role of Transit in Creating Livable Metropolitan Communities*** (1998), Appendices A and B.

[5]Quality of life and attracting people and jobs appear are shown in: Gottlieb, (1995); Greenwood, Hunt, Rickman, and Treyz, (1991); Salant, Carley, and Dillman, *(*1996); von Riechert and Rudzitis, (1992).

seeking a better balance between taxes and public goods provided, reducing or redesigning inefficient regulatory regimes, and withdrawing from activities that are better done by private sector providers.

The private sector helical strand in British Columbia and Vancouver is also changing its attitudes to government and universities. As Charts 6 through 11 demonstrate, the province has been a laggard in Canada in private sector investment in innovation, and as we have already seen, Canada has lagged other G-7 nations in this area, so that the province and its private sector have a great deal of catching up to do. There is a slow growing realization that government does have an important positive role in providing infrastructure and public goods, not just in minimizing taxes and spending. Suspicion of academia is also lessening, beyond the IT and biotech sectors. The merging of arts and technology in videogames, new media, and product design and marketing, serve to build bridges between business and academics.

Finally, our third strand, universities are changing dramatically in Canada and BC. Academic tradition in Canada has been reasonably conservative. Universities and their faculty members prided themselves on being independent and separate, much the way monks in monasteries did. Universities were as suspicious of external communities, especially government and business. The external communities reciprocated. The 1990s have brought fundamental changes in attitudes though, along with healthy discussion and dissent. The first change was wrought by significant funding cuts for universities by the federal and provincial governments. This was exacerbated in British Columbia by a five year freeze in tuition and funding, a 5% tuition cut in the sixth year (2001), loss of provincial funding for international graduate students, and required enrolment growth of 4% per year during the tuition freeze. Universities across Canada, but especially in BC, were forced to find new revenue sources including recruiting full fee paying international undergraduate students, commercializing intellectual property, building continuing education and executive development programs, finding research contracts, fundraising, and seeking sponsorship programs like the Coca Cola contract at UBC making Coke the exclusive provider of campus soft drinks in return for a significant up front cash payment.

Forced to find new sources of funding through links with business, government and external stakeholders, such links expanded quickly as did a growing acceptance of a university that is ***a part of*** its community not ***apart from*** it. Resistance to these links also strengthened but changed fundamentally in quality and tone from being against linkages to demanding debate on the processes and rules to be applied to existing and future links. Several high profile cases of interfering in new drug trials crystallized this issue and raised awareness in all quarters of the need for informed discussion of university-business links and how these ties should be governed.

In view of these major shifts in attitude by government, universities and business toward each other, Canada, British Columbia and the Vancouver region are fertile ground for triple helix innovation and growth strategies. The playing out of federal, provincial and local innovation initiatives in Vancouver is a solid case study of conscious efforts to

cooperate to develop an innovation and knowledge economy in the region to move it from its rent seeking natural resource historical base.

Vancouver is well positioned to seize the opportunities opened by new public policies and attitudes among the three sectors. It is the largest city in Western Canada. It is a year into a process repositioning and rebranding itself as an R&D and innovation driven centre. It is also home to excellent and diverse post-secondary institutions including the British Columbia Institute of Technology (BCIT), the Emily Carr School of Art and Design, Simon Fraser University (SFU) and the University of British Columbia (UBC), the second largest research university in the country. It is Canada's largest seaport. It is midway between Europe and Asia. Its airport is second only to Los Angeles as a trans-Pacific hub the West Coast of the Americas. Its population is highly diverse and international with strong ties to Europe and Asia.

Accordingly, we can explore how federal and provincial triple helix innovation policies manifest themselves in Vancouver and are realized and actuated spatially in a specific place, and not in the aspatial setting of national and provincial policy formulation. To do this, we begin by reviewing recent federal policy initiatives designed to bolster Canada's flagging innovation performance and then explore the direct impact of these programs in the Vancouver region. We also examine provincial policies that have been crafted to build on these federal policies and promote innovation in the province and attract the proffered federal funding. We next look at local efforts in Vancouver to provide the needed urban milieu within which both federal and provincial policies will work to attract innovative firms and people and stimulate innovation within the existing local economy. Lastly, we identify national, provincial and local barriers that might weaken or negate these recent innovation strategies.

B. The Policy Initiatives and their Realization in Vancouver

Keeping with the idea that place matters, this section illustrates how a variety of government innovation policies have been realized in Vancouver and their effect on stimulating innovation, HCB, and educating, attracting and retaining HQP with post-graduate degrees and high levels of advance technical skills.

1. Federal

The Canadian government with its large fiscal and legal powers has taken an aggressive lead in putting forth the broadly based innovation initiative discussed previously. Using our Vancouver innovation "urban laboratory" we can see precisely how these initiatives are changing the rate and culture of innovation in Vancouver.

The federal government in 1997 started developing a number of large and powerful programs to support the highest international quality research at Canadian research universities. The first was the Canada Foundation for Innovation that is responsible for a budget of $3.15 billion.[6] These monies are for classic triple helix

[6]CFI funds are: **Innovation Fund**, for research infrastructure in eligible institutions; **New Opportunities Fund** for infrastructure for new academic staff; **Infrastructure Operating Fund** for operating costs tied to CFI funded infrastructure projects; **Canada Research Chairs Infrastructure Fund** infrastructure for CRC

partnerships where, on average, the CFI contributes 40% of eligible costs, implying a total investment in Canadian research capacity of over $9.0 billion by 2010 (http://www.innovation.ca/about/index.cfm). In the global knowledge-based economy, Canada must be do first-rate international research. Toward this goal, the CFI has established two international funds, each with a $100 million budget. The Canadian portion of projects that qualify under both these funds will be financed at up to 100%.

> "Improving Canada's knowledge infrastructure means supporting a new generation of leaders, attracting the best researchers, and encouraging our graduates to put their talents to work here at home…. In the last two years, the Government has pursued an ambitious agenda to improve its support for advanced research in Canada. To build on this agenda, the Government will increase its support to the Granting Councils, enabling them to forge new partnerships with our universities to attract the best research minds in the world." [*Throne Speech*, 2 Nov 2002, www.chairs.gc.ca]

The CFI is a strong break with Canadian tradition as the funds are allocated to institutions based on excellence, and not to regions on the basis of politics as in most programs. Table 1 supports this in showing the cumulative allocations to British Columbia since the start of the CFI program through to 18 October 2002. Of the CAD$217.7 million of CFI funds allocated to BC, the Vancouver region received $197.1 or 91%,[7] while BC itself has received more CFI funding than any other province which in turn was matched by the BC Knowledge Development Fund.

Other pioneering federal programs focus on increasing research and development and the pool of highly qualified people needed to do such work. First, the Canada Research Chair Program was designed to reverse the "brain drain" that Canada was suffering during the height of the *dot.com* bubble. In BC this drain was particularly acute because of the close proximity to the giant R&D hotbeds of Seattle and Silicon Valley, and the neighbouring low-tax province of Alberta. The CRC initiative established 2000 fully funded chairs open to competition by universities across the country. Canada Research Chairs (CRCs), UBC has already filled 60 of its allotted 163 chairs. The CRCs can be used to attract or retain senior scholars of global repute (Tier I) or junior scholars of great promise (Tier II). They have been exceptionally successful in both spheres and allowed UBC and neighbouring SFU to attract or retain outstanding scholars, particularly in the sciences and engineering.

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chair holders [Chairs Program creates 2,000 world-class research positions at Canadian universities.] Also, an **International Joint Ventures Fund** lets Canadian institutions build infrastructure in Canada for up to four unique research links with leading foreign centres. An **International Access Fund** helps Canadian institutions and researchers join major global collaborative programs elsewhere.

[7] Looking at the institutions receiving the funds, the University of British Columbia alone received $152.6 million or just over 70%. In contrast, Simon Fraser University and the University of Victoria, which together have more students than UBC, in sum only, received under $30 million or just less than 19% of UBCs total, indicating that CFI monies are indeed being allocated on research excellence and intensiveness. This rewards the best, which is the only way to build the kind of globally competitive innovation centres being sought in Canada. In total in 2001-02 UBC received more than CAD$260 million in research funds. UBC also led all Canadian universities in the CFI funding it received.

Canada's research funding councils (the Social Sciences and Humanities Research Council (SSHRC), the Natural Sciences and Engineering Research Council (NSERC), the Canada Council (for visual and performing arts), the Canadian Institutes of Health Research (CIHR) and the National Research Council) have all had their grant budgets increased. However, until 2002 these grants excluded support for the indirect costs of research. Thus, the more council monies universities attracted, the poorer their research environments became. This year the federal government has allocated $200 million to cover these indirect costs. In 2002, UBC received $19.7 million for indirect costs with a growing federal commitment to fund a portion of indirect costs permanently as part of its larger commitment to innovation. The federal government also has embarked on the Millennium Scholars Program to fund the very best undergraduate students.

The federal funds destined for BC created Fuel Cells Canada headquartered at the NRC laboratories on the UBC Campus, and Genome BC, one of five national genomics centres established in 2000. Fuel Cells Canada receives some $25 million in federal funding and supports fuel cell technologies and commercializing them, a sector the Vancouver region has been a world leader to date. Fuel Cells Canada is a national non-profit organization (TD Securities (2000); Ladner (2000)).

The federal government has focused its research efforts in forestry and fisheries in BC as well. The three Canada Forest Research Institutes (PAPRICAN, Forintek, and Feric) are at UBC. The globally known Federal Pacific Biological Station in Nanaimo, the Western Canadian Universities Marine Biology Station (WACUMBS) in Bamfield, UBC's Fisheries Centre and West Van Marine Laboratory, the Vancouver Aquarium and the University of Victoria's Centre for Earth and Ocean Research combine to offer likely unequalled expertise in marine biology and oceanography.

Federal and provincial funds also support the BC Cancer Agency at Vancouver Hospital, Western Canada's largest acute care, teaching and research hospital, and NewMIC at SFU: *"a groundbreaking collaboration between industry, academia and government that focuses on the research, development and commercialization of new media technologies and applications. It brings technology developers together with artists, industry researchers together with academics, multinational companies together with entrepreneurs."* [www.newmediabc.com/fund.asp, 26 October 2002]. NewMIC is yet another triple helix innovation in a province where such models have been rare, but are increasingly seen as the key to successful innovation in varied sectors and regions in the province.

2. Provincial

Six of the most significant provincial efforts are: establishing the BC Progress Board; the BC Knowledge Development Fund (matching federal CFI and indirect costs of research monies); lifting the freeze on university tuition; funding the $160 million BC Life Sciences Centre at UBC; creating BC Leadership Chairs; and supporting the $60 million BC Learning Resource Centre on the UBC Campus. The previously noted BC Cancer Agency and NewMIC at SFU also receive joint federal and provincial support, as does *New Media BC* [www.newmediabc.com], and the Michael Smith Foundation for Health Research. The BC government also funds the BC Advanced Systems Institute, the Science Council of British Columbia and a growing list of research centres and

government-university-business partnerships across the province. Most provincial funding though goes to the Vancouver region then mostly to UBC and SFU.

The combined federal and provincial support partially reviewed here adds greatly to regional research facilities and activities at UBC, SFU, BCIT, the teaching and research hospitals, as well as to private and joint public private centres. Thus, an array of research centres and institutes are springing up or growing at virtually all of the province's post-secondary institutions and research organizations and noted next.

3. Local

Locally a great deal is also happening to bring business, universities and governments together. The recently re-energized Vancouver Economic Development Commission, combines prominent members from all three sectors on its board as well as strongly arguing from triple helix cooperative innovation and economic development strategies in the region. The BC Biotechnology Alliance (at UBC) and the BC Technology Industries Association all link business, government and universities on their boards, committees and policy agendas. The Business Council of British Columbia, includes the largest BC employers, and has senior members of the business and university communities among its members and Directors, and has argued strongly for greater links among business, universities and government.

One of the most radical innovations is the recent acquisition of 11 hectares of former industrial land adjacent to the downtown core by a joint venture that is comprised of the British Columbia Institute of Technology (BCIT), the Emily Carr School of Art and Design (ECSAD), SFU and UBC. These institutions had a long history of working separately and competitively and the joint campus with its focus on New Media, Computer and Information Technology, and Design (likely to include Architecture, Landscape Architecture, Industrial and Interior Design combined with new media) should make the new campus a hotbed for cutting edge creative arts and design, and the related computer and information technology. Also there are the downtown core facilities of BCIT, SFU and UBC and the close by Emily Carr campus (just south of the downtown core). These facilities now can and do serve both the business and government communities seven days a week and in some cases twenty-four hours per day. Because of these facilities and strong recent cooperation among the four institutions and their links to business and government, their potential is great to be true engines of innovation and key nodes in Canada's innovation effort.

Seeing UBC as a key driver of local innovation is instructive. Its University-Industry Liaison Office (UILO) has registered 183 patents, creating 109 spin-off companies that currently employ over 2,500 people, earn in excess of CAD$500 million annually, received over $1.5 billion in private investment and returned to UBC some $60 million in additional research funding, royalties and equity. This UBC UILO activity is largely responsible for placing Vancouver on the North American technology map and for spawning a growing and ever more successful entrepreneurial society in Vancouver. The UBC faculty, notably in the sciences and technology are superb and getting better with the federal support cited above. In 2001 UBC added 11 faculty members as Fellows of

the Royal Society of Canada, more than from any other Canadian university, and 2 faculty members were elected as Fellows of the Royal Society in the United Kingdom (the only Canadian scholars elected this year).

Also consider that at just UBC and only in the life sciences, federal and provincial funding is supporting: the Brain Research Centre, the Centre for Blood Research, the Aquatic Ecosystems Research Laboratory, the Integrated Biodiversity Laboratory, and the Multi-User Facility for Functional Proteomics to cite just a few. These new facilities are networked with existing units at UBC and elsewhere, yielding a solid base for innovation and research in the life sciences. Similar networks and centres exist in information technology and computing, metals and materials, and many more. The growing overlap of fields within the life sciences and between the life sciences and physical and engineering sciences, means these Vancouver facilities and networks provide solid basics to build triple helix partnerships in the region. UBC is also completing its third incubator facility of 10,000 square meters, larger than the first two incubators combined. These incubators allow UBC-related spin-offs to locate near their founding scientists on the campus, yet fully pay their costs and avoid conflicts of interest that loom when previous public goods (intellectual property from research) become private goods. The university covers its capital and operating costs from the incubators and earns a surplus to allow future incubators to be planned now.

Complementing these UBC-owned and operated incubators are the provincially chartered Discovery Parks, Inc. Discovery Parks, Inc. owns and operates science and technology parks adjacent to many of the province's post-secondary institutions to promote the development of ventures as they mature past the start-up phase. The most prominent of these parks are the ones located adjacent the BCIT, SFU and UBC main campuses. Here again, we find government-business-university cooperation at work and succeeding remarkably well, even in today's soft technology finance context.

C. Current or Potential Barriers to Vancouver Triple Helix Innovation

Despite the bright prospects cited above, there are still significant pitfalls and potential barriers lurking to derail the innovation initiatives discussed above.

1. Federal

There is a long history in Canada of supporting sick firms and regions. Funding uneconomic enterprises has gone on so long in Canada that many weak and dying firms and industries have come to see federal or provincial bailouts as an entitlement. This is a huge impediment to innovation. Unfit firms have often been rewarded with subsidies and have not borne the costs of their lack of innovation and poor operations.

The banking and capital markets in Canada, largely regulated by the federal government and are quite imperfect. The control of financial institutions and equity and bond markets in a few square blocks of downtown Toronto is virtually total and largely focused on the ups and downs of the Toronto and Ontario economies. These institutions are highly centralized: their Western Canada operations are tightly controlled, allocate credit by risk, and have limited say on pricing, which is set in Toronto. Small and new

firms with high risk profiles but with capacities to pay for needed operating capital, are not able to obtain needed funds from banks. The Vancouver and Calgary regional venture stock markets were purchased by the Toronto Stock Exchange, and essentially dismantled, adding to the woes of small innovative firms getting equity financing. To worsen the equity environment for new and innovative ventures in Vancouver (and Western Canada), the banks bought the largest investment dealers. Bank-owned investment dealers control over 90% of the equity and debt markets in Canada, focusing decision-making largely on Toronto, on Ontario, on Montreal and Quebec, the largest and nearest regions.

Federal airline and port policies also threaten innovation. The Vancouver International Airport Authority was created in 1992: a local operating authority, with power to borrow and manage the airport for the region's benefit in keeping with sound airport safety. Devolution is a huge success: Vancouver airport (YVR) is consistently first in North America among airports its size, and ranks globally in the top three over the past five years. Its future success is impeded by the very high rents paid to the Canadian Government (paying over half of all rent from two dozen airport authorities). Transport Canada refuses to actively pursue more open-skies agreements with the US and with linked airports in Europe and Asia. This is slowing or losing YVR's opportunity to be a major trans-Pacific and North American passenger and cargo hub, harming the region's ability to attract knowledge workers and firms, and ultimately depriving Canada too, of greater access to the Asia Pacific and the US West Coast.

One final deleterious affect of federal aviation policy has been the purchase of Western-based Canadian Airlines International by Montreal-based Air Canada. Air Canada now has a virtual monopoly, seriously cutting back service to YVR and smaller BC cities, a huge loss in attracting and retaining innovative people and firms.

2. Provincial

The first barrier to innovation is the preoccupation with bolstering forestry, mining and fishing, subsidizing some of the worst forest companies instead of letting them go bankrupt. This has weakened provincial efforts to promote an innovation-based economy linking government, business and universities. The year old BC Progress Board holds significant promise to change these past foci and attitudes.

A second major barrier is the poor history in building powerful and coordinated approaches to lobbying Ottawa for BC's fair share of innovation, federal contracts, economic development or capital funds. BC fails constantly to get business, government, universities and labour together to make coordinated and well reasoned arguments to the federal government to attract federal program and capital monies.

Lastly, cities and regions are creatures of provinces in Canada. Generations of provincial governments have failed to create strong regional governments who can coordinate, plan and finance essential transportation and land use infrastructure. Given local parochialisms discussed next, only the province can to step in to override local interests in order to build a strong, innovative and competitive Vancouver region.

3. Local

Until very recently regional leaders lacked any sense that innovation and using strong post-secondary institutions were issues. The 1990s tech era greatly expanded the number people or firms who understood the value of existing innovative firms, emerging technologies, and university intellectual property and research know-how.

However, the region is inept in lobbying the federal and provincial governments for policies and programs to advance the region. Unlike Quebec with its fabled group of business and government leaders dubbed ***"Quebec Inc. or Montreal Inc."*** there is no ***"BC Inc. or Vancouver Inc."*** The efforts to coordinate action were lost in policy battles with Victoria (BC's capital) or Ottawa (Canada's capital). A notable exception was the Asia Pacific Initiative of 1987-9 that linked the federal and provincial governments with private sector and university leaders and ultimately led to the devolution of Vancouver International Airport and the Vancouver Port Corporation giving both much more autonomy and scope for running these entities as businesses.

A third local barrier is the lack of effective regional bodies. NIMBY (**N**ot **I**n **M**y **B**ack**Y**ard) local governments and neighbourhoods are strong. NIMBY is institutionalized in the two existing regional bodies: the Greater Vancouver Regional District (GVRD) and Greater Vancouver Transportation Authority (GVTA known as *TransLink*) where well-paid directors are appointed by local councils and see local councils are their constituents not the region.

Poor regional governance led to growing traffic congestion, increasing urban sprawl, worsening air and water quality, and a decline in liveability. The lack of strong regional bodies to integrate infrastructure AND land use planning is taking a major toll, potentially impeding regional ability to attract innovators and innovative firms, lured by excellent liveability and public goods but repelled by poor living quality. Boeing left Seattle because of awful traffic congestion and worsening environmental quality. There is no will to create a strong regional body to integrate infrastructure and land use planning. Worse, the GVRD Board has kept staff from doing regional economic strategy: each municipality follows independent (and ineffectual) economic strategies. Without regional economic vision, strategy and strong governance, the region cannot invest in appropriate transportation, set land use and density, and protect biophysical environments so as to attract people and firms that build innovation based economies.

IV. Conclusions and Extensions

A. Conclusions

1. Canada is addressing its innovation shortfall

Canadian innovation initiatives unveiled in February 2002 focus explicitly on getting the three helical actors to talk with each other and develop productive working relationships. A triple helix based innovation strategy is radical and bold in the Canadian context, with its historical antipathy among the actors. The initiatives are providing solid support to promote innovation at firms and universities, while using its fiscal and political power to leverage matching private, provincial or local funding.

2. Canada is facing the role of place and space so far quite effectively

Canadian federal policy is bold in its recognition of the importance of place in creating and implementing innovation. Thus, the federal government is moving beyond its constitutional restrictions that limit it from supporting cities and education directly, by supporting university research, infrastructure, people (researchers through CRCs and students through Millennium Scholarships), and for the first time ever the overhead and indirect operating costs associated with university research activities.

3. In Sum: So Far, So Good, in Fact, Very Good

After cutting funding to improve its fiscal position, the federal government has supported university research strongly. It began by permanently funding the Networks of Excellence Program (NCE), recently funding Genome Canada and Fuel Cells Canada, increased support for the three federal granting councils, reinventing the Medical Research Council as the Canadian Institutes of Health, creating Millennium Scholarships the Canada Foundation for Innovation, and Canada Research Chairs; and most recently paying for the indirect costs of university research. The CFI alone will be responsible for over $9 billion of new university related research infrastructure. The federal innovation agenda is moving aggressively and appears on its way to raise Canada to the top five in competitiveness within the OECD from fifteenth place now.

The results of the innovation in Vancouver are very hopeful. Despite the global "tech wreck," Vancouver has become the 3rd largest high-tech region in Canada and the 16th largest in North America. UBC is contributing significantly to regional innovation activity: it has gotten more CFI funds than any other Canadian university, and in combination with provincial and donor support will build more than CAD$500 million of research and learning facilities in the next few years. Its 163 CRCs allow it to bring some of the best scholars in the world to UBC and Vancouver.

B. Needed Extensions

The federal government deserves full marks for its innovation initiatives, as do many of the provinces that have done their share. However, the innovation race is a marathon, not a sprint. Both levels of government need to signal at least a decade long timeframe to continue its efforts, so governments, universities and businesses can develop and carry out the long-term research programs that will change Canada's culture. Long term funding allows new hiring, capital spending, and graduate student recruitment that can create an innovation culture. Innovation funds should also be usable for global research and innovation partnerships inside and outside Canada.

Secondly, the federal government cannot relent on its innovation efforts: the required cultural change being sought takes a very long time to achieve. It took Canada 300 years to get into its rent seeking, production, and engineering mode. It will take considerable time to build a rent-creating innovation culture, continuously adding value to products and services to benefit customers.

Lastly, sustainable means must be found to ensure the values that guide the business community notably, and the other helical strand partners include: innovation; knowledge generation; investing in people and their workplace; and excitement about change. To be sure, global competition is frightening. It is also exciting and holds as many opportunities for the innovative as it does threats for laggards.

Appendix I: References

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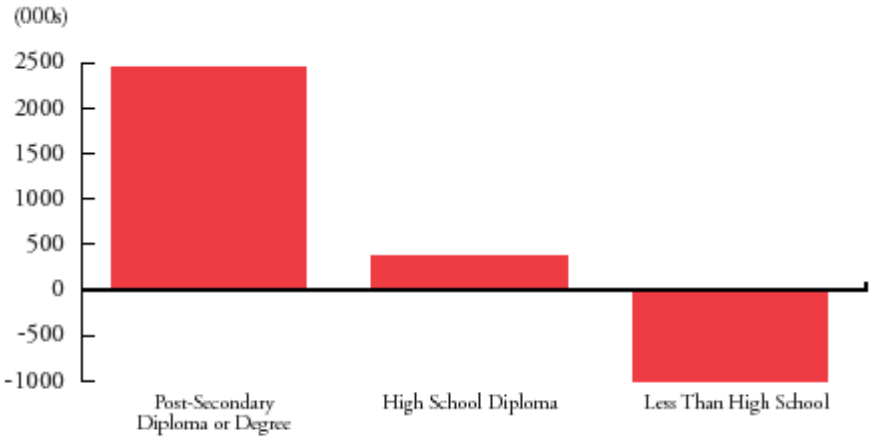
Chart 1: Net Change in Employment in Canada, 1990–2000



Source: Compilation based on Statistics Canada's Labour Force Surveys, 1990–2000.

Chart 2: Productivity in Canada and the US – 1977-1998

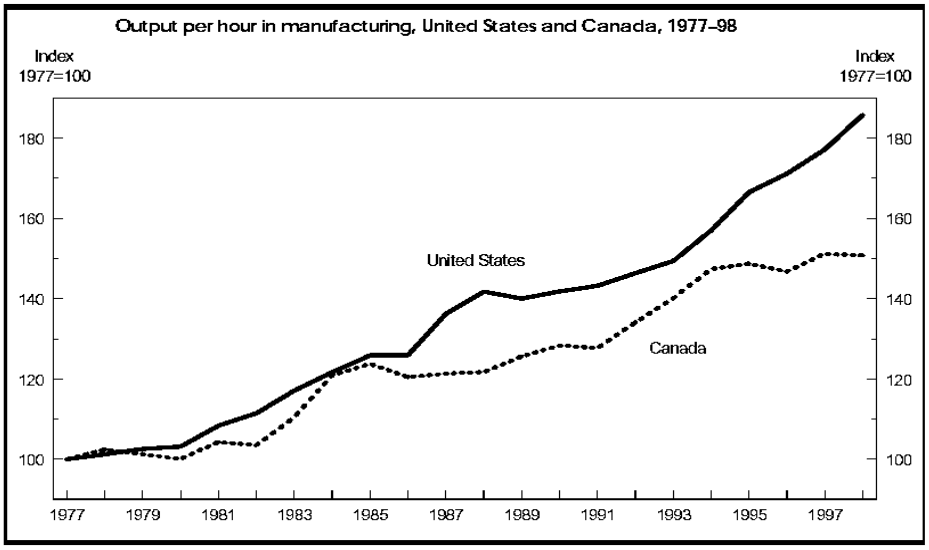
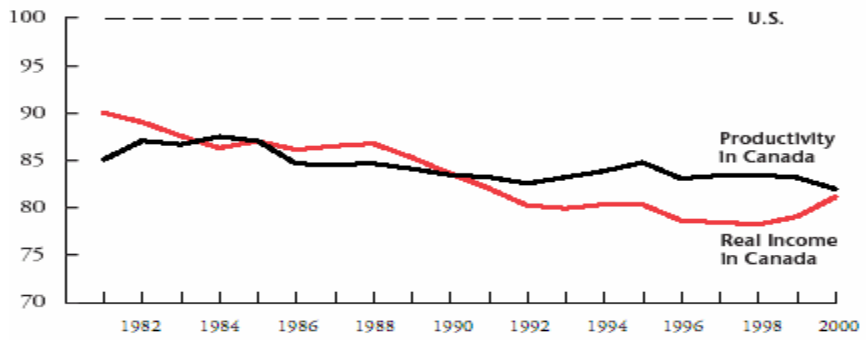


Chart 3: Standard of Living and Productivity*

Canada relative to the U.S. (U.S.=100)

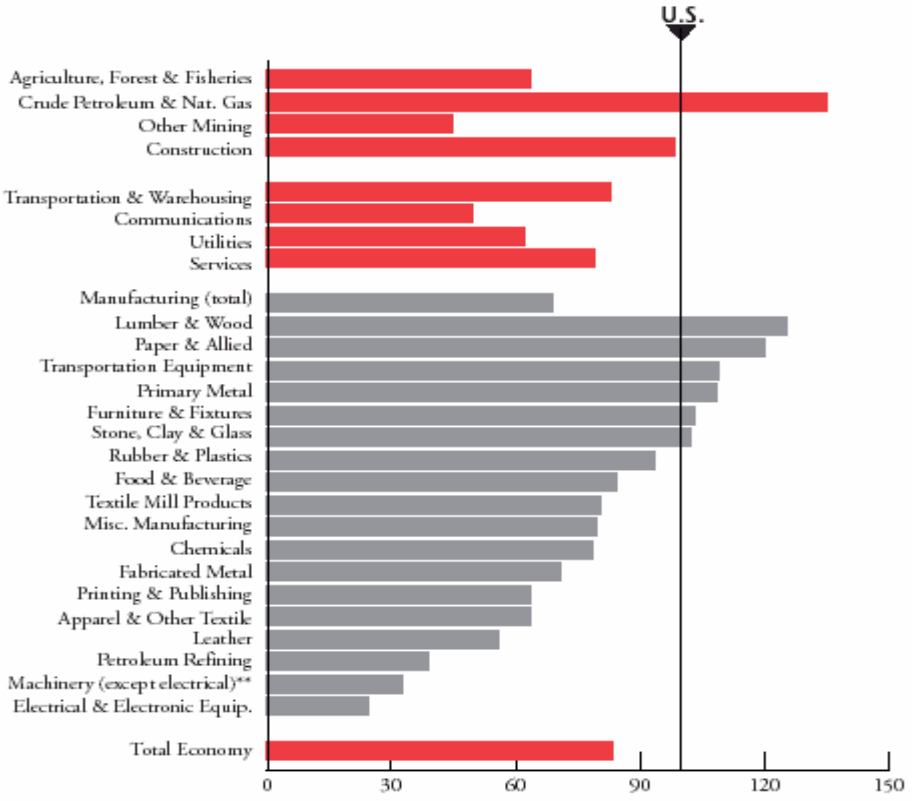


*Productivity is measured as real GDP per hour worked. Real income is measured as real GDP per capita. Canadian values were converted to 2000 US$ using 2000 purchasing-power parity.

Source: Compilations based on data from Statistics Canada and U.S. Bureau of Economic Analysis.

Chart 4: Labour Productivity,* 1999

Canada relative to the U.S. (U.S.=100)



*GDP per worker.
**Machinery industry includes Computer and Office Equipment.

Source: Industry Canada computations based on data from Statistics Canada, U.S. Bureau of Economic Analysis and OECD STAN database.

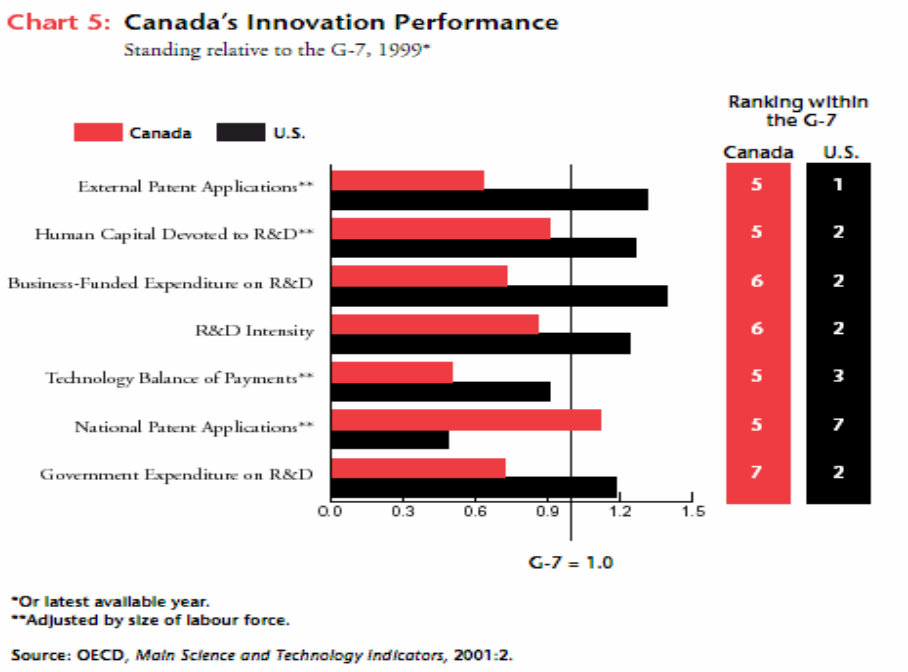


Table 1: Projects approved by the CFI (cumulative to 18 October 2002)

Institution	Maximum CFI contribution	# of projects
B.C. Cancer Agency	$27,800,000	1
British Columbia Institute of Technology	$639,990	3
Forintek Canada Corp.	$1,362,000	2
Malaspina University-College	$1,775,744	4
Okanagan University College	$676,568	3
Open Learning Agency	$514,000	1
Royal Roads University	$250,000	2
Selkirk College	$543,756	1
Simon Fraser University	$13,599,802	42
University of British Columbia	$152,600,985	161
University of Northern British Columbia	$1,977,808	9
University of Victoria	$15,324,996	35
Vancouver Aquarium Marine Science Centre	$617,859	1
Total – British Columbias	$217,683,508	265

Source: CFI (2002)

Where BC Ranks

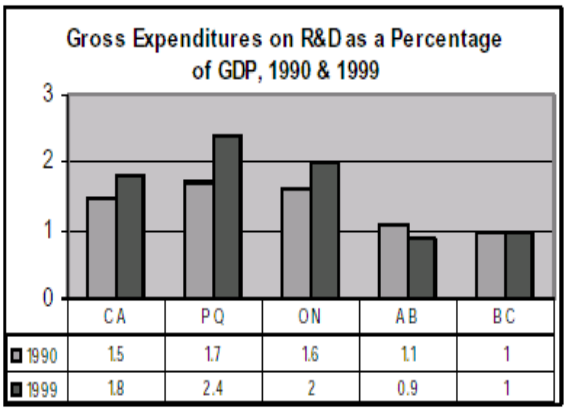
Economy, Innovation and Education

	Economy, Innovation & Education																		
	1. Economic Growth: Growth of Real GDP per Capita	2. Standard of Living: Real Pers. Disposable Income per Capita	3. Jobs: Employment to Population Ratio	1. Average Hourly Earnings	2. Productivity	3. Total Exports Per Capita	4. Tax Payer Supported Debt	5. Per Capita Tax Burden	6. Top Marginal Tax Rate	7. Provincial Deficit/Surplus	8. Net Inter-Provincial Migration	9. Business Gross Fixed Capital Formation	10. Secondary School Graduates	11. University Completion	12. R&D as a % of GDP	13. Natural and Applied Sciences and Related Occupations	Arithmetic Average	Overall Indicative Rank
By Province (last available data year)																			
Year	2000	2000	2000	2000	2000	2000	2000/01	2000/01	2001	2000/01	2000/01	2000	1999	2000	1998	2000		
BC	**6**	**3**	**5**	**2**	**5**	**7**	**2**	**7**	**3**	**3**	**8**	**6**	**9**	**2**	**6**	**4**	**4.88**	**3**
AB	3	2	1	3	1	2	1	5	1	1	1	1	10	6	4	3	2.81	1
SK	5	8	3	7	3	3	4	8	2	2	10	3	7	7	7	10	5.56	5
MB	8	4	2	6	7	5	3	6	4	8	7	10	8	3	8	6	5.94	6
ON	4	1	4	1	2	1	5	9	4	5	2	8	6	1	1	1	3.44	2
QB	2	5	7	4	4	4	8	10	10	7	6	9	3	4	2	2	5.44	4
NB	10	7	9	8	8	6	7	3	6	6	4	5	1	8	9	7	6.50	8
NS	9	6	8	9	9	10	10	4	7	10	5	4	4	5	3	8	6.94	9
PE	7	9	6	10	10	9	6	2	8	9	3	7	2	9	10	9	7.25	10
NF	1	10	10	5	6	8	9	1	9	3	9	2	5	10	5	5	6.13	7
One Year Progress Check																			
Year	2000	2000	2000	2000	2000	2000	2000	2000/01	2001	2000/01	2000/01	2000	1999	2000	1998	2000		
BC	**3**	**7**	**6**	**10**	**4**	**4**	**5**	**6**	**1**	**5**	**3**	**4**	**1**	**4**	**9**	**6**	**4.88**	**3**
AB	1	1	9	8	7	7	1	2	2	2	4	1	6	8	1	9	4.31	1
SK	2	2	8	4	2	2	3	1	3	3	9	8	2	5	10	8	4.50	2
MB	4	3	5	3	9	10	8	3	7	9	5	6	9	1	8	1	5.69	7
ON	8	5	3	7	6	6	2	7	8	6	7	5	4	3	3	2	5.13	4
QB	6	6	2	5	3	3	6	9	6	8	6	3	5	7	5	3	5.19	5
NB	9	8	7	2	8	9	4	10	5	7	1	7	3	9	6	7	6.38	8
NS	10	10	4	6	5	5	9	8	9	1	10	10	7	2	2	5	6.44	9
PE	5	9	1	9	10	8	7	4	10	9	8	2	10	10	4	10	7.25	10
NF	7	4	10	1	1	1	10	5	4	4	2	9	8	6	7	4	5.19	5
Period Progress Rank																			
Period	1991 - 2000	1991 - 2000	1991 - 2000	1991 - 2000	1991 - 2000	1991 - 2000	1991/92 - 2000/01	1991/92 - 2000/01	1992 - 2001	1991/92 - 2000/01	1991/92 - 2000/01	1991 - 2000	1990 - 1999	1991 - 2000	1990 - 1998	1991 - 2000		
BC	**10**	**10**	**10**	**2**	**8**	**10**	**6**	**3**	**4**	**4**	**8**	**10**	**3**	**2**	**6**	**3**	**6.19**	**8**
AB	2	7	5	1	4	9	1	1	1	1	1	1	8	10	3	8	3.94	1
SK	6	6	8	4	2	4	2	10	2	2	6	7	10	4	4	7	5.25	4
MB	8	8	3	5	6	6	3	7	3	10	5	5	9	7	8	2	5.94	7
ON	4	9	6	3	3	2	8	6	6	3	2	8	5	8	2	1	4.75	3
QB	5	4	4	8	5	5	9	8	9	7	4	9	1	1	1	5	5.31	5
NB	7	1	2	6	10	7	7	5	5	6	9	4	7	5	10	10	6.31	9
NS	9	3	7	10	7	8	5	4	8	9	10	3	4	9	5	9	6.88	10
PE	3	5	1	7	9	3	10	9	7	8	3	6	6	3	9	4	5.81	6
NF	1	2	9	9	1	1	4	2	10	4	7	2	2	6	7	6	4.56	2

Note on Table: An arithmetic average and "overall indicative ranking" is included for summary comparison purposes only. Each Target and Performance Indicator should be viewed independently with more emphasis being placed on the three "Target" measures for comparing British Columbia's overall economic performance relative to other provinces.

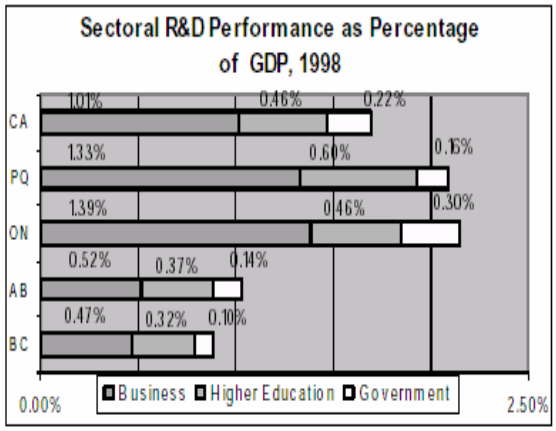
Source: BC Progress Board (2002)

Figure 6



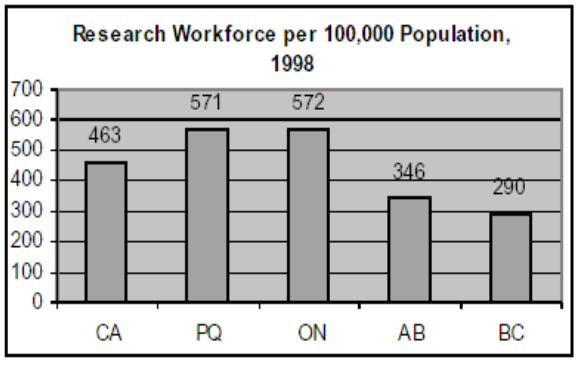
Source: Statistics Canada (ON & QC expenditures exclude federal government expenditures in the National Capital Region)

Figure 7



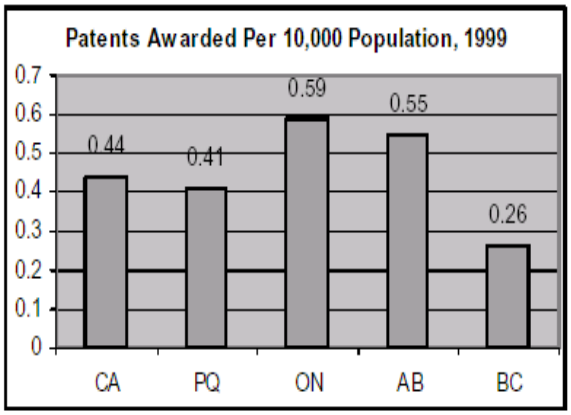
Source: BC Stats

Figure 8



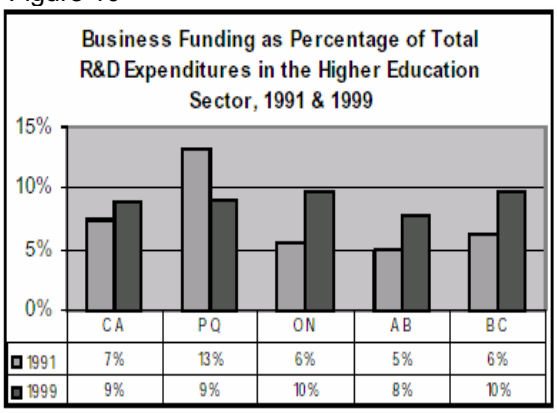
Source: Statistics Canada

Figure 9



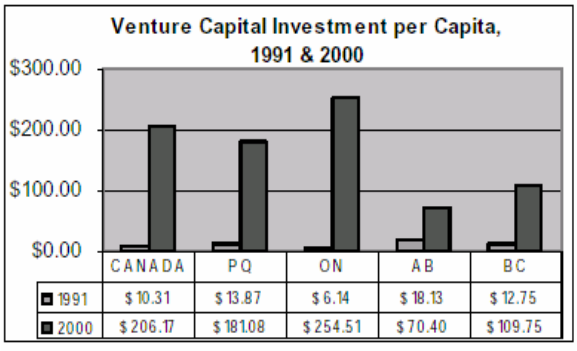
Source: Canadian Intellectual Property Office

Figure 10



Source: Statistics Canada

Figure 11



Source: Canadian Venture Capital Association