

# **British Columbia**

## **Integrated Technology Initiative**



**Executive Summary**  
**January 2006**

# The Integrated Technology Initiative

## The Integrated Technology Initiative is a collaborative strategy to support the highly competitive functional technology clusters in BC.

In January 2003, a group of technology leaders from seven leading technology organizations and two research consortia jointly developed a white paper entitled *An Integrated Strategy for British Columbia's Technology Clusters*<sup>1</sup> to capitalize on the growing awareness of the link between technology and long-term economic growth and competitiveness.

Prepared by PricewaterhouseCoopers, the document provides a preliminary assessment of the leading technology clusters in the province and a call to action to advance the progress of each of the sectors and to help accomplish the provincial goal of creating a significant knowledge-based economy in BC. This process yielded two conclusions:

- ▶ The clusters needed a collective voice and a cohesive strategy for growth to accelerate their individual and joint development.
- ▶ The provincial government needed a clear and objective assessment of where BC stood relative to other regions in order to confidently develop public policy to create a locally anchored, globally competitive technology industry in the province.

In response, the British Columbia Technology Industries Association (BCTIA), Leading Edge British Columbia, and the Canadian Institute for Market Intelligence launched the Integrated Technology Initiative (ITI) in June 2004. This four-phase project was to accomplish the necessary benchmarking and development of a comprehensive action plan to establish BC as a global competitor in technology innovation and adoption.

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<sup>1</sup>An Integrated Strategy for British Columbia's Technology Clusters "A whitepaper" Prepared and compiled by PricewaterhouseCoopers Electronic version available at [www.bctia.org/ITI-\\_industry\\_project](http://www.bctia.org/ITI-_industry_project)

# State of British Columbia Technology

**Technology is strong in BC.** The province's technology industry is experiencing rising employment and a continued concentration of unique clusters – indicators of a typical emerging technology industry. New supportive government policies and investments are helping to provide the foundation of support the growth of a knowledge-based economy in BC.

Over the past decade, the innovation-driven industries—Life Sciences, Information and Communications Technology, Wireless, New Media, and Power Technology—have dramatically outpaced the rest of the province's economy. Total employment in these clusters now exceeds 64,000. Overall growth in R&D expenditures is strong and suggests a more progressive outlook. BC is recognized as an emerging global player in high technology, with an impressive record for creating new start-ups.

**Employment in BC's tech industry continues to outpace all other industry sectors in the province – with over 64,000 employees, today.**

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Despite the advancements made to date, other North American jurisdictions are outpacing BC. For this reason, it is imperative that industry and all levels of government work collaboratively to address the issues identified as critical barriers to the future advancement and success of BC's technology industry. Critical barriers to be addressed include the following:

- ▶ On a per-capita basis, funding for academic and industrial R&D is lower than in other North American jurisdictions, which limits the development and commercialization of new technologies.
- ▶ BC needs to escalate its level of investments from both public and private sources.
- ▶ Human resources are vital to the growth and survival of BC's technology companies. An initiative focused on attracting and retaining the skilled professionals required to meet the needs of our technology companies is paramount.

**To capitalize on today's progress and investments, BC must develop the expansion-stage support system needed to drive innovation.**

As its technology clusters begin to mature, BC's technology reputation is growing. Establishing a competitive position requires greater market savvy, deeper competitive intelligence, and a more coordinated marketing plan. Delivering a comprehensive

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strategy will positively influence the marketplace as BC's technology community moves beyond entrepreneurship to tackle the challenges of competing in global markets.

**British Columbia must establish strong competitive advantages in all technology sectors as it is this diversification that will drive the establishment of a strong knowledge-based economy in the province.**

## British Columbia's Innovation Pipeline: The Key to Competitiveness for Technology Clusters

The **innovation pipeline** that generates competitive technology companies is made up of four linked systems of development:

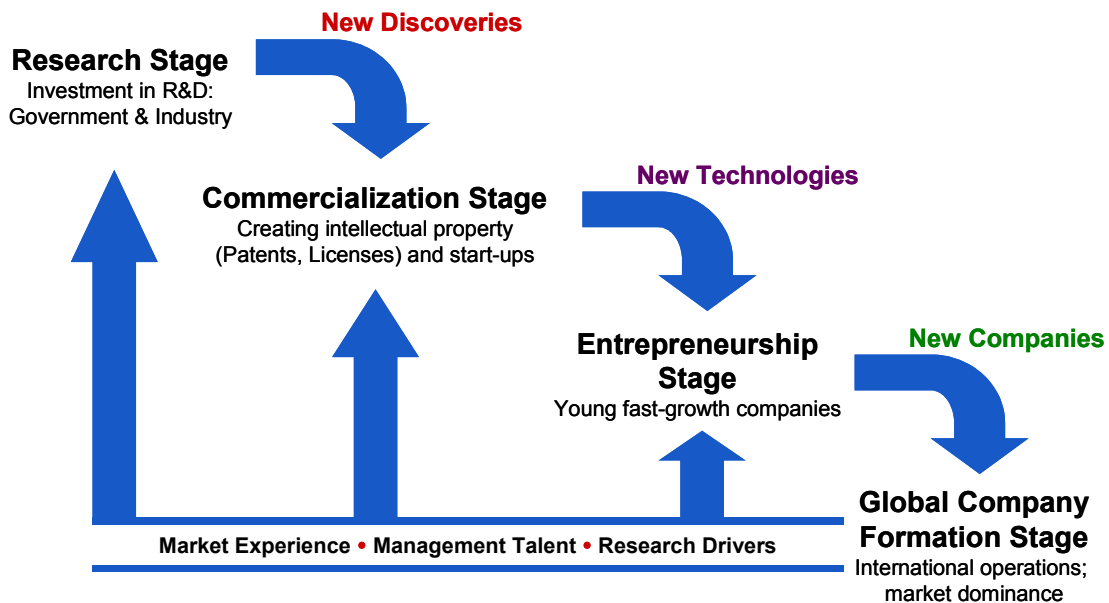
- ▶ Research,
- ▶ Commercialization,
- ▶ Entrepreneurship, and
- ▶ Global company formation.

These systems form a pipeline that channels inputs from each stage into the

next, increasing the efficiency of the system.

The Integrated Technology Initiative benchmarked each stage of the innovation pipeline to assess how well the province is performing relative to competing regions in North America, identifying strengths and weaknesses at each stage of development. These benchmarks pinpoint areas of required action and policy concern for creating BC's next-generation technology economy.

### Innovation Pipeline



# The Health of BC's Innovation Pipeline

## Research

### New Discoveries

- ▶ BC has a small research base compared to other regions in North America.
- ▶ BC has successfully taken aggressive steps to increase its share of national R&D, particularly in the life sciences.
- ▶ BC is relatively productive in terms of research outputs generated per dollar invested.

**Bottom Line:** Research is the fundamental ingredient of innovation pipelines. BC must expand its R&D investment until it is on a par with leading technology regions on a per-capita basis.

## Commercialization

### New Applications

- ▶ Relatively low levels of academic R&D funding hamper BC's aggregate production of intellectual property.
- ▶ While there are many innovation disclosures, these do not translate into many new licenses.
- ▶ BC is very effective in creating start-up companies—the most economically significant form of commercialization for the province.

**Bottom Line:** BC has many factors in place for successful commercialization, including an expanding pool of early-stage venture capital. The challenge will be to scale these systems as research funding expands.

**To enable BC's emerging technology clusters to become global leaders, we must expand research funding, scale commercialization and entrepreneurship, and retain growing companies.**

## Entrepreneurship

### New Companies

- ▶ BC's technology clusters have outpaced established leaders in entrepreneurial dynamism since 2000.
- ▶ Employment growth in these many emerging clusters has outpaced Canadian and North American averages.

**Bottom Line:** BC has shown impressive entrepreneurial dynamism; the challenge is to keep those companies rooted in the province as they grow.

## Global Company Development

### New Prosperity

- ▶ In most technology clusters, BC has fewer large, publicly traded, and globally dominant companies than the more established technology regions.
- ▶ The **Life Sciences Cluster** is something of an exception, however, with a healthy number of publicly traded biotechnology companies, though no large global players.

**Bottom Line:** BC has developed an environment where small technology firms can grow and thrive; the challenge now is to provide the late-stage venture funding and large-scale public and private financing to allow companies to grow rapidly in the province.

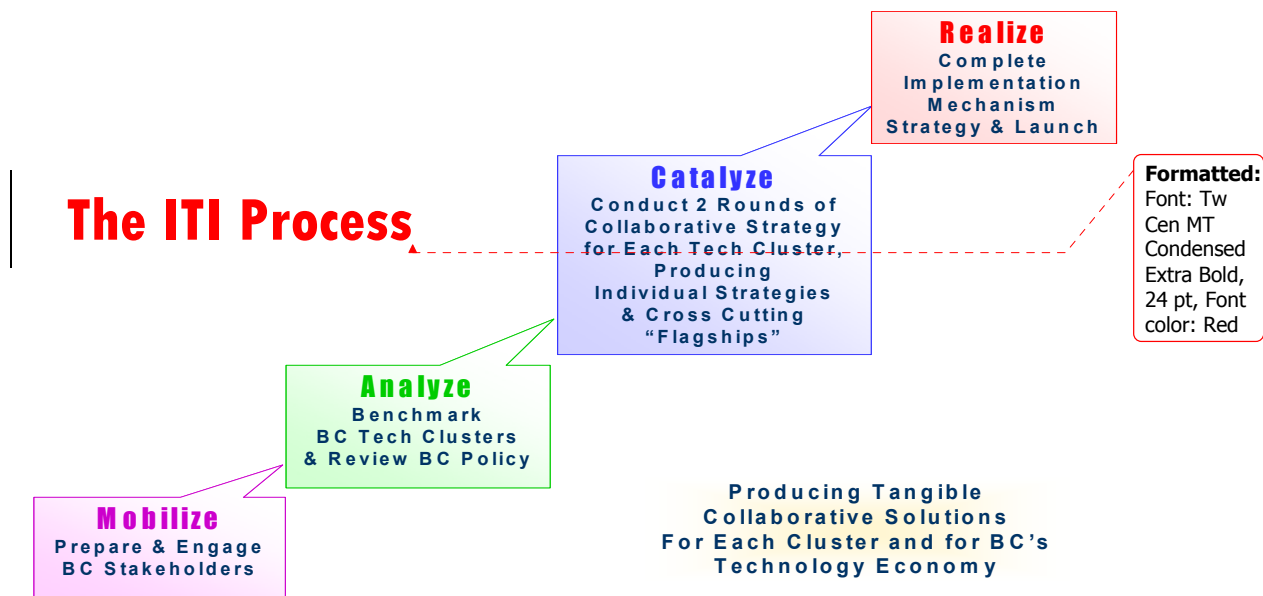
# From Analysis to Action

## A Community Engages

In September 2004, benchmarking results of BC against other select technology regions were presented to community leaders representing all technology industry sectors, universities, research agencies, and government.

In October 2004, representatives from each of the clusters were brought together to clearly articulate the challenges within their sectors that were seen as critical impediments to development. These consultations engaged over 400 individuals from company management, finance, law, accounting, research, education, government, and non-profit organizations to state requirements and challenges, and suggest corresponding actions to address them. Subsequent to the October sessions, smaller working groups convened to draft actions specific to their clusters and relevant to the technology sector as a whole.

In November 2004, the results were presented in a round of reporting sessions.



From these efforts, two levels of directives emerged:

- ▶ **Cluster-specific actions**, which strongly reinforced the initiatives of the industry associations and commitment of individual members to achieving results and
- ▶ **Higher-level "flagship" or core strategic actions**, which would spur substantial competitive gains for the technology sector and the economy as a whole by addressing **six strategic areas of competitiveness**—Finance, Human Resources, Marketing, Government, Innovation, and Infrastructure.

## Six Strategic Areas of Competitiveness

Just as a company must be strong in each facet of its operations to be successful, strength in all competitive areas of the economy is vital to achieving sustainable clusters, realistic growth goals, and overall prosperity.

### Finance

#### Providing the continuum of capital needed for research and commercialization

**A strong, connected capital continuum** is essential to develop and sustain the competitiveness of technology clusters.

**Expanding the R&D investment** in BC will drive the competitiveness of the companies, attracting talent and financing.

**The availability of seed funds** for market assessments, technology assessments, IP strategy, and business plans is critical to give early-stage companies a real opportunity for commercial viability.

**Creating home-grown global anchor companies** will depend on the availability of late-stage venture investments from a local, knowledgeable, and connected finance community.

The region overall has placed a high priority on developing local sources of early- and late-stage financing for rapidly growing BC-based companies through the following actions:

- ▶ Address Investor-readiness of entrepreneurs
- ▶ Harmonize federal and provincial SR & ED investments,
- ▶ Address cross-border challenges to capital attraction,
- ▶ Stimulate early-stage capital availability through expansion of programs such as the SBVCA,
- ▶ Develop local sources of later-stage/expansion capital by targeting and matching venture funds recruited by the province.

### Human Resources

#### Developing and sustaining the skills and workforce needed for competitiveness

Skilled workers in all operations—research and development, marketing, finance, production, and management—determine the competitiveness of an organization. This **“intellectual capital” is as essential as financial capital to sustain the region’s competitiveness** and should be “courted” and retained in the region to achieve maximum advantage.

Brainstorming in the area of human resources, one of the more passionately

discussed ITI topics, yielded the following resolutions:

- ▶ Develop and execute best practices strategies to drive retention and recruitment of technical and management talent,
- ▶ Communicate opportunities to secondary and post-secondary students,
- ▶ Build and expand university-industry skills development partnerships.

## Marketing

### Positioning products, setting up distribution, and building brand

Small technology companies often under-invest in marketing, and each cluster identified specific opportunities for collaboration and economies of scale in marketing and business development activities.

Many of the actions focused on **helping companies develop early product- or vertical-market focus to achieve revenues faster**. The following high-priority initiatives would accomplish this:

- ▶ Support the development of stronger marketing disciplines in early-stage technology companies through the delivery of educational programs,
- ▶ Create a central knowledge repository to close the gap between market intelligence and effective business practices,
- ▶ Develop regional/national markets to create a local feedback and innovation loop. Showcase regional partnerships in marketing materials.

## Innovation

### Generating knowledge and moving it into the marketplace

Harnessing BC's research and innovation pipeline, particularly within **universities and laboratories**, is also critical to remaining a recognized centre of innovation. BC's technology community cited the following as key innovation actions:

- ▶ Raise R & D Federal and Provincial investment in both the public and private sectors,
- ▶ Strengthen the match of UILO policies to industry needs,
- ▶ Expand the capacity of and services provided by UILOs, procuring pre-seed and seed funding as well as access to managerial and business service networks.

## Governance

### Improving the tax, regulatory, and administrative environment

BC has the potential to become a “technology province.” To achieve this goal, **changes in the government procurement and private sector incentives for technology adoption are required.**

Action in two key areas will advance the technology sector in both commercial maturity and reputation, with the added benefit of branding the region as knowledge-economy hub:

- ▶ Encourage the establishment of a Ministry of Technology for the Province of British Columbia,
- ▶ Encourage and enable government to be leader in the adoption of local technology,
- ▶ Develop showcase and communications plans for technology applications in conjunction with the 2006 World Urban Forum and the 2010 Winter Olympic Games.

## Infrastructure

### Acquiring research, development, and production facilities—from labs to tech parks

BC has consistently shown a marked advantage in doing more with less, especially in terms of R&D investment and venture financing.

One highly effective method to further leverage investments is to **create physical space focused on specific areas of expertise** that encourages knowledge flow and the movement of intellectual property into commercial ventures.

Infrastructure needs can be met through the establishment of collaborative working facilities that feature:

- ▶ Joint industry-academic R&D,
- ▶ Cost-sharing of services, space, and equipment,
- ▶ Experience-based learning and training for students.

## **British Columbia's Technology Clusters**

In addition to actions identified to enhance the entire technology sector and the economy as a whole, **priority actions for advancing the competitiveness of individual technology clusters** were also addressed.

Most of these were complementary to the clusters' existing strategic plans; however, the simultaneous focus of all sectors on specific issues yielded a strengthened resolve to meet aggressive goals and provided greater community support for individual advancement.

The concentrated process also engaged a broader array of participants and created heightened awareness at the provincial and federal government levels that BC's technology community is determined to excel on the global stage.

The following pages provide a snapshot of each cluster's key issues and actions.

## Life Sciences

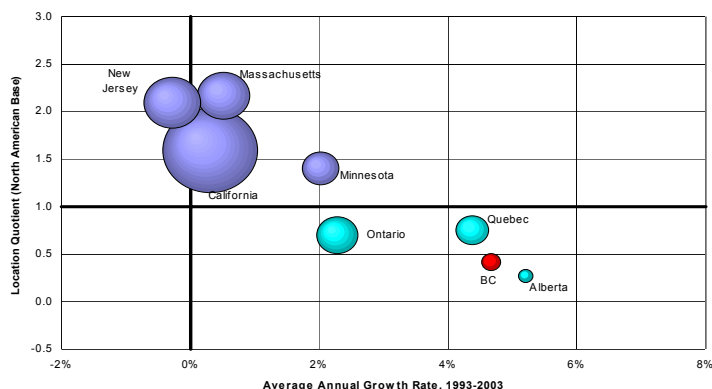
The **Life Sciences Cluster** is the largest and most significant of BC's export-focused technology clusters. With over 100 biotechnology anchor companies at its core, it is heavily focused in pharmaceuticals development, biotechnology activities, medical equipment, medical devices, and medical research services.

This cluster has added jobs at a faster rate than all three of the much-larger U.S. clusters in California, Massachusetts, and

New Jersey. Its growth has also outpaced the larger Canadian clusters in Ontario and Quebec.

BC has a relatively low employment concentration despite its employment growth—about half the North American average, and about a third of Minnesota's, a comparably-sized state. Most of the cluster is home-grown, having emerged locally from research conducted at provincial institutions, especially the University of British Columbia.

### Growth Share Matrix for British Columbia's Life Sciences Cluster



## Priority Issues

### High Priority

- ▶ Improve financing for proof of concept, early-stage, and late-stage (IPO) capital.
- ▶ Promote knowledge transfer among companies to encourage the use of global best practices.
- ▶ Increase early-stage procurement, a natural source of market growth for small companies.

### Medium Priority

- ▶ Promote late-stage manufacturing.
- ▶ Provide low-cost facilities for start-ups to give a competitive advantage.
- ▶ Develop markets with BC-based global companies in other industries, an excellent strategy in the longer run to develop private funding sources for new companies (but may not have a dramatic short-term impact).

## Cluster Actions

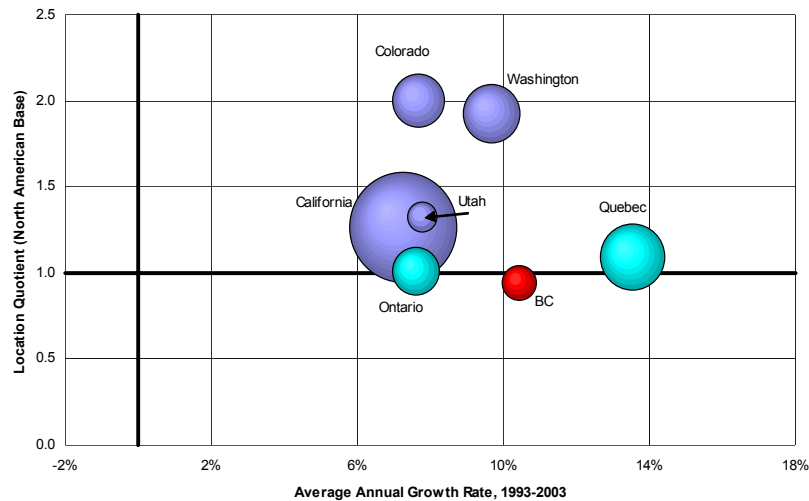
Recognizing the low level of critical mass but relatively impressive growth rate and strong research productivity and start-up capabilities in the Life Sciences Cluster, the leaders in this cluster's collaborative working group have prioritized strategic actions that would address existing gaps in the innovation infrastructure, particularly related to research dollars and connectivity of the various actors in the innovation process:

- ▶ Sustain world class research and innovation centres to strengthen marketplace-linked innovation.
- ▶ Raise and sustain R&D investment to create a more viable, self-sustaining cluster.
- ▶ Encourage global companies to locate R&D in BC to strengthen the province's labour force and create partnerships and marketing opportunities for smaller companies.
- ▶ Increase early-stage capital financing.

## Information Technology

The **Information Technology Cluster** was one of the earlier technology-based industries to develop in BC, experiencing its first growth spurt in the mid-1980s. It includes software and telecommunications services, software publishing, and computer hardware and telecommunications equipment manufacturing. It is the largest technology cluster in the province, although most of the companies are small service providers for local markets.

Over the 1993–2003 periods, BC's Information Technology Cluster grew faster than the North American average, and experienced stronger employment growth than that of competitor regions, including California, Ontario, Washington State, and Utah. While BC's employment concentration or "location quotient" is not especially low, it is lower than that of more well-known and established IT clusters in other jurisdictions.



**Growth Share Matrix for British Columbia's Information Technology Cluster**

## Priority Issues

### High Priority

- ▶ Secure both early- and late-stage capital, as BC lags competing regions in IT venture capital at every stage.
- ▶ Ensure sufficient early-stage funding, as the early-stage shortfall is particularly acute, a serious problem because entrepreneurial-stage companies play a significant role in the continued growth of the cluster.
- ▶ Ensure the availability of skilled talent.
- ▶ Acquire sufficient funds to fuel R&D.
- ▶ Increase global marketing and branding.

## Cluster Actions

To make a transformation from integrators of technology produced elsewhere to developers of technology and providers of global products, the leaders in the rapidly growing Information Technology Cluster have opted to focus early efforts on issues that would enable this local-serving cluster to develop intellectual and commercial leadership in various domains of IT product engineering and use:

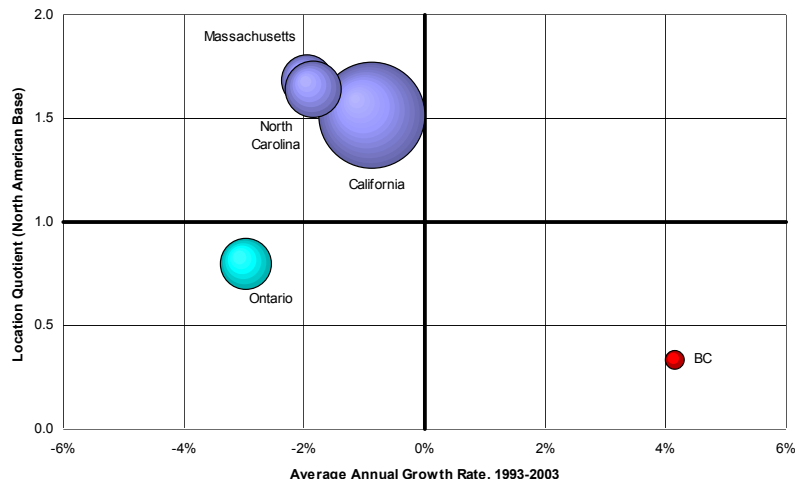
- ▶ Raise and sustain BC-based R&D investment to enable the cluster to develop intellectual leadership in various technology domains.
- ▶ Increase early-stage capital financing.
- ▶ Improve national and international marketing and positioning to improve the cluster's export performance and profile.
- ▶ Attract skilled workers to ensure a strong technology labour market.

## Energy Technologies

The **Energy Technologies Cluster** is an emerging force in BC. Highly export-focused, this cluster generated C\$620 million in revenues in 2002 and is predicted to reach C\$1 billion in 2005. The cluster employed 3,000 people in 2002, far fewer than competing regions such as California, Massachusetts, North Carolina, and Ontario.

However, the cluster has been growing 4% faster than the average annual growth rate for North America. Despite falling below the North American average in employment concentration, this cluster continues its trend of developing and expanding that adds jobs as larger competitors shrink.

### Growth Share Matrix for British Columbia's Energy Technologies Cluster



## Priority Issues

### High Priority

- ▶ Commercialize and prepare for the continuum of investment.
- ▶ Grow knowledge for application in BC energy technologies; R&D needs to be increased in all industries and this will require a compelling research and economic development case for government funding.
- ▶ Build a power technology industry buyer network; entrepreneurial-stage companies need to be plugged into national and global market networks.

## Cluster Actions

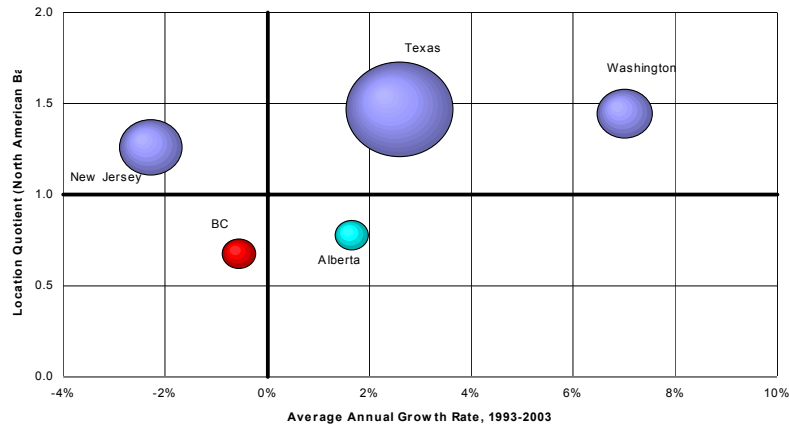
A growing cluster with an increasingly promising market environment, Energy Technologies consists of many diverse companies but a few anchor leaders and relatively small employment size and concentration. To move the cluster down the innovation pipeline, the leaders of the Energy Technologies Cluster group have identified a set of near-term priority actions to respond to challenges posed primarily by its small size:

- ▶ Raise and sustain R&D investment to encourage additional provincial funding for innovation and product commercialization.
- ▶ Ready and prepare entrepreneurs for the continuum of investment to achieve greater levels of commercialization in the cluster.
- ▶ Build an energy technologies cluster network to more easily promote activities, such as buyer-supplier exchanges.

## Wireless

The **Wireless Cluster** is a diverse, young, emerging cluster, with an estimated 150 BC companies. Currently, the cluster is small, with less relative employment concentration or “location quotient” than the

North American average. Still, it is at the earliest stages of development and poised to take advantage of clear opportunities in the rapidly expanding telecom services and equipment marketplace.



**Growth  
Share Matrix  
for British  
Columbia's  
Wireless  
Cluster**

### Priority Issues

#### High Priority

- ▶ Attract anchor multinationals to BC; this would be the most effective action, as private sector and international producers will be critical to increasing the R&D in the province by establishing a positive perception of the local innovation environment.
- ▶ Develop a funding map, particularly as part of company education.

#### Medium Priority

- ▶ Create a “deal generator,” which should be tied to public sector funding because although it is a critical need for all clusters, there may not be sufficient scale for such an activity for this cluster alone.
- ▶ Improve the wireless talent pool; BC needs a defined identity and value proposition for workers in the industry.
- ▶ Improve export promotion and marketing services to help companies globalize.

- ▶ Develop pilot test locations for wireless innovation demonstrations that could provide feedback on commercialization

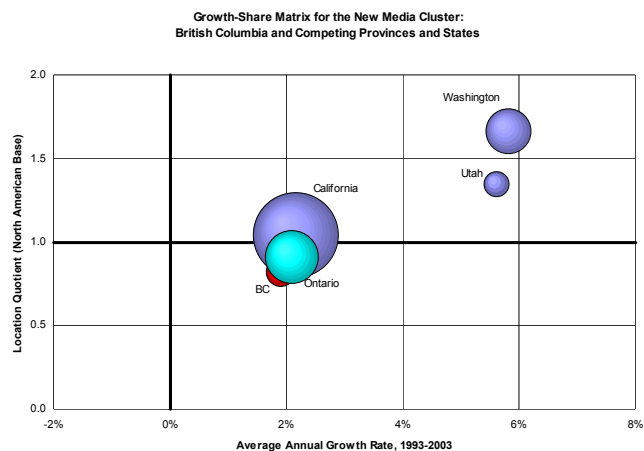
### Cluster Actions

Given the nascent nature of the Wireless Cluster, the leaders in this cluster's collaborative working group have opted to focus early efforts on issues that would help realise the cluster's growth potential and advance its development:

- ▶ Create a funding map to improve the investment environment for wireless companies.
- ▶ Attract anchor multinationals to BC that will in turn foster innovative spin-offs.
- ▶ Provide market intelligence and end-user feedback on wireless innovation to new companies.

## New Media

**New Media Clusters** have typically emerged out of old media or information technology/software industries. In BC, the cluster has emerged as a significant source of knowledge-based industries since the mid-1990s, with industry estimates as high as 700 firms and 14,000 employees. In Web-based and traditional media, the province is growing rapidly, matching the rate of California and Ontario. The emergence of new media over the past decade has led to the development of completely new industries and occupations, and government statistics do not adequately capture the cluster's performance. However, comparative case studies indicate that the cluster may be rapidly growing in BC, even as it stagnates or declines in other areas of North America.



## Priority Issues

### High Priority

- ▶ Increasing the cluster's readiness for investment and attracting investors are the highest priorities.
- ▶ Second in critical importance is encouraging networking through strengthening relationships within and across industries. This is essential to expand the New Media industries and markets and position it in a larger national and international marketplace. This growth requires more aggressive policies and practices to attract talent and develop skilled and experienced workers.

### Medium Priority

- ▶ Extend New Media distribution capacity and channels, which include critical human resources issues related to business training as well as market development.
- ▶ Harness BC's university innovation capabilities to better support New Media, given the need for a compelling research and innovation strategy for the cluster.

## Cluster Actions

New Media in BC is a small and highly entrepreneurial cluster with the potential to grow more rapidly than competitors in North America. However, to increase its attractiveness as a magnet for major venture financing, the leaders in the New Media Cluster Collaborative Working Group have prioritized issues that would help the cluster attract major investments across critical parts of the innovation pipeline, as well as increase its profile as a leading new media centre:

- ▶ Raise and sustain BC-based R&D investment to make the transformation from integrators of technology produced elsewhere to technology developers.
- ▶ Increase early-stage capital financing.
- ▶ Improve national and international marketing and positioning to enhance the cluster's export performance and profile.
- ▶ Attract skilled workers to ensure a strong technology labour market.

## **The ITI Leadership Group**

In January 2005, the **ITI Leadership Group** was established, with the British Columbia Technology Industries Association acting as secretariat and co-chair.

The mandate of the ITI Leadership Group is to:

- ▶ Collaborate and act as the common voice on the issues that are critical to the technology community as a whole,
- ▶ Measure progress and report back to the broader community on current activities and successes,
- ▶ Continuously re-evaluate flagship actions determining the relevance based on the current needs of the industry.

## **Participating Organizations**

**BC Biotech**

**BC Innovation Council**

**BC Med Tech**

**BC Technology Industries Association**

**Fuel Cells Canada**

**Genome BC**

**Leading Edge BC**

**New Media BC**

**Okanagan Science and Technology Council**

**Power Technology Alliance**

**Premier's Technology Council**

**University President's Council**

**Vancouver Island Advanced Technology Centre**

**Western Economic Diversification Canada**

**Wireless Innovation Network BC**

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