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Conseil de recherches en sciences naturelles et en génie du Canada
NSERC CRSNG

College and Community Innovation Pilot Program

Mid-term Review

Final Report

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1.0 INTRODUCTION

In the fall of 2002, NSERC Senior Management visited 19 community colleges across the country to learn more about the form, nature, and scope of applied research that is being carried out in Canadian colleges. Moreover, an understanding of the role colleges play in the overall innovation spectrum was sought. What was found was a range of research and innovation activity that was already contributing to the needs and opportunities of local industry. These activities at the colleges were generally not research as is typically supported by NSERC in universities, but included problem solving, prototype building, product development testing, and market studies, among other activities. NSERC concluded that the colleges have a significant role to play in building the innovative capacities of communities by helping firms commercialize new discoveries and adopt new technologies. This led to the development of the College and Community Innovation Pilot program.

The College pilot was one of three pilot programs established as result of commitments stemming from NSERC's Vision, which was approved by Council in October 2003. The other two pilots were the Regional Capacity Development at Small Universities, and the Centres for Youth, Science Teaching and Learning (CRYSTALs) programs. It was agreed that all three pilots should be reviewed mid-term, in order to provide NSERC management with information prior to the end of the grant period.

As the pilot with the shortest grant period[1], the College and Community Innovation Pilot program is the first of the three programs to be reviewed. The purpose of this review is to provide NSERC management and Council with the intelligence needed to assess the effectiveness of the College pilot's approach and the requirements for a continued effort. The study is to help inform decisions regarding whether or not the Pilot should be extended or made into a permanent program, and whether modifications to the design of the program are needed.

This report presents the findings of the mid-term review of the College and Community Innovation Pilot program. The report is divided into six main sections outlined below. It should be noted that while conclusions have been drawn, recommendations have not been put forth, since the intent of this review is not to be directive, but is rather meant to stimulate discussion and debate among senior management and Council.

- a brief overview of the college environment
- a program description
- the methodology employed for the review;
- a description of the six initiatives funded under the Pilot program;
- a presentation of the study findings; and
- conclusions.

[1] Grants were awarded for three years, in the other Pilots grants were awarded for five years.

2.0 COLLEGE[2] ENVIRONMENT

Canada has a national network of over 150 publicly-funded colleges and institutes of technology in over 900 communities in all regions of the country. These institutions are mandated by the provinces to support the socio-economic development of the communities and regions they serve. Colleges develop education and training programs to meet employer needs with direct input from business, industry and community partner organizations. All colleges offer two- and three-year diplomas in a variety of fields. Some colleges, including all of the cégeps in Quebec, have university transfer programs that enable students to transfer into a degree-granting program in a university. Many offer trades and apprenticeship programs and some provide specific training programs for employees of a particular industry. Recently, some colleges have begun to offer applied Bachelor degrees, and among these certain ones are developing applied Master's and PhD degrees.

2.1 Applied R&D at the Colleges

Some faculty at some colleges have been involved in applied R&D for various amounts of time. This has usually been carried out by individual faculty members who have advanced degrees and are pursuing applied R&D activities according to their interests, and often related to research they carried out as part of their degree. Other faculty have, from time to time, carried out applied R&D projects for industry, although this has tended to occur in an ad hoc manner.

In recent years, applied R&D at colleges has become more formalized as college Boards of Governors and the provinces recognize that colleges have an important role to play in innovation. This role derives from the mandate of the colleges to support socio-economic development of the community and forms an extension of the institutions' collaboration and partnerships with business, industry and community partners.

In 2001, the Association of Canadian Community Colleges (ACCC) administered a survey of colleges across Canada for Industry Canada to determine the extent to which colleges are contributing to the innovation agenda, and to identify barriers that are preventing them from attaining their full potential. The results of the survey were published in March 2002. The survey found that colleges contribute to economic development by helping firms commercialize new discoveries and adopt new technologies, a finding that was particularly important for small and medium-sized enterprises (SMEs) facing time and resource constraints. However, R&D activity varies widely across colleges. Some colleges are well established participants in applied R&D. Others are developing nascent capacities in the areas of prototype development, product testing, finalizing designs, developing marketing strategies, field testing etc., while many colleges are not involved in any of these activities. The survey results suggest that the lack of faculty time is the greatest barrier to increasing R&D activity. Other barriers include:

[2] The term "college" includes community colleges, institutes of technology and cégeps

lack of access to support from the public and private sectors; lack of a supportive mandate; and appropriate infrastructure and administrative support at the institution.

In 2005, ACCC supported a study by Jim Madder, currently Vice-President at Red Deer College in Alberta, to review the state of innovation at colleges in Canada. The results were published by ACCC in the report, *Innovation at Canadian Colleges and Institutes* (D.J. Madder, June 2005). The report describes the government policies and investments that support R&D at colleges; the college administrative structures and policy and fiscal support for R&D; the current practices and models at various colleges to support innovation; the challenges colleges face with respect to increasing innovation; and the report provides recommendations to further develop the innovation capacity at colleges.

Madder reports that, with respect to support for innovation activities, each college adapts itself to the resources and needs of their local and regional communities and no single model has been developed. He identifies four generic states to describe the level of innovation at the colleges (described below), but cautions that these should be viewed as a continuum rather than discrete categories. Also, the colleges are continuing to grow and evolve in this area.

- Institutions with no formal innovation policies and structure (approximately 40-50%)

  These colleges have not yet decided if they want to be involved in innovation and they have no formal structure in place to conduct applied research. If it is done, it is usually by faculty doing graduate studies or "by the side of their desk". They are not provided release time, there are no policies for staffing to support applied research and they are not tri-council eligible.

- Novice Innovation Institutions (approximately 20-25%)

  This is a transitional stage that is very unstable. At these colleges, innovation activities, research policies and the acquisition of operating equipment is very recent. Usually, research policies are developed to be compliant with funding agencies. Ad hoc fiscal and human resources systems are developed to support innovation and part-time staff may be recruited to support faculty doing applied research, but these positions are often temporary. Formal innovation activities are usually project-based, done in collaboration with industry and supported by cash or in-kind contributions from partners and government funding. These activities are limited in number and in scope.

- Established Innovation Institutions (approximately 25-30%)

  In these colleges, innovation is part of the mandate and policies regarding applied research, fiscal management, human resources and reporting are established. There is a position of Director of Research that reports to a senior VP and their relationship is dynamic. Facilities and equipment are established and may even require renewal. Faculty are released from teaching to do applied research and support staff is hired. These teams conduct multiple projects that interrelate and are contiguous in time, and they are fully funded to conduct their innovation activities. The projects may be local or regional in scope. These institutions have access to operational funding and may have multiple public/private sector partnerships.

- Integrated Innovation Institutions (less than 5%)

  These colleges have innovation and business development support systems in place and they have long standing innovation and business development activities. Their applied research projects may be regional, national or international in scope. These institutions have business incubators that are supported by and provide support to the college. Industry can access research and development resources to conduct their own applied research or to contract their research to the college.

3.0 COLLEGE AND COMMUNITY INNOVATION PILOT PROGRAM

3.1 Rationale for the NSERC Pilot Program

An innovative industry is a key ingredient for Canada to flourish economically in the knowledge-based economy. Currently Canada leads OECD countries in its public support for research and development; however, Canadian firms tend to under-invest in R&D technology and innovation compared to competitor OECD countries. Therefore, increasing the capacity of the colleges to support innovation at the community and/or regional level would benefit Canada's knowledge-based economy.

Much activity at the colleges in support of innovation was in the planned rather than actual stage as most colleges do not have the resources to move into this area in a more significant way. Moreover, heavy teaching loads prevent faculty from having time to devote to applied R&D. Therefore, colleges, while well positioned to contribute to Canada's innovation agenda, would need significant funding to develop this potential.

NSERC has the mandate of supporting innovation. Its main goal in its strategy for advancing innovation is to improve the receptor capacity for research results and increase the amount of R&D done in Canadian industry. NSERC also has the expertise to initiate a college innovation support system as it has proven selection processes and grant delivery and evaluation systems. NSERC therefore decided to use funds from its existing budget and develop a pilot program to increase the capacity of colleges to support innovation at the community and/or regional level.

NSERC recognized that because of the significant differences between university research and college activities in support of innovation, any program would have to be specifically designed to support and encourage the special advantages and strengths of the colleges. Only a program aimed specifically at the needs of the colleges and applying criteria for excellence that are appropriate to what they actually do would enable them to compete fairly for resources. NSERC worked closely with the Association of Canadian Community Colleges in developing the program description and the delivery mechanisms, and also consulted with the Canadian Manufacturers and Exporters whose members include companies that could benefit from working with the colleges.

3.2 Pilot Program Description

The objective of the College and Community Innovation Pilot Program is to increase the capacity of colleges to support innovation at the community and/or regional level. The program design and funding are intended to stimulate new partnerships and increased entrepreneurship, and to assist the colleges to take risks in developing new ways of working with local businesses and industries to spur innovation and economic growth.

The Pilot program awarded six grants on a competitive basis. A base grant of $100,000 a year for three years was made to successful applicants; funding for years two and three are contingent on successful progress in achieving the goals outlined in the proposal. In year two of the grant, up to an additional $100,000 is available based upon the college's ability to leverage an equivalent amount from sources outside the college. In year three, the base remains at

$100,000, and the maximum amount to be leveraged increases to $200,000. Again the funds eligible to be leveraged in years two and three may be in cash and/or auditable in-kind, but must be incremental and relate directly to the activities proposed by the college in support of innovation. Throughout the grant term, the progress of successful applicants is tracked via annual reporting requirements.

Grants are intended to be flexible and accommodate a wide variety of activities to initiate or increase innovation in one specific area, where the college has recognized expertise and that meets local community needs. The activities supported must be incremental to those already planned by the institution and must involve students.

It is expected that the College and Community Innovation Program will, in the long term, increase the economic development of the community and create new quality jobs based on know-how and technological innovation. This is to be achieved by increasing the capacity of the colleges to transform the results of R&D into economic activities more easily and more quickly. Intended outcomes of the Pilot program are depicted in the program logic model.

3.3 Pilot Program Logic Model

The logic model for the College and Community Innovation Pilot program is presented below.

Activities and Outputs: The College and Community Innovation Pilot program awards grants to Colleges for specific initiatives. Activities and Outputs generally revolve around program development as well as the administration of the application and review process, which includes communication with stakeholders and monitoring of the grant once awarded.

Immediate Outcomes: The Immediate Outcomes are divided under two headings because of the timing requirements for the outcomes. "Pre-Award" outcomes refer to those outcomes which occur as a result of the activities and outputs prior to the notification of decision. In other words, these outcomes involve the participation and reaction of applicants, reviewers and selection committees or panels. These were deemed outcomes because they are not under the control of NSERC but are nonetheless crucial to the success of the awards process. The "During Award" outcomes reflect the outcomes of the research process and activities. These focus on the actions of the grantee institutions, the partners and other stakeholders involved in the funded initiative.

Intermediate Outcomes: The Intermediate Outcomes occur after the funding period of the grant to the College. These outcomes range from the training of students and their subsequent employment, to the enhanced teaching activities and capacity of the college to transform new knowledge and technology to local businesses, to businesses adopting new technologies and obtaining new and improved products and processes. Because of their varying degrees of complexity, many of these intermediate outcomes can take years to appear. Rather, many of these intermediate outcomes will be measured and aggregated at a broader program level.

Ultimate Outcomes: Ultimate Outcomes represent the broad societal impacts that the Pilot program contributes to along with many other programs and initiatives. These are usually not

measured at the program level due to problems with attribution, but rather at a departmental or even governmental level using aggregate measures.

College and Community Innovation Program
Logic Model

Ultimate Outcomes

FO4 – Stronger Canadian economy
FO3 – Increase in economic development of the community
FO2 – Increase in the number of high quality jobs based on know-how and technological innovation in the community
FO1 – Local businesses and industries improve their market share

Intermediate Outcomes

INT5 – Local industries and businesses have new and improved products and processes.
INT4 – Local industries and businesses adopt new technologies
INT3 – The capacity of the colleges to transform new knowledge and technology into economic benefit is increased.
INT2 – Teaching activities of the college faculty are enhanced
INT1 – Students receiving training obtain employment requiring their skills and knowledge

Immediate Outcomes

During Award:

IMM8 – Colleges work with local businesses, industries and other organizations on activities to advance innovation in a particular area.
IMM7 – Local businesses, industries and institutions are aware of the benefits of working with the colleges
IMM6 – Students receive hands-on training and financial support to work on projects advancing innovation in the local community
IMM5 – Faculty released from teaching work on activities supporting innovation
IMM4 – Colleges use grants according to their plan and budget, meet project milestones, respect NSERC's rules on use of funds and accountability.

Pre-Award

IMM3 – Selection committee understands its role, recommends meritorious proposals for funding having geographic distribution, and mix of large, small, urban, rural, provide feedback to applicants and advice on program.
IMM2 – Colleges submit proposals meeting program guidelines and criteria
IMM1 – Colleges apply for eligibility to administer NSERC grants

Activities and Outputs

AO6 – Assessing preliminary impacts and determining whether to seek funding to institute program on a permanent basis
AO5 – Ongoing administration, monitoring progress and financial reviews
AO4 – Evaluation of proposals and recommendations for funding by the Selection Committee
AO3 – Receiving and processing applications
AO2 – Appointment of the selection committee
AO1 – Development of the pilot program description in consultation with ACCC and the advisory committee

Program Rationale

- ❑ Increasing and encouraging partnerships and interactions between the colleges and local industries and businesses.
- ❑ Training people to have the skills required to work in local industries and businesses that are introducing and adapting new technologies.
- ❑ Building the capacity of community colleges to enhance innovation in the local community.

4.0 METHODOLOGY

As there were only six colleges participating in the Pilot program, the primary approach involved conducting case studies of each of the six colleges funded under the Pilot program in order to explore evidence of impacts of the Pilot program on college administration, faculty and training, as well as on the local industry and community. The case studies were also intended to provide feedback for improving program delivery. It is important to note that as the Pilot program was only in its second year, the assessment of impacts was, in some cases, limited to assessing progress towards expected outcomes.

4.1 Case Studies

Interviews with college representatives, students and partners were the main source of data for the case studies. Case studies also involved reviews of program files and documents (e.g., proposals, progress reports). Relevant reports and material provided by colleges were reviewed to provide contextual information. College web sites were referenced to obtain additional details about the colleges, their partners and the projects they are working on.

Interviews were conducted over the course of 2 months (May and June 2006) with senior administrators (n=21), other administration (n=10), faculty (n=19), partners (n=15) and students (n=16) from the colleges funded. All interviews were conducted in-person, on-site at each of the colleges. Most of the interviews were conducted individually (i.e., one-on-one), but on occasion group interviews with a particular respondent group (e.g., students, faculty) were also conducted. Interviews generally lasted about an hour, but the length of the interview varied by respondent group; senior administrators taking the longest (60-90 minutes), and industry partners (45 minutes) and students (30 minutes) taking the least amount of time.

4.2 Key informant interviews

In addition to case studies, interviews were also conducted with Selection committee members (n=4) and representatives from colleges with unsuccessful applications (n=5) in order to gain additional insight relating to program improvements.

These interviews were conducted in November and December 2006. They were conducted over the telephone and lasted between 30 and 60 minutes.

4.3 Reporting

Based on the information collected, individual case studies for each of the funded colleges were prepared; these were provided to respondents for validation. This report represents the aggregate findings from the individual case studies.

5.0 "THE NSERC SIX"

The six colleges receiving grants in the pilot program range from the *novice* to *integrated* innovation institution as per the categories identified by Madder in section 2.1. Most were in the *established* innovation institution category; one institution was in transition from *novice* to *established* and although one of the colleges was an *integrated* innovation institution, the school within the institution could be considered to be at the *established* level.

Research administrative positions and policies at the institutions are either well established and continuing to evolve, or have recently been put in place. Four of the six colleges had already obtained eligibility to administer NSERC grants at the time of the competition. For the two others their application for eligibility was still under review when their proposal was recommended for funding and were declared eligible three months later delaying the start of the grant. Even for those institutions where research administration is well established, applied R&D activity is usually limited to one or two specific areas. Lack of financial resources usually limits expansion of this activity beyond these areas.

Facilities and equipment to conduct applied R&D were in place at all six institutions when the grant was awarded. This was often the result of a CFI grant and/or funding from other sources (e.g. the college or the province). All six colleges already had good contact with local businesses through program advisory committees, consultations regarding personnel and training needs and, in a couple of cases, providing solutions to technical problems. However they were most well known for their training rather than their applied R&D activities.

Details regarding the environment and the NSERC supported initiative at each of the six colleges receiving funding in the program are recorded in the individual case studies. A brief overview follows to provide context for this report.

5.1 BCIT, Vancouver, BC

BCIT is a large urban institution and is provincial in scope. Its mandate is broader than that of a typical community college and includes applied R&D and technology transfer activities. At BCIT applied R&D is an important and evolving part of the mandate[3]. Senior administrators believe it is important for faculty to engage in applied R&D; however, not all faculty are expected to do both teaching and applied R&D.

All applied R&D at BCIT directed towards industry needs. BCIT is driven by industry and its core mandate is to work with business and industry. Relationships with industry are very strong. There is also considerable research collaboration with universities.

Applied R&D is carried out in the Technology Centre which has developed a comprehensive research administration structure and provides a range of support and services to faculty.

[3] Since receiving the NSERC award, BCIT formally requested to be eligible as a university and in the Fall of 2006 were granted "conditional university status" until they adjusted one of their policies.

There is a Vice-President Research who is part of the BCIT senior administration and an Office of Research Services. In addition each of the six BCIT Schools carries out applied R&D. Each school has its own research committee that brings together faculty and staff from different disciplines and departments within the school to identify common and emerging areas of expertise and interest. The school's research plan is then presented to the BCIT Research Committee.

The NSERC funded initiative, located in the School of Construction and the Environment, supports the expansion of their applied research capacity in the area of green roof technology, and the creation of a Centre for the Advancement of Green Roof Technology (CAGRT) to respond to the growing demand from industry. The Centre is supporting process and technology innovation within the growing regional green roof industry. It provides SMEs with the expertise and equipment to conduct product testing and development, and to work with local building authorities and standards organizations to develop protocols for validation of green roof products/systems. These efforts are supporting entrepreneurs who are endeavouring to bring new products, processes, services and new technology into the BC market place. It also provides a practical learning environment for students, and is leading to new applied R&D opportunities.

Partners include: manufacturers and suppliers of green roof materials and systems, Environment Canada, Canada Mortgage and Housing and the Greater Vancouver Region.

The initiative is now in its third year. In addition to the base funding of $100,000 per year for each of the three years, the college has received an additional $93,312 in year two and $200,000 in year 3 by their leveraging partner contributions.

5.2 Olds College, Olds, Alberta

Olds College is a small rural institution with roots in agriculture and a focus on land-based industries (e.g., horticulture, land administration and oil/gas, environmental studies, Agricultural mechanization). The College is structured into six schools and offers one-year certificates, two-year diplomas, three-year applied degrees and baccalaureate degrees.

Prior to 2004 Alberta legislation did not allow colleges to engage in research; therefore in 1999 the Olds College Centre for Innovation (OCCI) Ltd was created as a separate not-for-profit company with funding from Alberta Agriculture, Food and Rural Development, the Canada Foundation for Innovation, and the Alberta Value-Added Corporation. While the college found raising the funds to establish the Centre fairly easy, finding on-going operating funds proved difficult. In 2004, with changes to Alberta legislation, applied research became part of the college mandate and OCCI became a school of the college, renamed Olds College School of Innovation (OCSI). It is considered the hub of applied R&D activity at the College. The principal investigators are full-time researchers, and are not appointed to faculty. Faculty become involved in applied R&D projects at OCSI as required, according to their discipline.

Applied R&D is also conducted outside of OCSI, much of which is contract research. Faculty also engage in applied R&D projects on their own time on an ad-hoc basis

The Vice President Academic Services has responsibility for all applied R&D at the College; the Director of Innovation (located at OCSI) and the Principal Investigators at OCSI report directly to him and all applied R&D projects undertaken by faculty must be approved by his office. The current business plan (2006-2010) states, "The College actively pursues involvement in applied research that advances innovation-based rural economic development in Alberta. The applied research activity undertaken by the faculty and research staff at the College supports and informs the curriculum by exposing learners to the most innovative and up-to-date information available in a variety of disciplines".

There is good interaction with the local business community through more than 75 formal relationships and partnerships. The partners are from both public and private sectors and include both large multinationals and individual entrepreneurs.

The NSERC funded project is managed by the Olds College School of Innovation (OCSI) and focuses on technology transfer and commercialization of nutraceutical and functional food products in Central Alberta. The goal is to increase capacity, commercialization and sustainability for small and medium sized enterprises (SMEs) in the agricultural sector within Central Alberta. The focus is on three products (black currants, Saskatoon berries and minor work with dwarf sour cherries) in three agro-climatic regions in Alberta (short-grass prairie, parkland and boreal forest).

The overall approach involves:

- Science: testing for antioxidants and antioxidant activity to support promotion of the berries for their health benefits.
- Agronomy: developing biological control options for typical pests to assist black current growers and pest and testing plants to maximize desired elements (plant material type, plant hardiness, fertilizer).
- Marketing: implementing a strategic marketing plan for the dark berry industry, including: market evaluation and development; business plan and prototype development, benefits awareness and promotion.

Partners include: Crop Diversification Centre South part of Alberta Agriculture and Rural Development and growers in the area.

The initiative is in its second year. Work was delayed in year one due to the current state of the berry industry. The college has received the base funding of $100,000 per year for the two first years and is now beginning to attract some support from partners that can be leveraged for additional funding in year three.

5.3 Red River College, Winnipeg, Manitoba

Red River College is an urban institution with a provincial rather than local mandate. It is the largest college in Manitoba and offers a diversity of credentials, including post-secondary joint baccalaureate, advanced diploma, diploma, certificate and preparatory programs in various fields. In addition, the College provides training for apprentices in 28 designated trades.

The college has a long standing practice of working with industry on problem solving (e.g., redesign of products – visual modeling) in an ad hoc manner; initiated by either an industry contact or by a faculty member. This activity has grown and led the college to take steps to formalize applied research at the college. In 2004, an Office of Applied Research and Commercialization was established with a Director reporting to the Vice President Academic and Research (the term research was recently added to the title). The office created an Institutional Research Plan which identified six focus areas for applied research. An applied research fund has been created to support faculty research and a speaker's series established.

The primary role of applied research at the college is to assist industry, especially SMEs, and to engage students. Much of the applied R&D to date has been conducted via student projects within the curriculum, but this is evolving. The core responsibility of the faculty is teaching but it can be supplemented by applied research activity.

The College is currently constructing a Centre for Applied Research in Sustainable Infrastructure (CARSI) with funding from the Canada Foundation for Innovation and a matching grant from the Manitoba Innovation Fund. CARSI will undertake applied research relating to construction material and building systems. Its main objective is to conduct applied research that leads to the development of innovative and emerging sustainable infrastructure technologies in construction material systems.

The NSERC funded initiative is in the area of Leading Advanced Manufacturing Practices and focuses on the development of a "test bed" which incorporates: a model factory with a flexible manufacturing cell; the application of Virtual Reality (VR) to design and manufacturing; and the practical aspects of using technology roadmaps for production engineering challenges in manufacturing. During the first year, projects were undertaken in order to expand the Model Factory to include VR work stations as well as projects on the application of technology roadmaps. It was intended that the "test bed" would serve to help industry and other potential users to determine the value of adding VR to their operations.

The Model Factory has proven to be an excellent training and demonstration tool but not sufficiently flexible to be useful to industry for a variety of projects . The college has, however, expanded its capacity to work with industry in the area advanced manufacturing and is now in the process of developing partnerships with industries to work on a variety of projects. They received $100,000 in year one, and are preparing a revised proposal to submit to NSERC for the two remaining years of funding.

5.4 Niagara College, Niagara-on-the-Lake, Ontario

Niagara College is a medium-sized college, both urban and rural, with three campuses in the Niagara region of Ontario, and offering more than 70 post-secondary diploma and graduate certificate programs, as well as apprenticeship training and three degree programs.

Economic development has always been part of the mandate of colleges in Ontario. The actual Ontario college act was changed in 2000 to include research; however, research activities are not funded through the base funding that the colleges receive from the province. At Niagara College, the Board of Governors has required that research be part of the strategic direction of

the college for the past seven years. The college has identified three priority areas where it is building breadth and depth, from teaching through to specialized research.

Research administration at Niagara College has developed and evolved significantly between 2000 and the present. Initially, research was the responsibility of individual deans or directors. As R&D became an increasingly important part of the College, the position of Director, Research and Innovation, was created reporting to Vice-President Corporate Services.

Roughly sixty per cent of the applied R&D at Niagara College is in the area of Advanced Visualization. The Centre for Applied Visualization was established in 2000 with funding from CFI, Ontario Innovation Trust (OIT) and industry. Since then CFAV has been engaged in an effort to explore the potential of using 3D visualization as a communication tool with land use planners. The centre has permanent administrative and research staff, and collaborates with local and bi-national companies.

The NSERC funded initiative is located at CFAV. The goal is to expand the college's capacity to work with municipalities and engineering and planning firms, including some SMEs, to further evolve VR technology to create more realistic land use planning models. This involves using a variety of programming tools to visualize traffic and crowd scenarios created with traffic micro-simulation tools, and to explore the use of real-time lighting technologies. They are continuing to create tools and processes that permit existing 3D data (from CAD, GISs, etc.) to be inserted into VR presentations. During the course of the grant they have continued to work with existing partners as well as new partners to expand the applications of the technology

The initiative is in its third year. In addition to the base funding of $100,000 per year for each of the three years, the college has received an additional $100,000 in year two and $200,000 in year three by leveraging partner contributions.

5.5 CÉGEP Lévis-Lauzon, Lévis, Québec

CÉGEP Lévis-Lauzon is one of 48 CÉGEPs in the province of Quebec. Students enter CEGEP after completing six years of elementary school and five years of secondary school. They offer pre-university programs and technical career programs. They play an active role in the social and economic life of their communities, particularly by providing technical support and training services to business.

In the CEGEP system, most research is done in the Centres collégiaux de transfert de technologie (CCTTs). The network of CCTTs was established by the Quebec government in the 1980s to conduct technological research and provide technical assistance, information and training for companies in regions that are often poorly served by other laboratories. They are active in traditional as well as certain high tech manufacturing sectors. The centres rely on the technical equipment and personnel in the CEGEP. Through agreements with the CEGEPs faculty can be granted teaching release to conduct research at the CCTTs.

CÉGEP Lévis-Lauzon, established in 1969, is located in Levis in the Chaudières-Appalaches region of Quebec. It offers 10 programs in the pre-university stream, 12 programs in the technical stream as well as approximately 20 Diplomas of College Studies / Bachelor degrees in

collaboration with four universities. Its origins are from the Lauzon Institute of Technology and therefore the institution has always had a focus on technology. Two CCTTs are located at CEGEP Levis-Lauzon, one in the area of Biotechnology (Trans BioTech) and the other in the area of Robotics (Centre de Robotique Industrielle Inc.).

The NSERC funded initiative is being carried out at Trans BioTech. The goal is to develop a platform technology and related expertise for designing analytical equipment for calculating the level of a given substance in a complex biological matrix, and then adapt this technology for a variety of industrial applications. Initially, a number of bio-receptors are being developed starting with those specific to taxanes[4], and then a prototype bio-sensor will be created that will give an accurate reading of the activity level and /or concentration of taxanes in Canadian yew trees. During the first year of the project the team was successful in developing methods for extraction and purification of taxanes but the molecular biology was delayed due to problems with culturing. They have now made good progress on producing recombinant antibodies. They will develop the means to select the best recombinant antibodies for recognizing taxanes and proceed with the production of these antibodies by biofermentation. Their initial partner, Bioxel Pharma, has continued to be interested in the project but has not provided financial support due to a change in leadership at the company. At the end of year two they were successful in obtaining funding from one company and have several others interested in the technology.

The initiative is now in its third year. In addition to the base funding of $100,000 per year for each of the three years, the college has received an additional $190,000 in year three by leveraging partner contributions.

5.6 Nova Scotia Community College (NSCC)

Nova Scotia Community College (NSCC) was established in 1988 by an act of the Nova Scotia legislature as a branch of the Department of Education. It has thirteen separate campuses both urban and rural. The Annapolis Valley Campus is a rural campus created in 1998 through the merger of the Annapolis campus in Middleton, and the College of Geographic Sciences (COGS) located in Lawrencetown.

With the development of NSCC's Strategic Plan in 1999, research at the college began to take shape. NSCC determined that applied research was within its mandate as a natural extension of the college's role in the economic and social development of the province, and that it should develop its applied research and technology transfer capacities. With a grant from CFI, the college established the Applied Geomatics Research Group (AGRG) at the Annapolis Valley campus in 2000 marking the beginning of research at NSCC. Research in other areas is conducted on a more ad hoc basis. NSCC is committed to expanding research at the college and

[4] Taxanes are diterpenes (a class of hydrocarbons) produced by plants of the genus *Taxus* (yews). They are anti-cancer agents that are used in chemotherapy and which also show promise of being effective against other diseases like Alzheimer's and cardiovascular disorders.

would like to use the AGRG model to develop research programs, but fiscally this has not been possible.

The mandate of the Applied Geomatics Research Group (AGRG) is to undertake research that applies the technologies of GPS, Remote Sensing, and GIS to socio-economic and environmental problems, as defined by government, NGOs, academia and the private sector. Funding from CFI and the Atlantic Innovation Fund (AIF) have enabled them to acquire a critical mass of environmental and geomatics technologies, as well as research scientists. Research at AGRG is carried out by a combination of permanent researchers and faculty seconded from teaching duties. Although the majority of their funding is soft money, it has enabled AGRG to create small teams of researchers to build their capacity in applied research.

AGRG has been developing collaborations with industry, universities and government agencies. In the past two years, they have been working with the municipalities and the regional development agency to establish a Business Innovation Centre in the Annapolis Valley with a concentration on new environmental and geomatics technologies.

The NSERC funded initiative, located at AGRG focuses on integrating environmental and geomatics technologies for landscape monitoring, assessment and restoration. AGRG is using the funding to conduct research using environmental and geomatics technology in this region, where high quality data sets from LiDAR (Light Detection and Ranging) and digital aerial photography are available, in order to answer questions of interest for agriculture and forestry management. It is also providing access to new technologies for Atlantic geomatics companies and is working with a variety of SMEs in Nova Scotia to demonstrate how these technologies can be used in a variety of applications.

Their long term goal is to support business innovation in the region by conducting applied research that has direct relevance to the local community and to provide a mechanism for transfer of new technologies.

The initiative is being led by the senior research scientist responsible for AGRG. A Manager of Business Incubation has been hired and he is responsible for developing contacts with industry, and encouraging them to undertake collaborative research projects with AGRG.

The initiative is in its third year. In addition to the base funding of $100,000 per year for each of the three years, the college has received an additional $100,000 in year two and $ 200,000 in year three by leveraging partner contributions.

6.0 FINDINGS

This section presents the aggregate findings from the case studies conducted at the six colleges, relating to impacts of the grant to-date and challenges experienced. Not all of the impacts described in this section were found at all the colleges. All of the participating colleges are at different stages and, more importantly, what the grant funded at each college is quite different. Nonetheless, similar findings were frequently observed at two or more of the colleges. Similarly, the challenges reported were experienced by the six colleges to varying degrees.

6.1 Impacts

When interviews were conducted for this review, colleges were only just completing their second year of funding. It was expected that immediate outcomes (as per the logic model) would be observed, but that only progress towards intermediate outcomes might be expected. It is noteworthy that even during the award period, intermediate outcomes such as improved products and processes and competitive advantages were observed.

6.1.1 Impacts on the Partners

Although it was too soon to know the full impact of the work with the colleges, a few industry partners anticipated product and process improvements that will save money. In three cases, partners foresaw tangible economic benefits when the results were eventually applied, and believed that they could be quantified in a cost-benefit analysis.

An extremely important benefit for partners of three of the colleges, was the validation and credibility of the results. In one case, this was required because to advance a technology, third-party verification is needed. Partners cited the scientific basis of the work conducted by the college and of the consequent credibility of the results; explaining that because of the credibility, the results could be shared within the industry. In two of these cases, the results of applied research demonstrating the benefits and applications of the products will have a greater impact because they were obtained in an independent study by a college and will be published.

Even at this early stage in their collaborations, partners reported specific benefits. These benefits included access to information and technology; improvements in products or processes; and potential economic impacts. Specific examples are presented below.

Niagara College. Existing partners have worked with the college to enhance a visualization tool, which can be used for public consultations. Not only did this increased one partner's effectiveness at holding public consultations, but also the firm's ability to demonstrate this effectiveness to potential clients; this has improved the marketability of the firm, which has led to increased business. The enhanced visualization tool has enabled the partner to expedite decisions on road construction and engineering projects; as reductions in delays (due to an increased ability to make changes to projects in a more timely manner) will have cost savings on the overall projects.

NSCC. In several short term projects, companies have had problems solved using the technology available at the college and this will have an economic benefit. One industry

partner reported that the project with the college was at the forefront of where the industry is going – asynchronous java (AJAX) is a new and more efficient means to deliver and display mapping over the internet. The hope is that employing this new programming language will improve the service that the company provides to customers, and ultimately, lead, to increased business. Another partner had been completely unaware of LiDAR (Light Detection and Ranging) technology, which can be used to create multi-dimensional topographic maps; the project has led to a better understanding of the technology and the company now has a new exploration tool. It is too soon to tell if this new tool is less costly compared to others at the company's disposal, but more importantly it was believed that the tool will enable them to make more accurate business decisions, and hence reduce their risk. For example, the company was able to determine the optimum location to place their next gravel operation, a place they would not have chosen based on other evidence. This will eventually lead to a cost savings.

Potential for longer term benefit to the community:

BCIT. The work will provide manufacturers with information on how their products behave in green roof systems that will be valuable to them in terms of optimizing their systems and also for marketing their products. It is hoped that this will lead to increased market reach and increased revenues. The information will also serve to demonstrate the benefits of a new technology – not only to customers, but to municipalities. The city of Vancouver will have evidence of the benefits of green roofs under their conditions and be able to promote their use, which will have longer term environmental and social impacts. For example, storm water run off is a major environmental challenge and can disturb the marine and ecological balance and affect the fishing industry. The project will provide useful data regarding the utilization of green roofs as a source control tool in storm water management.

Olds. The College is already providing information to berry producers, currently a fledging industry in Alberta. This information is helping them with production and will be providing information on properties of the products that will help them with marketing. If they can make a success of berry production it will have an economic impact on the producers and therefore the local economy.

Lévis-Lauzon. The applied research underway has the potential to develop a new platform technology that will be useful for several food and biotechnology companies in the province. The college is attempting to develop a portable biosensor that can measure the concentration of specific biological products. If successful, the project will reduce the amount of time required for analysis and could reduce production costs in the field significantly.

Red River. The NSERC funded initiative has not advanced far enough for impacts on industry partners and to be able to predict economic benefits.

6.1.2 Impacts on the Institution

The Pilot program has had a positive impact on all six colleges and for some, it had a particular impact on an individual school, department or centre. Overall, the experience to-date of participating in the Pilot program has met or exceeded the expectations of senior

administrators. Impacts were reported on the following: research capacity and infrastructure; recognition and credibility; and training and curricula. These are described below.

a) Research Capacity/Infrastructure

Research capacity and infrastructure refers to research administration (including policies and procedures), as well as people and equipment. The NSERC grant has led to improvements in research capacity and infrastructure, to varying degrees, at all six colleges.

For three colleges, participating in the Pilot program increased their capacity in research administration. Grant administration (e.g., accountability issues, operations) was enhanced in two colleges and a structure for planning and reporting was developed in a third. In the latter case, the college also developed a more formal articulation of the technology/knowledge transfer process from the college's perspective (i.e., "technology pull" - starting with the company need), while also developing a college-specific technology transfer framework and tools. They have used the NSERC grant to support three studies by a technology assessment firm. This institution plans to share this information with other colleges. In two of these institutions, finalizing NSERC eligibility requirements enabled them to formalize a number of research related policies (e.g., Research Involving Human Subjects, Integrity in Research).

In four institutions, participating in the Pilot program resulted in the development of internal strategies for involving faculty and students in applied R&D activities with business and industry. In one case, this strategy is still in the developmental phase, and focuses mainly on how to involve faculty.

The NSERC grant has provided people and equipment for conducting applied R&D. In all cases, the grant was used to increase the number of faculty (via teaching release) involved in formal applied R&D activities and to have some form of student involvement. In two cases it provided funds to hire research scientists/principal investigators. Also in two cases, the grant was used to establish new administrative positions to support business outreach activities. At one of these two institutions it also enabled the purchase of hardware and software that the institution could not have otherwise obtained. The stability of the funding (i.e., core funding for three years) has been particularly useful for the colleges, as it facilitates the planning of teaching release for faculty and enhances their ability to attract other staff (because they are able to offer a 3-year contract if they need to).

b) Improved Reputation

For all six institutions, improved recognition, credibility and visibility were important impacts of the NSERC grant, particularly with respect to applied R&D. Some saw this as one of the most important impacts. For many, this increased credibility was due to NSERC's reputation and the fact that the institution received funding in a national competition.

Although all six colleges identified recognition as an impact, it meant different things to different institutions. For example, for two institutions, receiving funding from NSERC has facilitated discussion with universities; and for them collaboration with universities is important. For another institution, participating in the Pilot program has raised the profile of

applied R&D at the college internally, giving the perception of quality, validation and prestige. Three institutions tended to focus on increased credibility with industry partners; it was believed that industry partners now viewed the colleges as more than a "mill" for generating students.

For three institutions, improved credibility and visibility translated into an improved ability to obtain additional support, from internal (i.e., within the college) or external sources (e.g., provincial funding). Two institutions reported that the NSERC grant enabled them to leverage funding from other external sources such as the province. In one of these two cases, the grant also resulted in the institution allocating additional resources to the Centre directly affected by the grant. In yet another college, the grant strengthened a department's position within the institution and improved its ability to compete for funds for applied R&D from a central administration budget.

The colleges all reported that the NSERC grant had an impact on their partnerships with the private sector. They reported that existing partnerships had been strengthened or taken to a new level. The grant also led to partnerships with additional companies (including new types of companies that the Centre affected by the grant had never worked with previously), enabled the institutions to build relationships with industry in a particular area or sector, and enabled the colleges to expand the range of services that they could offer to companies, particularly SMEs.

c) Curricula and Training

Although it was not a primary objective of the Pilot program, there was a noteworthy impact on curriculum and training. Faculty and administrators at all six institutions reported that the NSERC grant has enriched training for the students directly involved and has had an important impact on course content and curricula. One of the primary impacts on curricula has been the use of examples from the applied R&D projects. Faculty participating in the applied R&D supported by the NSERC grant take what they learn back to the classroom and have been able to provide timely, direct and relevant examples in teaching. Everything evolves so quickly in some fields that it is very important to keep up to date and to provide students with some insight into where an area is going in the future. This can be very exciting for the students. In addition, working with industry is also a means for faculty to stay current with industry practice and thus enhances training. This allows for a better rounded student who can see the "big picture rather" than just the individual piece they are trying to learn.

New courses have been developed and introduced at three of the colleges and a fourth expects the same before the grant is complete. At one of these institutions a faculty member completely rewrote a course specifically because of the work supported by the NSERC grant; this was not just adding a unit to a course but a whole new way of presenting the subject (of note, this faculty member reported receiving his highest ever teaching ratings that year).

At one of the colleges, the NSERC grant resulted in the development of an entirely new model for training. This institution had offered an advanced diploma program that included course work and a research project. Entry requirements were an undergraduate degree or an

advanced diploma in the field. Having students work on applied R&D projects for industry as part of the advanced diploma program did not fit with the students' schedules nor was it easy to be responsiveness to industry needs. Therefore, an internship program was created in 2005. The program provides six month positions – with a stipend – to work on a project defined by industry, and jointly supervised by industry and college personnel.

At another institution, in the first year of the grant a training facility was enhanced; increasing its teaching capacity. As a result of the enhancement, it enabled students to undertake more sophisticated projects requiring specific computer skills. In addition, the enhancement reduced the amount of time required to complete a process; which meant that students could complete a project in a single lab period, and increased the number of students able to participate in the lab.

6.1.3 Impacts on Faculty

At all six institutions, the Pilot program had an impact on faculty; the main impact was that the grant permitted release from teaching. By providing release time from teaching, the NSERC grant enabled faculty at all six institutions to undertake applied R&D projects that interested them and that were useful for industry in the region, and, in some cases, beyond. This happened to a greater or lesser extent depending on the institution. In two cases, the grants allowed faculty members to be released from teaching full-time (for a period of time) to focus on the applied R&D project without interruption.

Faculty found the opportunity to participate in applied R&D projects enriching and reported personal impacts such as excitement and pride in what they have been able to accomplish and increased motivation to work on more applied R&D projects. In some cases, working on the projects has also increased faculty members' expertise, expanded their skills or kept them current with what was going on in industry.

6.1.4 Impacts on Students

Although each institution used the NSERC grant to support students from their institution, this was more limited than anticipated. In three cases, institutions had a student enrolled in a university program, or a student who had just completed their college diploma or degree, working on the projects. (Note: the university student was not paid from the NSERC grant). In a third case, an institution created an entirely new stream of trainees via internships, which were not technically students in the way NSERC typically defines them.

The students enrolled in programs at colleges who participated in the projects supported by the NSERC grant generally did this during work terms (co-op program), as a summer job, in brief work study periods, or in satisfying program requirements for work experience. The impact on students has varied among the institutions and depended on the skill level of the student and the length of time they were able to work on the project.

Students found the opportunity to work on applied R&D projects to be stimulating and enhanced their learning experience by providing an experience that was very different from classroom learning. Several students reported that it had benefited their course work, helping them understand the theory that is taught in class and enabling them to see the implications of

the work (e.g., how industry would benefit). For some students, participating provided them with technical skills (e.g., sampling techniques) and new knowledge; some also noted that in addition to technical skills, the experience increased their confidence and enabled them to become more autonomous and better able to make decisions.

Industry exposure was also an important feature; the experience enhanced their resumes by adding relevant experience and made them more marketable for employment prospects. In some cases it also introduced them to potential employers. Even in cases where there was no interaction with industrial partners, students found that the practical work was helpful and similar to what they expected they would experience (and in one case did experience) in industry.

Students participating in the internship program (described in the section on training) reported similar impacts to the other students working on NSERC supported projects; however the extent (strength) of the impact was much higher as they worked only on a research project and did not take courses. They found the internship to be an excellent opportunity for conducting applied R&D, acquiring new skills, and upgrading existing skills outside of a classroom setting. In addition to technical skills they identified report writing, communications, presentation, and analytical skills. They also appreciated the opportunity to be involved in transferring knowledge to the industry partner. Working with a research scientist one-on-one was a unique opportunity for them. Most interns said the experience prepared them well for the work force. One student who planned to go to graduate school said that he believes the knowledge and the relationships he developed with researchers and businesses in the industry will help him perform more comprehensive and successful graduate work. According to the interns the experience was unique. The knowledge gained in the project is very specific to a quickly growing industry. They would not have access to this technology in other circumstances.

In addition to the impacts on students who participated in the applied R&D projects supported by the grant, a wider number of students have benefited by enhancements to courses and training (discussed above in the section on institutional impacts - curricula and training).

6.2 Challenges

College administrators and faculty were asked to identify any challenges they had experienced during their participation in the Pilot program. These could be challenges experienced during interactions with NSERC or challenges which limited their ability to participate in the Pilot program. It is important to note that a number of the difficulties reported by colleges could be considered "growing pains"; these were challenges associated with the fact that it was the first time that NSERC and the colleges were interacting directly (as the Pilot program was NSERC's first initiative to provide funding directly to the colleges). For the colleges, participating in the Pilot program required a learning process: understanding what NSERC was looking for in a project; what needed to be reported on in progress reports (and what level of detail was required); and understanding the guidelines around leveraging (i.e., under what circumstances funds can be matched). For NSERC, there were challenges communicating all of these things in a fashion that would be clearly understood by the colleges. One of the most frequently levelled criticisms was concerning NSERC's forms, in that they were not appropriate for the college

context. For example, NSERC's form 183A gathers information on industrial partners, but is normally associated with a grant directed at an *individual* grantee, as opposed to an institution. Furthermore, the Form 300, used to gather information on financial expenditures by a grantee has numerous student categories appearing on it that are not applicable to colleges (i.e., undergraduate, masters, Ph.D., Post-Doctoral Fellow). For a few individuals, application forms and reporting templates were confusing and difficult to understand and the information on NSERC's website was not helpful.

Other challenges experienced by colleges are described below and relate to: timing; faculty release time; involvement of students; finding partners; responsiveness to businesses; administrative infrastructure; and sustainability.

a) Timing

Challenges related to timing included delays at start-up as well as the timing of the grant (in relation to the notification period).

- *Delays*. For one college, the project required substantial time to ramp up because of the nature of the project (an agricultural project that had to wait for the growing season to begin). Having to report on their progress in June became problematic as there hadn't been much progress. The college was given the choice as to whether or not it would have to report, and this college elected to do so, not realizing what impact it might have on subsequent instalments. In future, for these types of projects, there should be some flexibility in negotiating the funding start-date.
- *Eligibility*. The start of funding for two colleges was delayed until November, the time when they were granted eligibility to administer NSERC grants. For one college, it was felt that the delay in eligibility had an impact on their ability to report on progress the following June.
- *Notification of funds*. Colleges had a great deal of difficulty with the length of time between the notification and award of funds. They are notified at the end of August with respect to funding that starts September 1st; this does not allow sufficient lead time to release faculty for September. There needs to be much more lead time between the point at which colleges are notified of the grant and when the funds are actually released. An award start date of September seems to be appropriate, only as long as the colleges know how much money they will receive by at least early May.

b) Faculty release time

Managing faculty release time, especially on a short term basis, can be challenging. For college administration, it is difficult to find faculty replacements for terms of only a few months. One college is exploring the possibility of creating a "floater" position to address this. College faculty have fairly high "contact hours" (i.e., the number of hours faculty teach) per course; it varies from program to program (and by institution) and can be in the range of 10-15 hours per week. From the faculty perspective, because of the high number of contact hours, if they are not

fully released during a semester, it can be quite challenging to balance academic duties with applied R&D activities, creating job stress.

c) Involvement of students

All colleges reported that there are challenges having students participate in applied R&D projects in a meaningful way; either with respect to timing their involvement or, in some cases, finding students with the necessary experience and skills. As noted earlier, one college, which offered an advanced diploma program, established an internship program; this addressed both the issue of timing and skill level.

- *Timing of involvement*. College students typically do their co-op placements in the summer. During the school year, student involvement has to be limited because of their course load. However, projects that are driven by industry can be time-sensitive and it will not always be possible to wait until summer or to involve students on a part-time basis.
- *Skill level*. Although it is very much dependent on the project, there are some issues relating to the skill sets of the students, and whether they are at a high enough level to work on projects for industry. It is important to note that these students are still in training and in most cases, may only be in their first or second year of post-secondary education. The type of involvement and the extent to which they can be involved will be determined by their skill level.

d) Finding partners

Colleges have traditionally had very close ties to industry, but these have mainly been with respect to providing training as opposed to carrying out applied R&D and problem solving. For some colleges, much of the problem-solving for businesses seems mostly to have occurred via student projects, but not beyond this scale. Challenges finding partners for more in-depth applied research can be grouped into two categories, challenges relating to outreach, and leveraging.

- *Educating local businesses/Outreach to businesses*. Some colleges have had to work at outreach to local industry to begin a formal dialogue on how the college can help them solve problems. Some colleges held workshops (supported by the grant) and invited local businesses to explore new opportunities for how the college could work with the private sector.
- *Leveraging*. Some colleges experienced challenges finding suitable partners whose contributions would be eligible for matching under the Pilot. One college has created a position (supported by the grant) to actively look for opportunities for the college to interact with businesses. Another has administrative staff, among whose functions are to liaise with businesses and understand how the college can assist them.

e) Ability to be responsive to businesses

Meeting industry needs that are time sensitive is challenging because of many of the issues above, such as those related to students and faculty release time. Colleges without full-time

researchers do not have the capacity to respond quickly; because faculty release time needs to be planned and students are not always available.

f) (Administrative) Infrastructure

Applied R&D operations can require a great deal of administrative support, (e.g., project coordination). Finding the resources to put these support systems in place can be a difficulty.

g) Sustainability

The Pilot program grants have assisted colleges in building their capacity to conduct applied R&D projects with local industry. However, once the grant finishes, it is not clear how (or in some cases, if) the colleges will be able to continue the type of interaction they have had with the local business community under the Pilot program. Pilot program funding has been an excellent vehicle for the colleges to obtain teaching release for faculty to work on applied R&D projects with industry. Once funding ceases, however, colleges will find themselves in the same situation as prior to the pilot – they are primarily teaching institutions and it is extremely difficult, as funding sources are limited, to find the requisite funds to engage in the kinds of projects that have been funded by the NSERC Pilot.

7.0 CONCLUSIONS

Conclusion 1: Colleges are well positioned to work with local industry beyond the provision of training. In particular, Colleges with an established applied R&D capacity are well placed to help companies address problems via applied R&D projects and to assist them in adopting new technology.

The six colleges in the Pilot (as do many colleges) have longstanding relationships with local and or regional industry. In most cases, the companies knew the college best as a trainer and provider of trained graduates, able to adjust its programs to meet companies' needs. Industry partners have hired students for co-op or work experience term and in, some cases, the college has provided training to partners' employees. Prior to participating in the pilot, the partners did not necessarily know that the college was able to work with them on applied R&D projects or provide results from applied R&D projects to meet their needs.

In all cases, during the relatively short period (less than two years) of the NSERC grant, selected sectors of local industry became aware, or more aware, of additional capabilities of the college. The impacts that the industry partners experienced from working with the six colleges in the pilot provide evidence that the colleges are well positioned to work with local industry.

The extent to which this "position" can be exploited, will depend on the level of applied R&D capacity at the college. Evidence from other studies reveals that the states of innovation and applied R&D activity vary widely across colleges[5]. It is important to note that the six colleges participating in the pilot range from *novice* to *integrated* innovation institution (as described in section 2.1 of this report) and it is in the novice institution in which the NSERC funded initiative has not advanced far enough for impacts on industry partners and to be able to predict economic benefits.

Conclusion 2: The capacity of the six colleges awarded grants in the Pilot program to conduct applied R&D and to work with local businesses was enhanced.

For colleges (or schools within colleges) the process of beginning to undertake applied R&D projects in a formal way, and of preparing the proposal for the pilot, provided a focal point for applied R&D within the college. For colleges that were already formally undertaking applied R&D projects, the Pilot enhanced the institutions' applied R&D capacity: it increased the scope of the projects and greatly facilitated the colleges' capacity to involve faculty in these projects – by providing stable funding over an extended period of time (3 years). This made it easier to plan for the release of faculty and provided the actual funds for faculty release time.

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[5] Madder, D.J., *Innovation at Canadian Colleges and Institutes* (June 2005); ACCC survey of colleges (March 2002).

Each of the six colleges established relationships with new partners and enhanced/strengthened relationships with existing partners. In all cases, the relationships were different than they had been in the past.

Conclusion 3: Specific circumstances facilitate carrying out applied R&D at the colleges

The following were observed to facilitate applied R&D at the colleges:

- support from senior administration;
- having research administration and infrastructure in place;
- committed/interested faculty; and
- dedicated staff for applied R&D (i.e., permanent researchers).

The situation that appeared most conducive to applied R&D at a college involved permanent researchers who carried out applied R&D full time and appropriate administrative support to attract the interest of industry. This thus enables faculty and students to work on projects during periods of teaching release and/or student work terms.

Colleges best able to capitalize on the NSERC grant had a research centre or facility in place. Several of these had been the result of funding from CFI and subsequent commitment of the administration to dedicate resources to operating the facility.

Conclusion 4: It is too early to conclude that innovation and economic revitalization within the communities where the colleges are located has been enhanced as these are longer term benefits. However, there have been some short term benefits to local industry in some cases, and in others there is the potential to have longer term economic benefits.

In several of the projects, short term impacts and benefits have been realized by the industrial partners. This has included the companies gaining access to leading-edge information management technology to carry out tasks in a more efficient and cost-effective manner, to create more advanced mapping tools, and to develop effective demonstrations of new technologies. Moreover, some partners were able to apply the results of the research to carry out improvements in products and processes. Beyond relatively short term impacts, there have also been potential impacts on the development of standards and by-law codes, and the provision of information that can be used to develop and expand markets for products – both concepts that may have long term benefit.

Conclusion 5: Because of the nature of the colleges and their mandate from the provinces they face many challenges in carrying out applied R&D to assist local industry.

The mandates of the six participating colleges include economic development of their local community, and their boards of governors are urging them to carry out applied R&D to assist local industry. However, the funding the colleges receive from the provinces is designated for teaching, and the colleges find it difficult to allocate resources for applied R&D, including administrative support, facilities and equipment, salaries for researchers and faculty release

time. Of those colleges that have been able to dedicate some resources to applied R&D, most have usually only been able to do so in one area.

Conclusion 6: Colleges need stable financial support to be able to carry out applied R&D projects with local industry, in particular SMEs.

To be able to increase their capacity to carry out applied R&D with local industry, funding is needed for the colleges (i.e., the institutions as a whole). This includes infrastructure funding for equipment and facilities to establish research centres, as well as operating funds (e.g., staff salaries, research administration, equipment maintenance) to keep these efforts sustainable.

Project funding is also needed to provide support for applied R&D projects undertaken with local industry. These projects should be true collaborations and not contract research. Leveraging industry funds for applied R&D projects would assist in covering the costs of faculty release time and student stipends, among other required expenses.