Leading to Competitiveness: Atlantic Canada’s Knowledge-Based Future

Association of Atlantic Universities
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Introduction

Picture a region with great strength and great potential – but with challenges to overcome. The region has built on its strong resource base to create an increasingly knowledge-intensive economy, and a rich learning infrastructure. Determined measures by government have restored the fiscal health of the public sector. These achievements both enable and in turn are reinforced by a highly educated and trained population, a caring, inclusive society, and an outstanding quality of life. But these achievements are vulnerable to erosion in a competitive globalized economy, as other regions move quickly to seize new opportunities.

What are those vulnerable areas? The region has lagged in innovation. Firms underinvest in R&D and training, influenced in part by historical economic structures of externally controlled firms and a high proportion of SMEs. Dependency on government and university R&D is above average. Productivity and entrepreneurship are lower than adjacent jurisdictions. Risk capital is limited. Fears exist about the loss of highly educated citizens to other jurisdictions, and about the erosion of cultural distinctiveness and social capital – given that the region has only one-tenth the population of its larger neighbour. Uneasiness is mounting about the widening disparities between rural and urban regions. Progress is being made on a number of these fronts, and indeed, in many ways, the region is doing better than ever before – but other regions are moving even faster, and some gaps are widening. Strong action is needed to create a virtuous cycle of sustainable economic growth and social well-being.

Is this a description of Atlantic Canada? Or is it a picture of Canada as painted in the Government of Canada’s recent innovation paper, Achieving Excellence? The answer is yes, to both questions. Atlantic Canada is not qualitatively different from the rest of Canada; rather, it is Canada writ smaller, exhibiting some of its challenges in greater measure – a result of a complex mix of history and geography, economics and politics.

Now, the world is moving rapidly into a new era when growth and well-being depend on human capital and innovation, and when the key success factors of the industrial era – scale, location, raw resources, physical infrastructure – are no longer all-important. In this era, we – both the Atlantic region, and Canada as a whole – have the opportunity to leave some of yesterday’s obstacles behind, and to build on our strengths to hurdle the barriers of today and tomorrow. In the Atlantic region, the challenges are somewhat greater in degree, but offsetting this, they are smaller in scale. A moderate investment, by national standards, will have major impacts.

The foci for that investment are clear – innovation, the knowledge and skills of the people, and a concerted effort by all
partners, brought together to build world-class clusters in the region and niches of excellence in its communities. Strong leadership is needed to weave these elements together into a coherent strategy to fully realize Atlantic Canada’s potential for sustained growth and competitiveness.

The Association of Atlantic Universities has prepared this paper as a contribution to discussion of that strategy. The historical roots and present status of the challenges and the gaps affecting the region have already been well documented\(^1\), and will not be repeated here. Rather, the paper will set out an innovation-based strategy to make Atlantic Canada a strong competitor in the global economy – a strategy founded in the region’s communities small and large, and based on the synergy between economic and social development. In partnership with industry, governments, and communities, Atlantic Canada’s post-secondary institutions will play an integral role in that strategy.

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**Vision**

The foundation of the strategy is the region’s rich resource base – the long-established wealth of land, forest, and fishery resources, and the emerging promise of the region’s oceans, through aquaculture, oil and gas. For centuries, these resources have yielded only a fraction of their potential value. Now, that wealth can be more fully tapped by applying core technologies such as information technology, biotechnology, engineering, environmental technologies, and materials science, to transform those resource sectors into high value-added, knowledge-intensive industries. This reflects the mature understanding that the knowledge-based economy is not merely a narrow range of “new economy,” industry sectors concentrated in large urban centres. Rather, the knowledge-based economy leverages those core technology sectors to effect a transformation throughout industries in all regions of the country.

This approach will both build on and secure the region’s exceptional human and social capital – its skilled workforce, its researchers and highly qualified personnel, its close-knit communities, its cohesive society and distinctive, vibrant culture. In the past, many of these elements were seen as costs to be underwritten by the wealth extracted from the region’s resource base. In today’s economy, they are recognized as resources in their own right – a source of wealth through innovation, productivity, and unique knowledge products and services. The more fully those resources can be developed, the greater the
potential for wealth and prosperity. As such, it is a central theme of this paper that economic and social development should, indeed must, proceed hand-in-hand. No community and no group will be left out or left behind. If this can be achieved, the strategy will itself become a knowledge product of great value to other jurisdictions grappling with similar challenges.

How is this vision to be realized? It will depend on innovation and entrepreneurship, on knowledge and skills, and on vision and partnership. On all these factors, the Atlantic region’s twenty-one public post-secondary institutions play a vital role. They are the core of the region’s innovation capability and the key to strengthened commercialization performance. They develop the advanced knowledge and skills essential to competitiveness and productivity in today’s and tomorrow’s economy, and have a formative influence on many of its future leaders. They constitute a network with a presence in every region and every major community, and a myriad of linkages to the public, private, and volunteer sectors. And, increasingly, they share an understanding of their role and potential impact in the transformation of Atlantic Canada, and a consensus on how to move toward that goal. This paper sets out that consensus.

The Elements of Success

Core Technologies

Core technologies are at the heart of the knowledge economy.

They are the most rapidly growing, high-value, knowledge-intensive sectors of the economy – but even more important, they are the key to unlock the potential wealth in Atlantic Canada’s resource base, its people, and its communities, in a way which maintains and enhances environmental quality. These technologies include:

- information technologies and geomatics;
- biotechnology and genomics;
- engineering, particularly ocean engineering;
- environmental technologies; and
- materials science.

The region has a strong and growing capacity in each of these areas.

Information and Communications Technologies

Information and communications technologies, or ICTs, are at the core of the new economy. The extraordinary pace of innovation in the sector has had twin effects – high-speed growth in the sector itself, and rapid increases in technology and knowledge intensiveness in every sector of the economy and society. Strength in both the development and dissemination of ICTs is vital to the knowledge economy in Atlantic Canada.

Atlantic universities are moving rapidly to expand and extend their capabilities in this area.
Memorial University of Newfoundland is home to the Advanced Computation and Visualization Centre (CVC), the most powerful research computer system in Atlantic Canada. The CVC gives researchers unprecedented access to parallel computing and high-end graphics capabilities, useful for numerical modelling and simulation -- an emerging and increasingly popular way for scientists to visualize complex processes or structures. The CVC is part of a Canadian network of high performance computer centres, which gives researchers the benefit of tapping into the computational system best suited to their work. As well, a networked CVC computer is located at each of the following universities: St. Francis Xavier, the University of New Brunswick, and the University of Prince Edward Island. This powerful infrastructure is complemented by a record of innovation in learning: Memorial University was the first university in Canada to offer an interdisciplinary Master of Science in Computational Science.

Saint Mary’s University has developed a high-performance computing facility and is aiming at international excellence in computational astrophysics and astronomy by establishing the Institute of Computational Astrophysics, and allocating it two Canada Research Chairs. The University also plans to establish a Scientific Computing Facility, to be made up of the Institute for Computational Astrophysics, an Institute for Computational Modeling, and an Institute for Spatial Analysis Research.

Since the amalgamation of the Technical University of Nova Scotia with Dalhousie in 1997, Dalhousie University has built a major and diversified computer science capability. Areas of technology development in the future include networking, communications technologies, and management informatics. Areas of applied ICT development include e-commerce and e-health and the Global Information Networking Institute, discussed later in this paper. Five Canada Research Chairs have been allocated in this area of research.

The University of Prince Edward Island recognizes the importance of and supports the use of ICT in research, teaching and administration of the university. UPEI has played a lead role introducing the campus community and the rest of Prince Edward Island to the first starts of the Internet and, through provincial and national partnerships, to the quickly evolving research Internet in Canada (CA*net 4). The University of Prince Edward Island is the provincial hub for CA*net 4 and the local education and research optical regional advanced network (PEIORAN).

UPEI has received funding from CFI to support the creation of leading edge ICT infrastructure needed to support the next-generation applications and research underway on campus including a supercomputer scale high-performance beowulf cluster to investigate the properties of polymeric systems and mechanisms of protein folding.

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UPEI is also a member of the NB/PEI Educational Computer Network (NB/PEI ECN) which is a regional source of ICT expertise.

Acadia University is a pioneer in the pedagogical use of ICT. Since 1996 Acadia has used mobile computing to integrate technology with teaching through the Acadia Advantage program. The totally wired campus ensures students, faculty and staff are connected to each other and the world at all times. Acadia Advantage graduates possess an ICT skill set, including research and advanced analytical skills, of significant value to knowledge economy employers. The Acadia Institute for Teaching and Technology is the research and development centre that leads innovation in teaching and technology at Acadia, supports faculty initiatives and provides training programs and consulting services to teachers and academic institutions across Canada and the USA.

The Intelligent Information Technology Research Centre, at the Jodrey School of Computer Science, applies artificial intelligence research techniques and agent technology to standard information-technology business problems and specializing in intelligent software agents. The School developed the world’s first undergraduate computer science degree with e-commerce specialization. Acadia has designated a Canada Research Chair in Computer Networking to develop research capacity in networking.

St. Francis Xavier University (StFX) plans to develop a computer modelling and simulation capacity of great value to the region’s industries – particularly in the oil and gas sector – and to researchers at other institutions. A newly-appointed Canada Research Chair in Modelling and Simulation will be attached to the High Performance Computing Research Unit in StFX’s Centre for Applied Petroleum Sciences.

The University College of Cape Breton has been designated by the Province as a Centre of Excellence in Information Technology. Its Information Technology Innovation Centre focuses on design issues related to anytime anywhere access to wired and wireless networking systems, working closely with the region’s growing ICT industries. As well, UCCB is home to the CAD-CAM Centre, providing support to eastern Nova Scotia enterprises in a range of areas related to CAD-CAM programming and training; prototype design and manufacture; robotics; CAC-CNC communications, configuration, and commissioning; and specialized technical support.

Université de Moncton has identified information and communication technologies, digital approaches and simulations as a priority within its science and engineering faculty.

The University of New Brunswick has long placed priority...
on information and communications technology. UNB is one of 14 Canadian nodes on the recently announced CA*Net 4 OC192 (10 Gbps) Canadian Research and Education Internet backbone, and contributes the largest number of computer Science graduates in the region each year. The Faculty have developed expertise in high performance computing, data communications, bioinformatics, cryptography, and geometric computing. The faculty has an outreach arm, the Information Technology Center (ITC), which engages in R&D projects with regional industries, particularly in developing prototypes for proof of concept of new software and in undertaking usability studies on industry prototypes. In July 2002, UNB received AIF support to partner with other universities and private sector firms to improve existing and develop new communications networks and services that would see improvements in radio software, wireless communications systems, data traffic analysis and information access controls.

< The University of New Brunswick has developed a strong e-commerce capability at its Saint John campus, described further below in The Connected Community.

Within the overall field of ICTs, the Atlantic region has particular strengths in the area of geomatics.

< In Fredericton, UNB has been engaged in spatial data infrastructure research since 1993. Early technical research funded by CANARIE led to the development of one of the first commercial Internet based GIS software packages in North America (the CARIS Internet Server) in 1994. Currently, the university has a strong presence in the Geomatics Network of Centres of Excellence (NCE).

< Dalhousie’s Computational Hydraulics-GIS/RS Laboratory has commercialized products including a multimedia driven Environmental Engineering Analysis System with EOA Scientific Systems Inc., and remotely sensed discharge measuring systems with NS Dept of Environment and Shaw Ltd.

< Saint Mary’s University plans to establish a spatial analysis research group based on modern GIS and GPS technologies. This is an opportunity to partner with both the public and private sector, for example in archeological research along pipeline corridors, assessing the risk of catastrophic flooding around the Bay of Fundy, and developing a new Atlantic Provinces Atlas.

< Memorial has particular expertise in GIS and remote sensing in coastal regions. Its Geographical and Information and Digital Analysis Laboratory (GEOIDAL) has researched the analysis of remotely sensed data for coastal studies and the integration of satellite data and terrain data for terrain analysis.
Biotechnology and Genomics

Although ICTs have long been the core technology associated with the knowledge economy, biotechnology is achieving a comparable status. The opportunities opened by genomics research, and the enhanced efficiency and impact of the innovation process across a wide range of fields, hold the potential for far-reaching economic and social progress.

Together, the region's universities are rapidly expanding their capacity to apply biotechnology and genomics to transform the region's bioresource industries and to enhance human health.

Dalhousie University is engaged in a wide range of biotechnology and genomics research. The university coordinates the Genomics and Evolutionary Biology Research Program, making it the lead institution in the Canadian Institute for Advanced Research sponsored program in Evolutionary Biology. Dal is involved in the development of research programs of Genome Atlantic through Genome Canada and has received funding for two large scale genomics projects. A major component of the Atlantic Genome Centre will involve large-scale sequencing projects in microbial genomics and protists, as well as antibiotic-resistant microbes and microbiology related to human health, aquaculture, forestry and agriculture. Two Canada Chairs have been awarded for research in genomics, and through various programs Dalhousie intends to at least double its capacity in genomics research. These studies will have major impacts in the area of human infectious diseases as well as other biotechnology sectors.

In the bioresources area, Dalhousie has established a strong track record in the area of fisheries resource and conservation genetics through its Marine Gene Probe Laboratory, with strengths in the genetics of population structuring, stock mixing and forensics, informed aquaculture development through pedigree analyses, live gene-banking for endangered populations, and quantifying genetic biodiversity from the level of genes through to ecosystems. Development of research strength in marine biodiversity is being supported through support of research chairs by the Department of Fisheries and the Canada Research Chairs program. In the forestry area, two new industry supported research chairs are exploring issues related to genomics, population genetics and molecular breeding of trees.

The University of New Brunswick, with established strengths on its two campuses in aquaculture, fisheries and forest biology, is adding molecular genetic expertise to link with genetic improvement programs in fish species, potatoes, and forestry. The university is placing priority on its Marine Molecular Biology Initiative, which applies fundamental molecular biology tools to biological diversity and conservation issues. It plans to build its current capacity into an internationally recognized multi-disciplinary...
research program on algal evolution and diversity, unique in Canada. UNB is also a major partner in the Atlantic Genome Centre and expects to play a primary role in some aspects of its program, including comparative genomics and systematics, bioinformatics, and the legal, ethical, and environmental aspects of the genome initiative.

Biotechnology lies within several strategic research areas at Memorial University of Newfoundland. The Departments of Biology and Biochemistry and the Oceans Sciences Centre in the Faculty of Science, and the Faculty of Medicine’s Discipline of Genetics and Division of Basic Sciences all have strengths and opportunities to develop aspects of biotechnology. The Faculty of Medicine is enhancing capability in development areas in direct support of biotechnology, such as genomics and immunology. The Faculty of Science is strengthening the areas of molecular biology, marine biotechnology, and bioinformatics. In response to the opportunities created by the recent establishment of the Atlantic Genome Centre, Memorial is developing initiatives in applied genomics, (in particular to human genetics related to disease states) and the genomics and genetics of selected marine species. Across these areas of research, emphasis will be placed on developing the ethical and environmental analysis of biotechnology. The impact and reach of this work is being enhanced through partnerships with BioEast, the provincial biotechnology organization; through linkages to the growing private sector through Seabright Corporation; and through greater collaboration with regional research institutions such as the National Research Council’s Institute of Marine Biosciences.

Saint Mary’s University is expanding research in molecular biology with an emphasis on agricultural genomics through a CFI-funded laboratory. The University is a partner, with Dalhousie, on a major Genome Atlantic funded project on spruce tree genomics.

Nova Scotia Agricultural College has identified Molecular Biology as one of its core research themes, strengthening current research programs in the areas of reproductive biology, animal breeding, potato physiology, nutrient-gene interactions, and forage genetics.

The Université de Moncton is placing particular emphasis on biotechnology and food science, through its Food Research Centre.

UPEI’s expanding biotechnology expertise is within the area of bioresources and nutrition and will be centered in a planned Institute of Bioresource Innovation.

Memorial University is focussing its efforts on marine biotechnology. In July 2002, its Ocean Sciences Centre received AIF support for biotechnology research to investigate and improve the mechanisms of disease resistance in Atlantic Salmon.
Mount Allison has appointed a Tier II Canada Research Chair, whose contributions to biotechnology are gaining increased recognition, and are the subject of several recent patent applications to produce commercially available Global Antibodies that will recognize all the members of a protein family with uniform specificity, from any species of origin.

Environmental Technologies

Environmental sciences and technologies represent an area of strength and a priority for the region’s universities, most of whom are now linked through the Atlantic Environmental Science Network. Leading areas include water-related environmental studies, waste management and remediation, and fish and wildlife.

In the area of water-related environmental studies, the region is strongly represented in the Canadian Water Network NCE, with capacities including the following:

- The University of New Brunswick has identified Global Environment and Resources as one of its five research priorities. The university has established the Canadian Rivers Institute, a unique multi-disciplinary initiative focussing on the biota of rivers and their valleys from headwaters to estuarine and coastal marine environments, including the physical and chemical processes that influence ecosystem health. It plans to make this area its international flagship, and is placing it at the core of its five-year $100 million capital campaign, as well as allocating two Tier I chairs, one in River Ecosystem Science and the other on Ecosystem Health Assessment.

  Capacity in the area of coastal ecosystems is also provided through UNB Saint John’s Centre for Coastal Studies and Aquaculture. Areas of expertise within the Centre include the role of integrated aquaculture in sustainability and the physiological ecology of marine invertebrates, many of which are commercially important.

- At Memorial, a strong interdisciplinary research and teaching capacity has evolved in the area of biophysical and socio-economic analysis of the environment. This capacity is reflected in the recently awarded NSERC/SSHRC “Coasts Under Stress” project, a substantial interdisciplinary initiative which will explore interactive relationships between environmental, industrial, social and political restructuring, and the health of environments, individuals, families and communities on Canada’s east and west coasts. Much of the work will take place at Sir Wilfred Grenfell College in Corner Brook, in partnership with the College of the North Atlantic in the GeoSpatial Research Facility for Terrestrial Ecosystems, with support from Memorial’s GIS, computational, and dissemination capabilities. Sir Wilfred Grenfell College will increase its activities in environmental research, and is exploring the scope to establish an Environmental Policy...
Research Institute jointly with the Humber Economic Development Board. The Labrador Institute (an outreach unit established in Labrador by Memorial to focus research and teaching in matters specific to Labrador) will facilitate research on issues such as those surrounding Voisey’s Bay, Churchill Falls, and the trans-Labrador highway. Other initiatives in support of environmental research at Memorial include the development of socio-economic and health databases in collaboration with the province; expanded capacity in water treatment and process technologies at the Engineering Faculty; and expanded equipment capabilities in the Science Faculty.

At Dalhousie, Ocean Environmental Processes forms one of three sub-themes within the university’s core area of Ocean Studies. The Centre for Marine Environmental Prediction (CMEP), through support of a major CFI award and working with government departments and the private sector, is building Dalhousie’s strengths in the real-time observation and prediction of the marine environment.

Mount Allison’s Coastal Wetlands Institute focuses on both the biophysical process and the human ecology of an important ecological habitat, using a new technically sophisticated glasshouse and aquatic research lab facility funded through the Canada Foundation for Innovation. The university has identified Coastal Wetland Environmental Sciences as one of its four research priorities. The present membership of the Institute consists of 10 permanent faculty members, including a Tier II Canada Research Chair in Environmental Sciences, and a growing number of associates. The Institute’s mandate is to promote and conduct research and educational outreach on scientific, social and economic aspects of coastal wetland environments, especially those of eastern Canada.

The environment is a key research focus at Acadia University. Three Canada Research Chairs will build on current research expertise and lead a multidisciplinary approach to research on environmental issues, through the newly formed Academy for the Environment. A gift from the Irving family to Acadia, the Environmental Science Research Centre, Botanical Gardens and Meeting Place embodies Acadia’s vision for environmental study and research. Using state-of-the-art phytotrons, this world-class facility will support the research activity in the areas of global and climate change, plant physiology, conservation genetics, and estuarine research. The six-acre botanical garden containing the plant species of the Acadian forest region, a seed bank, herbarium and the DNA sequencing laboratory makes this facility a key regional asset to support conservation research in the face of unprecedented global change.

The Acadia Centre for Estuarine Research, established in 1985, focuses research attention on the estuaries and nearshore coastal waters of Eastern Canada, with emphasis on the estuarine systems of the Bay of Fundy,
Gulf of Maine and Georges Bank. In cooperation with regional, national and international researchers, ACER studies diverse subjects, including saltmarsh productivity, the dynamic properties of estuarine sediments, feeding and migratory behaviour of diadromous fish, shoreline erosion, and carries out environmental impact studies. As part of the NCE Canadian Water Network, Acadia researchers are leading research to develop capacity to respond to water resource challenges in the Annapolis Valley.

St. Francis Xavier University brings an integrated approach to the understanding, use and management of aquatic resources, through its Interdisciplinary Studies in Aquatic Resources (ISAR) program. The university’s St. George’s Bay Ecosystem Project brings a community dimension to this field. The university’s Earth Science Research Laboratory conducts research in the transport and transformation of chemicals, in agricultural watersheds. To extend these strengths, the university is planning a Canada Research Chair in Aquatic Ecology and another in Physical Oceanography.

UPEI has identified Aquatic Sciences and Environmental Sciences as two of its seven constellations of research strength. Its aquatic research addresses the health, distribution, conservation, and aquaculture of natural resources in aquatic ecosystems. As well, as a member of the Canadian Rivers’ Institute, researchers at UPEI collaborate with others across the region to address problems in watersheds resulting from land use practices.

Saint Mary's University serves as the National Secretariat of the Ocean Management Research Network, funded by DFO and SSHRC. This network links researchers across Canada with an interest in managing ocean uses – including fisheries and aquaculture, oil and gas, ports and shipping, naval and coast guard activities and tourism.

In the area of remediation and waste management:

The Nova Scotia Agricultural College has identified Waste Management and Resource Management as two of its six research priorities, with reference to the region’s agricultural and aquaculture industries. Areas of emphasis include air quality management and monitoring; pathogen management in relation to surface and groundwater; nitrogen, phosphorus, and pesticide management in relation to total maximum daily loading; bioremediation; agricultural systems modelling; soil conservation management and soil quality.

At the Université de Moncton, a significant capability has been developed through the Centre de recherche en sciences de l’environnement, which focuses on the prevention of damage to ecosystems and the rehabilitation of ecosystems, and through the Laboratoire de recherche pour l’industrie et l’environnement, which investigates the impact of environmental contaminants.
At Saint Mary’s University, Environmental Studies and Sustainable Development is one of five research priorities. A Canada Research Chair has been allocated to environmental science. SMU’s Environmental Studies and Remediation Centre carries out research on environmental science in Atlantic Region and provides outreach to the international community in methods and strategies of environmental research. The university’s recently established pollutant monitoring and ecosystem remediation facility will have the capacity to monitor chemical pollutants and carry out research on ecosystem remediation.

In the area of wildlife ecology, management, and conservation:

The University of New Brunswick has Canada’s largest concentration of research expertise, through its Sir James Dunn Wildlife Research Centre, its leading role in the Atlantic Cooperative Wildlife Ecology Research Network, and its founding role in the Atlantic Environmental Science Network. Complementary capacity exists at Mount Allison University through its recently established Atlantic Canada Conservation Data Centre, the newest node in a hemispheric network dedicated to collecting and managing biological diversity information on rare and endangered species. Mount Saint Vincent University contributes to this expertise with faculty research on wildlife conservation and environmental policy.

Acadia University has long been recognized for its environmental, wildlife and conservation research capacity. The Centre for Wildlife and Conservation Biology works on rare and endangered species, migratory fish, and forestry-wildlife linkages. Acadia’s researchers are involved with several regional and international research networks, including, in partnership with UNB and MUN, the Atlantic Cooperative Wildlife Ecology Research Network and the developing Atlantic Environmental Research Network. Acadia is home to the Science and Management of Protected Areas Association, which links scientists with natural resource managers to develop scientifically sound policy. Acadia has several field research stations established throughout Nova Scotia to study and monitor various species and habitats.

The University of Prince Edward Island has particular strength in the study of ecosystems, with emphasis on both integrity of natural ecosystems, and the study of the health of agricultural and aquatic ecosystems. Research encompasses studies from the molecular to the population levels on ecosystem integrity, especially as affected by land use activity and other environmental stressors. The university proposes to establish an Ecosystem Health Research Centre at its Health Research Institute and to add faculty in this area.

The Université de Moncton has designated environmental studies and environmental science as one of its five
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research priorities. The university has particular strength in the health and sustainable development of forest resources and in model forests through its K.C. Irving Chair in Sustainable Development and the Canada Research Chair in Landscape Conservation. Also, the Université de Moncton has a Master’s program in Environmental Studies which has strong linkages with the communities.

< St. Francis Xavier University’s Environmental Earth Science Research Laboratory is Atlantic Canada’s leading centre for the study of climate change. Researchers at the laboratory have recently gained international recognition for their work on global warming. Areas of focus include the study of energy variations at the Earth’s surface over time in all continents; and the use of non-traditional methods to understand the dynamics of greenhouse gas production, especially carbon dioxide and nitrous oxide, in soil and the controlling variables (such as soil temperature and moisture). StFX is also playing a major role in the evolving Atlantic Environmental Science Network (AESN).

< Dalhousie has a significant and growing materials research program, including establishment, in late 2001, of the university-wide Institute for Research in Materials, with more than 60 faculty members; appointment of at least five Canada Research Chairs in materials research; and the recently announced CFI-funded Facilities for Materials Characterization. Research involves a range of new and innovative materials from high impact concrete, through ceramics and composites, to bio-materials, electronic and optical materials, to new insulating materials, fuel cells and batteries. Extensive support and interaction with the government agencies and private sector partners have been established.

< The University of New Brunswick Fredericton has significant and growing strengths in advanced materials research, including a planned Canada Research Chair in materials imaging, and an Institute for Materials Visualization and Analysis which received AIF support in July 2002 to enhance its capabilities. The university has been a leader in synthesis, analysis, characterization and testing of new molecules and materials, and in new means of producing and using these products. Materials range from organic molecules, to pulp and paper, polymers, composite materials, wood and engineered wood products, concrete, and materials that constitute a threat to humans. The analysis, characterization and testing research includes spectroscopy and lasers, MRI, neutron scattering and vibrational and stress analysis. Much of this research

Materials Science

The area of materials science is a strong and growing capability throughout the region. As a key enabling technology for modern industrial competitiveness and new product development, materials science is receiving increasing priority at most of the region’s institutions.
is highly collaborative and multi-disciplinary. Research includes all levels from the molecular structure to the macroscopic behaviour of the materials. Major facilities include the Electron Microscopy Centre, the MRI Centre, the Wood Science and Technology Centre, the Centre for Lasers Atomic and Molecular Science, the Limerick Pulp and Paper Centre, and the Threat Materials Research Centre.

Memorial University’s Department of Chemistry has research programs in fuel cells, nanotechnology (such as molecular magnets, switches and electronics), and novel photochemical devices for artificial photosynthetic applications. The Department’s fuel cell research is currently supported by two NSERC Strategic Project grants and by companies in Montréal and the US. The Genesis Group has filed for patent protection for fuel cell technologies arising from this research, and is pursuing commercialization. In the coming decade, researchers in Memorial’s chemistry department will apply their expertise in synthetic and materials chemistry to further promote economic development in the region. The planned Materials Technology Network for Atlantic Canada (MATNET, pending CFI and AIF funding) will be instrumental in this process by fostering collaboration between universities and with industry. Nanotechnology is a component of this plan. Memorial also has research strength in the area of porous semiconductor materials, which hold great promise for a variety of biomedical applications. The Department of Physics and Physical Oceanography has received CFI funding towards the development of a state-of-the-art laboratory to study the properties of such materials.

At Acadia University, materials research is a priority as indicated by the recent establishment of Acadia Centre for Microstructural Analysis and the university’s plan to assign a Canada Research Chair to this field. Acadia University faculty in Physics, Chemistry and Biology carry out interdisciplinary research and provide services to small industry, consulting firms and government agencies through the Acadia Centre for Microstructural Analysis. This CFI-funded facility provides the regional R&D community with access to an array of state-of-the-art instrumentation, including scanning and transmission electron microscopes and NMR for microstructural and chemical characterization of materials. The recent naming of a Canada Research Chair in Materials Science will further enhance ACMA’s research capacity. With CFI-funded infrastructure, the Chair will study the physical, electronic and optical properties of semiconductor nanostructures.

St. Francis Xavier University has several well-established programs in materials related areas, with particular strength in the areas of surfactants and chemical synthesis. The Chemistry Department has undertaken fundamental colloid research to synthesize and
characterize new surfactants, with important practical applications, particularly in the oil and gas industry (e.g., soil remediation, control of biofilm growth on equipment, and treatment of sour gas deposits). A Canada Research Chair in Colloid Chemistry will be attached to StFX’s Centre for Applied Petroleum Sciences. This CRC will expand the research group’s expertise and allow work to broaden in other commercial areas such as food processing, herbicide/pesticide application, and formulation of detergents.

Université de Moncton is conducting a significant research program in areas of advanced materials, especially in composite materials and optoelectronic films. In July 2002, the U. de Moncton received AIF support for work to develop superior quality advanced optical materials and devices as well as techniques and instruments to improve processes in the optics, ophthalmic and photonic industries.

At UPEI, materials science has been identified as one of the university’s seven constellations of research strength. Research in materials science is carried out by chemists and physicists within the CFI-funded Centre for Structure Determination which continues to be augmented by multiple CFI New Opportunities awards. Research focuses on several inter-related areas: supramolecular chemistry, biomembranes, surface defects in materials and the synthesis and characterization of new nanocomposite materials.

At Saint Mary’s University, crystal engineering is one of the research specialties within the Department of Chemistry. Molecules of specific shape and size are developed for industrial or medical applications.

The strengths of Dalhousie, Acadia, MUN, U. de Moncton, UNB, UPEI and StFX will be pooled in an initiative supported by the Atlantic Innovation Fund for a Materials Technology Network for Atlantic Canada. MATNET will bring together universities and industry researchers to discover new materials and processes, leading to production of new products and services in the region. The research program will address significant and exciting technologies, from smart materials and systems for monitoring public buildings and highways, through corrosion resistant materials for harsh marine environments, to development of new materials for information and energy technologies, and novel regeneration strategies to replace diseased or damaged tissues in humans and animals.

Engineering

Engineering continues to be a strategic sector – a source of new products and knowledge-based services for international export, as well as a key element in the productivity and competitiveness of Atlantic Canada’s resource industries. Several of the region’s leading institutions are building on long-recognized excellence in this area to meet the needs of the future on both land and sea.
The Faculty of Engineering at Dalhousie University has extensive facilities for the study of fisheries technology, minerals engineering, development of intelligent structures and innovative materials, degradation of materials, advanced design and manufacturing, and information and communication technology and environmental technologies. In addition to taking first year students into engineering, Dalhousie also facilitates the transfer of engineering students after two years of study at its Associated Universities: Acadia, UPEI, St. Francis Xavier, St. Mary’s and University College of Cape Breton.

Memorial University has a major and growing capacity in ocean engineering. The university has identified Ocean Engineering and Structures as one of three key areas of investment under its broad research priority of Oceans and Coastal Studies. Its capabilities include the Centre for Cold Ocean Resources Engineering, the Centre for Marine Simulation, and the Ocean Engineering Research Centre. These units do everything from testing off-shore equipment to improving aquaculture methods to developing methods for detecting icebergs:

- Research at the Centre for Cold Ocean Resources Engineering (C-CORE) includes remote sensing target detection, shore-based ground wave radar technology used for long-range detection of ice hazards, and Coastal Ocean Dynamics Applications Radar (CODAR). C-CORE is also the site of Canada’s largest centrifuge facility which expands C-CORE’s strengths in cold ocean science, space and environmental fields. In July 2002, C-CORE received AIF support to migrate its core expertise to develop technical solutions to industry-identified problems in other natural resource sectors such as mining, forest products and terrestrial gas pipelines.

- The Ocean Engineering Research Centre (OERC) is involved in research and development, including consulting services for the offshore and shipbuilding industries, scale model experiments, numerical modelling, software development and structural testing. Areas of research include sea-ice and ice structure interaction, hydrodynamics (especially propeller hydrodynamics), wave/structure interaction, offshore structures, and ocean monitoring and instrumentation.

- Memorial University in collaboration with C-CORE, also hosts the J.I. Clark Chair of Intelligent Systems for Operations in Harsh Environments. This senior research chair position is building upon Memorial’s strength in robotics and intelligent control systems for the mining, oil and gas, and aquaculture industries. Memorial, in collaboration with the National Research Council’s (NRC) Institute for Marine Dynamics (IMD), is also leading the way in research related to autonomous underwater vehicles. Research in this area will have a significant impact on the use of AUVs for environmental monitoring of discharges of produced water, drilling muds and cuttings in the offshore oil and gas industry. The research includes the development of AUV technology, the building and testing...
of an AUV and the use of existing vehicles for monitoring missions.

The University of New Brunswick Fredericton houses comprehensive and advanced engineering research facilities. It has an extensive network of laboratories and industrial research chairs in pulp and paper engineering, nuclear engineering, construction, advanced instrumentation, geomatics and ocean mapping and technology management. It is developing strengths in such new areas as computer engineering, advanced materials, gas technology, infrastructure management and environmental engineering.

The Faculty of Engineering at Université de Moncton offers bachelor’s and master’s programs in civil engineering, electrical engineering, industrial engineering and mechanical engineering. Research activities are focused in the following areas: high-performance concrete, structures, hydrology, environmental engineering, geotechnical engineering, power electronics, ergonomics, computer integrated manufacturing, maintenance and reliability engineering, production and warehousing logistics, fluid mechanics, energy conversion, refrigerants, modelling of robotic systems and mechatronics.

In conclusion, core technologies are the key to the innovativeness, productivity, competitiveness, and sustainability of the region’s industries. Development of these core technologies will enhance the knowledge intensity of the region’s resource based and traditional industries, enable the development of new, higher-value products and services, and promote the overall competitiveness of the regional economy. Taken together, the rapidly expanding and diversifying strengths described above hold enormous potential for the development of Atlantic Canada. Continued investment, coupled with a strong emphasis on partnership among institutions and with the private sector, will reap major returns for the region and for Canada.

Rich, Value-Added Resources

The Atlantic region’s rich resource base has traditionally been a source of exports, employment and wealth throughout the region. These benefits, however, have been accompanied by disadvantages of a seasonal, low-skilled, low value-added economy. In recent years, development emphasis has shifted from replacing these industries, to building and moving up the value chains associated with those sectors. Increasingly, these industries – agriculture, forestry, fisheries, mining, and more recently aquaculture and oil and gas – also form the foundation for a year-round economy based on high-value, exportable products and knowledge in such areas as:

< offshore oil and gas production systems and services.
< premium branded and high value added products such as nutraceuticals and biopharmaceuticals;
< animal and fish health; and
< food production and processing systems.
Oil and Gas

The East Coast petroleum industry holds great promise for the creation of an economically powerful and technologically competitive industrial base for Atlantic Canada, and will enhance continental energy security and Canada’s balance of payments. However, the experience of other frontier jurisdictions and that of Atlantic Canada itself to date has demonstrated that industrial benefits depend on the region’s ability to participate fully in the technological innovation and engineering design process. The geological and environmental challenges on Canada’s East Coast demand innovative technological solutions, and the region’s post-secondary institutions are moving to provide those solutions.

These strengths are evident in a major initiative recently supported by the Atlantic Innovation Fund, led by Memorial University and including Dalhousie and UNB. Its objective is the development of world-class technology and skills, which not only meet the needs of the petroleum sector in Atlantic Canada, but also position the region as a leading exporter of innovative products and services to marine and offshore petroleum markets worldwide. In consultation with the private sector, the partners will conduct research in five key target areas: exploration, development, production, pipelines, and refining. These build on existing capabilities in the region, including the following:

< Memorial’s wide-ranging capabilities and infrastructure in ocean research and engineering (described above), and its long involvement with the development of Newfoundland’s offshore oil resources, have established it as an internationally recognized leader in this field, with particular expertise in offshore production in ice-prone waters. Memorial is host to several senior research chairs, including the Canada Research Chair in petroleum geoscience and the Petro-Canada Chair in applied seismology. Applications are in place for Canada Research Chairs in areas such as asset integrity management, petroleum reservoir engineering and characterization, and autonomous underwater vehicles. Memorial is also home to the Decisionarium, a 3D visualization centre used for imaging of geological structures, and modelling and visualization of hydrodynamic flows. Key research areas for Memorial include reservoir characterization, geology and advanced seismology, immersive visualization and simulation, underwater operations and intelligent systems, asset integrity management, and socio-economic and environmental impacts and issues. New researchers and equipment will be put in place in a number of these areas. The impact of this capacity will be leveraged through expanded research partnerships with national and international academic institutions and with industry.

< Dalhousie has appointed an endowment-supported Killam Chair, and initiated the Atlantic Canada Petroleum Institute, which is currently being restructured to become a fully pan-Atlantic institute. This initiative involves substantial support
from the private sector, and collaboration with other universities in Atlantic Canada. The university plans to allocate three Canada Research Chairs in this area, and is currently engaged in a planning process for their deployment. The Faculty of Science is also developing and expanding geosciences expertise related to exploration and development of offshore oil and gas.

< The University College of Cape Breton has identified petroleum development and operations as one of its four strategic research priorities. Its Centre of Excellence in Offshore Petroleum, established in 1999, engages in applied research on the technical problems related to drilling, production, and operations, such as gas and liquid processing, flow properties, and pneumatic controls, as well as commercial applications, technology transfer, testing, and simulations. Facilities include:

< the Shell Canada Process Operations Lab, a pilot plant facility with equipment demonstrating plant process technology, including fractionation and distillation;
< the Petroleum Simulation Lab, the main learning facility for the petroleum students and a site for research projects associated with reservoir studies and hydrocarbon production simulation and analysis; and
< the newly redesigned Fluid Flow and Measurement Lab, with state-of-the-art equipment in fluid flow measurement devices as well as a full meter run and meter proving facility.

< At Acadia University, there is significant interest in various facets of oil and gas research. Research associates of the Acadia Centre for Estuarine Research have expertise in such areas as toxicology of fresh and coastal waters and ecotoxicology of coastal waters. The Wetlands laboratory infrastructure in the new Irving facility, not available elsewhere in the region, will provide controlled laboratory conditions for estuarine studies and environmental impact studies of oil on coastal sediments. Expertise in ocean modelling and the kinetics of oil and gas reactions are areas of expertise that would be of value in collaborative research efforts.

< St. Francis Xavier University is building upon and complementing its existing oil and gas-related research strengths, and those of others in Atlantic Canada and elsewhere, by the creation of the Centre for Applied Petroleum Sciences. The Centre, which in July 2002 was awarded support from the AIF, will focus on applied research and the development of commercial applications in niche areas related to surfactants, fluid inclusions, organometallic catalysis, bacterial activity, and onshore petroleum potential, and in its more broadly-based areas of expertise in high performance computing. StFX has allocated four (4) Canada Research Chairs (Colloid Chemistry, Physical Oceanography, Petroleum
Geochemistry, and Modelling and Simulation) and $16.11 M of its own funds for this major initiative ($31.36 M). StFX is also collaborating with other universities, with government agencies and with the private sector in these research areas.

As well, StFX is establishing complementary CRCs in Aquatic Ecology and in New Economy and Governance in Atlantic Canada. The latter, along with colleagues in the StFX Political Science Department, will research issues relating to the management of offshore resources and will add an important public policy dimension to the region’s expertise. StFX has been playing an active role in the restructuring of the Atlantic Canada Petroleum Institute; the university will be an active member of this revitalized pan-Atlantic organization. StFX’s new Charles V. Keating Millennium Centre is also providing a state-of-the-art conference and training facility for industry in northeastern Nova Scotia.

The University of New Brunswick’s commitment to oil and gas development centers on both on- and off-shore reservoir evaluation through utilization of comparative models based on modern sedimentary environments and associated biogenic activity, in conjunction with innovative imaging and visualization techniques (MRI, CT scanning, electron microscopy). The latter enterprise involves researchers from geology, physics, and both chemical and mechanical engineering. Additional expertise in hydrocarbon transport has been developed in chemical engineering.

Saint Mary’s University is committed to maintaining and expanding its strong existing partnerships with both government and industry in the field of oil and gas geoscience. The University has proven expertise on Scotian basin geology and has hired a new faculty member to study Carboniferous basins. Perhaps the most exciting research efforts are in petroleum chemistry: sweetening of sour gas using ionic liquids; fingerprinting of oil sources using gas or liquid chromatography and mass spectroscopy to characterize oil/gas from exploration sites with potential commercial value; and studying the interaction of petroleum derivatives with particulates to investigate transport of contaminated sediments.

**Premium Branded and High-Value Products**

The region’s resource industries hold promise for a wealth of high-value, knowledge intensive products, building on the region’s image of quality in both the environment and in its production systems. Examples of these opportunities include nutraceuticals and biopharmaceuticals, high health breeding stock, and premium products.

The region’s bioresources hold great potential for the development of bioactive compounds upon which to base a range of high-value exportable products in the rapidly growing
functional food, nutraceutical and biopharmaceutical sectors. Indeed, this area represents the single most promising knowledge-based opportunity to build on the region’s bioresource industries. That was the conclusion of a recent roadmapping and implementation planning exercise undertaken by the National Research Council in conjunction with partners in Prince Edward Island and the region.

The region has considerable strength in bioactives research, dispersed throughout a number of its universities and research institutions as well as a number of strong, science based private sector firms. In July 2002, the AIF awarded support to several projects in this area, including a UPEI-led initiative for an Atlantic Canada Bioactive Compounds Network, an award to the PEI Food Technology Centre and a partnership between the U. de Moncton and the Beausejour Medical Research Institute to develop cancer-preventing nutraceuticals and functional foods. The Chemistry Department of Mount Allison University conducts NSERC funded research in bioactive compounds, and has specific expertise in the area of antioxidants. Moreover, a recent US provisional patent for a bioactive compound, coming out of the Biology Department, may lead to applications in therapeutics and pain relief. These projects seek to develop a science-based critical mass in a new industry sector which is currently fragmented and not yet geared to the emerging regulatory and quality environments. By developing science-based products based on bioresources in which the region has a comparative advantage, the region’s universities are fostering a strong competitive advantage in the rapidly growing worldwide nutraceutical and biopharmaceutical markets – building a cluster uniquely equipped with a critical mass of scientific researchers, integrated technical infrastructure, outstanding GMP manufacturing facilities, and commercial attitudes oriented to global markets and strategic alliances.

Livestock genetics comprise another major opportunity, as a major component of Canada’s annual $5 billion in livestock exports, and an area where Canada is internationally recognized for excellence. Atlantic Canada has particular strengths through the moderate size of its industry, the structure of small independent herds, the cohesive industry organizations, and the outstanding research and innovation support available from the Atlantic Veterinary College and the Nova Scotia Agricultural College. These opportunities are being pursued through the AVC’s current efforts to develop a high health swine industry on PEI, and the NSAC’s recent Dairy Atlantic proposal, in partnership with AVC and other organizations including Acadia University.

Premium and branded food and forest products are an area of broad potential. Significant capacity exists in a number of institutions in these areas:

- The University of New Brunswick and the Université de Moncton have substantial expertise in forest products. In partnership with UNB Fredericton, UNB Saint John offers a Forest Products Marketing track to full-time MBA students. This innovative program focuses on forest
products commerce within the existing UNB Saint John MBA program. The track’s first three modules are delivered on the Saint John campus. Nine forestry courses are then delivered by UNB Fredericton’s Faculty of Forestry & Environmental Management during modules four and five.

The Université de Moncton and UPEI also have strong programs in food science, complemented by PEI’s Food Technology Centre.

The Nova Scotia Agricultural College is home to the Organic Agriculture Centre of Canada, and plans to establish an internationally known Centre of Excellence in this field within five years.

Dalhousie hosts the Canadian Institute for Fisheries Technology, where a major initiative involving many private sector partners is underway in the development of new educational programs and applied research initiatives in Food Sciences.

StFX’s Food Research Laboratory, in conjunction with the Department of Human Nutrition, has a strong record of interdisciplinary research on seafood, dairy products and canola, using spectroscopic, chemical and mathematical methods of analysis.

Animal and Fish Health

Health is a technology-intensive, high-value, and rapidly growing industry. While the region’s strengths in human health are discussed later in this paper, the area of animal and fish health also represents a major opportunity for the region to build on its bioresource base and expertise. Several Atlantic institutions have substantial capacity in this promising field.

UPEI’s Atlantic Veterinary College is a world leader in the health of fish, shellfish, and crustaceans. The university has identified Aquatic Science as a priority, with emphasis on the health, distribution, conservation, and aquaculture of natural resources in aquatic ecosystems. Almost twenty researchers are engaged in this area, including a seven-member finfish Population Health Research Group. Fish health research facilities include the CFI-funded Centre for Marine and Aquatic Research which complements the extensive in-house facilities in which virtually any type of aquatic environment can be created. AVC is also home to the Lobster Research Centre, and conducts further research at its Cardigan Fish Hatchery. In addition, industry and provincially supported field research is carried out in conjunction with commercial fin-fish and shellfish producers. This capability forms the core of UPEI’s commercial spin-offs to date, with the establishment of for-profit firms in the areas of fish health consulting and international training under the umbrella of AVC Inc. In July 2002, AVC received support from the AIF for two
projects: expanded R&D capacity in lobster health at the Lobster Research Centre, and support to the Centre for Aquatic Health Sciences to expand its work.

As well, the AVC has a strong and diverse capability in the area of livestock health. Areas of emphasis include swine health and the development of a high health swine industry on PEI, supported by a new swine research facility; dairy health; and equine health. Building on close working relationships with these industries, AVC research focuses on population health through epidemiological studies.

The Nova Scotia Agricultural College also has strong and diverse capabilities in livestock health and aquaculture. NSAC has recently erected a new Aquaculture Centre, and has identified Aquaculture Nutrition as one of its six strategic research priorities. Its research program over the next five years will define the nutritional requirements for marine finfish and shellfish, establish alternative protein sources for carnivorous fish, and develop salmonid diets which respond to changing seasonal nutrition requirements and minimize the release of N and P into the water, thereby enhancing both profitability and sustainability for the industry.

Faculty members associated with the Centre for Coastal Studies and Aquaculture at UNB Saint John are conducting a wide range of research on a local, national and international scale. Fundamental research topics include the behaviour, ecology and physiology of seaweeds, snails, salmon, sturgeon and seals in New Brunswick and as far away as Antarctica. Integrated aquaculture research is investigating the use of marine plants and bivalves to reduce nutrient levels adjacent to finfish aquaculture cages and provide additional revenue sources. Bivalve feeding, new species for rearing in aquaculture facilities (especially haddock and flounder) and marine mammal predation on cage sites are also under investigation. The Canadian Rivers Institute, a bi-campus initiative at UNB, has also developed expertise in fish physiology including the physiology and metabolism of salmonids.

The Université de Moncton, through its Department of Biology and the Shippagan Campus, is developing research programs in aquaculture and fish health. Two CFI grants have been obtained to support these research programs.

Mount Allison’s Department of Geography is participating with the Université de Moncton’s Department of History and Geography in a joint research project funded by AquaNet that examines property rights, aquaculture and mariculture, and takes a multidisciplinary approach to institutional changes arising from variations in ocean resource use practices.

StFX’s Department of Biology is leading the development of the Invasive Marine Organisms Network, as part of the
Atlantic Environmental Science Network (AESN). Combining pure science with major economic issues, the Invasive Marine Organisms Network is an interdisciplinary group of Atlantic researchers who will coordinate the study of invasive species (e.g., green crab) and their impact on the commercial fisheries (e.g., lobsters, oysters, mussels, rock crab, clams).

**Bioresource Production and Processing Systems**

The region’s resource industries hold potential on many fronts for the development of a knowledge-based economy throughout Atlantic Canada’s rural regions. In addition to the knowledge-based services and high-value end products described above, the resource industries also hold broad promise for the development and sale of technologies related to the production and processing of resources. As can be seen from the foregoing discussion, strong capabilities in this area exist in a number of the region’s institutions, including:

- oil and gas at Memorial, Dalhousie, Saint Mary’s University, StFX, and UCCB;
- forestry and forest products at the University of New Brunswick, Université de Moncton, and Dalhousie;
- agriculture and fisheries at the Nova Scotia Agricultural College, UPEI, Université de Moncton, Memorial, Saint Mary’s University, and Dalhousie; and
- aquaculture at UPEI’s Atlantic Veterinary College, Nova Scotia Agricultural College, the University of New Brunswick, Memorial, Dalhousie, and Université de Moncton.

These capabilities will be furthered through several AIF awards announced in July 2002. In addition to the Pan-Atlantic Petroleum Systems Consortium noted earlier, the AIF also supported work by MUN’s Canadian Centre for Fisheries Innovation to undertake an eight-part research program in support of the region’s fishery and aquaculture sectors and a project by MUN’s Ocean Sciences Centre to support the establishment of an Atlantic commercial cod aquaculture industry and assist development of a halibut aquaculture industry; support for the College of the North Atlantic to establish a Geospatial Research Facility for Terrestrial Ecosystems at its Corner Brook campus.

**A Healthy Society**

Health and culture are increasingly recognized as essential elements of a knowledge-based economy and society. Innovation and development in these areas build social and human capital, reduce public expenditures, and foster the entrepreneurial spirit, energy, and the social cohesion to compete and thrive. In so doing, health and culture themselves become a source of wealth and competitive advantage. Here, too, the potential of the Atlantic region is only beginning to be tapped.
In the health sector, particular strengths exist in the areas of:

- life sciences
- e-health
- health policy and population health.

**Life Sciences**

The region’s research in health-related life sciences has traditionally been centred at its two medical schools, at Dalhousie and Memorial Universities, and these institutions continue to make health a priority. Their strengths are complemented by growing emphasis and capabilities at a number of other universities in the region.

- At Dalhousie University, Health Studies represents the largest and most diverse area of research strength, accounts for over 60% of all external institutional research support, and is one of two Areas of Special Emphasis in the university’s research plan. It embraces the three Health Science Faculties of Medicine, Dentistry and Health Professions, as well as elements of the Faculties of Architecture, Arts and Social Sciences, Computer Science, Engineering, Law and Science. An essential component of this interdisciplinary environment is Dalhousie’s close working relationship with the four affiliated teaching hospitals, as well as with the Atlantic provincial Departments of Health and other provincial and regional bodies, and with the NRC Institute for Marine Biosciences.

- Dalhousie University proposes to build capacity in health research and research training in three broad sub-areas:
  - biomolecular structure and function, genomics and genetics, discussed above in the section on Biotechnology and Genomics;
  - clinical research and translation to care; and
  - health, environment and society, discussed in Population health below.

  Between these three sub-areas there is extensive interaction and interdependence. They are further connected by three cross-cutting themes: health informatics, bioethics, and health law.

  In the area of clinical research and translation to care, current or planned major initiatives involve clinical trials, health outcomes, and health services, with a particular focus on cardiovascular, cancer care, microbial genomics, infectious diseases and vaccines, brain repair and pain, mental health and addiction research, transplantation and development of drug policy. Dalhousie has several major research initiatives concerning the control of chronic intractable pain from accidents, cancer and degenerative diseases and in the diagnosis and management of pain in infants and children.

- Memorial’s Faculty of Medicine accounts for one-sixth of the university’s total external research support. Memorial
has major research initiatives concerning colorectal cancer, recovery from stroke, hepatitis B and C, basic cancer research and bone metabolism. Clinical trials are carried out through the Patient Research Centre of the St. John’s Health Care Corporation, which is responsible for liaising with industry to link research projects with appropriate investigators, hiring and training research nurses, contract negotiation and budgeting, facilitation of ethics review and access to community research networks.

Memorial places strong emphasis on partnerships and interdisciplinary approaches to health research. Researchers at the Faculty of Medicine work closely with the School of Pharmacy, the School of Nursing, the Health Care Corporation of St. John’s Newfoundland Cancer Treatment and Research Foundation, the Newfoundland Centre for Applied Health Research and the Faculty of Engineering and Applied Science to conduct health research projects ranging from genetics and clinical epidemiology to health policy research and contract clinical trials. These partnerships are enhanced by close physical proximity, as many of the partners are located in the Health Sciences Centre at the St. John’s campus. In the spring of 2000, further impetus was given to health research through establishment of the Office of Marketing and Development for Health Sciences Research, with a mandate to increase the level of investment in all aspects of health sciences research within the university, to foster closer ties with the pharmaceutical companies that support such research, and to increase public awareness. The office also acts as a liaison for companies interested in carrying out research in Newfoundland and Labrador by linking them with appropriate investigators.

An example of interdisciplinary research is SafetyNet, a community research alliance on health and safety in marine and coastal work. Operating under the umbrella of the Newfoundland and Labrador Centre for Applied Health Research, SafetyNet consists of nine inter-related research projects in fisheries, oil and gas, and cold working conditions. Another initiative is the Anakin Project -- an attempt to make it easier for health professionals in remote locations to update their skills in neonatal resuscitation methods through mechatronics, the science of integrating electronic devices into mechanical ones. Named after the child protagonist of the Star Wars saga, Anakin is a group effort of Engineering, the Faculty of Medicine, and the Janeway Children’s Health and Rehabilitation Centre to develop computer software instrumentation packages that will render neonatal mannequins more lifelike and improve their utility for distance education.

At the University of New Brunswick, Health and Human Wellness is one of the five core research themes. In Fredericton, the Institute of Biomedical Engineering has gained international recognition for its work, including its focus on understanding the characteristics of biomedical signal processing. Equally acclaimed has been
bioinformatics and functional genomics work linking researchers in Molecular Biology with those in Mathematics and Computer Science to combine computational analysis with molecular biology and genetics.

The Faculty of Nursing at the University of New Brunswick Fredericton brings a holistic, primary health care perspective to interdisciplinary, intersectoral research directed at enhancing health across the lifespan, providing evidence to support health public policy and programs, and determining the best practices for health care delivery. Current faculty research efforts focus on vulnerable populations, living with a chronic illness, caregiving, health practices and education.

Health and life sciences has recently been determined as an axis of priority of development at the Université de Moncton. Besides having relatively strong research groups in different fields related to health, the Université de Moncton has recently created the Faculty of Health Sciences and Community Services. The new faculty includes the School of Food Science, Nutrition and Family Studies, the School of Kinesiology and Recreology, the School of Nursing and the School of Psychology. Also, the Faculty of Sciences is developing research programs in medical biotechnology and nutraceuticals. The Université de Moncton has recently signed a collaboration agreement within the Institut de recherche médicale Beauséjour and the Beausejour Hospital Corporation in Moncton.

Across the University of Prince Edward Island, health has been identified as a main research theme and health research is viewed broadly to include both human and animal health. The PEI Health Research Institute was recently established at UPEI and its affiliated researchers are currently work in the areas of cardiovascular and respiratory health, cancer research, drug and environmental exposures, health services and promotion, human development and cognition, and nutrition, metabolism and diabetes. Within the Faculty of Science a strong research program in human health is conducted along several foci. Foremost among these are “disease prevention,” focussing particularly on the role of diet, and on pharmaceuticals and nutraceuticals. UPEI’s School of Nursing’s research interests centre on health promotion and conceptual models of nursing. The AVC’s comparative biomedical science focus encompasses numerous aspects of animal and human health and disease, elucidating cross species similarities and differences through enhanced understanding of basic disease mechanisms.

Mount Allison has identified health-related research as an emerging research strength, one of four strategic research themes, with three areas of particular emphasis:

In the area of pharmaceutical chemistry, three
current and upcoming faculty in Chemistry are creating research strength in drug development and the role chemistry plays in medicine, with AIF support in July 2002 for some aspects of the work;

In the area of biophysics, recent appointments in field of X-ray diffraction, and in atomic, molecular, and laser physics have complemented established research strength in astrophysics. A Tier II Canada Research Chair is now in place and has been designated as a CIHR chair by the Tri-Council secretariat. The Chair’s research program in biophysics concerns itself with the study of lead exposure and lead dynamics within the human body;

Health psychology is an emerging area of research strength. Faculty engage in research on aging, palliative care and behaviors affecting health. Recent appointments in areas of human developmental psychology, and in neuropsychology, have increased research capacity in the area, and this will be further enhanced through the establishment of a Canada Research Chair in Health Psychology.

E-Health

The application of information and communications technologies to the field of health holds great potential to enhance the quality and efficiency of health care and to promote better health outcomes. Strong increases in capacity are occurring and planned in this area.

Memorial University has a long history of leadership in telemedicine and telelearning. The university’s Telemedicine Centre has been involved in research in the use of interactive communications technologies to supplement health and education in remote areas. Slow Scan Television (SSTV) allows the transfer of still pictures and electroencephalogram (EEG) results to remote sites. Memorial's Telemedicine research has been applied in Uganda, Kenya, Scotland, the West Indies and the Philippines. Memorial has identified E-health as a sub-theme within its overall research priority of health. In addition to the development of new integrated communication and media technologies, Memorial University will also focus its research on issues associated with E-health, such as regulations, information systems and integrated practice through distance.

A recent initiative by Memorial University’s Office of Professional Development in the Faculty of Medicine offers new opportunities for the education of rural physicians in Canada through a new Web portal, RuralMDcme.ca, launched in January 2002. The portal, developed in partnership with ZeddComm, an IT firm, currently offers online courses on dementia/Alzheimers, emergency medicine, telehealth, whiplash and back injuries, diabetes, and hypercholesterolemia. The project began in February 2001 with support from Health Canada's Rural Health Fund, and received further support from the Atlantic Innovation Fund in July 2002 to develop additional courses
and practice management tools. Other partners include the University of Calgary, the University of Ottawa, the University of Alberta, Pfizer Canada, medical and government groups, and the private sector.

< At Dalhousie, E-Health is one of five sub-themes within the university’s research priority of ICTs. The field is emerging as a multi-disciplinary area that addresses how to improve the productivity of patient health care, and is a central focus of Dalhousie’s new Global Information Networking Institute (GINI). Current research areas include medical outcomes, quality of service, privacy and patient records, and data compressions.

< The University of New Brunswick’s Institute for Health Studies at the Saint John campus is developing as a virtual hospital, linking world-class telecommunication providers to virtual health care delivery systems. The University of New Brunswick Saint John enjoys excellent working relationships with the Atlantic Health Science Corporation, a leader in innovative medical service delivery; Aliant, a leader in telecommunications and network infrastructure; the National Research Council of Canada, and other private-sector organizations interested in e-health initiatives. Building on the success of several past projects, the Electronic Commerce Centre and all three faculties at UNB Saint John are currently working on several e-health related initiatives with their partners.

< UPEI’s Atlantic Veterinary College is a leader in the application of ICTs to animal health though such initiatives as its APHINet system for promotion of livestock herd health.

Health Policy and Population Health

The environmental and social determinants of health form an increasingly important focus for health research and provide an opportunity for a number of the region’s universities to contribute to research on health policy, population health, and health promotion and prevention.

< Dalhousie University has identified Health, Environment, and Society as one of three sub-themes under its overarching theme of Health Studies, and plans to deploy a Canada Research Chair in each of three categories: Social, Cultural and Environmental Determinants of Health; Sector Health (health of children, youth, women and the aged); and Health Promotion and Education:

< Social and cultural determinants of health, population health and health policy are areas of strengths and expertise that are coalescing at Dalhousie, and will be further strengthened through a recently approved Statistics Canada Regional Data Centre in Halifax.

< In environmental determinants of health, Dalhousie has a long established tradition in developing and evaluating proactive measures for protecting health
through improvements to the environment, through the School for Resource and Environmental Studies, the Centre for Water Resources Studies and participation in the Atlantic Environmental Design initiative. The Elizabeth May Chair in Health and the Environment is also dedicated to environmental determinants of health.

In Sector Health, Dalhousie has established strengths in the areas of health of children and youth, women, and the aged.

Health promotion at Dalhousie has been successfully fostered through the Atlantic Health Promotion Research Centre which supports interdisciplinary approaches to health research that extend from the academic and health care institutions to the community.

At Memorial, the society, culture and health of populations forms one of three sub-themes within the university’s overall priority of health. Major projects in this area, by the Health Research Unit of the Division of Community Health, include the following:

A provincial model is being developed of services and programming for persons with autism spectrum disorders to achieve optimum health and well being for all ages from early childhood through adulthood. This project is funded by the Centre for Applied Health Research and by the Newfoundland and Labrador Department of Health and Community Services.

A study is underway to assess the impact of regionalization in the health care system in Newfoundland and Labrador on governance of the system. The project has been funded through the Centre for Applied Health Research.

Research is being conducted to determine the needs of blind and visually impaired aboriginal peoples in Atlantic Canada. The objectives are to identify barriers to accessing vision related services and to develop and maintain effective program delivery to aboriginal communities in the Atlantic provinces. The project will lead to better designed educational programs for preventing blindness and development of a culturally appropriate service model for aboriginal communities.

Under the University of New Brunswick’s Health and Human Wellness theme, social scientists at UNB Fredericton examine the role of cognition in coping with illnesses such as breast cancer, the conditions surrounding mental health disorders, and the challenges to social-psychological health. In another area of strength, mathematical modelling and applied statistics are used by researchers from the Department of Mathematics, in collaboration with the Department of Biology and the Canadian Research Institute for Social Policy (CRISP), to develop epidemiological parameters of population health
and wellness. CRISP, a repository for Statistics Canada databases and a research centre for the National Longitudinal Study on Children and Youth (NLSCY), analyses large data sets pertaining to significant health, education, and social policy issues.

< UPEI has identified human development and health as one of its seven constellations of research strength and a key part of its core focus of health studies. The area involves 22 researchers from five faculties and schools, is also supported by the Centre for the Study of Health and Aging, established at UPEI in 1988, and its researchers are engaged in a variety of research activities broadly related to population health, health promotion and prevention. A recently funded endowed Chair will also pursue work in this area.

< St. Thomas University’s Centre for Research on Youth at Risk brings together faculty from Social Work, Criminology, Psychology, Education, Sociology, and Native Studies. In addition, faculty members from universities in all parts of the country hold positions as research fellows. The CRYAR also partners with a wide range of community organizations. Current CRYAR projects include research on high-school dropout rates, adolescent eating disorders, street youth, youth violence, youth illiteracy, substance abuse, youth and sexually transmitted diseases. The university has also produced exceptional research in recent years in Gerontology; it houses an international longitudinal study of frail seniors and has a world-class reputation in the field of narrative gerontology.

< St. Francis Xavier University has a tradition of interdisciplinary and applied health-related research. Faculty in Nursing (which operates a joint StFX-UCCB program), Biology, Chemistry, Human Nutrition, Human Kinetics, Psychology, Sociology and Anthropology, Political Science, Philosophy, Religious Studies, Education, Adult Education, and the Coady International Institute are engaged in various dimensions of health research, sponsored by a wide spectrum of industry and community partners.

< The Université de Moncton has identified community health as a major research theme. Areas of emphasis include health prevention and promotion through nutrition, exercise, leisure and recreation; health in the workplace; aging with independence; and healthy communities.

< Saint Mary’s University has established the CN Centre for Occupational Health and Safety. Building on the University’s strengths in human resource management and industrial and organizational psychology, the CN Centre will promote interdisciplinary research in occupational health and safety. Research interest at Saint Mary’s University also focuses on examining how individuals’ health affects Atlantic and Canadian businesses and households. Healthy workplace and intervention studies
designed to reduce work-related psychological and physical disorders and the promotion of non-technical (i.e., decision-making and communication skills) competencies of surgical teams to reduce medical errors highlight Saint Mary’s University’s commitment to community-based approaches to social science and humanities health research.

Researchers from several disciplines at Acadia University are actively involved in research on behavioural, environmental, nutritional and psychological aspects health issues. Acadia will be bolstering this research activity with leadership from a Canada Research Chair in Health and Wellness. Through the Centre of Lifestyle Studies, research is being conducted on interventions in the ageing process, including dietary components, physical activity and immune function. With infrastructure support from the CFI, researchers are determining the potential of countermeasures to restore muscle atrophied through the ageing process and from spinal cord injuries. The Psychology Department has significant research expertise in health related issues, including research on the effects of maternal drug, alcohol and tobacco use on newborn infant development and, through the Centre for Organizational Research and Development, and in collaboration with researchers and corporate management around the world, occupational stress and burnout.

The University College of Cape Breton is home to the Cape Breton Wellness Centre which engages in research, education and community health promotion based a community development approach. The university college has been awarded an Institutional Development Grant from the Canadian Institutes for Health Research to develop its health research capacity and to establish a Cape Breton health research interest group to bring university researchers together with community partners to foster collaboration in health research.

At Mount Saint Vincent University, Child/Family Development and Aging are identified as strategic research themes, with an emphasis on the social determinant of family health across the lifespan. Leadership from a Canada Research Chair in Aging and Caregiving Policy, and from the Nova Scotia Centre for Aging located on campus, will coordinate graduate and research projects on the analysis and improvement of social support for caregivers. At the Maritime Data Centre for Aging Research and Policy Analysis, established with support from the Canadian Foundation for Innovation, sophisticated analysis of data collected on home care, caregivers, and the future of the health care system as the Canadian population ages, will allow researchers to translate their findings into practical tools. Health research capacity will be enhanced in home and continuing care, and in child health and development. Policy analysis and policy development are embedded in Atlantic initiatives.
A Vibrant Culture

The vibrant, distinctive cultures and heritages of the region’s communities are a rich source of content for the global information and entertainment industries and a magnet for the growing high-end cultural and educational tourism sector – two of the most rapidly growing industries worldwide. Through the application of core technologies to the cultural sector, new forms of cultural expression such as multimedia offer further potential for growth. Growing emphasis throughout the region on entrepreneurship holds promise to foster a more outward-looking, innovative, risk-taking society in the region.

Most of the region’s universities address issues related to the region’s culture and heritage within their social sciences and humanities, creating a strong foundation for Atlantic Canadians’ self-awareness, confidence, and attachment to place. In many cases, comparative approaches create national and international linkages and relationships. This work also creates a rich resource of educational and entertainment content for possible development. This area represents a particular strength for some of the region’s smaller undergraduate universities:

- Memorial University has named North Atlantic/Newfoundland and Labrador Studies as one of its four research priorities. Its Institute for Economic and Social Research (ISER) specializes in empirically based social scientific research in Newfoundland, Atlantic Canada, the eastern Arctic and the North American rim.

ISER has attained a reputation as a leading social science research institute and is currently engaged in a large cross-disciplinary research project on the sustainability of communities in cold ocean coastal environments. The university plans to strengthen its research in archeology, cultural ecology, linguistics and the cultural milieu of Newfoundland and Labrador to sustain a world leading authority in these areas. The challenge of developing public policy and practice that reflect a broad range of social and economic issues will be pursued in the context of the province and how these issues relate in an international context.

- The University of Prince Edward Island has identified “island studies” as one of its two main research themes across the university. Island studies research is a multi- and inter-disciplinary effort that involves comparative research on small island jurisdictions and their economies, geographies, environments, cultures, politics, public policies and literatures. UPEI’s long-term objective is to establish UPEI as Canada’s centre of excellence for the study of islands. An interdisciplinary graduate program is planned, and this sector will receive UPEI’s Canada Research Chair in the social sciences.

UPEI is also the site of a major CFI-funded initiative to establish the Centre for Culture, Multimedia, Technology and Cognition which seeks to not only create a digital library of regional cultural content but also to understand...
the cognitive underpinnings of interactive and multimedia learning technologies.

< St. Francis Xavier University is a long-established centre of cultural activity and research in Atlantic Canada. The Celtic Studies Department, which has been instrumental in salvaging and reinvigorating the study of Scottish Gaelic in Atlantic Canada, ranks with the leading Celtic Studies programs in North America (including Harvard's). The department's innovative initiatives have led to a renewed pride and interest in Scottish-Gaelic culture among all age groups – both residents of northeastern Nova Scotia and visitors to the area. The Art Department includes some of Atlantic Canada's best artists; their compelling work reflects the essence of our people and landscape. Faculty in the Music Department are well-known in Canada and beyond as teachers, composers and performers of jazz. Theatre Antigonish, Nova Scotia's longest-running professional repertory theatre festival, has attracted tourists to northeastern Nova Scotia since 1988. StFX is also home to a number of award-winning creative writers, whose work interprets our culture to the world and whose writing workshops draw visitors young and old to our region. StFX's new Charles V. Keating Millennium Centre now offers a world-class venue for large-scale cultural events and conferences in northeastern Nova Scotia.

< The University of New Brunswick has established New Brunswick as a Socio-Cultural Environment as one of its five research priorities, encompassing a wide range of research into social, cultural, educational, and political issues.

The Electronic Text Centre at the University of New Brunswick is a multi-faceted electronic publishing enterprise. The Centre leverages academic, private, and public partnerships to provide leadership in the development of scholarly electronic publishing.

< The Université de Moncton and the Université Sainte-Anne both address aspects of the Acadian culture and heritage. Université de Moncton has identified the focus of its social sciences and humanities as the study of the Acadian language and culture, encompassing issues of bilingualism, minority status, and French language education. At the Université Sainte-Anne, the Centre Acadien conducts research into Acadian history and genealogy. Furthermore, a Canadian Research Institute on Linguistic Minorities has recently been announced and will be implemented in the near future.

< Dalhousie has an international profile in Arts and Culture Research, and produces four internationally distributed journals in these areas. Its work in literary, historical, linguistic and philosophical studies and in the performing arts is enriched by multiple linkages with regional and national arts and heritage organizations, industries and departments. These linkages make it a major contributor to
Leading to Competitiveness: Atlantic Canada’s Knowledge-Based Future

At the University College of Cape Breton, the Beaton Institute is a research centre and archives mandated to collect and conserve the social, economic, political, and cultural history of Cape Breton Island. The Institute houses the Mikmaq Resource Centre which, along with the Mikmaq College Institute, contributes to research and education in Mikmaq Studies, an area of concentration within the university’s arts degrees. The latter offering is just one example of the programming offered through the Department of Cultural, Heritage and Leisure Studies which was established in 1994. There are also extensive offerings and active faculty research in Celtic Studies and Gaelic, supported by the Beaton Institute, the University College Library’s highly specialized Scottish Collection and a federation agreement with St. Ann’s Gaelic College. The University College has recently launched an arts major and a visiting scholar series in Cape Breton Studies. The institution is also well-known for its extensive involvement in drama, playing an important role in the development of some of Canada’s best-known playwrights, and houses two national-standard art galleries.

Mount Allison University has named Canadian Studies as one of its four research priorities. The university created the Centre for Canadian Studies in 1969, one of only a few such in Canada, and possessing a wide range of expertise in Maritime and Canadian history, literature, geography, economy, sociology, etc. One of the more important research projects coming out of The Centre is near completion. Entitled Canada Today: A Democratic Audit, this multi-year project will result in a series of books (in partnership with the University of British Columbia Press) examining the status of Canadian democracy at the outset of the 21st Century. Critical Cultural Theory forms another of Mount A’s four areas of priority.

Acadia University has a long tradition of research pursuits that examine diverse cultures and civilizations. With the research activity of the Centre for Planter Studies and with expertise in Atlantic history, culture and politics supports, Acadia has identified Culture and Civilization as a strategic priority, and in particular, the history and culture of the Gulf of Maine region. As well, building on its traditional music program, the School of Music at Acadia has developed a program in Music Technology that explores the exchange of creativity between music and computers. Students study the theoretical and practical applications of technology and transform their laptop computers into mobile recording studios.

Arts and culture are the focus of the Nova Scotia College of Art and Design. More specialized niches exist at universities throughout the region in such areas as music,
the performing arts, and literature.

< Mount Allison University, for example, offers a splendid environment for specialized work in music and drama.

< The study and performance of music has been a special feature offered by the university since 1874. Today its versatile faculty provide a thoroughly professional experience for emerging performers; and faculty engage in serious research to do with topics of broad interest to musicologists and cultural historians.

< The Windsor Theatre is the laboratory for Mount Allison’s Drama program. It is the locus of a vibrant culture of theatre production, stage design, acting and directing. The Theatre typically offers between eight and ten productions yearly. In addition, *Tintamarre* is Mount A’s unique bilingual theatre troupe, which presents collaboratively developed bilingual productions on a given theme, as well as classics from the French or Quebecois repertoires (with English interpolations). The group actively tours high schools in the Maritime Provinces, and presents commissioned productions for conferences and other occasions.

< At Saint Mary’s University, the Gorsebrook Research Institute is an interdisciplinary research centre concerned with a variety of social, economic, and cultural issues specific to Atlantic Canada. The resource centre has regional data sets, audiovisual materials, theses, Atlantic Canada bibliographies and relevant manuscripts, periodicals, and articles, and is a distribution point from which all Gorsebrook publications are available. The centre is also the depository for the Nova Scotia 18th Century Newspaper Survey, the Gorsebrook’s contribution to the SSHRC funded Atlantic Canada Newspaper Survey.

< Currently, Dalhousie University, Saint Mary’s University and Université de Moncton are coordinating a broad coalition of Atlantic Universities to develop a Metropolis project that will study immigration issues in collaboration with Federal government departments and non-governmental agencies. This project will be directed towards understanding and improving the experience of immigrant populations in Atlantic Canada.

### Strong Communities

The two streams of success in today’s world – economic competitiveness and social well-being – must meet and merge at the community level. The core goal, and the central challenge, of knowledge-based development is to ensure that it benefits all communities and all citizens. To date, knowledge-based growth, while rapid everywhere, has been strongest in the cities. As growth in the cities outpaces that of rural and remote communities, the disparities in opportunity widen, and the cities
become an ever stronger magnet, attracting skilled people and investment. Recently released census results attest to the impact of these forces, with a shift of population from rural and smaller provinces to large, central provinces. Within provinces, this pattern is replicated as population shifts from outlying and rural areas to the urban centres – eroding the human and social capital of rural communities and further diminishing their attractiveness as places to live and invest.

Is this pattern inevitable? If so, it spells long-term decline for rural Canada in general and for several of its regions.

It is the premise of this paper, however, that other and better futures are possible. Atlantic Canada can and will become a model of distributed, inclusive growth in the knowledge based economy. Its cities will be home to many of its core technology industries, serving both a global market and the increasingly knowledge-based resource industries of the region. Those resource industries, dispersed through every community in the Atlantic region, will continue to increase their knowledge intensity, develop their value chain within the region, and shift toward more high quality full-year jobs. City and country will be connected to each other and the world by leading edge broadband infrastructure and technologies. The dynamic interrelationship and synergy between these two sectors will work to the benefit of both.

The Atlantic region’s most vital resource – its people – is integral to the success of this strategy. Demographic and structural economic shifts are rapidly moving Canada and other industrialized countries into an era of labour shortages. The Government of Canada notes, in Achieving Excellence, that the two ways to raise the standard of living are to get more people working and to increase productivity – and only the latter route is seen as feasible for Canada. In much of Atlantic Canada, however, both approaches are possible – creating synergistic forces for accelerated growth. The region’s lower levels of labour force participation and skills, higher unemployment, and seasonality have long been seen as part of the syndrome of problems affecting Atlantic Canada. In today’s climate, however, those features represent opportunity. Atlantic Canada’s people are an under-utilized and under-developed resource – a resource for which there is growing demand. If that resource is developed, through education and training, and accompanied by an appropriate economic and policy climate, inward investment will follow. Those investments will increase opportunities, thus holding the region’s skilled and educated people and launching a virtuous circle of further growth and development.

The region’s post-secondary institutions are the pivot point of both those strategies – knowledge creation and commercialization, and education and training. They also play an increasingly vital role in several of the areas fundamental to this vision of distributed growth in successful communities:

< the connected community;
< E-democracy;
< literacy and learning;
entrepreneurship; and
community development.

Emphasis on those areas is vital to realize the future described above. These areas also represent capabilities of great value to a global market, and will themselves become sources of high value exportable technologies and services.

The Connected Community

The potential of the Internet to foster social and economic development, particularly in rural Canada, is underlined by the emphasis which the Government of Canada has placed on “connecting Canada,” and the clear intent, in its recent innovation paper, to continue making this the centrepiece of its rural development strategy. The Atlantic region has been a leader in taking up the opportunities offered by this technology, and in making those opportunities accessible to all its citizens, and the region’s universities have shared in that leadership.

New Brunswick is a world leader in its installed ICT infrastructure, with a CA-Net 3 backbone, high bandwidth fibre optic through the province, and many homes on high speed Internet. The University of New Brunswick is maximizing this supportive environment, on both its campuses, for studying and prototyping e-commerce and e-business practices and for conducting research on ICTs, and has established the Knowledge Based Economy as one of its five research priorities. The university has partnered with the private sector on many projects which have resulted in specialized expertise in technical, e-business, e-learning, and e-governance. As well, it has maintained a significant track record in management research through the J. Herbert Smith Chair in Technology Management and Entrepreneurship on the Fredericton campus and the NSERC/SSHRC/NB POWER Research Chair in the Management of Technological Change on the Saint John campus. The Electronic Commerce Centre at UNBSJ focusses on business models and enablement issues for small to medium-sized businesses. Other innovative UNB research includes: applications of e-business to property management at the Centre for Property Studies in Fredericton, management of new paradigms, monitoring of on-line learning resources, and applications of e-learning in a number of fields.

Saint Mary’s University has expertise in the fast developing area of electronic commerce and has an interdisciplinary team working on technical and organizational problems and opportunities in this field. It led the development of the CLEAR proposal to the Atlantic Innovation Fund, an accelerator for the adoption of e-business by Atlantic Canadian SMEs. The project proposes to pool the strengths of the partners to provide a variety of services and supports to reduce barriers to and promote the adoption of e-business approaches.
At Dalhousie, e-commerce is one of five sub-themes within the ICT research priority. The university has created the first Canadian interdisciplinary Master’s degree in Electronic Commerce. The program brings together the disciplines of computer science, business and law, and provides a fertile environment for the pursuit of collaborative and interdisciplinary research. The rich array of research topics includes data security and privacy, public key infrastructure, on-line consumer protection, intellectual property protection, regulatory and jurisdictional issues, dispute resolution mechanisms, web concepts and applications for business, web architectures and networking. As well, a Masters degree program in Advanced Networking is actively subscribed and this area of research has recently received an award from CFI.

Acadia University, through the Acadia Advantage program, is at the forefront of connectedness in North America. The program, recognized for its pioneering innovation by the Smithsonian Institute in 1999, offers to all faculty and students a world-class Intranet connected to the Internet with access from the user’s preferred location. This technological development has transformed the learning environment by empowering students and leading to the development of superior communication and problem solving skills as well as an enhanced ability to work in teams. The Acadia program serves as a model, and exemplifies how a rural community, connected to the world at all times, can thrive and develop through innovation.

St. Francis Xavier University’s Centre for Applied Petroleum Sciences will have a High Performance Computing (HPC) Research Unit, augmented by a Canada Research Chair in Modelling and Simulation. The HPC Unit will carry out computer simulation with applications to the oil and gas industry in Atlantic Canada and support research programs at the Centre and elsewhere that are computationally intensive. The HPC Unit will encourage the participation of HPC users at other Atlantic universities to form a shared network, comparable to the SHARC-NET system at several Ontario universities, and participate in the national C3 computing grid.

The University of Prince Edward Island is actively exploring the use of ICT to initiate and maintain connection to the extended campus community and beyond. The Atlantic Veterinary College, for example, uses high-speed internet based video conferencing for cooperative teaching, collaborating with research colleagues, and connecting graduate students with their supervisors and mentors at a distance. UPEI is a participant in community level projects such as Industry Canada’s Smart Communities programs and leverages the use of ICT to reach many target audiences.

Through facilities like the island broadband network, the Internet, CA*net 4 and the NB/PEI educational computer network, UPEI is able to reach a much broader community; geography is overcome and virtual communities are built.
Literacy and Learning

Literacy and life-long learning will play a core role in the transformation of Atlantic Canada to a knowledge-based society. Strong capacity in this field is needed to meet the challenges of bringing levels of education among the adult population up to and beyond national averages, and closing a growing gap in post-secondary educational participation between rural and urban youth. A widespread and diverse capability in this area exists in the region’s post-secondary institutions, with a strong and growing capacity in distributed learning. Five of the region’s institutions participate in the Language and Literacy Research NCE, accounting for one-fifth the total number of researchers.

Memorial University’s Telemedicine Centre, the Division of Educational Technology and the Telemedicine and Educational Technology Resource Agency (TETRA) conduct research on the use of interactive communications technologies to supplement health and education in rural and remote areas. This research has been applied provincially and internationally. The university has the largest representation of the several in the region involved in the Telelearning NCE. In July 2002, the AIF awarded support to the Electronic Rural Medicine Strategy, an initiative to design, develop, and deliver online professional development training tools and resources for physicians.

Mount Saint Vincent University employs technology-enhanced learning delivery methods which are among the most innovative in the country. Our recent Canadian Foundation for Innovation project, Technology Learning: An Applied Centre for Education, will provide the environment to study theoretical and applied aspects of technology learning and facilitate applied research in such areas as instructional design and learning-outcome evaluation. Technology Enhanced Learning is one of its three strategic research themes, and the university will deploy one of its three Canada Research Chairs in this area. The Mount also has strengths in the areas of women’s education and literacy and adult learning.

Acadia, as a pioneer in innovative uses of technology, through the Acadia Advantage program, has placed faculty at the forefront of the field of technology and learning. The Centre for Organizational Research and Development is examining the impact of technology on the teaching and learning process at the institutional level. As part of the Canadian Language and Literacy Research NCE, several researchers are investigating how technology can support literacy and cognitive development. Under the Valuing Literacy in Canada program investigators are studying issues surrounding the implementation of effective workplace literacy programs using computer-assisted instruction. With this significant research expertise and the support of the AITT, the Canada Research Chair in Information Society, Learning and Teaching Technology, soon to be nominated, will have fertile ground to expand and develop the theme of technology, literacy and learning.
At the Université de Moncton, e-learning is being developed through faculty members and the IDITAE project, in collaboration with the e-learning group of the National Research Council established on the Moncton campus. As well, the Université de Moncton has recently obtained research projects and funding in the language and literacy research NCE.

St. Francis Xavier University’s award-winning Adult Education Department is a leader in promoting research and training in life-long learning, distance education and adult literacy.

UPEI works within the area of Literacy and Language through on-campus programs such as our Writing Centre, Learning Disabilities Services and Writing Intensive Courses across the curriculum, as well as through its electronic and outreach initiatives. As members of the NCE’s Canadian Language and Literacy Research Network, work on family literacy is undertaking with PEI’s rural and aboriginal communities.

King’s College participates in advising and reviewing interdisciplinary and “core-text” programmes across North America and contributes to the growing literature on such programmes, including methodology.

PEI’s community college, Holland College, received support from the AIF in July 2002 for the Justice Knowledge Network (JKN) initiative. This five-year R&D project builds on Holland College’s Justice Institute of Canada Centre of Excellence to create a comprehensive network of groundbreaking services, products, tools and technologies for law enforcement/correctional services organizations and their members.

Several of the region’s universities have directed their efforts to enhancing the accessibility of learning for particular groups:

The Université de Moncton and the Université St-Anne are focussed on enhancing the learning opportunities available to the region’s Acadian population and to francophones.

At Mount Allison, the Meighen Centre for Learning Assistance and Research provides support to university students with learning disabilities to enable them to achieve their academic and social potential. The Centre also conducts research, produces resource materials, and provides advocacy leadership pertaining to learning disabled adolescents and adults.

Saint Mary’s University’s Atlantic Centre of Research, Access and Support for Students with Disabilities promotes and carries out research related to the support of students with disabilities. Accessibility for persons with disabilities has long been a cornerstone of the philosophy of Saint Mary’s University. The Atlantic Centre provides services to students and to clients throughout Nova Scotia.
St. Francis Xavier University’s Centre for Educational Research in Diverse Cultures (CERDC) promotes collaborative research in multicultural education, most notably African-Canadian and First Nations education.

The University College of Cape Breton has identified Integrative Science as one of its four major research themes. The field involves the study of Western science knowledge and aboriginal knowledge, including their common ground and differences. This field, which is seen as having global significance, has achieved a massive increase in number of aboriginal students enrolled in science at UCCB. UCCB has designated a Tier 1 Canada Research Chair in this field.

Entrepreneurship and Management

Management skills grounded in an entrepreneurial spirit are fundamental to realizing the potential wealth of the Atlantic region. A number of the region’s universities have established programs in these areas, assisted by ACOA support for the enhancement of entrepreneurship support capacity. Institutions placing particular emphasis on this area include the following:

At Mount Allison University, the Dobson Centre for Microenterprise and Entrepreneurship Studies conducts research on micro-lending and small business and provides consulting services to those in this sector. The Centre also brings high-profile entrepreneurs to campus, and offers an executive-in-residence program.

The University of New Brunswick established the Dr. J. Herbert Smith / ACOA Chair in Technology Management and Entrepreneurship in 1988 to address a need for business and entrepreneurial education for engineers and others with an interest and/or background in technology. The Chair enhances and complements the activities of other industry oriented activities at UNB.

UNB Saint John’s MBA program has a workplace internship component which allows MBA candidates to become consultants who identify an opportunity in an organization, analyse its source, address the key issues to be considered, offer and evaluate alternative courses of action, and make recommendations, including clear guidelines for implementation. These internships reinforce the Program’s ties with the business community by providing expertise to help participating organizations meet their challenges. Further, through the Adopt-a-Concentration initiative, the local business community provides personnel to work with UNB Saint John MBA instructors to advise on the shaping of course subject matter, to discuss the challenges faced by their organizations, and to guest lecture on subjects of expertise. This initiative also gives organizations the opportunity to provide projects or case studies for MBA candidates to tackle as part of a class mini-research project.
The Université de Moncton has a well-established centre, the Assomption Centre for Research and Development in Entrepreneurship, which has the mandate to develop an entrepreneurial culture in the region.

Saint Mary’s University is the largest Atlantic University in business studies and is recognized for innovation in the field. Its Frank K. Sobey Faculty of Commerce, is the largest business school in Atlantic Canada, with 64 full-time faculty, and the region’s only doctoral program in business. Complementary to the new PhD program in Business Management, the university will appoint a Canada Research Chair in Human Resources Management, a crucially important aspect of the knowledge-based economy. Saint Mary’s also plans to seek private sector support for other emerging fields such as supply chain management. The Business Development Centre founded in 1989 with on-going ACOA funding provided business students (BComm and MBA) with opportunities for real-life projects including the preparation of business plans.

At Acadia, graduates from the Fred C. Manning School of Business Administration’s new electronic business initiative, based on the Acadia Advantage program, provides graduates with an enhanced skill set. This program develops managerial and strategic views of e-business, an integrative perspective on e-business and enhanced technological literacy skills, all of significant value to employers in the region and beyond. The Acadia Centre for Small Business Enterprise, established in 1988 with the support of ACOA, provides students and the community with business counselling and entrepreneurial skills development. With the support of the Dobson Foundation, ACSBE has developed the Entrepreneurship Skills Development program, which, in 2001, served over 1500 Acadia students, assisting them to become goal-oriented, self-confident and innovative individuals.

St. Francis Xavier University has identified ICTs in Small Business as one of its seven strategic research themes. Its planned Canada Research Chair will help consolidate and coordinate the established research interest in this area at the Gerald W. Schwartz School of Business, and will assist both local SMEs and the Coady International Institute and the Enterprise Development Centre in their missions. A complementary CRC in the New Economy and Governance in Atlantic Canada will assist with the study of public policy. StFX’s new Charles V. Keating Millennium Centre offers a state-of-the-art technology training facility for the private sector in northeastern Nova Scotia.

The University College of Cape Breton’s Small and Medium-sized Enterprise Institute provides faculty and students with a base from which research into the SME sector can be undertaken.
The Centre for Women in Business at Mount Saint Vincent University is a resource centre for women business owners and entrepreneurs that focuses on opportunities for small business, and that has already undertaken local, regional, and international initiatives.

At the Université Sainte-Anne, the Jodrey Centre carries out applied research into entrepreneurship and business opportunities for small businesses.

Dalhousie University’s Faculty of Management hosts four distinct management schools: Business Administration, Public Administration, Library & Information Studies, and Resource & Environmental Studies. The Faculty offers a unique Masters in Electronic Commerce in cooperation with Law and Computer Science and cooperates with the Institute of Canadian Bankers to offer a special MBA (Financial Services). Dalhousie offers the region’s largest co-op program for undergraduate business students.

In April 2002, the Faculty of Business Administration at Memorial University became the first in Atlantic Canada to be accredited by AACSB International—the Association to Advance Collegiate Schools of Business. This accreditation is the highest distinction offered to business schools both nationally and internationally, and attests to the quality of the faculty’s innovative programs and research. The Faculty has placed particular emphasis on promoting accessibility through on-line delivery of courses. Of the required courses for the bachelor of commerce and bachelor of business administration degrees, all but one has been developed for Web delivery and the remaining course is in development. In addition, many business electives are now available on the Web.

Entrepreneurship education has long been a priority at Memorial. The P.J. Gardiner Institute for Small Business Studies at Memorial was the first small business consulting centre to be established within a Canadian university. The institute provides assistance to entrepreneurs and small business owners through counseling and consulting services. Emerging business people at Memorial – both students and faculty -- receive start-up support from the Enterprise and Entrepreneurship Gateway (Gateway), launched in October, 2001. The Institute has also headed a collaborative initiative to develop an E-Learning Repository of online learning modules for entrepreneurs in Ireland and Newfoundland and Labrador.

The Hubert W. Kelly Chair in Youth-focused Technological Entrepreneurship (YTE Chair) continues to bring together organizations from across Newfoundland and Labrador that deliver programs related to entrepreneurship education. These meetings are designed to facilitate collaboration and coordination on future entrepreneurship education initiatives. The YTE Chair also assists various student companies in their commercialization initiatives, participates on various boards and committees and
presents to many organizations on entrepreneurial awareness.

Research activity by the Faculty includes the study of human resources issues in the knowledge-based economy, focusing on the issues of recruitment, training, and retention. This work is part of a larger project being funded by SSHRC, Challenges and Opportunities of a Knowledge Based Economy in Newfoundland and Labrador.

UPEI’s School of Business’ new community outreach initiative, the Business Education and Research Center (BERC) enables the Centre to be PEI’s facilitator, connector, and leader in business knowledge, education, and practices, assisting the Island’s communities in sustainable growth and future planning. The School of Business also conducts a Co-op Business education program where students are placed in small businesses, micro businesses, and start ups. This program is focused especially for rural areas to aide regional entrepreneurship and self employment efforts. Additionally UPEI conducts the very successful Women in Management program to assist women in their work environments.

Community Development

The locus of knowledge-based development at the community level brings issues of community capacity and community self-determination to the fore. The wealth and potential of the region will only be realized if Atlantic Canada’s communities can develop coherent, inclusive innovation strategies and work together to develop broader regional areas of excellence. In this climate, the region’s long-established excellence in community development will play a greater role than ever before in building the region and contributing to international development.

St. Francis Xavier University has a long-established tradition of community service, and this mission is reflected in the programmes of the Extension Department and the University’s Coady International Institute, the latter a global leader in community-based development. The university is developing particular expertise in community-based coastal management, through such initiatives as the St. Georges Bay Ecosystem Project and the Interdisciplinary Studies in Aquatic Resources (ISAR) initiative, a unique StFX programme that focuses on contemporary social and economic issues in Atlantic Canada’s rural and coastal communities, especially on the creative use of its aquatic resources. The Centre for Community Based Management (CCBM) draws on the expertise of the StFX Extension Department and the Coady International Institute to assist communities with the implementation of current models for community-based management with a focus on natural resources. The Centre for Regional Studies (CRS) promotes research on the cultural, social, political, historical and educational dimensions of work in Atlantic Canada. The Centre also supports a continuing
programme of seminars and public presentations, reflecting topical issues of community development.

StFX has identified New Economy and Governance in Atlantic Canada as one of its seven CRC research themes and plans to appoint a Tier II chair in this field in 2004-05. The research will focus on the region’s shift from a heavy-industry and resource-based economy to a technology-based, knowledge-driven production and marketing system. Suggested research themes include the impact of the new economy on communities, especially rural communities; non-profit and volunteer activity as a medium for social capital development; and regional and community-based governance systems.

Memorial University’s Institute for Economic and Social Research (ISER) specializes in empirically based social scientific research in Newfoundland, Atlantic Canada, the eastern Arctic and the North American rim. ISER has attained a reputation as a leading social science research institute and is currently engaged in a large cross-disciplinary research project on the sustainability of communities in cold ocean coastal environments.

Mount Allison’s Rural and Small Towns Program, on a fee-for-service basis, conducts independent applied and policy-related research focussed on the social, environmental, and economic issues confronting small communities in Canada. The Program links research and community outreach by generating and sharing new knowledge, developing self-help tools, and providing information and educational services which lead to innovative solutions for developing sustainable rural communities and small towns. The Program has strong ties in the Atlantic region, as well as a role on the national stage, including projects on emergency preparedness of rural Maritime communities, business retention and expansion in small towns, housing markets analysis, quality of life and mental well-being research for isolated communities, home ownership education and training programs.

Nova Scotia Agricultural College has identified Agricultural and Environmental Policy as one of its six research priorities. Foci include the opportunities and threats posed by globalization, the effects of domestic policies and institutional arrangements on farming and rural communities, and policies and institutions for rural resource management from a broader rural development perspective. Currently four researchers in area, and the College has an active Rural Research program in its Department of Business and Social Studies. (CRC Plan) (Also cited in Bioresource Production and Processing section above.)

At Saint Mary’s University, the Gorsebrook Research Institute for Atlantic Canada Studies is an interdisciplinary research centre concerned with a variety of social, economic and cultural issues specific to Atlantic Canada.

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The Institute encourages and facilitates social, economic and policy-related research pertaining to development in Atlantic Canada; acts as a resource base and data centre; and encourages University to Community outreach through collaborative research projects.

Saint Mary’s has exported its expertise in community development internationally through the International Development Studies Program and its International Activities Centre. The university has broad experience in international development, research links to Caribbean, Latin America, sub-Saharan Africa and Southeast Asia, and is the lead organization on a major CIDA Environmental Development project in Southeast Asia.

< The University College of Cape Breton has several initiatives in the area of community development:

< Its Community Economic Development Institute promotes, encourages and supports community economic development research and initiatives within a participatory framework. The CED Institute offers community economic development training, policy advice and evaluation, organization and community strategic planning, and information about community consultative processes. UCCB also offers a Masters of Business Administration program in Community Economic Development.

< The Tompkins Institute investigates the impact of technological change on society in general and, more particularly, on the Cape Breton community.

< The Chair, Management of Technological Change, focuses on the problem of developing models for more comprehensive processes in the management of technological change.

< Acadia’s Strategic Research Plan identifies community participation and involvement as an important outcome. For several years, researchers at the Acadia Centre for Estuarine Research have been providing scientific expertise to community volunteers, working with such groups as the Clean Annapolis River Project and the Friends of the Cornwallis River. Following on the successes of ACER’s community participation, the vision of the newly formed Academy for the Environment and the Irving gift of the Environmental Science Research Centre, Botanical Gardens and Campus Meeting Place is one in which students and the broad community will be welcomed to interact with researchers to participate in and develop a better understanding of our role in environmental sustainability.

< The Université de Moncton has identified regional development as one of its research priorities. The university is home to the nationally recognized Canadian Institute for Research on Regional Development.

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At the University of New Brunswick, the Canadian Research Institute for Social Policy (CRISP) is a multidisciplinary research organization dedicated to improving the effectiveness of social policy in Canada, helping Canadian communities provide better education and care for their children, and contributing to capacity building efforts in developing countries. The Institute carries out its mission by conducting detailed evaluations of local, national, and international policy initiatives and by analyzing large data bases pertaining to health and education.

Also located at the University of New Brunswick is the Muriel McQueen Fergusson Centre for Family Violence Research. The mandate of the Centre is to conduct action-oriented research whose goal is the reduction and ultimate elimination of family violence. The research is done in a multi-disciplinary context between academic researchers and researchers from the community. With the users of the research being involved from the outset, the research produces results that are more meaningful and more concretely applicable.

The Faculty of Nursing at the University of New Brunswick is in the process of establishing an off-campus Health Clinic serving the homeless population in Fredericton. The purpose of this project is to develop and implement a health clinic designed to address the health needs of the homeless and those living in unstable housing and poverty in Fredericton.

At the University of Prince Edward Island, the Island Studies area places strong emphasis on comparative research to identify and transfer new approaches to the economic and social development of communities. Its international linkages, in turn, offer major opportunities for the export of expertise in this area.

At the University of Prince Edward Island, the Institute of Island Studies (IIS) and its affiliated researchers place strong emphasis on comparative research to identify and transfer new approaches to the economic and social development of communities. IIS’s international linkages, in turn, offer major opportunities for the export of expertise in this area. As well, a core group of UPEI researchers have established a collaborative research team known as CHART, the Children’s Health and Applied Research Team which, in collaboration with the Children’s Secretariat and the Province of PEI, works to advance research on the social, cognitive and physical development of infants and children.

Dalhousie also has a strong outward orientation to its development expertise, with strong research programs in the areas of international development studies, globalization and transnational relations. The university has seen strong growth in its International Development Studies undergraduate and graduate programs; Masters
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programs which focus on global issues such as the Masters in Development Economics, Marine Management and Environmental Studies; the projects and publications of the Centre for Foreign Policy Studies and the Centre for International Business Studies; and two WHO Collaborating Centres - the only two in Atlantic Canada. Dalhousie’s numerous CIDA and IDRC projects draw on the university’s internationally recognized researchers and involve partners in Southeast Asia, the Caribbean including Cuba, and the Baltic States. Areas particularly active in international project work include environment, trade policy, coastal zone management, and public and economic management and training. Strong linkages also exist with NATO, NAFTA, the Nordic Council, the European Union, and the UN. Through partnerships among the region’s institutions, this international capacity at Dalhousie offers significant opportunities for the export of expertise in community development.

Commercialization Capabilities and Achievements

The transformative effect of universities on the Atlantic Region’s social and economic development can only be fully realized through a strong capability for technology transfer and commercialization. This capability is rapidly being established and extended at universities throughout the region, accompanied by a growing number and range of successes.

Acadia University recently established its Industry Liaison Office, with a mandate to provide technology transfer functions to the university, including the evaluation, protection and commercialization of new technologies. Since its inception, the ILO has facilitated Acadia’s partnerships with other institutions and with industry, recognizing that success in leading-edge research is increasingly dependent upon multi-party collaborations. Contract research sponsored by government and industry increased by 44% in 2002 over 2001, from $473,000 to $683,000.

The ILO provides a range of expert support and evaluation functions to university researchers, and is building a strong base of processes and procedures to enable the university’s participation in commercialization activities. It has assisted in a number of IP disclosures, and anticipates patenting and spin-off successes in the near future. The ILO has assisted in a number of commercialization initiatives, for example:

- Negotiated research agreements with industry located in Montreal and Minnesota to enable Acadia researchers and students to perform industry sponsored research in food sciences.
- Drafted licensing agreement for a survey developed with SSHRC funding for use with a consulting company in Sweden and several Italian hospitals; research contracts have been entered into with a leading U.S. university, a major Toronto Hospital and a teacher’s union, to conduct studies using the survey.
Drafted a standard service agreement and collaborative research agreement for use with industry partners; drafted a standard invention disclosure form for use by Acadia researchers.

Dalhousie University is currently involved in 468 contracts, grants, and clinical trials with the private sector. Clinical trials account for $10.7 million in funding, while other research accounts for a further $2.7 million. Commercialization of intellectual property at Dalhousie is facilitated by two organizations: Nova Universities Technology Inc. (NU-TECH) and the Business Development Office in the Faculty of Medicine.

Created in 1996, NU-TECH’s mission is to license technology from its member institutions, Dalhousie and the Nova Scotia Agricultural College. Over its first five years, more than $1.7 million has been invested in building and protecting a large technology portfolio. Gross license revenue has reached over $930,000, which has been distributed among the inventors, the university and NU-TECH. NU-TECH has also completed agreements generating over $3.3 million in industrial funding support for its member institutions.

NU-TECH has received 150 disclosures and filed for almost 130 patents; of those, 38 have been granted or allowed, and a further 60 are pending. Eighty technologies are being actively marketed, and a number of agreements have been reached with industry, including 21 material transfer agreements, 75 confidential disclosure agreements, and ten options agreements. Seven technology licenses are in effect, and a further eight are in negotiation. Six start-up companies based on technologies managed by NU-TECH have been formed, with aggregate new funding commitments already exceeding $2.1 million. At least 12 high-tech jobs have also been created through these start-up companies. Currently, three more start-up companies are in the pipeline.

The Faculty of Medicine’s Business Development Office provides expertise and support for industry partnerships and commercialization activities. The Office has assisted in securing $11.5 million in venture funding and research grants for four firms, and has obtained $6.5 million from the Canadian Medical Discoveries Fund, for seed funding for medical discoveries, to be disbursed through MedInnova Partners. Business development projects include Dal Telehealth/International Health Office and the Brain Repair Centre. The Office has built a base for further success through evaluation of approximately 100 scientific projects and completion of a number of market and intellectual property analyses.

Memorial University is currently involved in 197 research grants and contracts with Canadian firms, worth over $7.2 million, and a further 33 grants and contracts with foreign firms, worth $5.3 million, for a total of 230 industry research projects worth $12.5 million, including in-kind support. Through Memorial University’s GENESIS Group, formerly known as Seabright Corporation, university research is transferred to industry and to the marketplace through licensing and transfer agreements, contract research services and collaborative research and development projects. GENESIS Group has been in continuous operation since 1987, and today consists of four divisions:
Genesis Research - responsible for IP and facilitation of commercialization;
Genesis Centre - responsible for the incubation of new high tech companies;
Genesis Web - responsible for on-line incubation via the web; and
Genesis Bioeast - functions as the secretariat for the biotech industry in Nfld.

The Genesis Group and its predecessor, Seabright Corporation, have been major catalysts for Newfoundland's biotechnology sector. Several companies have already grown out of biotechnology research, and additional technologies are being explored for further development. Some examples of commercialization successes at Memorial follow:

- A novel gene discovered by Faculty of Medicine researchers is being investigated for its small molecule blocker potential, through a $350,000 collaboration between the university, MethylGene Inc. of Montreal, and University Medical Discoveries Inc.

- The university has entered into a Population Genetics Partnership Initiative with Xenon Inc. of British Columbia, a $250,000 research agreement in the area of hereditary sensory neuropathy and potentially other diseases.

- A new company called Nova Lipids Inc. has been established this year to commercialize a novel Vaccine Delivery System for animals. Over the past three years Genesis Group, through a partnership with Alpharma SA of Norway, a world leader in fish vaccines, the technology has been refined and is in the final testing stages. Over $1 million has been invested in the development to this date. It is anticipated that the delivery system product will be produced in Newfoundland by Nova Lipids and the freeze dried product shipped to Norway where the vaccine will be embedded and then shipped to worldwide markets. NovaLipids is also pursuing the extension of the technology to domestic and companion animals.

- Memorial's spin-off company A/F Protein and its affiliate Aqua Bounty Farms continues to pursue the commercialization of its patented fast growth transgenic fish. The company has recently completed a new $6 million round of venture capital financing (bringing the total to over $12 million). It operates a hatchery in PEI and a protein production facility in Newfoundland, employs over 20 people, and is currently in the review process with the FDA in the United States.

The Nova Scotia Agricultural College pursues transfer and commercialization of its innovations through several channels:

- The NSAC has developed a unique Research Chairs partnership with industry and government, through which the salaries of researchers are jointly supported by private sector organizations and the Nova Scotia Department of Agriculture and Fisheries. This has resulted in several positions specializing in particular areas such as blueberries, carrots, turfgrass, potatoes and cropping systems.
The NSAC is also a partner in AgriTECH Park, a research and development incubation facility, located near the campus. This facility is intended to facilitate the commercial development of research performed at the College as well as creating linkages between external research initiatives and College researchers.

As well, the NSAC is in partnership with Dalhousie University to achieve technology transfer through NU-TECH (Nova Universities Technology Inc.), described above.

Saint Mary’s University faculty currently pursue research or hold patents with commercial applications on, for example: substances which enhance plant growth promoting rhizobacteria; derivatives of chitosan as anti-adhesion agents for surgery (currently undergoing clinical trials in the US); the use of ionic liquids as “green” solvents for a variety of synthetic process (a recent success is a provisional patent in which a morphine derivative is synthesized using ionic liquids); the synthesis of new organic molecules containing nitrogen that have potential anti-tumour activity; technology to stabilize micro-satellites in space and software to interpret the results to increase the effectiveness of space telescopes.

St. Francis Xavier University (StFX) is in the process of establishing an industry liaison function (IL office). This initiative is an outgrowth of StFX’s track record as the top recipient of NSERC funding among small Atlantic universities, and the commitment of StFX and its faculty to capitalize on the university’s increased academic research base in areas of interest to the private sector. This initiative also forms part of the institutional priority to create the Centre for Applied Petroleum Sciences at StFX, which will focus on conducting applied research and developing commercial applications for the oil and gas industry. StFX will designate an on-site industry liaison officer to engage in building awareness within the faculty concerning the commercialization process, receptor capacity, and intellectual property protection. At the same time, this officer will also develop relationships with industry.

StFX currently has 20-25 corporate-funded research projects, totalling approximately $398,000 for the year ending March 31, 2001 and $921,800 for the year ending March 31, 2002. Research encompasses the investigation of dispersants in hydrocarbon solvents; the efficiency of anti-microbials in a food environment; characterization of biofilms that cause gas pipeline corrosion; software and learnware development; and research into fraud-related issues for the insurance industry.

The University College of Cape Breton pursues the commercialization of intellectual property through its Department of Economic and Technological Innovation (DETI). In keeping with its mandate to support economic development and diversification of the Cape Breton economy, UCCB has committed considerable resources over the past two and one-half years putting infrastructure in place to support innovation and commercialization activities. DETI has also created the capability, for the first time, to track the university’s impact on commercialization, and thus to enhance that impact.

New centres have been implemented within DETI to foster innovation and commercialization, including the Information Technology Innovation Centre, the Centre of Excellence in
Petroleum Development, the CAD-CAM Centre, all described previously in this paper; as well as a range of applied research projects for industry.

In all, UCCB is currently involved in 18 industry-funded research activities, involving $1,265,000 in funding. While it does not as yet hold any patents, its innovation activities include 22 formal MOUs, four Letters of Intent, and fourteen non-disclosure agreements. The university has given rise to three start-up companies: Environmental Services Laboratory Inc., LearnCorp International Inc., and Applied Technology Communication Inc. In addition, UCCB is also home to the Maritimes' first university-based incubation facility, the Technology Enterprise Center, established in 1998. The Center’s mission is to provide access to the technical resources of the University College, to nurture entrepreneurs in technology-based businesses, to foster their growth, to attract to Cape Breton new technology-based enterprises and to encourage technology transfer. TEC is currently at over 100% occupancy; with almost 60 employees. Since its inception, TEC has assisted in the development of eight private-sector businesses through its resident and affiliate programs. All of the companies with which TEC has been involved are still in commercial operation, and span a range of business activities which include production of cattle feed supplements, document scanning and archiving, design and manufacture of engine automation systems, “hotel room” gaming systems and environmental testing and analysis.

The Université de Moncton has recently expanded its unit responsible for innovation, technology transfer and intellectual property. The former Technology Transfer Office has been renamed Bureau de soutien à l’innovation (BSI) (Innovation Support Office) to better represent its new role across all disciplines. The BSI has a staff of three part-time employees: a director and two innovation agents.

The Director of the BSI is chairing a university-wide committee that will finalize a global intellectual property policy. This policy will build on existing policies and collective agreements to provide a comprehensive and proactive approach to innovation, commercialisation and partnerships while ensuring that academic and scholarly activities are not compromised. Mechanisms for the stimulation of commercialisation efforts will be implemented.

In the last year, one invention disclosure has been received by the BSI and IP protection is being pursued as well as evaluation of commercial potential. Collaboration with IP personnel at the University of New Brunswick is used to supplement local expertise.

The Université de Moncton is planning an expansion to its Science Park to provide an entrepreneurial resource for the development of spin-off and high technology companies. The arrival of the Moncton office of the new NRC-IT laboratory provides a unique opportunity to expand the receptor and mentoring capabilities of the park which houses Genieo Solutions Inc. Since 1983, Genieo (formerly Concept + Inc. and CADMI-Moncton) has been a key source of ideas for the creation of new high tech businesses such as Spielo Gaming International, Nanoptix, and Micro Optics Design Corporation.

In the health sector, a partnership agreement has recently been signed between the Université de Moncton, the Régie Régionale
Beauséjour, and the Institut de recherche en santé Beauséjour. Existing research collaborations are being expanded with many activities, especially in biotechnology, promising increased occasions for innovation.

With growing partnerships in e-learning with NRC-NB and others, it is expected that IP and commercialisation activities should increase in the coming years.

UPEI is growing its technology transfer and commercialization capabilities in concert with regional and national partners. This growth is evident in the hiring of a technology transfer manager, expanding research collaborations with industry and an enhanced pursuit of IP protection and licensing. These factors provide a firm basis for development of a planned Industrial Partnership Facility.

The University of King’s College is extending its already strong linkages with the private sector media industry. It produces content, including a weekly news and current affairs program for Eastlink and a daily news digest distributed through MTT/Aliant’s "Mediapipe" web site. The College’s Journalism Advisory Board includes almost two dozen creative and executive members of the private sector media, who provide guidance to its program. The College also supports industry excellence and cohesion by organizing and sponsoring the annual Atlantic Journalism Awards and the Atlantic Journalism Weekend workshop program.

Commercialization activities at the University of New Brunswick are supported by UNB, its wholly-owned, non-profit corporation, Enterprise UNB, and through the operation of the Greater Fredericton Knowledge Park:

- UNB supports commercialization through its technology transfer and licensing program, in operation since August 1999. The program provides intellectual property (IP) management services to its affiliated researchers and technology developers. These services are provided both directly to technology developers and via UNB’s research contracts group. The services include identifying and assessing technology, protecting IP, marketing IP, negotiating technology transfer related agreements, and developing business cases and plans.

- Enterprise UNB, established in January 2002 (formerly Incutech), supports commercialization by providing affordable facilities and services to small business enterprises. The facilities and business services are offered to UNB spin-off companies and off-campus firms. The services include those IP management services offered by UNB, plus services to support the creation and growth of new ventures, with a focus on management training, marketing, and obtaining investments.

- The Greater Fredericton Knowledge Park opened in June 1998. It features first-rate facilities in close proximity to UNB. The Knowledge Park is intended to be the next step for UNB spin-off companies growing out of Enterprise UNB, and as a vehicle for attracting knowledge-based firms to New Brunswick.

In 2001/2002 UNB received approximately $20,900,000 in sponsored research funding. Since August 1999, fifty-five
disclosures have been received by UNB, seven UNB inventions have been the subject of patent applications, and eight IP option and technology transfer agreements have been signed. Revenue payable from optionees, licensees and spin-off companies during the first three years of the technology transfer and licensing program is $385,592. This amount does not include the value of UNB’s equity in spin-off companies.

UNB has six spin-off companies, of which two are profiled below.

< Q1 Labs Inc., a UNB spin-off company, is commercializing a patented network visualization program, qVision, following transfer of rights in the technology in April 2001. Q1 Labs Inc. presently has six full time staff, and has offices in Saint John, Fredericton, San Francisco, and San Jose.

< Mathis Instruments Ltd., a UNB spin-off company, is commercializing the TC Probe, a probe that non-destructively measures thermal conductivity and other thermal properties of various materials and substances. UNB transferred rights in the technology to the company in February 2002, upon closing of a $7.5 million venture capital investment agreement. Mathis Instruments Ltd. presently has over ten full time employees, and is located at Enterprise UNB in Fredericton.

As a small university, Mount Allison has been able to strengthen its commercialization capabilities through its Office of Research Development (ORD) by developing collaborative relationships with the technology transfer offices of other universities and organizations.

< Mount Allison works closely with the University of New Brunswick on matters to do with technology transfer, patenting, as well as research and licensing contracts. Mount Allison’s direct participation in these activities through its ORD has led up to a Memorandum of Understanding (MOU) with UNB in support of innovation and technology transfer.

< Mount Allison is also part of Atlantech. Through participation in this network its ORD has been exposed to the services of Bereskin & Parr, specialists in Intellectual Property Law. The firm has been enlisted to assist in the filing of a US provisional patent application.

< In support of potential commercialization projects ORD has enlisted the services of BioMed Management Inc, a privately owned technology development and management services company, operating out of Halifax.

< Mount A’s ORD has supported efforts in the submission of Canadian, US and Patent Cooperation Treaty filings (PCT) as of August 2002 for a novel process that generates global antibodies to detect protein components of photosynthesis, carbon and nitrogen metabolism. Furthermore, a research contract with University Health Network (UHN) in Toronto and Medinnova Partners Inc. has resulted in external funding from Medinnova in the order of $327,800 over a period of 18 months (March 2002 – August 2003). Mount Allison’s share of this funding amounts to a total of $111,550. European, US and Japanese patent applications that are related to this contract have been submitted through UHN.
ORD has also administered the formal disclosure of a discovery of a new and powerful bioactive compound. This project may lead to future commercialization partnerships with Medinova Partners and other SME’s in New Brunswick. Another disclosure is related to various novel microbiological mechanisms associated with the tuberculosis bacterium. This may lead to future partnerships with the University of Toronto’s medical school and its Innovation Foundation.

In response to the findings of the Expert Panel on Commercialization of University Research, and the opportunities created by the Atlantic Innovation Fund, the region’s universities have worked together to develop a shared capacity for commercialization. Universities have proposed to develop the Atlantech Network, comprised of existing Technology Commercialization Offices at Universities throughout the Atlantic Region, with additional regional capacity added to achieve the critical mass of expertise required to serve all affiliate members in the region. Atlantech’s goal would be to provide the Atlantic Region with the scale of commercialization organization associated with major Canadian research universities. The initiative is intended to cement the collaboration between universities and business, and to form the foundation for continued economic growth in the region’s knowledge-based industries.

It was proposed that Atlantech’s roles include: commercializing technologies arising from funded research at Atlantic Universities; actively seeking industry partnerships; transferring technologies to existing Atlantic companies to help grow indigenous companies; attracting larger companies to pursue the commercialization of the technology in Atlantic Canada; and using “platform” technologies to form spin-offs which can raise venture capital to establish new companies, and potentially new industries, in the Atlantic Region.

## Tapping the Potential

How can the opportunities of the knowledge economy be more fully realized for Atlantic Canada, and this strategy refined and launched?

In 2001, the Association of Atlantic Universities began a process of discussion and consultation on the issues outlined above. The work culminated in a concept paper which “[outlined] the elements of a strategic initiative to develop and fulfill the potential of Atlantic Canada’s universities and colleges to lead the region to global competitiveness. In the current environment, such an initiative is more possible than ever before; it is more needed than ever before; and it holds more potential to succeed in securing the region’s future than ever before.”

To realize these opportunities, the paper outlined some key priorities – the leading one being human capital. Atlantic universities must build on and enhance clusters of talent, skills, and capacity in their strong core programs related to the region’s pillars of excellence. This effort must be guided by recognition that excellence in undergraduate and diploma programs is a key

2 Association of Atlantic Universities, *Leading to Competitiveness: Atlantic Canada’s Knowledge-Based Future* (Halifax: AAU, October 2001) p. 1
strategy in forming, retaining and recruiting the researchers and personnel who are the foundation of success in the targeted sectors. Priority will be placed on the following strategic elements:

< Attracting world-leading talent to the region to build internationally competitive clusters: Competition has always been strong for research leaders, and this competition promises to intensify in light of the growing demand from industry and academe across North America. It is essential to build on the progress achieved by the Canada Research Chairs program and the Canadian Foundation for Innovation, to ensure that Atlantic Canada’s universities can hold their own in this competitive market and attract the renowned researchers needed to secure the region’s future. Infrastructure renewal and enhancement are critical to attracting these research leaders. Measures are also needed to address the region’s structural barriers to finding matching funding for federal programs.

< Developing new faculty and retaining leading young researchers in the region through enhanced support for post-doctoral research: The region’s universities have a strong and demonstrated capacity to develop outstanding young researchers. Expanded research capacity and expanded support for researchers, as proposed by the AUCC, will allow this capacity to be fulfilled and expanded. 

< Developing the next generation of researchers through investment in both graduate and undergraduate research: With 12% of the nation’s faculty and 10.5% of its students, Atlantic Canada can make a strong contribution to the federal goal of annual 5% growth in the number of graduate students. Through investment in research capacity and graduate student support, as proposed by the AUCC, the region’s universities can fulfill this potential.  

< Building the support teams of technicians and technical supports needed for research excellence and impact: The full innovation impact of world-leading research talent, renewed and expanded faculty, and more graduate students can only be realized if they have the skilled personnel and systems to support their work. Investment in this area is an integral element of an innovation strategy for the region.

< Educating the HQP and training the skilled workers essential to innovation-based economic and social development: Atlantic Canada is already a net contributor to Canada’s high-skilled labour force. Almost eleven thousand students from other provinces of Canada were enrolled in university programs throughout the region in 1998-99, double the number of Atlantic Canadians studying elsewhere. Net enrolment from outside the region that year was just over 4,000 undergraduate FTEs and a further 340 graduate FTEs. Stable or declining populations in the region over the coming decade mean that Atlantic Canada’s post-secondary sector can make a major contribution to addressing the enrolment increases forecast in other regions over the coming decade, and meeting Canada’s growing needs for highly skilled workers.
Building teams across sectors, disciplines, and institutions, as well as linkages with key non-university partners: The region’s post-secondary institutions are placing growing emphasis on pooling their strengths through collaborative, multi-disciplinary approaches, as indicated by the many pan-Atlantic and multi-partner proposals submitted to the Atlantic Innovation Fund in response to its first call for proposals.

These investments in human capital can only reach their full potential if accompanied by investments in physical and technological infrastructure:

The issue of deferred maintenance is being addressed by the AUCC. The AAU supports the concept in their proposal for a partnership of governments and universities to address infrastructure renewal through a dedicated fund administered in an open and accountable way. The design of this fund must recognize that the issue of deferred maintenance is more acute in Atlantic Canada than in other regions. According to a study by the Canadian Association of University Business Officers, released in 2000, over $644 million in deferred maintenance is required across the four provinces – 18% of the national total. On a per student basis, the study estimated that the maintenance deficit in Atlantic Canada is 70% higher than the national level. A dedicated national commitment to renew infrastructure is an urgent priority if Atlantic Canada’s universities are to play a leadership role in achieving competitiveness for the region.

As well, if Atlantic Canada is to develop internationally recognized clusters of excellence, its post-secondary institutions need new infrastructure for the new economy. This can be achieved through a combination of targeted funding, support from national programs, and matching funding related to areas of excellence. We must build, in a sustainable way, the research and innovation potential of smaller universities. The AAU supports the AUCC’s recent proposal for a ten-year federal program to build research capacity at smaller universities, recognizing their special challenges of scale, cost structures, and critical mass. A federal initiative based on research excellence would serve this purpose and would reinforce the infrastructure that supports research activity in small universities.

The AAU supports the AUCC’s recommendation for a permanent program to fund the indirect costs of federally-sponsored research. A permanent solution will enhance the region’s research efforts and help sustain a vibrant and competitive research environment. These indirect costs are a significant burden on university operating budgets. It is estimated that, at a minimum, for each research grant dollar received, an additional 40 cents is necessary to cover indirect costs. In the 2001 budget, the federal government provided a one-time contribution of $200 million to help universities defray the costs. The AAU supports the existing formula used in the one-time payment to ensure a fair allocation of available funds.

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3The Canadian Association of University Business Officers. A Point of No Return: The Urgent Need for Infrastructure Renewal at Canadian Universities (April 2000) P. 23
the event that additional funds are provided to bring the initial allocation to a level consistent with the requirement needed to cover indirect costs at an average rate of 40%, the AAU believes that this increase should be shared among all the eligible institutions so as to ensure similar proportions to the initial one-time payment. As well, the AAU strongly endorses the notion that indirect costs be paid to the universities as a single annual grant.

The AAU fully endorses the policy objectives and fiscal commitments of the Atlantic Innovation Fund and the Atlantic Investment Partnership. AAU commits to work together with the regional caucus and the federal government to seek a continuation of these commitments, and to engaging with others in a reflective process aimed at achieving optimal results.

For their part, the region’s post-secondary institutions are committed to contributing to the innovation-based development of Atlantic Canada and Canada as a whole. Particular emphasis will be placed on the following areas.

With regard to its teaching mission, the region’s post-secondary sector will examine:

- a coordinated distributed learning environment that achieves synergy through enhanced collaboration and information sharing; and
- increasing and linking capacity, particularly between universities and colleges, to meet the growing needs of citizens for literacy, continuing education, skills development, and lifelong learning.

The federal government’s Connecting Canada initiatives has helped make Canada an international leader in technology enhanced learning (TEL). To continue and extend that leadership, governments must continue to play a major role. The AUCC has called on the federal government to support research, to establish a TEL infrastructure fund, and to ensure an enabling regulatory climate with regard to digital copyright. Provincial governments also have a role to play through sharing of best practices and co-funding of TEL infrastructure. The AAU supports those proposals.

With regard to its research mission, the region’s post-secondary system will coordinate its commercialization capacity and further build R&D partnerships. It must focus on its areas of excellence, and create the structures, processes, and activities to support innovation and commercialization. Through those measures, Atlantic Canada will meet or exceed the AUCC’s commitment to triple the direct results of commercialization by 2010.

With regard to its community development mission, the region’s post-secondary institutions will build on existing linkages and partnerships with the communities of the region to build a sustainable distributed model of learning, health, and vibrant commerce and growth.

Every aspect of this strategy is guided by a core principle: to achieve a level of excellence that will be internationally recognized – in teaching, learning, innovation, products and services, and partnerships – making Atlantic Canada globally competitive in its areas of strength.
These themes, and the strategic priorities outlined above, are strongly in accord with the recently released Government of Canada paper, *Achieving Excellence*. That paper shows an understanding of both the opportunities and the challenges that lie ahead. Its commitments create a positive climate within which to develop and bring forward this strategy. Many of the measures outlined in the paper echo those envisaged by this initiative – increased investment in innovation, encouragement of commercialization activity, coverage of the indirect costs of research, increased support for graduate study, expansion of broadband infrastructure, support for cluster development and for community-based innovation strategies.

In its skills agenda, *Knowledge Matters*, the federal government proposes a number of further measures, aimed at enhancing the accessibility and excellence of post-secondary education, and developing a world-class workforce – areas in which the region’s colleges will play a particularly strong role. The paper also identifies deferred maintenance at Canadian universities as an issue which must be addressed if the goal of increased access to higher education is to be achieved.

These proposals, coupled with the paper’s commitment to inclusion and its sensitivity to the circumstances of smaller universities, provide a strong foundation upon which to build a different and better future for Atlantic Canada.

**Conclusion**

Atlantic Canada’s challenges are not unique. Nor are its strengths and opportunities unique. Both differ only in degree from those experienced in many other regions and countries. The key to overcoming these challenges and seizing those opportunities – in a world of competitors seeking to do the same – is an integrated strategy which focuses the region’s energies on a shared vision and links its strengths to achieve that vision.

The months ahead hold great promise for developing such a vision and strategy, through further discussions among the region’s universities and colleges, and through participation in the consultation process on the federal government’s innovation strategy. In those discussions, the areas of excellence outlined in this paper will be refined, the strategies and investments needed to achieve global competitiveness in those areas will be more fully developed, and the measures needed to ensure benefits throughout Atlantic Canada will be identified.

Atlantic Canada’s post-secondary institutions are eager to help shape that vision and to share in its attainment. As individual institutions, the region’s universities and colleges already have a profound impact on their communities. As a network with a presence in every part of the region, working together to implement a shared vision, they can – and will – achieve a social and economic transformation in Atlantic Canada.