October 2005

Newfoundland and Labrador Innovation Report

amec

October 25, 2005

Honorable Kathy Dunderdale
Minster of Innovation
Trade and Rural Development
P.O. Box 8700
St. John's, NL A1B 4J6

Dear Minister Dunderdale:

On behalf of AMEC and the other members of AMEC's Innovation Team, I am pleased to provide you with a final printed and electronic version of the Innovation Report as well as a stand -alone Executive Summary and a separate volume of appendices**.**

It has been a pleasure working with the Department of Innovation, Trade and Rural Development and we appreciate the valuable advice that your Department has consistently provided to us over the life of the project. We would like to make it clear, however, that the views expressed in this report summarize and build on the thoughts of more than 500 Newfoundlanders and Labradorians and do not necessarily reflect those of the government of Newfoundland and Labrador or the Department of Innovation, Trade and Rural Development. We also recognize that the Innovation report consultations took place almost a year ago and that much has changed within the government since that time.

Thank you again for the opportunity to become involved in this important contract and we look forward to working with you and your department in the future.

Regards,

Susan Sherk

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NEWFOUNDLAND AND LABRADOR INNOVATION REPORT

Final Report

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Executive Summary

This document forms part of an expansive and inclusive process to develop an Innovation Strategy for the Government of Newfoundland and Labrador. It is based on months of research and a critical series of consultations with key sectors, organizations and individuals throughout Newfoundland and Labrador. Their advice was often blunt, but always encouraging, reflecting both the hard-won realism and fierce pride of place that define the people of this province.

The goal of this document was to present an Innovation Report both realistic and visionary, one based on Newfoundland and Labrador's existing strengths, but one that also provides a foundation for exciting growth in the decades to come. In this report, we offer a blueprint upon which to build an innovative society in Newfoundland and Labrador. It will now be up to the Province to decide which elements are most achievable and put in place creative policies and programs to take its innovation agenda forward.

There is no lasting progress without change. The key findings and recommendations of this report are structured around that reality. This is a province of great and enduring strengths, but we must also acknowledge where we need to do better.

The province is strong in many areas. The resiliency and creativity of its people are ingrained through generations of isolation and hardship. Today, the province has world-class R&D and educational facilities, internationally recognized resources and expertise in oceans and marine technology, and business and academic communities that increasingly embrace innovation as the key to progress. Its vibrant culture and heritage is the source of legendary pride and spirit.

There is enormous potential in the province's strengths, opportunities waiting to be tapped in imaginative and sensible ways. The growing core of knowledge-based industries and infrastructure must be further developed to benefit all regions of the province. Value-added opportunities must be increased to improve economic growth. Promising areas such as distance education and telemedicine must be strengthened to reinvigorate our rural economies.

To build towards a position where this province can compete on an equal footing, in every sphere, with the rest of the world, systemic weaknesses must be corrected that threaten our progress on innovation. This will require courage and perseverance. The province's R&D infrastructure is under-funded and in some areas, showing signs of decay, affecting the ability to attract investment and top-flight researchers. Our education system falls short in meeting the needs of industry and in molding future business innovators. There is a lack of investment funding, especially sufficient seed capital and long-term financing, to support the commercialization of viable research findings. There is not enough R&D financed by the private sector. And, more must be done to overcome a deep-rooted cultural tendency to avoid risk and change.

The impetus to develop an innovation agenda becomes all the more pressing in light of the province's aging population, out-migration and low birth rate. At this pivotal stage in our history, a duty exists to act responsibly and seize the opportunity to

create a more productive society, both for ourselves and for generations to follow. The research and consultations conducted for this report led to a number of conclusions as to how to proceed on that path.

Investment must be made in Newfoundland and Labrador's strengths in order for this province to compete globally. That means employing resources in strategic areas and developing regional core centres of expertise – Innovation Hubs - around those areas, and in some instances imbedding them in the regional college system. It is also vital that innovation successes are "showcased" through an enterprising and integrated marketing strategy that promotes an identifiable "brand" around the world.

Education and skills development need to be in step with the needs of industry and the future economic direction of the province. This will require more collaboration between industry and educational institutions, and the introduction or strengthening of courses at the junior-high school level that teach the value of innovation and entrepreneurship.

The Province must support wider collaboration among industry, government and institutions to advance innovation. It must put in place mechanisms to enable the building of these relationships, including giving government employees the training and tools they need to further collaboration among all these groups.

It is incumbent on Government to introduce better policies and programs to stimulate innovation and business growth. It must reshape the bureaucracy so that government departments and agencies are rewarded for innovative practices and charged with making the province more competitive. This is not a finite process, and will require ongoing leadership to drive change and improvement throughout government.

An R&D agenda for the province must be developed and implemented that co-ordinates the resources of government, institutions and industry, and is tied to an overall strategic direction. The Province must provide more support to businesses that can bring innovation to market, and set targets for expanding R&D in Newfoundland and Labrador.

Effective financing and investment tools are critical to fuelling business growth and innovation and development over the long term. Multi-year funding programs with higher ceilings, better access to venture capital, and a tax regime that encourages, not inhibits, R&D and business investment form part of this necessary package.

A competitive infrastructure must be provided that supports innovative activity. That means continuous investment in facilities and equipment throughout the province. A broadband and advanced communications networking strategy is needed to target growth in this key area.

The final building block binds together all of these objectives and is, perhaps, the most important. A culture of innovation must be created that values knowledge, embraces risk and honours success. We must know what we are capable of, and go about getting there. We must believe in ourselves.

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Acronyms used in this report

ACOA – Atlantic Canada Opportunities Agency
AUCC - Association of Universities and Colleges of Canada
AIF – Atlantic Innovation Fund
BERD – Business Expenditure on R & D
BRAND – Broadband for Rural and Northern Development
CCMC – Canadian Centre for Marine Communications
CEE – Centre for Environmental Excellence
CNA – College of the North Atlantic
CRM – Customer Relationship Management
FINALY! – Futures in Newfoundland and Labrador's Youth
GDP – Gross Domestic Product
GradSWEP – Graduate Student Work Experience Program
HQP – Highly Qualified People
INTRD – Department of Innovation, Trade and Rural Development
IP – Intellectual Property
Nati – Newfoundland and Labrador Association of Technology Industries
NOIA – Newfoundland Ocean Industries Association
NRC – National Research Council
OECD – Organisation for Economic Co-operation and Development
PACE – Program of Achievement in Community Enterprise
R & D – Research and Development
SME – Small and Medium Sized Enterprises
SPC – Seafood Processing Consultants
SWOT – Strengths, Weaknesses, Opportunities and Threats
TARA – Telecom Applications Research Alliance
U.S. – United States
UK – United Kingdom
VC – Venture Capital

1.0 INTRODUCTION

The principal objective of every modern government is to create economic growth. The most progressive governments understand the power of knowledge and provide policies that encourage the spread of knowledge across borders and cultures. In a global economy, this means building societies that promote creative thinking and the constant exchange of new ideas. It is only when knowledge is shared and ideas put into action that society benefits and wealth is created. Putting new knowledge into action is the essence of innovation.

Innovation is defined as:

The creation, sharing and implementation of new ideas resulting in economic value and/or social gain.

Why is innovation important? It motivates individuals, cultures and nations to succeed. It demands the best of human ingenuity to advance society, improve lives and exceed current notions of excellence. Without innovation, we would not have the telephone, the artificial heart or e-mail. In Newfoundland and Labrador, we must seize the wealth of knowledge and human potential that this province holds and is waiting to be developed.

In the past decade, investments by government and government agencies have brought significant economic returns and helped stimulate innovation and growth in the province. Educational institutions and businesses, as well as industry associations and development agencies, have contributed to this process. But a more cohesive and vital approach is needed, involving all these groups, to reach our greatest potential.

This report builds on a process begun by the Government of Newfoundland and Labrador, as well as by federal departments and agencies such as the Atlantic Canada Opportunities Agency (ACOA), National Research Council (NRC) and Industry Canada, to achieve a diversified economy. And it responds to recent calls for greater national productivity (e.g. Globe and Mail editorials, November 6 – 9, 2005) as well as academic research (e.g. Association of Universities and Colleges of Canada, October 2005).

The Government of Newfoundland and Labrador sees innovation as the cornerstone of a stronger, more varied economy. The recommendations contained in this document offer a practical but visionary approach to improve the province's performance in this critical area. Four elements support this strategy. They are:

- Cohesiveness – ensuring the elements exist for an innovative economy
- Creativity – identifying the elements that enable a growing culture of innovation
- Insight – providing the elements that affect the province's innovation performance
- Practicality – setting realistic goals to achieve a more competitive and productive economy

In developing this report, we recognized the need to consult with as many groups and individuals as possible. The report is based upon extensive consultations with many sectors, communities and regions of the province.

A team of highly qualified individuals, brought together by AMEC, prepared the report. The team consisted of Susan Sherk of AMEC, Daryl Genge of Genge Consulting Group and David Wells of Seafood Processing Consultants (SPC). Each has a strong background in socio-economic development, business growth and planning. Their experience crosses many sectors, from natural resources to culture to knowledge industries, research, education and skills development. The team's chief researcher was Kathy-Jane Elton, who worked tirelessly to track down and verify information. The team was supported by Jeana McGrath and David Robbins of AMEC, Dr. Mary Kilfoil of Gardner Pinfold Consulting Economists, Dr. Alan Cornford, and Cathy Finn, each of whom brought valuable skills and energy to the project.

Between January and March 2005, the AMEC team conducted focus groups, regional round tables and interviews. More than 460 individuals took part in the consultation process, and the team received 25 written submissions. Contributing sectors included advanced technology, life sciences, research and education, tourism, ocean technology and natural resources. The consultants sought opinions from individuals representing labour, government, educational institutions, business and community organizations. The team also carried out 13 jurisdictional assessments that focused on economies similar to Newfoundland and Labrador's as well as models of innovative economies.

The results of this process form the basis of this report's recommendations. Almost without exception, participants were positive about the future of the province -- provided certain structural elements are put in place to stimulate a genuine climate of innovation. Participants stressed that stakeholders must work together to achieve that goal, and that all levels of government must do what is necessary to create a strong business climate and innovative environment.

This document presents the strategic elements required to build a dynamic and innovative province and discusses the factors impeding that objective. It identifies new opportunities for economic growth in our strongest and most promising sectors. It offers a blueprint for reinvigorating rural areas and developing strong regions through the creation of Innovation Hubs. It suggests a new course by which to market the province, focus the delivery of business services, attract outside investment, and effectively leverage federal innovation funds through increased provincial research and development (R&D) funding. It also provides information on commercialization and other innovative models.

Section 2.1 is an overview of the Newfoundland and Labrador economy, including factors that affect the development of an innovation culture.

Section 2.2 outlines provincial innovation strategies and global trends and benchmarks in innovative performance among Organisation for Economic Co-operation and Development (OECD) countries, including Canada.

Section 2.3 summarizes strengths, weaknesses, opportunities and threats (SWOT) regarding innovation, as articulated by those consulted.

Section 3 introduces the framework developed for this innovation report.
Section 4 presents the recommendations.
Section 5 suggests the next steps.

2.0 INNOVATIVE PERFORMANCE BACKGROUND AND ANALYSIS

2.1 NEWFOUNDLAND AND LABRADOR—ECONOMIC OVERVIEW

For hundreds of years, Newfoundlanders and Labradorians have made a living from the land and sea in an isolated and rugged corner of North America. For the most part, they have depended on traditional resource sectors, particularly fishing, forestry and mining.

The discovery of commercial offshore oil and gas reserves in the late 1970s changed the profile of the provincial economy and, in particular, the marine resources sector, bringing with it new opportunities for growth. The oil and gas sector accounted for almost 18% of the provincial Gross Domestic Product (GDP) and 2.7% of total labour income in 2003,[1] providing a significant surge in the provincial economy in recent years.

Elsewhere, the tourism sector has undergone impressive growth and manufacturing has become more important to our economy.

Despite this progress, the provincial economy remains limited and highly dependent on the export of its primary resources. This economic structure has resulted in a destructive seasonal employment rate - three times that of the national average, a low value-added production rate, limited export opportunities and overall unemployment that is approximately twice the Canadian rate. Most rural economies rely on a single industry and are especially vulnerable to economic shifts.

In the face of these challenges, the people of Newfoundland and Labrador continue to prove their legendary resiliency in surviving economic challenges in an unforgiving environment. Perseverance, strength of character and ingenuity have resulted in important successes including being pioneers in distance education and telemedicine and becoming renown for our expertise in cold ocean and marine technologies. Momentum is building for a broad-based ocean and marine technology cluster and internationally recognized centres of excellence have been established. World-class biotechnology research is conducted and expertise in environmental systems and information and communications technology is being developed. New companies are being established in such sectors as remote sensing and financial asset tracking.

The province is developing the information and communications infrastructure so essential to fostering innovation. Broadband capabilities are being built throughout the province, easing the competitive disadvantage that comes with distance and remoteness.

Talented artists, academic achievers and creative problem-solvers are found throughout the province. Newfoundlanders and Labradorians are university presidents, respected international scientists, founders of high-tech companies, and internationally acclaimed musicians, writers and artists.

[1] *The Economy 2004: Newfoundland and Labrador*. Economic Research and Analysis, Department of Finance, Government of Newfoundland and Labrador, 2004.

2.1.1 Demographics

A decline in population is one of the most serious challenges facing this province. It is the result of two trends: increasing out-migration and falling birth rates. Overall, the provincial population decreased by 11% between 1991-2004, compared to an 11% increase nationally[2]. This loss was concentrated among the 0-19 age group, which saw a decline of 29.4%.[3]

Most out-migration occurs among those aged 20-30. Many of these young people are well-educated and form the natural group from which to develop a strong labour pool. While out-migration has slowed in recent years, that trend could be temporary should the province's economic performance stall. Should out-migration increase, the impact will be felt in critical ways: a reduced work force, loss of our "best and brightest", added pressure on the health care sector, declining support for educational facilities, a smaller revenue base (particularly for our sparsely populated rural economies), and fewer opportunities for economic growth.[4]

Birth rates are declining because of complex social, economic and cultural factors and are now the lowest in the country. Couples in Newfoundland and Labrador are having fewer children, and out-migration has contributed to an overall decline in the population of young adults of childbearing age. Alarmingly, the birth rate is projected to continue its slide, with the number of deaths soon to exceed the number of births in this province. While the population is growing older throughout Canada, this province has the most rapidly aging population in the country.[5]

A greater migration is also occurring from rural Newfoundland and Labrador to urban regions. While no conclusive data exists on the extent of this pattern, housing starts (as shown in Table 1) in St. John's and surrounding communities indicate significant growth in the population that cannot be attributed solely to interprovincial in-migration or the birth rate. Records show that housing starts have consistently out-performed economic predictions and were revised several times based on strong quarterly growth.

Table 1: Housing Starts: St. John's, NL

Year	Number	% Change
2004	1834	14.3%+
2003	1604	20%+
2002	1350	35%+
2001	1029	31.2%+

Source: City of St. John's

[2] Population Statistics. Newfoundland Statistics Agency, Department of Finance, Government of Newfoundland and Labrador. 2005.
[3] *Demographic Change: Newfoundland and Labrador Issues and Implications*. Government of Newfoundland and Labrador, April 2002.
[4] Ibid.
[5] Ibid

2.1.2 Business Climate and Structure

Almost 60% of the province's businesses are located in the St. John's area, with the others being proportionately dispersed throughout other regions. A healthy number of businesses (57%) have been operating for more than 10 years, while the number of businesses started in the past three years is under 13%[6].

***"Business is not pulling its weight as far as community work is concerned; they need to be more engaged."* - Marystown round table**

The province's small population and diffuse market mean fewer opportunities for entrepreneurs to develop their businesses here. Research shows that the key driver for business innovation is increasing market share[7]. With limited opportunities to achieve this provincially, firms must expand their businesses through export opportunities. The province ranks eighth in Canada and third in Atlantic Canada for total exports as a percentage of GDP (54.8%, averaged from 2001 to 2004).[8] During the public consultation process, we heard repeatedly that while periodic seminars, training sessions and trade missions are useful, there is a great need for regular mentoring and hands-on support. We were also reminded that most firms have limited financial resources to cushion the risk associated with exploring and developing markets outside the province.

Taxation levels in Newfoundland and Labrador also affect our ability to attract and encourage innovation. Corporate tax rates are a major consideration for investors in deciding where to invest. Many national and international jurisdictions have responded successfully to this fact by introducing tax credits and other financial mechanisms to promote investment in innovation. Our corporate tax rates are competitive with the rest of the country. Our general corporate rate is 14%, our manufacturing and processing rate is 5%, as is our small business rate. These and other indicators (e.g. quality of life) have moved St. John's recently into first position nationally as the best place to establish a business. [9] But an ongoing restrictive issue is our high personal income tax rates, and we must remain competitive with other jurisdictions.

2.1.3 Current R&D Performance

As a percentage of GDP (2001-2002) in Newfoundland and Labrador, Research & Development (R&D) was 0.9% compared to 2.0% for Canada. Business and foreign R&D expenditures as a percentage of GDP (2001-02) measured 16.2%, relative to the Canadian average of 60.0%.[10] Many factors have contributed to the low level of R&D here, including the small size of industry "clusters" (industry clusters encourage R&D

[6] *Innovation Business Survey. A Survey of Innovation and Research and Development Activity in Newfoundland and Labrador's Private Sector*. Commissioned by ACOA and Industry Canada. Prepared by Barry Shepard, Wade Locke, Scott Lynch, 2002.
[7] Ibid.
[8] Data calculated by the Newfoundland Statistics Agency, Department of Finance and Statistics Canada. This data provided to AMEC by the Strategic Partnership Secretariat, Government of Newfoundland and Labrador. June 2005.
[9] *Canadian Business Magazine*, October 2005.
[10]. Data calculated by the Newfoundland Statistics Agency, Department of Finance and Statistics Canada. This data provided to AMEC by the Strategic Partnership Secretariat, Government of Newfoundland and Labrador. June 2005

and collaboration) and the lack of corporate head offices (which traditionally house and oversee R&D activities) in the province. The uneven distribution of R&D expenditures between the public and private sectors is another concern. In Newfoundland and Labrador, the balance between university and industry R&D spending is the reverse of that in most innovative economies. Memorial University's (MUN) research spending stands at almost three times that of industry.

The extent to which the private sector invests in R&D is a prime indicator of a region's investment climate. In a strong knowledge-based economy, industry normally accounts for about 60% of innovation investments, the educational sector about 30% of total investments (e.g. 2004 - Canada business investment - 51.2%; all universities - 38.1%; federal government – 9.1%, provinces – 1.3% and not-for profit - 0.9%). Here, in Newfoundland and Labrador, the ratios are almost reversed. In 2002, the business sector was responsible for 14% of overall R&D spending, the education sector, 63%.[11] As well, economic projections for the province's capital investments for the years 2005-2007, which reflect R&D expenditures, indicate a decline in spending of 5-8%.[12] At the same time, the province's R&D workforce is the smallest in the country as a share of total employment.[13]

R&D in the province is also ill-served by the tepid level of the transfer of R&D knowledge and experience to the private sector. Groups and individuals consulted for this report expressed concern about the lack of collaboration between R&D facilities and the business community. They are equally dismayed that much of the R&D work done in the province does not reflect the needs of industry. Only 16% of industry here collaborated with research facilities/institutions on R&D, compared to 33% nationally.[14] Moreover, businesses, particularly those in rural areas, do not have easy access to R&D facilities. They are restricted by distance, the increased financial commitment that may be required, and the reality that facilities based in St. John's control the direction of R&D.

2.1.4 Commercialization, Intellectual Property and Technology Transfer

The process of innovation may be described as a continuous stream of commercially relevant new ideas[15], and commercialization as the creation of local wealth using those ideas. The process of technological change can be thought of as a 'supply chain,' i.e., pure research creates inventions that may lead to applied research. This research may result in commercial products that are then marketed and bought, thereby creating sales and wealth. The process is not a simple one-way flow. There is considerable feedback from each stage to previous stages and to the marketplace.

The evidence we have gathered suggests several main objectives are necessary to drive this process. The province must succeed in meeting these objectives if it is to move forward. They include:

[11] *Indicators for Benchmarking Innovation in Atlantic Canada*. (Wade Locke, et al). March 2004.
[12] Economic Research and Analysis, Department of Finance, Government of Newfoundland and Labrador. www.economic.gov.nf/frcstsellnd.asp.
[13] *Indicators for Benchmarking Innovation in Atlantic Canada*. (Wade Locke, et al.). 2004
[14] Ibid.
[15] *The New Challenge to America's Prosperity: Findings from the Innovation Index*. Porter, M, Stern, S., and the US Council on Competitiveness. 1999

- developing a culture of innovation;
- collaborating among research institutions, businesses and government agencies;
- increasing the number of Highly Qualified People (HQP) in the local workforce to improve the rate and flow of innovation and commercialization;
- increasing private R&D (and the ratio of private versus public R&D);
- increasing access to higher levels of federal and provincial R&D funding;
- accelerating the commercialization process; and
- increasing commercial product and process opportunities from both public and private R&D.

Based on the above, provincial policies designed to improve the number of new products and processes become all the more critical. As well, Memorial University and CNA, must increase their rates of commercialization if they are to meet the AUCCs target of tripling commercialization performance of post secondary educational institutions by 2010 (AUCC, 2005)[16]. To help achieve these ambitious goals, policies must help to:

- increase collaboration between research agencies and industry in order to identify and engage in applied R&D that will result in new products and processes; and
- harness the pure knowledge that underlies new technologies and nurture it to the commercialization stage.

In the long term, fundamental research (both public and private) is the basic engine of technological change. The aim of private sector R&D follows the specific stages described above. Only a portion of public sector R&D has local industry relevance and is disseminated to the private sector at one or more of these stages. That is why Newfoundland and Labrador falls short in this regard.

"People need to find the time to figure out how to do things better, that's the only way we'll move forward and stay ahead of others." - **Clarenville round table.**

2.1.5 Knowledge Infrastructure

Memorial University of Newfoundland (MUN), which includes the Marine Institute as well as Sir Wilfred Grenfell College, and the College of the North Atlantic (CNA) are the province's chief post secondary educational institutions. The vast majority of R&D infrastructure in this province is contained within these institutions, specifically Memorial University, and many of their research facilities are considered world-class (e.g. INCO Innovation Centre; Core Research Equipment and Instrument Training Network – CREAIT Network; Atlantic Computational Excellence Network - ACEnet) As a percentage of GDP, capital investment levels from 2001-2004 totalled 25.9%, placing the province second in the country behind Alberta. But, these were singular investments associated with increased activity in the mining and oil and gas sectors and could decline if offshore activity does not increase in the near future. Investments in machinery

[16] *Momentum, the 2005 Report on University Research and Knowledge Transfer*. Association of Universities and Colleges of Canada. October 2005.

and equipment from 2001-2004 (as a percentage of GDP) were 6.9%, the third lowest in the country.[17]

The limited investment in R&D is felt throughout the provincial R&D community. Industry personnel cite declining resources, infrastructure in decline, lost competitiveness, a lack of space and an inability to attract leading researchers. The threat of losing more competitive ground is real and, without sustained investment and the ability to leverage outside funding sources, infrastructure will continue to deteriorate and the inability to attract top researchers will increase.

High-speed broadband telecommunications is increasingly recognized as a critical support for businesses everywhere. Without broadband, industry cannot access the resources used by its competitors and is compromised in its ability to find information, develop new markets, pursue new trading partners and compete effectively in a global economy. Without broadband, it is much harder for Newfoundland and Labrador industry to build alliances and attract investment.

Even when Industry Canada's current Broadband for Rural and Northern Development (BRAND) program is completed, only 80% of the population and 40% of communities will have access to broadband. The lack of access will affect rural and remote areas, continuing a technological divide that hampers economic development in much of the province. In terms of research network distribution, facilities in St. John's are seen to have adequate capacity, while overall provincial levels are well below the national level. Overcoming these discrepancies will require consistent investment based on a provincial broadband strategy.[18]

2.1.6 Higher Education and Skills Development

Trained and talented people drive economic advancement. The development of a skilled and educated population depends on excellent primary and secondary education (K-12), post-secondary education and continued adult learning. The province's educational expenditures have been strong at 7.2% of GDP for 2001-03, the second highest in Canada. But, as a percentage of total GDP, educational expenditures have declined. Overall, education levels among the province's working population are the lowest in Canada.

Overall, educational attainment levels in Newfoundland and Labrador have been steadily improving in recent decades. The proportion of the Province's population working–age population (25-64) who have completed post-secondary education increased from 39% in 1991 to 49% in 2001. Although the proportion remains lower than that for Canada overall (53%) and is one of the lowest proportions in the country, the trend toward improvement will continue given stronger educational attainment profiles for the province's younger age groups. Also, Census 2001 reported that Newfoundland and Labrador showed the largest decline among the provinces in the proportion of the working age population with high school education or less. An examination of specific

[17] Data calculated by the Newfoundland Statistics Agency, Department of Finance and Statistics Canada. This data provided to AMEC by the Strategic Partnership Secretariat, Government of Newfoundland and Labrador. June 2005 ,
[18] Government of Newfoundland and Labrador

education levels shows both strengths and weaknesses: 21% have a trades certificate or diploma compared to 13% for Canada; 14% have a university degree compared to 23% nationally; and 35% have less than high school compared to 23% for the country as a whole.

Table 2 shows selected education indicators for Newfoundland and Labrador and Canada that are important measurements of our ability to compete with other jurisdictions.

Table 2: Selected Indicators for Education

Selected Indicators	Newfoundland and Labrador	Canadian Average
Full time post-secondary enrolment as percent of population, ages 15-24, 2004	25.7%	24.2%
Percent of working age population who have completed high school, 2004	67.0%	75.6%
Percent of working age population who have completed university, 2004 (25+ years)	11.0%	17.2%
Percent university enrolment in biology, physical sciences and engineering, 1999	18.6%	19.6%
University participation rate, ages18-21, 2002/03	24.2%	19.7%

Source: Statistics Canada; Strategic Partnership Secretariat, Government of Newfoundland and Labrador. June 2005. The Price of Knowledge 2004 by Canada Millennium Scholarship Foundation

Newfoundland and Labrador's standing in the Programme for International Student Assessment (PISA) has improved substantially, both internationally and nationally, since the last assessment in 2000. In 2003 NL students achieved at the Canadian average in reading and science. While not yet at the Canadian average in Mathematics, Newfoundland and Labrador performed better than most G8 countries. Within the Atlantic Region., NL led the provinces in all three testing areas and was the only Atlantic Province to achieve the Canadian average in reading and science.

Within the post-secondary system, university completion at the undergraduate and Master's level is on par with other provinces. But, critically, the province has the lowest number of graduates in the science and technology fields (14% provincially vs. 23% nationally) and the lowest graduation rates at the doctorate level.

Since 1992, many high schools have offered a number of courses (e.g. Business Enterprise 1100, Canadian Economy 2203, Consumer Studies 1202, Cultural Tourism 3127, Enterprise 3205, Hospitality/Tourism 3120, Youth Internship Business Enterprise 3228, and Cooperative Education 1100, 2220 and 3220) in the area of Enterprise

education. However, it should be noted that since 1992, many high schools have offered a range of courses in the area of Enterprise education, and for some courses the provincial enrolment is as high as 3,500 students. Students actively learn the merits of entrepreneurship, self-employment or skilled trades as a viable career choice. Despite these successes, participants in the public consultations were blunt in their assessment that the school curriculum in Newfoundland and Labrador fails to address the labour demands of a global economy. Perhaps the issue is due to lack of communication since, the participants in the public consultations were not aware of these requirements and felt that the core business skills were not being taught, and that the teachers lacked the skills to provide such instruction.

The 2003 Adult Education and Training Survey (AETS) conducted by Statistics Canada reported that 29.5% of Newfoundlanders and Labradorians aged 25 to 64 participated in formal job-related training and 19.9% participated in employer-supported job related training. The report shows that participation rates have increased since an earlier study in 1998 but remain the lowest rates among the provinces.

2.1.7 Financial Supports and Access to Venture Capital

While funding programs are available to support R&D and small business development, increased investment in R&D and high-risk investment will require, among other things, better access to venture capital (VC). In 2003 (US, 2000 only), an average of $20.04 per capita in VC was invested in the province, the bulk of those investments in the information technologies sector. [19] Our national ranking is sixth. The Canadian average is far more productive at $46.93 per capita.

Overall for 2002, the province ranked seventh in Canada and second in Atlantic Canada in R&D expenditures made at post-secondary institutions on a per capita basis.

Both the Federal and Provincial governments are taking positive steps to encourage more private sector investment in Atlantic Canada through various funding initiatives. Table 3 lists the major funding programs available to the province from both the federal and provincial governments.

Table 3 – Summary of Major Federal and Provincial Funding Programs

Federal Programs	Provincial Programs
The Atlantic Investment Partnership provides funding to build new partnerships to help Atlantic Canadians compete in an increasingly global, knowledge-based economy. Funds are targeted at improving the province's research infrastructure and promoting cluster development. The program provides $700 million to all four Atlantic provinces	*The Economic Diversification and Growth Enterprises Program (EDGE)* provides significant tax and other incentives to encourage new business investment in the province. The goal is to help diversify the economy and stimulate new private sector job creation, particularly in rural areas.

[19] Data calculated by the Newfoundland Statistics Agency, Department of Finance and Statistics Canada. This data provided to AMEC by the Strategic Partnership Secretariat, Government of Newfoundland and Labrador. June 2005

over five years through the *Atlantic Innovation Fund* (AIF) ($300 million), the National Research Council and the Strategic Community Investment Fund.	
The Canadian Foundation for Innovation provides project funding to strengthen the capacity of Canadian universities, colleges, research hospitals and non-profit research institutions to conduct world-class research and technology development. The foundation supports infrastructure development, capacity building, research personnel and other innovation components that generate economic growth	*The Small Business and Market Development Program* provides funding to new entrepreneurs and expanding small businesses. The goal is to help them acquire the necessary expertise to pursue new ideas and markets for their products or services. The program aims to support new opportunities for economic growth, such as value-added manufacturing activities and export-oriented initiatives.
The National Science and Engineering Research Council invests in university research and training in natural sciences and engineering.	*The Industrial Research and Innovation Fund* (INTRD), administered by INTRD in trust at MUN, fosters research and innovation in post-secondary educational institutions, targeting high-growth "clusters of excellence" (e.g. marine technology, pharmaceutical research, biotechnology, and the oil and gas industry).
The National Research Council's *Industrial Research Assistance Program* (NRC-IRAP) is Canada's premier innovation assistance program for small and medium-sized Canadian enterprises (SMEs). As a key enabler within Canada's innovation system, NRC-IRAP provides Canadian SMEs with value-added technological and business advice, financial assistance and a range of other innovation assistance.	The *Small and Medium Enterprise Fund* provides term loans and equity investments to small and medium-sized businesses in strategic growth sectors with special emphasis on value-added manufacturing, information technology, aquaculture, bio-technology, marine services, agrifoods and tourism, where local competitive impact is not an issue. The fund targets businesses with export potential that need assistance to enter or expand in external markets.
The *Canadian Institutes of Health Research* (CIHR) is the major federal agency responsible for funding health research in Canada. As Canada's foremost health research funding agency, it funds more than 8,500 researchers in universities, teaching hospitals and research institutes across Canada.	The *Regional/Sectoral Diversification Fund* provides financial support for the development and implementation of economic initiatives towards sector and regional priorities by way of non-repayable contributions to eligible organizations.

Source: ACOA, INTRD, NRC, and CFI.

However, key problems remain with respect to accessing funding support under these programs. They include a cumbersome and time-consuming application process, a slow decision-making process, and the failure of such programs to support ventures that take a long time to achieve results. The provincial marketplace offers limited opportunities for venture capitalists. In some cases, local firms are not "VC ready" in that they fail to provide the supporting documentation and planning required by investors.

2.1.8 Where Do We Rank?

Many jurisdictions use a scorecard of indicators to compare their progress on innovation with other jurisdictions. This province has developed the following innovation scorecard (Table 4), using a number of previously-discussed and broadly-accepted indicators of

progress and for which data is available for other jurisdictions (See 5.0 for background on an innovation scorecard).

Newfoundland and Labrador ranks reasonably well in terms of educational achievement and the number of people trained in science and technology fields. The presence of more HQP in the provincial workforce has made a difference in the number of innovations and respective commercialization of these innovations.

But, when the proportion of private sector expenditures as a percentage of GDP is examined, the province is well behind other jurisdictions. Private sector R&D is much more productive than public sector R&D in increasing the rate and flow of commercialization. As well, the success of both public and private R&D in this area determines the level of local VC required.

Table 4: Jurisdictional Scorecard: Measures of Innovation[20]

	NL	PEI	NS	NB	QC	ON	MN	SK	AB	BC	CAN
Investment in NAICS industries 31-33 and 54 as a percentage of GDP, average 2001-04 *	1.0%	1.5%	1.7%	2.1%	2.3%	2.1%	1.6%	1.6%	1.3%	1.1%	1.9%
Total R&D spending as a percentage of GDP, 2001-02	0.9%	0.9%	1.4%	0.8%	2.7%	2.2%	1.3%	1.2%	1.1%	1.3%	2.0%
Business/Foreign R&D spending as a percentage of total R&D expenditures, 2001-02	16.2%	14.7%	24.5%	23.3%	62.6%	71.0%	38.6%	25.0%	48.3%	58.5%	60%
Total R&D expenditures at universities and colleges, 2002	$95 M	$19M	$224M	$99M	$2,167M	$2,877M	$225M	$259M	$727M	$737M	$9,319M
Total R&D expenditures at universities and colleges on per capita basis, 2002	$183.00	$139.00	$240.00	$132.00	$291.00	$238.00	$195.00	$260.00	$233.00	$179.00	$297.00
Investment in machinery and equipment as a percentage of GDP, average 2001-04	6.9%	7.0%	7.9%	6.7%	7.0%	7.4%	7.8%	6.9%	9.1%	6.1%	7.4%
VC investment per capita 2003[21]	$20.04	N/A	$19.53	$35.78	$76.72	$53.97	$15.69	$21.82	$14.60	$26.01	$46.93
VC end of year stock per ca pita, 2003 **	$23.15	N/A	$130.46	$97.88	$1,561.66	$629.09	$273.96	$676.82	$186.19	$295.51	$708.30
No. of firms in NAICS industries 31-33 and 54 as a percentage of total firms, 2004	9.4%	9.0%	11.9%	10.5%	16.2%	19.5%	11.8%	9.1%	19.6%	16.7%	17.0%
Percentage of households that accessed Internet services, 2003	44.2%	46.6%	52.7%	42.7%	44.5%	59.7%	52.3%	50.6%	58.2%	61.7%	54.5%
Percentage of employment in natural and applied science and related occupations, average 2001-04	5.9%	5.0%	5.7%	5.6%	6.7%	7.3%	5.0%	3.9%	7.2%	6.1%	6.7%
Employment growth in natural and applied sciences and related occupations, 2001-04	-9.7%	0.0%	6.4%	11.3%	15.6%	-4.2%	11.3%	2.1%	11.3%	1.7%	3.6%
Percentage of employment personnel engaged in R&D activity, 2002	0.6%	0.4%	0.8%	0.5%	1.6%	1.3%	0.6%	0.6%	0.7%	0.8%	1.2%
Share of employment post Bachelor's degree, average 2001-04	5.0%	5.5%	6.3%	4.3%	5.6%	7.7%	5.4%	4.2%	5.1%	6.7%	6.5%
Percentage of population ages 15-44 with university degree, average 2001-04	11.3%	13.2%	16.8%	13.4%	17.4%	20.3%	14.9%	12.5%	15.2%	17.0%	17.8%

*North American Industry Classification System (NAICS); Industries 31-33 include manufacturing industries; Industries 54 include Professional, Scientific and Technical industries

**Measures the cumulative venture capital invested over time - therein capturing the changes that occur from year to year - as opposed to measuring for a single year. This is referred to as the cumulative stock.

[20] Data sources include: Statistics Canada, McDonald and Associates (Venture Capital) and Newfoundland Statistics Agency; Data provided by the Strategic Partnership Secretariat.
[21] Venture Capital data available through McDonald and Associates.

2.2 INNOVATION PERFORMANCE TRENDS

2.2.1 Introduction

A review of the current literature on innovation and commercialization shows that there is no common prescription for successful innovation strategies across provincial/state, regional or national economies. Differences in regional infrastructure, demographics, R&D and industry capacity are evident across regions. However, Canadian innovation strategies have similar themes and objectives for moving the provinces to the front ranks internationally. The Government of Canada's Innovation Agenda (February 2002) calls for investing in people, knowledge and opportunities, as well as collaboration among all sectors of society to ensure that Canadians have the tools to achieve excellence in the workplace.

2.2.2 Canadian Provincial Review

The following is a brief summary of the various provincial approaches to encourage innovation. The strategies include:

- frameworks,
- primary delivery agencies,
- targeted sectors (including cluster development),
- main challenges/gaps,
- regional development goals and challenges,
- infrastructure,
- financial support,
- federal/provincial strategies and incentives,
- human resources development strategies,
- legislatives and regulatory strategies,
- collaborative mechanisms, commercialization,
- benchmarks, and
- best practices.

In common with the federal Innovation Agenda, each province has developed an innovation strategy, or its equivalent, that reflects its strengths and potential:

- **British Columbia's** Innovation Strategy (October 2003) focuses primarily on the expansion of its science and technology-based economy through commercialization, technology transfers, growing science and technology community and specific projects. Targeted sectors include information and wireless technology, biotechnology, new media, life sciences and fuel cells. The BC Innovation Council supports new and small businesses, ensures transfer of technologies, establishes science and technology resources, promotes collaboration and develops funding program and other support mechanisms.

- **Alberta's** Innovation Strategy (May 1999) concentrates on bringing together all science, research and technology-based activities and programs under one umbrella, and attracting and developing private sector expertise in innovation. The targeted sectors of Alberta Innovation and Science (AIS), a dedicated Ministry, are energy research, information and communications technology and

life science. Clustered development is another goal. The Alberta Research Council works towards the commercialization of promising technologies.

- **Saskatchewan's** *Blueprint for Innovation* (October 1998) targets key sectors (biotechnology, life sciences, information technology and environmental science) and the creation of infrastructure to aid their development. While there is no formal innovation strategy, Saskatchewan Industry and Resources supports industry development and the Investment Attraction Council promotes collaboration among government departments and agencies.
- **Manitoba's** Innovation Strategy (May 2001) focuses on strategic partnership investments and sector development in targeted areas (manufacturing, aerospace, alternative energy, life sciences, including agriculture, and biotechnology). This approach is based on the strengths and capabilities of established research centres. The Department of Energy, Science and Technology leads innovation initiatives.
- **Ontario's** Innovation Strategy (March 1999) hopes to achieve an innovation culture through industry development and the generation of wealth. Key sectors include information and communications, life sciences, biotechnology and health sciences and research. While the Ministry of Energy, Science and Technology administer the Strategy, the Ontario Science and Innovation Council advise the Premier directly on innovation and long-term strategies. Securing intellectual property (IP) is a key Ontario focus. A separate commercialization strategy (2004) promotes promising research.
- The **New Brunswick** Innovation Foundation (February 2002) is responsible for that province's innovation agenda. The strategy focuses on global competitiveness in the knowledge sectors, life sciences, advanced manufacturing and value-added natural resource development.
- *Innovative **Nova Scotia*** (June 2003) is a policy document that provides an actionable policy framework on how to support Innovation. In addition, Nova Scotia Business, a Corporation run by the private sector, works to stimulate economic development and manage front-line business development. The Nova Scotia Development Agency supports the corporation in this task and advises the government. The Office of Economic Development oversees an innovation policy framework that targets the life sciences and biotechnology sectors, energy, the digital economy and advanced manufacturing.
- **Prince Edward Island** has no innovation strategy, but has developed a successful model for small business prospecting. The approach has worked to advance targeted sectors (agriculture, aerospace, bio-science, aquaculture, export manufacturing, renewable energy, financial services, interactive IT) by using the province's research infrastructures. Technology PEI is responsible for supporting IT companies and a crown corporation, PEI Business Development, for business prospecting.

Table 5 summarizes the provincial innovation approaches.

Table 5: Summary Table of Canadian Jurisdictions' Innovation Strategy Characteristics

Characteristics		BC	AL	SK	MN	ON	NB	NS	PEI	NL
Governance and Partnerships	Innovation Strategy or Model for Business Prospecting Implemented	√	√	No formal strategy in place but an economic strategy exists	√	√	√	√	No formal strategy in place but an economic strategy exists	In progress
	Year of Introduction	2003	1999	n/a	2003	1999	2002	2003	2003	In progress
	Primary Delivery Agency	Provincial Crown Agency	Provincial Dept.	Provincial Dept.	Provincial Dept.	Provincial Dept.	Non-Profit Corp.	Private Sector Corp.	Provincial Dept.	Provincial Dept.
	Government/ Education Partnerships	√	√	√	√	√	√	√	√	
	Education/ Industry Partnerships	√	√	√	√	√		√	√	√
Focus of Strategy	Targeted Sectors Identified	√	√	√	√	√	√	√	√	In progress
Incentives	Provincial Tax Incentives	√	√	√	√	√	√	√	√	√
	Access to VC	Multi-sources	Multi-sources	Multi-sources	Unique source	Multi-sources	Multi-sources	Multi-sources	Multi-sources	Multi-sources
Measures in support of Strategy	Targeted HR Programs	√	√			√				
	Benchmarking	√	√	√	√	√	√	√		Refer to work

Almost all provinces face the same challenges in promoting innovation. They are required to supply innovation agendas that further the development of industry clusters and achieve economies of scale, but must also address the particular challenges of rural and regional development. Other shared barriers to progress include out-migration, lack of broadband access in rural areas, the ongoing competition (with each other) to attract investment and government funding support, and the continuing need for seed capital and effective strategies to commercialize R&D.

There is wide consensus as to the "best practices" used by innovative societies. We identified and reviewed below some of the core ingredients of a productive innovation and commercialization process.

2.2.3 International Innovation Performance Trends

2.2.3.1. R&D: The Basis for Innovation

In the emerging knowledge-based economy, the ability to create, disseminate, transform and use applied research and knowledge is critical to national prosperity. That prosperity depends as much on the sharing of knowledge as it does on the production of knowledge. It is clear that support for research infrastructure, collaboration between the public and private sectors, and the dissemination of knowledge are key elements of an effective innovation system.

According to the Conference Board of Canada, one yardstick used to compare wealth creation around the world is the amount of Business Expenditure on R&D (BERD) as a percentage of GDP. OECD countries increasingly recognize the need to invest in business driven R&D to compete globally.

Several countries have set long-term targets for raising R&D spending. For example, businesses in Japan and the European Union increased their levels of R&D in 2002 to 2.32% and 1.17% of GDP respectively. Canada's goal is to be among the top five investors in R&D among OECD countries by 2010. Meeting that target will require all sectors of the economy, particularly the private sector, to increase their R&D activities substantially in the coming years.

Universities must also step up by providing industry with more HQP to conduct private R&D and expanding their role as public R&D facilitators. Industry must improve its leveraging of R&D knowledge to create new opportunities for commercialization.

Over time, more private sector R&D investment will result in reduced government spending on R&D, as is the case in the world's most innovative countries. For example, in Japan, the United States and Sweden, the government conducts an even smaller proportion of each nation's R&D. That is because businesses in Japan and the European Union have increased their levels of R&D relative to government spending in that area. The result has been greater prosperity for these countries.

According to the recent report, *Exploring Canada's Innovation Character — Benchmarking Against Global Best*,[22] Canadian universities have a strong collaborative relationship with industry on R&D, and Canada has sound foreign investment in R&D. But the country lags in its efforts to make money from this research, as does Newfoundland and Labrador.

The report compares Canada's innovation efforts - from R&D expenditure as a percentage of GDP, business expenditure on R&D as a percentage of GDP, the regulatory environment, R&D tax treatment, investment in VC to labour force education rankings — to those of 11 other countries, including Sweden, Germany, the UK, Australia and the U.S. In most areas, Canada falls in the middle of the pack. The exception is educational achievement, where we rank number one.

2.2.3.2 R&D Focus and Policies

In Canada and abroad, changing research practices reflect the emergence of new systems for producing knowledge. These new methodologies have led to dramatic changes in research infrastructure, notably the ways in which research is encouraged and evaluated. A shift has occurred - away from the promotion of basic research and towards the championing of applied research in universities and other research institutions. This evolution has involved sweeping reforms to traditional systems for creating knowledge, including changes to research evaluation and the IP policies of research institutions.

What is becoming apparent worldwide is a major restructuring of the R&D focus towards:

- creating a coherent set of incentives for the creation, production and distribution of research information;
- providing the infrastructure and tools to support collaborative research activities;
- enabling access to essential information resources;
- equipping users with appropriate skills to use new knowledge; and,
- encouraging the development of an effective system for sharing knowledge.

2.2.3.3 Investment Profiling

Successful governments, institutions and industries learn to balance their resources effectively. They understand that continuing collaboration with each other helps to ensure the optimal use of financial investment, human resources and infrastructure, to the greater benefit of all.

***"We should look at our education system as a way to attract new people and new expertise to the province."* - St. John's round table**

Based on an R&D review of other countries, we concluded that the following are the factors most responsible for creating innovative societies:

- number of HQP
- public R&D investment

[22] See Conference Board of Canada: "Exploring Canada's Innovation Character — Benchmarking Against Global Best"

- R&D funded by private industry

A "best practices" innovation plan will include these components, and one other key driver - collaborating on ideas, expertise and assets *before* R&D is conducted.

2.2.3.4 Regulatory Environment

Our review of other modern economies shows that the most innovative countries have worked to improve the regulatory environment and devise a more competitive and productive regulatory framework. Regulatory reform has helped to strengthen economic performance, increase the flow of investment and produce flexible labour markets and world-class financial services.

***"Government needs to set clear policies and then let business do its job."* - Business focus group**

To improve regulatory decision-making, innovative governments have also consulted with business and the community to develop a practical guide for policy-makers.

2.2.3.5 Public-Private Collaboration

Businesses are the engine of a knowledge-based economy. They may conduct their own R&D, contract R&D from private or public institutions, or adapt results and/or product opportunities from other research. More internal R&D follows to be integrated into their product development, supply chain and commercialization processes.

Government policies often fail to emphasize private sector R&D, by far the greatest influence on innovation. Policies must focus on greater collaboration, joint investment and progressive tax incentives to improve competitiveness. Policies are needed that encourage links among private R&D, educational institutions and agencies that provide financial capital. This policy recommendation is based on best practices worldwide and represents a fundamental change of approach.

A number of countries have already begun to reform their public research systems to produce greater industry collaboration. Denmark, Japan and Slovakia have given universities more autonomy and made it easier for them to work more closely with industry. Norway and Switzerland recently introduced laws to better enable public research institutions to own and market IP. Iceland and Finland are preparing similar legislation. Governments are increasingly looking to public/private partnerships to better link public research to national needs.

2.3 THE CONSULTATION PROCESS

If a workable blueprint for creating an innovative province is to be created, the lead must come from the people of Newfoundland and Labrador. Everyone is affected by this formidable challenge and process of change. And everyone has a stake in its success. Those actively involved in the drive towards innovation – industry, small business, educational institutions, research facilities, community groups and all levels of government – understand what is required to get there. Thus, in preparing this report, it was essential to listen to what the people of this province, and many other committed

individuals, had to say about this monumental task. In preparing this report we spoke to nearly 500 people, who were consulted through18 focus groups representing all sectors and 12 round tables held throughout the province. We also conducted more than 50 interviews with key individual proponents.

We have used the rich and varied information gathered from the consultation process in several ways. First and foremost, it forms the basis of the SWOT analysis described in Section 2.4 and Table 7; it underpins the Strategic Actions outlined in Sections 3 and 4; and, it is used to illustrate points throughout the document. The findings and conclusions differed by region and sector. A very brief summary of that information is provided by region in Table 6.

Table 6 – Synopsis of Issues and Ideas Raised at Regional Round Tables

Town	Issues								
	Gov't as an enabler	**Collaboration**	**Focus**	**R&D/comer-cialization**	**Education & skills aligned with economic development**	**Leadership and success**	**Culture of innovation**	**Financial instruments**	**Infrastructure**
Port aux Basques	Reduce red tape	Gov't needs more market intelligence; foster connection among groups	Transportation; focus on industry needs	Flexibility	Trades underfunded; align trends with skills training; educate guidance counsellors and teachers to industry needs; foster entrepreneurship	Create Centres of Excellence	Provide incentives; promote success stories; teach entrepreneurship at early age	Create incentives	Analyze needs of region and determine applicability to regions
Corner Brook	Develop single point of contact; too many silos; need faster gov't decision- making; need entrepreneurial mindset within gov't	Create, publicize and promote long-term plan with a common strategic focus	R&D, transportation; all-inclusive hubs; regional strengths	Need applied research; business to follow best practices	Develop new ideas; education must be practical; connect job opportunities with youth and training; promote mentorship; review junior high school curriculum	Set direction for success; promote risk; provide access to updated research; provide incentive programs	Create climate of creativity; instil determination and perseverance	Establish trust fund for R&D; tax incentives; Innovation fund; bonus programs for R&D, VC	Foster clusters based on Centres of Excellence; give more autonomy to CNA.
HV-GB	Flexibility	One-stop shopping; less duplication	Core capacities, Northern Research Centre; leadership	Establish Labrador research fund and separate regional initiatives; expand post- secondary ed.; instil best practices	Increase enterprise ed., trade and career counselling, apprenticeship programs	Promote and reward volunteerism; increase number of exchanges	Celebrate success and creativity; foster role models; reward new ideas	Offer tax credits for volunteer work; flexibility in funding different regions	Transportation; education, research chair; broadband technology; multi-functional centres
Labrador Coast	Bureaucracy and distance challenges ability to undertake opportunities	Between Nunavut and Labrador in area of trade	Forest products, fishing, tourism and culture, secondary processing, stone	Creative distance delivery	Need new models of training; increased training beyond ABE; some training related to a region's strengths; more emphasis on youth	Nain is beginning to see success	Labrador Straits always been entrepreneurial	Funding is a big challenge	Broad band critical; continuation of Smart Labrador, local radio, transportation
Labrador West	Recognize and celebrate regional differences; realignment of resources; better communications	Develop true partnerships; provide less duplication	Establish Centres of excellence; regional priorities	Foster partnerships between colleges and universities; better access to R&D ed.; promote better understanding of industry needs	Involve schools in industry; develop apprenticeship programs; improve reputation of trades	Celebrate labour, college and company partnerships	Start young to create problem-solving mindset; use business support organizations	Offer more flexible financing; long-term support; tax breaks for innovation; incentives	Identify competitive infrastructure needs; nee invest in ourselves; Labr needs are great and infrastructure not in place (e.g. 127 MW electricity)
St. John's	Faster decision-making; lead by example; enable decision- making at lower levels of gov't; better facilitation	Develop formal and informal partnerships	Pursue sectors with competitive advantages, including culture and tourism; cluster competitive advantages; undertake more focused job of promoting province	Increase immigration; create business -friendly environment; foster applied research. Transfer intellectual property into wider use; gear research to business and people; increase CNAs capacity; help non-profit research	Need to recruit and retain more academics; need better evidence-based innovation; guidance counsellors need better data labour market trends; provide linkages between K-12 and outside workforce	Invest in leadership, mentoring, cross-fertilization; recruit skilled immigrants; expand "Getting the Message Out'; more programs for mature students	Promote innovation/ investment; embrace innovation at all levels; show NL as a "can do" province; erase "you are not from here" syndrome; "good" is insufficient, need "best"; more effective marketing; promote risk- taking	Create sufficient strategic investment fund to leverage federal money; provide broad-based incentive/rewards; tax credits; more start-up money	Human and social infrastructure; broadband communications; transportation
Grand Falls-Windsor	Ensure less political interference; more decentralization; strategic alliances	REDBs need to make regions stronger;	Look at industry needs and focus on sectors other than resource; better small business counselling	Look at sectors' R&D needs outside of St. John's; R&D data base; R&D	Align ed. system with industry skills; need more exposure to career options before reaching post-secondary; better skills	Create optimism; start early in school and build positive attitudes; engage	Need attitude change in bureaucrats; celebrate success; reject mediocrity; ensure gov't	Provide longer term financing; higher tolerance for risk; funding to	Transportation; broadband; networks of excellence/innovation

	between R&D, business and ed.; more open-minded gov't.; more flexible policies; remove policies that impede business			based on commercialization	forecasting; local advisory groups to contribute to ed. programming	industry early on; give school credit for work in private sector	adopts a "can do" approach;	better reflect business cycle needs; less bureaucracy; shorter review time	
Gander	Less gov't stifling of entrepreneurship; need to build positive relationships with business; establish timelines for decision-making	Establish dispute resolution mechanism; recognize importance of timeliness to business	One on one relationships in marketing effort; focus on developing business-friendly environment – don't have one now	Mentoring; funding should be available only for R&D commercialization; share R&D resources through companies; R&D should be private sector-driven	School should incorporate IT and business into curriculum	Connect people with specific interests to correct ed. institutions;	Acknowledge all trades and skills, don't focus only on MUN	Long-term funding	Broadband
St. Anthony	Change Crown lands policies; less red tape and bureaucracy; recognize regional differences	Ensure municipal and econ. plans done in concert; need all groups at same table	Match industry needs with skills training; focus on trades and what we are good at	Make R&D accessible to everyone; private sector shouldn't have to compete with gov't	Build on our strengths; don't make everyone go to St. John's for 1st year; skills training at CNA: more career guidance in schools	Make gov't programs fit projects, not the reverse; focus on marketplace;	Use Northern Peninsula business network as model; will help to build clusters in rural areas	Develop venture capital fund; use Credit Unions more; need "patient" capital where no pressure to pay back immediately	Infrastructure is foundation of province; needed to attract business; if funded by gov't, need provision to maintain it
Clarenville	External review of gov't policies; process the problem, not policies; need ongoing review; one- stop shopping	Need land use policy; strategies developed properly before they are implemented; collaboration within gov't depts.	Focus on strengthening existing businesses; neutraceuticals, fur farming and renewable energy	Focus on applied commercialization	Entrepreneurship & business training should be mandatory; EI system detrimental to ec. dev; schools need to raise standards	Base training programs on industry needs; better counselling to guide our youth; more business mentoring at school level	Increase immigration; re-engineer ed. system; eliminate bureaucracy; bring innovation experts to province	Payroll tax is a disincentive; Venture Growth Tax Benefit one year too late; more venture capital; better tax system	Determine where province lacking competencies
Bonavista	Make gov't staff accountable; proactive rather than reactive; flexible gov't programs	Provide one-stop shopping; quality; core funding for continuity; better gov't/business partnership	Cottage industries; build on successful businesses; human capital	Establish Centres of Excellence province-wide; more immigration	Industry/school involvement; entrepreneurships and business skills; training based on industry	Think globally; industry promote innovation	Target successful NLers who have left; start at early age; increase role models	Financial incentives to hire graduates; business counsellors with practical experience; gov't-backed equity program; tax holidays	Broadband
Marystown	Gov't needs to set example as innovator; gov't should not compete with business on providing certain services; less bureaucracy; flexibility	More private sector involvement in decision-making; allow unsolicited proposals; one-stop shopping	Focus on human resource development; entrepreneurship; land use planning	R&D managed by private sector; move towards more knowledge- based than resource-based economy; regionalize R&D more	More training in retaining business; tourism and life sciences; align with industry needs; entrepreneurship; skills straining; better school guidance	Trades losing influence	Teach entrepreneurship and businesses at early age; teach problem-solving skills; science caps; create student work and service programs	Regional seed capital; tax credits to student who stay in province; incentives for people to stay in province; take politics out of decision-making	Broadband; transportation; mining and environmental science; centres of excellence and expertise; infrastructure to support clusters

2.4 STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

The SWOT (strengths, weaknesses, opportunities and threats) analysis summarized in Table 7 identifies provincial strengths that provide a strong foundation for the creation of an innovation strategy, as well as the barriers or impediments that will compromise this strategy. While several research sources were used for this analysis, the main sources were the focus groups, round tables and interviews described previously. All information collected from the focus groups and interviews was collapsed and categorized by key issues, which then provided the basis for the round table discussions.

Table 7: SWOT Analysis

Strengths	**Weaknesses**
➢ The creativity and determination of our people ➢ The basis of World-class R&D and education ➢ Acquired knowledge and expertise from overcoming the challenges of our harsh environment and a dispersed population ➢ Emerging critical mass of oceans-related technology and marine resources ➢ Strong attachment of expatriate Newfoundlanders and Labradorians to their province ➢ Well-defined culture and heritage ➢ Well-developed business supports/organizations that champion the development of industries and HQPs ➢ Small population base making it easier to mobilize towards a common goal	➢ True (open access) broadband communications infrastructure does not exist in many areas of the province ➢ The education system does not meet the needs of industry in terms of skill sets or performance standards ➢ Lack of investment funding, particularly seed capital and long-term financing to support commercialization. ➢ Lack of a small business environment conducive to attracting VC (venture capital) ➢ Low levels of export activity and limited international linkages among small business/entrepreneurs ➢ Insufficient transportation infrastructure ➢ Lack of provincial marketing strategy that capitalizes on our strengths ➢ A government system and a provincial society that is generally risk-averse ➢ Relatively low levels of private sector-driven R&D ➢ Insufficient linkages among R&D, education, government, industry and community groups
Opportunities	**Threats**
➢ Take advantage of new windows of opportunity and a growing sense of optimism in the province ➢ Capitalize on the expanding critical mass of knowledge industries, institutions, infrastructure and HQPs ➢ Increase economic growth through value-added opportunities related to our wealth of natural resources	➢ An aging and declining population, notably a shrinking labour pool among the 20-30 age group, the result of out-migration and a low birth rate ➢ Lack of local leadership and co-ordinated approach to fostering innovation and developing human potential ➢ General lack of results oriented collaboration among private sector, educational institutions and

➢ Capitalize on our climate to develop expertise, products, technologies and processes that can be exported to other harsh environments ➢ Develop our rural economies by becoming a leader in rural service delivery (e.g., telemedicine, distance education)	government ➢ Lack of continued investment in R&D infrastructure relative to other jurisdictions which could impede our future ability to attract investment and quality research, essential for international competition ➢ Government, particularly the provincial government, has not done enough to eliminate red tape, speed up decision-making or improve tax regimes in an effort to help business ➢ For the reasons above, the bureaucracy is unable to support business development – specifically, growth industries

Source: Innovation SWOT Analysis, 2005

If there is a critical or decisive point to emerge from the SWOT analysis, it is the current, and even more importantly, future lack of a critical mass of HQP in Newfoundland and Labrador. We have scientists, technicians and professors conducting research, and some commercialization support services (export advisors, lawyers versed in IP and commercialization issues, business development experts), but a vital indictor of an innovative society is the development and retention of an increasing number of HQPs. We have already discussed the exodus of many of our most promising graduates. Researchers generally do not relocate here because of our lower salaries, physical isolation and the attendant difficulty of travelling to and from the province. For others, run down and under-funded facilities and inadequate research support services are the problem. We also heard reference to the lack of cultural diversity among the population. In an increasingly global business environment, diversity spurs the creation of new ideas and opportunities. This is borne out by recent research[23] on Canadian Small Business potential, in which one of the eight indicators is the share of the population that is foreign-born -- the greater the proportion, the greater the potential. For 2001, the four Atlantic Provinces had the smallest share of foreign-born residents (NB - 3.1%; NS - 4.6%, PEI - 3.1%, and NL - 1.6%), in the country. By comparison, ON's share is 26.8% and BC's, 26.1%.

[23] *Canadian Small Business: A Growing Force*, Canadian Imperial Bank of Commerce (CIBC) World Markets publication. Benjamin Tal 2003

3.0 ENHANCING NEWFOUNDLAND AND LABRADOR'S INNOVATION PERFORMANCE: A STRATEGIC APPROACH

If we are to develop a culture of innovation, we must focus our efforts and available resources on specific areas of opportunity. At the same time, the strategy must be broad enough to support the needs of industry, institutions and regions and enable them to explore and develop viable new opportunities.

In this section, we discuss the building blocks of a successful strategy:

1. Part one highlights the need to view innovation in the context of a system. Systems approaches provide a framework for governments to understand the dynamics of a knowledge-driven economy and to set a direction towards that goal.

2. Part two ties the overall approach to specific recommendations, provides a context for individual strategies and actions, and suggests how they can be directed at targeted areas.

3.1 CREATING A COMPREHENSIVE INNOVATION SYSTEM FOR THE PROVINCE

An innovation system is commonly described as a complex set of relationships among entities that drive successful innovation – businesses, universities, government research institutions and industry organizations. A region's cultural awareness and financial and regulatory environment, as well as the skills of its population, further define the system. All of these elements, directed towards a common purpose, determine overall innovation performance. This approach is being used to great success in OECD member states representing many of the world's leading innovative economies, including Finland, Sweden, and Iceland.

Newfoundland and Labrador's innovation performance will be predicated on this model - a system that not only produces effective collaboration among the players, but is also tied to the conditions of an innovative economy (see Figure 1).

A qualitative approach to an innovation system is emphasized, one that links all relevant indicators of an innovative economy. The scorecard (Section 5) will measure those indicators quantitatively. These two pieces, along with the actual strategy components, will help to develop, build and measure the province's innovation performance.

Figure 1: Innovation System[24]

This model is based on a detailed analysis of systems in other jurisdictions and adapted to meet the needs of Newfoundland and Labrador. These are the building blocks of a productive innovation system:

- a highly qualified and experienced workforce (HQPs) that sustains innovation in both the public and private sectors;
- strong R&D capacity (both basic and applied) that is linked to industry and the regions, and can effect the transfer of knowledge;
- a flexible government regulatory and policy environment that reduces constraints, encourages public-private collaboration, supports initiative and directs spending in strategic areas;
- an industry structure characterized by a balance of 1) larger firms that are leaders in their sectors and help to create the demand for local innovation, and 2) a critical mass of smaller firms that can quickly take innovation from concept to application;
- strategic infrastructure such as research laboratories, education and training facilities, communications networks, that provide the foundation for innovative activity;

[24] Source: Designed by AMEC

- public and private financing supports and incentives that stimulate commercialization and R&D among the public and private sectors, and support growth enterprises as well as established industries; and

- an entrepreneurial mentality and an innovative culture that supports risk-taking, rewards innovation and demonstrates confidence.

Based on the research and the consultation process for this report, the province's innovation performance is middling compared to other jurisdictions. Collaboration among academic and training institutions, industry, government and communities is limited. There is collaboration in specific areas (for example, MUN has significantly increased its ties with industry, especially in the fields of oil and gas development and mining), but few ongoing, formalized relationships among all parties. There is little interaction between larger institutions and small business, particularly in rural areas. Other gaps include weak industry structures and a lack of effective innovation policies and financing tools to stimulate innovation. The general failure to grasp the importance of innovation and entrepreneurship to overall economic development is also of concern.

***"Having a strategy means nothing unless we get people excited and focused on implementing it." -* Advanced Technology focus group**

3.2 ORGANIZING ACTIONS AND STRATEGIES: A THREE-TIERED PROCESS

This innovation report has three discrete but interconnected layers. The first priority is to ensure that the conditions needed to promote innovation are in place. The second priority is to enable organizations and individuals to execute the strategy by providing the necessary organizational structures and practices. Finally, key players and investments must be focused on realistic areas of opportunity that will result in measurable growth for the province (see Figure 2).

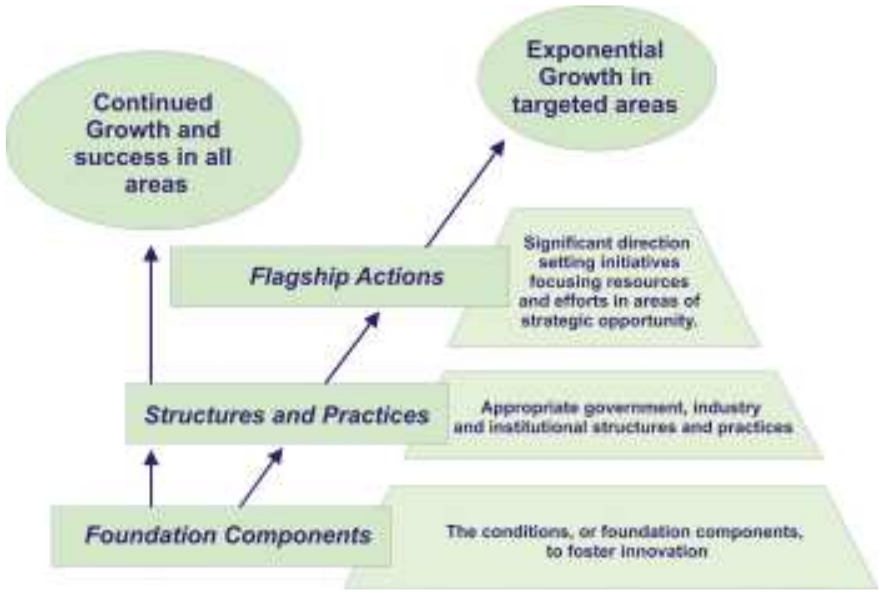

Figure 2

The **foundation components** must address serious gaps in both public and private sector innovation supports and policies. A comprehensive suite of public and private support mechanisms need to be put in place involving the province, the federal government, industry and academia, to foster innovation. Effective **structures and practices** then need to be developed to take the innovation agenda forward. This will mean reassessing the role and structure of government departments, agencies and external entities reporting to government, and strengthening relationships between governments, industry and institutions, so that everyone is focused on a common strategic objective.

***"Having a strategy means nothing unless we get people excited and focused on implementing it."* - Advanced Technology focus group**

Once these structures are in place, **key actions** must be implemented that builds on the province's strengths and focuses all energies and resources on the province's strategic areas of opportunity. These include industry-driven R&D and commercialization, ocean sciences and related technologies, agrifoods development, life sciences, environmental sustainability, mining, oil and gas, harsh environment research, eco-tourism, among others.

***"The strategy should have something in it to make sure people (industry, government and academia) get together to talk about the future, not just the present."* Forestry focus group**

4.0 KEY FINDINGS AND RECOMMENDATIONS

The overwhelming consensus of those consulted during this process is that the province must 1) set a daring vision and 2) ensure long-term support for the strategy in order to realize that vision.

The goal is to build a province that becomes:

the most attractive place for innovative businesses to thrive, for people from diverse cultures to live, and where business, academic and training institutions and governments work together to generate new economic opportunities.

They further agreed that, as a small province with limited financial and human resources, *we cannot be everything to everyone*. Efforts and investment must be directed in areas that make the most sense and are most likely to succeed.

The following recommendations offer an agenda that is both pragmatic and visionary, articulating our key innovation goals and the most important and immediate actions required to achieve success.

4.1 GOALS, STRATEGIES AND ACTIONS

4.1.1 Newfoundland and Labrador's Competitive Position

In addition to the exploitation of Newfoundland and Labrador's natural resources, the province must strengthen its competitive position by focusing on strategic areas that have the greatest potential for successful development. These include:

***"We are the only Atlantic province with a northern region – we can make this an opportunity."* - Happy Valley-Goose Bay round table**

- *marine technology and ocean sciences* (e.g., harsh environment research, ocean engineering and hydrodynamics, remote sensing, biotechnology);[25]
- *life sciences and health* (e.g., interdisciplinary research on the mechanisms of human health and disease; genetics and genomics; workplace health and safety; clinical epidemiology and clinical trials; social and ethical health issues; and causes, treatment and prevention of key health problems (e.g., cancer, diabetes, obesity, stroke);[26]
- *value-added R&D products, services and techniques* for such sectors as mining, energy (oil and gas, hydro, wind), forestry, fisheries and aquaculture;
- *agriculture* (agrifoods and life sciences in a harsh environment);[27]
- *small-scale manufacturing* (e.g., boat building, plastics, metalworking, building products, craft, gift and apparel, agrifoods);[28]

[25] Ocean Technology sector focus group, INTRD
[26] Centre for Applied Health Research; Life Sciences focus group
[27] Agrifoods focus group
[28] Focus group on manufacturing, INTRD

- *visualization and simulation* (e.g., industrial, scientific and media/entertainment built upon MUN's high-performance computing capacity and CNA's training capacity);[29]
- *environmental organization and management;*[30]
- *educational/cultural, adventure and eco-tourism;*[31] *and*
- *information and communications technologies* (e.g., intelligent solutions, network applications, data management, learning technologies, wireless systems).[32]

As well, the research capacity of the primary educational institutions is growing in many areas. MUN is doing valuable work in health and safety, mining and minerals, oil and gas, ocean technologies, and molecular and systems sciences (including biotechnology), materials and mining process engineering, and Newfoundland and Labrador culture and heritage; the Marine Institute is focused on fisheries, marine transportation, marine recreation, defence, aquaculture and biotechnology and energy, in addition to ocean technology; environment and living resources, safety, security and emergency response and policies and regulations and management. CNA has a growing emphasis on applied research based on new opportunities, and is developing its core curriculum in information technology, engineering technology, applied arts, business, health sciences, natural resources and industrial education/trade.

***"We should not try to match other provinces; we should have confidence in our own ideas and carry them through."* - Business Support Agencies focus group**

The challenge is to mobilize the province's knowledge and resources in these areas to create a distinct competitive advantage for the province. To succeed, HQP and successful companies must be attracted to the province to help foster innovation. That means promoting Newfoundland and Labrador as an attractive place to perform applied research and one that prides itself on innovative thinking and practices.

In reshaping the province's image to the world, international "best practices" must be carefully considered. For example, the Irish government took a strategic view of what it wanted to accomplish, focused on particular technologies and markets and went after them with imagination and skill. One of the dangers of a lack of focus is that we end up doing a little of everything and no single thing very well. We need a vision to give us focus.

By concentrating on areas of strategic importance, the development of a critical mass of infrastructure will be created that are vital to competitive industries. These will be spurred by "Innovation hubs" or thriving, centralized regional centres of innovative research and activity. The core elements of the Innovation Hubs will be resident and acquired expertise, existing and planned infrastructure, an industrial community that has the ability to take R&D to commercial application and a collaborative network within the Hub. Established and emerging clusters offer the greatest potential for near-term

[29] MUN, CONA
[30] Environmental focus group
[31] Focus groups on Tourism, and Culture; Department of Tourism, Culture and Recreation
[32] Advanced Technology focus group

growth. To diversify our industrial base, innovative capacity must be built into all clusters, not just the knowledge-based clusters. The creation of formalized centres of expertise, or Innovation Hubs, permits this.

Recommendation #1: Create a global reputation for Newfoundland and Labrador as a competitive and innovative province with recognized strengths.

Strategies

- Focus investments and resources in areas of strategic importance and create centres of expertise built upon our strengths.
- Develop a world-class competitive infrastructure, highly-qualified people and innovative businesses.
- Build a reputation that emphasizes our strengths.
- Develop a marketing strategy that promotes the province as a good place to do business.

We must declare that the ocean is important to this province (develop, invest and take risk here), influence the national government to move larger and larger parts of DFO and CCG to Newfoundland and Labrador, and be pro-active in encouraging business at home. **(Oceans Advance, 2005)**

Key Actions

- Develop regional centres of expertise, or Innovation Hubs, that have a critical mass of supporting industry, modern facilities and technical knowledge. The Innovation Hubs should complement the Comprehensive Regional Diversification Strategy and its nine sustainable regions as well as the proposed immigration strategy, and be a core resource for promoting innovative thinking, collaboration and commercial activities. Government and communities must play a strategic role in facilitating their operation. Hubs must have the resident expertise and facilities to support applied R&D and industry must take the lead in using R&D for economic and social benefit.

  St. John's and Corner Brook are two obvious locations for Innovation Hubs. The Comprehensive Regional Diversification Strategy lists seven regional priority sectors[33], one of which is the environmental sector. Corner Brook has a distinct advantage in this area with its planned Centre of Environmental Excellence. Corner Brook and surrounding areas have the population, educational institutions, industrial base, transportation and communication links, and social infrastructure to attract and retain expertise.

[33] Agrifoods and Fishery, Environmental, Post Secondary Education, Mining and Energy, Manufacturing, Tourism and Communications and Information Technology. Source: Department of Innovation, Trade and Rural Development, 2005.

St. John's is developing a critical mass of expertise, infrastructure and networks in ocean-related technologies. The list includes the Centre for Cold Oceans Resources Engineering, NRC Institute for Ocean Technology, MUN, the Marine Institute, Ocean Sciences Centre, Oceans Advance, Canadian Centre for Marine Communications (CCMC), Nati, Newfoundland Ocean Industries Association (NOIA), technology industries, federal, provincial and municipal agencies and departments, and other key industry supports.

Other locations in which CNA, supporting industry, modern facilities and technology are located can also form the basis of Innovation Hubs (e.g. Marystown, Grand Falls, Clarenville, Labrador West).

Other Actions

- Promote as role models institutions and agencies that have established a benchmark in terms of leadership, innovation, R&D, partnerships and collaboration, international contracts, niche markets (e.g., MUN, the Marine Institute, C-CORE and the Genesis Centre as well CNA).

- Develop a provincial marketing strategy that celebrates the province's innovative culture and progressive business environment. The strategy should champion our people, research and education infrastructure, investment climate and business opportunities.

- Create a Newfoundland and Labrador Marketing Agency to oversee development of an aggressive promotional and integrated branding campaign to raise the profile of the province in the areas of innovation, business, education and tourism. The Agency will take the lead in supporting external market development activities and consist of a partnership of industry, government and educational institutions.

- MUN's R&D expertise and infrastructure are central to the marketing strategy. Key areas of focus include ocean technologies, large-scale simulation and visualization, oil and gas, materials and mining, process engineering, molecular and systems science, health and safety and Newfoundland and Labrador culture and heritage

***"We have to develop our human capital - people create ideas"* - Clarenville round table**

4.1.2 Education and Skills Development

The province's economic future depends on a skilled and educated population that is prepared to compete and lead in a global society. If the province is to become innovative, it must invest in education at all levels and its people must commit to life-long learning.

We cannot overstate this need. Despite the province's strengths, almost 40% of our rural population has not graduated from high school. Newfoundland and Labrador will continue to be held back if this record does not improve.

Throughout the consultations, we were asked to stress the need for early innovation and enterprise education. Innovative school programs such as Junior Achievement, Shad Valley, enterprise education, Program of Achievement in Community Enterprise (PACE) must become an integral part of our educational system.
Similar opportunities must be made available through a lifelong system of learning, as people of all ages are encouraged to upgrade their skills and expand their knowledge.

***"Schools can bring in international students with new ideas."* - Labrador West round table.**

One of the province's main challenges is to attract and retain the best educators, researchers and HQP. Competitive salaries must be offered and a renewed commitment must be accelerated to recruit top-level R&D professionals and educators. Incentive programs for recent graduates to remain in the province should be explored as part of the solution.

Recommendation #2: Align education and skills development with the future economic direction of the province.

Strategies

- Increase collaboration between educational institutions and industry to nurture an entrepreneurial culture and develop a skilled population.
- Attract top educators and researchers to increase the competitiveness of our educational institutions and make them attractive to students and industry.
- Develop a program curriculum that meets current and future needs and balances technical, business, trades, scientific and liberal arts education.

"Industry needs to be more involved in education ***and education needs to be more integrated with industry and industry needs."* - Gander round table**

Key Actions

- Give greater autonomy to the CNA so that strategic areas within the College system can be developed to more fully respond to the needs, particularly regional needs, of the province. (For example, have the President report to a Board of Directors rather than to a line department, and allow the College to set its budget within an overall funding allocation.) This would give the College greater flexibility in recruiting expertise, deciding compensation for instructors and researchers, establishing a more effective approach to funding and programs, and retaining contract funding that supports reinvestment in the College system.
- This approach would allow the College, through its individual campuses, to create independent Technology and Research Centres that would be used in conjunction with other regional development agencies and industries. The College would be the focal point in the creation and operation of Innovation Hubs and reap the benefits of a growing international reputation in targeted industries.

- This structure of governance would help establish programming, budgetary and infrastructure priorities and improve decision-making and response times with respect to industry partnerships, applied research and training needs and contract opportunities. These changes would give the College a measure of equality and respectability regarding applied research.

Other Actions

- Establish a new Education Council (or reshape the existing Council on Higher Education), comprising representatives from MUN, CNA, Department of Education, HRLE, INTRD, and the Department of Business, to ensure that education policy meets the economic development needs of the province.

- Introduce education programs starting in Grade 9 that instill the importance of innovation, entrepreneurship and career choices. There must be sufficient instruction and guidance at the provincial and school board level to support the new career planning course 2211, the co-operative education program and other proven initiatives (e.g. the Community Career Centre).

"There needs to be more focus on exposing students at an early age to the economic opportunities that exist in the province." **(FINALY! – Province wide)**

- Promote more collaboration between youth-oriented entrepreneurial and innovation programs (e.g. Junior Achievement, Shad Valley, PACE, Bridging the Gap, Science Fairs) and government, industry and industry/community organizations (e.g. Nati, NEIA, Chambers of Commerce).

- Support more entrepreneurship and business training through MUN and CNA. Programs should increase understanding of global business practices and connect new entrepreneurs with real business opportunities.

- Raise the profile of the Graduate Program offered through HRLE and take the following steps to encourage recent graduates to stay in the province:

  ⇒ *Tax incentive* program for industry to enable provincial businesses to hire recent graduates and place them in challenging positions
  ⇒ *Student loans offset* program for students to stay in Newfoundland and Labrador and work with growth firms.
  ⇒ *New entrepreneurs* program to offset the cost associated with student loans. For graduates who want to remain here and start innovative businesses.

- Strengthen co-op education programs and apprenticeships to provide workplace experience.

4.1.3 Collaboration and Partnerships

Industry, government and institutions must work together more effectively to lead our progress towards innovation.

***"Government should engage communities and business people in the decision making process."* - Gander round table**

The people of all regions believe in collaboration. *"We all have to be partners…true partners. As stakeholders, we put a lot of time into strategies and activities, but in many cases the government has already made up its mind. If it is to be a true stakeholder, give us the reason it can't be done, but don't string us along."* Labrador West round table

Industry worldwide recognizes the advantage of partnerships with research and education institutions. Institutions are learning to build better relationships with industry and government, and to market their capabilities. Halifax has done this through its Greater Halifax Partnership and Business Expansion Retention Program.

Commercialization and wealth creation does not happen without the private sector. We must create the conditions for successful collaboration and provide ongoing support for these structures.

Recommendation #3: Promote collaboration among industry, government and institutions to drive innovation in the province.

Strategies

- Encourage partnerships among governments, industry, institutions, communities, labour, not-for-profits, etc., with specific goals and areas of responsibility to affect R&D, commercialization and regional innovation.

- Facilitate opportunities for government employees to collaborate effectively with business and academic institutions.

***"This will be successful if we can get people on the same page and working together."* - Marine Technologies focus group**

- Ensure that industry support programs are designed and delivered in collaboration with industry and industry organizations.

- Establish intergovernmental (federal, provincial and municipal) partnerships to plan and attract investment.

Actions

- Develop a program for government employees that train them in effective collaboration and the building of strategic alliances. The program should emphasize the importance of collaboration in stimulating economic growth and social development.

- Implement a strategic-partnering benefit clause as part of all government-supported initiatives.
- Transfer select government programs to industry that are currently in competition with or could be more effectively provided by industry (e.g. materials testing, certain research areas).
- Ensure cross representation on the boards of MUN (including the Marine Institute) and CNA. This will encourage greater collaboration and integration of programming, research and outreach activities.
- Establish a *Collaboration Award* Program that celebrates successful and diverse partnerships.
- Develop an *Innovation Leaders Forum*, hosted by the province that brings together national and international leaders to discuss best practices and new opportunities.

4.1.4 Government as an Enabler of Innovation

A recurrent theme of our consultations was the need for government to become an *enabler* of innovation and business growth. The federal and provincial governments must establish adaptable and flexible policies and programs that meet the needs of business and bolster economic growth.

Participants believe that given the province's small population, it is cumbersome, costly and confusing to operate two levels of government, a multitude of funding programs, and two provincial departments oriented towards business, the Department of Business and the Department of Innovation, Trade and Rural Development (INTRD).

***"Politics and the provision of government services need to be separate"* – Port aux Basques round table**

A proactive, "can-do" mentality must start at the top of government and permeate down through the public service. The results-driven approach of the other Atlantic Provinces towards business prospecting and attraction underscores the need for a fundamental change in our approach to business development.

***"The Government needs to create a business friendly atmosphere, and it needs to start at the top"* – St. Anthony round table**

Many participants from within the provincial public service told us that innovation and creativity receives little encouragement within government departments. Public servants want to do a better job, but don't often see a mechanism that enables them to be proactive and creative. Other provinces[34] use a performance appraisal/bonus system to help address this problem.

[34] PEI and NS

Recommendation #4: Create a provincial government that nurtures innovation and business growth.

Strategies

- Develop effective departmental policies that support and reward innovative practices and promote and adapt local innovation.
- Create a business-friendly government culture that recognizes the important role of government in building a productive business climate.
- Engage "champions of change" both within and outside government to generate ideas and lead continuous change and improvement throughout the public service.

"Regional development officers should be proactive rather than reactive. They should travel throughout their regions meeting with businesses and asking them what they need. Why is business on bended knee asking government for help?" - **Bonavista round table**

Key Actions

- Ensure that the lead department for Innovation, the Department of Innovation, Trade and Rural Development, is given sufficient tools and authority to guide strategic and tactical activities to create an innovative business climate in the province.
- INTRD must:
  - ⇒ Introduce a modernization strategy for the provincial government in partnership with other levels of government and relevant organizations. The strategy should include a comprehensive system of customer-service management, an integrated online service delivery network for all public services, and performance standards (including an electronic accountability system) for dealing with business.
  - ⇒ Provide a single point of contact for provincial, national and international companies wishing to do business here and address the full range of business information needs, including R&D support, policy and regulations, financing, etc.
  - ⇒ Establish a legal and regulatory framework that is in line with modern business practices (e.g. e-business, privacy).
  - ⇒ Become the focal point for attracting foreign direct investment, particularly as it relates to targeted growth sectors. This also calls for the development of a creative and aggressive promotional campaign to market the province's strengths and highlight the value of doing business here.

"Timing is critical… Government has to learn to understand the impact of its decisions." **- Labrador West round table**

⇒ Leverage the major development opportunities in the province (i.e. energy development) to build local supplier capacity, particularly knowledge-driven industries.

- Establish a provincial investment, research and innovation authority (*Innovation Inc.*) to oversee execution of the province's innovation strategy. As in other Atlantic Provinces, this may best be achieved through an outside agency that is focused purely on innovation and is not responsible to a governing bureaucratic mandate, but is overseen by key representatives of academia, government and business.

"Regulations are causing opportunities to become unsustainable"
- Natural Resources Focus Group

Innovation Inc. would report to the Department of Innovation, Trade and Rural Development (see Figure 3) and advise the Economic Policy Committee of Cabinet on innovation matters. Innovation Inc. would also oversee two separate operating agencies:

- NL Research and Commercialization Partnerships (see page 39 for more details)
- NL Growth Industries Investment Corporation (see page 42 for more details)

Figure 3

Other Actions

- Implement a "First Adopter" policy throughout the provincial government to ensure that government departments and agencies look first to local industry for innovative solutions. This would enable industry to use government as a test-bed for new products/services and as a reference when exploring export markets.

- Institute results based-performance standards under the auspices of the service modernization strategy within INTRD.

- Enhance the secondment program of government to make better use of the skills and capabilities of public servants who demonstrative initiative and excellence.

- Give front-line government staff more authority and responsibility to make decisions in response to business needs.

4.1.5 Research, Development and Commercialization

A stronger research base must be developed that promotes research excellence and carries out strategic research.

This calls for improving our existing research capacity at public institutions such as MUN and CNA. The private and public sectors must also increase their research competencies in the higher education and public research sectors to meet the needs of industry and society.

***"R&D is an economic industry in itself: 65%-75% of operating grants are for personnel; the other 25% are for the purchase of goods and services."* – (Memorial University, 2005)**

A robust research environment that is linked to industry, where ideas are developed, leads to wealth creation and improved public services. This can be achieved by bringing together industry and institutions to determine "niche" research needs that will support the development of new products and services for the world market. Joint research activities will also help to direct funding to strategic areas where we can develop recognized competencies in applied research.

Recommendation #5: Build an environment that recognizes the economic and social value of research and knowledge, and supports R&D as a key driver of economic growth.

Strategies

- Develop a co-ordinated research agenda for government, institutions and industry that links investments to the province's overall strategic direction.

- Create innovative public-private approaches to support industry-driven R&D.

- Increase the province's capacity to support businesses that can bring innovation to market.
- Continue to support basic research as the foundation for innovation.
- Set targets for growth in R&D in the province.

Key Actions

- Develop a 10-year R&D agenda for the province that will oversee investments in both public and private R&D activities and be tied to specific results.
- Build on the province's Industrial Research and Innovation Fund by ensuring that an initial seed research fund is maintained and financially enhanced in the range of $8 to $12 million to support the R&D agenda. This fund is critical for institutions such as MUN in leveraging major federal programs such as the Canada Foundation for Innovation or collaborating with other institutions and the private sector for research supported by the Atlantic Innovation Fund. The enhanced provincial fund should support up to 30% of the total cost of research projects, which will be selected on the basis of their compatibility with the R&D agenda.
- Develop a long-term strategic growth plan to position Memorial University as an international research and education institution and leverage this position as a means to prepare Newfoundlanders and Labradorians to compete in the global knowledge economy; attract national and international investment; attract major industry investments; and ensure the continued development of world class research and teaching expertise.
- As part of Innovation Inc., described on page 37, establish the *NL Research and Commercialization Partnerships* to advance industry-driven R&D in areas of strategic advantage. The initiative will provide support for the creation of Innovation Hubs throughout the province, attract private sector R&D investment, enhance the federal R&D presence in the province, and oversee the establishment of public-private ventures built upon successful models such as C-CORE, TRLabs, and Telecom Applications Research Alliance (TARA).

***Memorial needs to focus on conducting research in partnership with large international companies so that we can apply our research to other countries where these companies are operating.* (MUN - 2005)**

> *Newfoundland and Labrador relies most heavily upon the higher education sector to perform its R&D: the $95M performed in 2002 was 64.2% of the total. In contrast, higher education performs 33.4% of Canada's R&D and 29.4% of R&D in Ontario. To translate the NL higher education sector strength in R&D, and that of the federal government, into economic value, private sector collaboration, technology transfer, and commercialization is critical.* (ACOA, 2005)

Other Actions

- Create a Newfoundland and Labrador *Innovation Commercialization Experts* program. This program will help support the costs of attracting specialized professionals to the province to provide expertise to researchers and new entrepreneurs in product development, IP management, financing, export development and marketing and business management. The program is intended to drive rapid commercialization of high value IP. These services would be brokered through existing research, incubation and entrepreneurship support offices.

- Establish an *International Research and Business Networks* program based on the Ireland Business Partnership model. This program would also support costs associated with bringing world-class research expertise to the province, provide opportunities for work/study exchanges with partner institutions around the world, and assist with technology transfer and the formation of venture creation/partnerships.

"We have to rid ourselves of the "You're not from here" attitude." – St. John's round table

- Enhance the Embedded Entrepreneur initiative of the National Research Council-Institute of Ocean Technology (NRC-IOT) that provides incentives for entrepreneurs to work with researchers to focus research on areas of opportunity and to help bring industry relevant ideas from concept to prototype.

- Ensure that the province's proposed Immigration Strategy[35] is implemented as soon as possible in order that a priority can be placed on attracting and retaining top researchers from around the world. Accordingly, the Provincial Nominee Program PNP) must be given sufficient resources to publicize and manage its growing and much needed services.

***Relative to the size of our university, R&D and the number of graduate students is small. We need to focus on increasing both with a view to retaining an increasing number of our graduate students.* (Memorial University, 2005)**

- Support MUN's Graduate Student Work Experience program (GradSWEP) by funding a similar opportunity at the senior undergraduate level at the Marine Institute and CNA. A regional opportunities research bursary would enable researchers and graduate students to work for up to three months with communities and not-for-profit agencies to identify new economic development initiatives in rural areas of the province.

- Expand the role of MUN's Campus Incubation Consortium (e.g. Enterprise and Entrepreneurship Gateway, Gateway West, Genesis Group, NRC Institute for Ocean Technology, and the Inco Innovation Centre) in guiding entrepreneurs through MUN's innovation support system, and add CNA as a core member.

[35] *An Immigration Strategy for Newfoundland and Labrador: Opportunity for Growth, Discussion Paper.* Government of Newfoundland and Labrador. June 2005.

- Increase support for CNA's Research and Innovation Network to test new technologies and practices to improve delivery in such areas as distributed learning, digital animation, geospatial resource management and aquaculture, among several others.

4.1.6 Financing and Investment

Government recognizes that successful businesses, regardless of size or location, are fundamental to the overall economic success and social development of the province, and that it must provide ongoing financial incentives to sustain innovation and growth.

Our research of other jurisdictions shows that flourishing economies have developed broadly-based policies that address tax incentives and rates, investments in infrastructure, provision of government-sponsored grants and better support for science and technology education and research facilities. The Conference Board of Canada has also endorsed this approach.

There are several key areas where innovation initiatives are underway, but need to be more effective. These initiatives include:

- co-ordinated efforts between government and the private sector to increase investment available for technology and science firms, particularly small and medium-sized businesses;
- science grants and other types of support to applied R&D efforts;
- enhanced science and technology infrastructure such as access broadband and fibre networks;
- increased government funding of new science and research centres outside urban areas to spread the gains of R&D efforts across regions and sectors;
- reducing costs and securing investment. Tax reform (in the form of lower tax rates or R&D tax concession) lowers business costs and boosts exports. Tax reform measures for small business help reduce red tape, cut the cost of compliance, accelerate the reform of government rules and regulations, and improve access to remedies against unfair business practices. The government is aware of this issue and is currently undertaking a province wide Red Tape Reduction initiative (RTR) and,
- establishing Venture Capital networks that promote the industry and encourage investment in growing business enterprises.

Recommendation #6: Create a financing and investment regime that advances business growth and supports sustained innovation and development

Strategies

- Establish joint public-private financial supports and structures to address the needs of growth businesses from pre-seed to venture financing.
- Develop financing tools that address the long-term requirements of innovative businesses, and ensure that multi-year funding programs are in place.
- Create new sources of VC.
- Enhance corporate and R&D tax policies and practices to ensure that they are competitive with other jurisdictions, and are attractive to investors and businesses.
- Introduce a simplified tax credit program to support innovation and that is fair to all regions of the province.

Key Actions

- Establish the *NL Growth Industries Investment Corporation* to manage a group of flexible programs targeted at high-growth companies in Newfoundland and Labrador. The corporation would be an arms-length agency of government whose mandate is to develop a critical mass of growth firms in the province within 10 years. As in the case of Innovation Inc. (See page 37), this agency should operate outside of government so that staff can focus on programs without being distracted by other government responsibilities.

  The agency would have a Board of Directors comprising senior representatives of the public and private sectors and academia, including members from outside of Newfoundland and Labrador. The Board would report to the Minister through Innovation Inc., maintain an investment advisory committee made up of members from other public and private investment organizations, and oversee a global investment network.
- Implement a *Newfoundland and Labrador Innovation Fund* (recommended range of $10-14 million). This is an equity investment fund to support high-growth firms that require VC to take them to the next level. Individual investments would range from $250,000 to $1,000,000 and could be used to lever additional private and public funds (e.g. individual angel investors, GrowthWorks, ACOA).
- Establish an *Enterprise Seed Fund* (recommended range of $1.5 to $2.5 million) to support new technology enterprises. This fund would provide a non-repayable contribution (recommended upper limit of $100,000) to private industry to develop

prototypes and initiate IP commercialization. The funding must increase if companies are to compete effectively with other provinces and leverage other funds.

Other Actions

- Enhance the comprehensive Innovation Tax Credit package to focus on research and investment in strategic growth sectors. Recommended improvements to existing tax credit programs include:

  ⇒ Increase the NL labour-sponsored fund tax credit from 15% to 20% to maintain a competitive position within Atlantic Canada
  ⇒ Adopt a commercialization tax credit that complements the R&D tax credit, to offset costs associated with bringing new products and innovative services to market
  ⇒ Remove the payroll tax

- Create an informal Newfoundland and Labrador *Angel Investors Network* comprising prospective investors from NL and elsewhere around the world that would be interested in investing in local companies. Many angel investors are successful entrepreneurs who want to help other entrepreneurs get their business off the ground. Usually they are the bridge from the self-funded stage of the business to the point that the business needs the level of funding that a venture capitalist would offer.[36].

- Establish *The Innovators* program to award individuals who provide innovative ideas to advance science, enterprise and community development. The awards would be made available through organizations, communities, schools, etc., willing to sponsor innovation initiatives. The purpose of the program is to create awareness of opportunities in entrepreneurship, innovation and technology.

- Create a *Corporate Opportunities* program to support partnerships between large corporations and SME's to research new product/service opportunities, develop joint ventures, license IP, and develop and market products/services.

- Create an *Investor Readiness* program. Delivered through existing management and business support groups, the program would provide intensive training and guidance to firms looking to attract VC (and other forms of public and private sector financing).

[36] *Small Business Notes*, Kautz, Judith, 2005.

4.1.7 Infrastructure Supporting Innovation

Strategic development of competitive infrastructure must be developed, whether it is for R&D facilities, specialized equipment or communications networks that sustain an innovative economy.

Advanced economies understand the need for continuing investment in leading-edge infrastructure linked to a strategic direction. They recognize the value of infrastructure and HQP in attracting investment and building new wealth. They work to ensure that governments and academia are in step with local industry needs.

Recommendation #7: Undertake the strategic development and maintenance of competitive infrastructure that supports innovative activities throughout the province.

Strategies

- Identify critical infrastructure and match investments in infrastructure with the province's overall strategic direction.
- Make infrastructure more accessible so that industry and communities in all regions can develop new opportunities.
- Leverage the province's word-class infrastructure to attract investment and people.
- Increase awareness of opportunities and technology solutions through promotion of facilities at MUN and CNA.

Actions

- Develop a provincial broadband and advanced communications networking strategy. This strategy would build on the current broadband infrastructure analysis prepared by the federal and provincial governments. It should address the following issues: the lack of appropriate infrastructure throughout all regions of the province, local competitive environment, lack of competitive inter-connection facilities off island, open access standards, technologies, aggregating demand (specifically pertaining to public sector users), national and international best-practices, and the feasibility of creating a comprehensive wide-area network throughout the province. The strategy should meet specific needs in the areas of research, education, health care and regional and business development, and be aligned with the establishment of Innovation Hubs throughout the province.

"We need to develop a critical mass of relevant infrastructure in targeted industries."
- Grand Falls-Windsor round table

- Analyze existing infrastructure and gaps. The analysis should be tied to strategic directions across institutions and governments and be based on the ongoing needs of Innovation Hubs. Examine the province's social

infrastructure in conjunction with the Rural Secretariat to ensure that appropriate social infrastructure (e.g. hospitals, schools, and recreation) exists to attract researchers and businesses to move to the Innovation Hubs.

- Coordinate with the Government of Canada to develop a multi-year infrastructure modernization initiative to ensure the upgrading and maintenance of critical research and development infrastructure and facilities at MUN and CNA.

***"Government has to be a champion of "real" relationships. These relationships will build other relationships over time."* – Corner Brook round table**

4.1.8 The Culture of Innovation

To become an innovative province, all Newfoundlanders and Labradorians must be encouraged to take risks and everyone must celebrate and reward success. People in all regions of the province believe in a bright future for Newfoundland and Labrador. They want government to nourish a 'can-do' spirit here by recognizing regional differences instead of providing formulaic programs and services across the province.

Industry Canada's Innovation Strategy report, *A New Magnetic North*, (2002) defines a culture of innovation in this way:

A culture where all Canadians feel empowered to constantly find new methods of addressing and improving upon the challenges they face in their particular sphere of life, whether that be scientific research, business, politics, community affairs of any other realm. It also means that Canadians must feel confident that their communities will respect, support and promote ingenuity in its many facets. In short, we believe that Canada must strive to be a community of creative thinkers, one where new ideas and approaches are held in the highest regard.

"People in this province are committed to making things happen – that's why all the major players are at the table." - Healthcare focus group

The Canadian Manufacturers & Exporters underscores the importance of "encouraging a business culture of innovation by stressing the need for problem-solving, leadership and entrepreneurship and by emulating best practices from around the world." [37]

Both government and industry must do a better job of explaining the balance between risk and reward to all those involved in the innovation chain - individuals, institutions, communities, corporations and government. By educating society on what can be gained through both success (wealth, experience, recognition) and defeat (experience, leadership ability, lessons for the future), we can begin to instill support for innovation in our province.

[37] *The Business Case for Innovation*, Canadian Manufacturers & Exporters, Aug., 2001.

Recommendation #8: Create a culture of innovation throughout the province that embraces risk, rewards success and enables people to work together towards the highest standards and objectives.

Strategies

- Celebrate our risk-takers and successes.
- Attract and engage leaders and champions.
- Instill confidence in people's ideas and abilities.
- Set the highest standards in government, academia and business.

***"Because of geographical challenges, it's more difficult for our young people (living in small communities) to think outside the box."* - Labrador coast video-conference round table**

Actions

- Develop a dynamic promotional campaign that uses senior political, industry and government leaders as the central spokespeople and aims to position Newfoundland and Labrador as an exciting and innovative place for individuals and industry.
- Celebrate and promote our risk-takers, entrepreneurs and successes:
  - ⇒ Expand the *Getting the Message Out* initiative (e.g., tie it in with entrepreneurial youth programs (e.g. Junior Achievement; Shad Valley).
  - ⇒ Use *the Ambassador Program* as part of a general investment attraction initiative.
  - ⇒ Institute an *Innovation and R&D Awards* program similar to the Export and Community Economic Development Awards, including a category for young innovators and entrepreneurs.
- Establish an industry-human resources technology transfer program that facilitates exchanges between local, national and international companies.
- Demonstrate an ongoing commitment to achievement by rewarding excellence in government, academia, business and labour.

5.0 THE NEXT STEP – THE INNOVATION SCORECARD

The provincial government should consider tracking its progress on innovation using the accepted method of measurement, an innovation scorecard. The scorecard would define, measure and compare the progress of our innovative economy with other jurisdictions for which data is available. An innovation scorecard generally includes such indicators as product and service innovation, technology acquisition, leadership, human resources and competitiveness. Specific indicators for this province's scorecard would include those discussed previously, including total R&D spending as a percentage of

GDP, percentage of households with access to Internet services and percentage of population ages 15-44 with a university degree.

The impact of these indicators is such that more innovative jurisdictions have a higher ratio of indicators, e.g., private-to-public R&D ratio, than others. By moving Newfoundland and Labrador's ratio towards that of the more progressive economies (e.g., Sweden, Finland or the U.S), it will also guide our innovative activity towards that of other jurisdictions. Aggregate evidence[38] suggests the three factors that matter most to this process are:

- Private sector R&D/public sector R&D
- HQP
- Number of new product/process opportunities

Table 4 (discussed in Section 2.1.8) provides the suggested scorecard components and our current ranking (based on the most recent data) with other provinces and the nation as a whole. Nova Scotia uses a similar tool to measure its innovation progress. [39]

6.0 CONCLUSION

Innovation is a continuous and dynamic process. This report offers a foundation for the province to construct a society that prizes knowledge, creativity and excellence, and is able to compete at any level, anywhere in the world.

The action items listed, particularly the key initiatives, embody the hopes and concerns of the nearly 500 voices that contributed to our consultations and reflect a significant body of research. We believe that these initiatives will help to make innovation a pillar of economic and social progress in Newfoundland and Labrador. The provincial government must now decide which strategy components are most useful and prepare an implementation plan for those recommendations.

Finally, all of us must come to understand that innovation propels progress in the modern economy. We must reject fears that change will destroy the values and traditions that make Newfoundland and Labrador a wonderful and stimulating place to live. If we can do that, we will be off on a thrilling journey, one that allows us and our children to stay and prosper here, if we wish.

[38] Association of University Technology Managers (AUTM): AUTM Licensing Survey: FY2001 Survey Summary: www.autm.net; Porter, M, Stern, S., and the US Council on Competitiveness: The New Challenge to America's Prosperity: Findings from the Innovation Index, 1999. The US Council on Competitiveness framework builds on the research from both economics as well as technology policy (including seminal contributions by among others, Schumpeter, 1943; Bush 1945; Solow 1956; Porter 1990, Romer 1990; and Nelson 1993). p 25; US National Science Board – Science and Engineering Indicators 2002 Vol1,2: 2002: National Science Foundation (NSB-02-1)

[39] NovaKnowledge financed by the Nova Scotia Technology and Science Secretariat.

entrepreneurs
strategy