Applied Research at Canadian Colleges and Institutes

Association of Canadian Community Colleges

May 2006

Acknowledgement

The Association of Canadian Community Colleges (ACCC) wishes to express its sincerest thanks and appreciation to those colleges, institutes of technology, cégeps and university-colleges who responded to the survey.

Table of Contents

EXECUTIVE SUMMARY

1. INTRODUCTION

Canada has a national network of over 150 colleges and institutes in over 900 communities in all regions of the country. These institutions are mandated to support the socio-economic development of the communities and regions. Colleges and institutes develop education and training programs to meet employer needs with direct input from business, industry and community partner organizations. Colleges' and institutes' role in applied research, development and commercialization is reflective of this mandate and is an extension of institutions' collaboration and partnerships with business, industry and community partners.

In order to define and capture the level and scope of applied research activity that colleges and institutes are currently performing, the Association of Canadian Community Colleges (ACCC) led an on-line survey of member institutions in January - March 2006. A total of 59 colleges, institutes of technology, cégeps and university-colleges from the six regions of Canada completed the survey. This is 42 percent of the 140 member institutions which were invited to complete the survey.

2. BACKGROUND

The recognition of the role of colleges and institutes in innovation, applied research and commercialization is a key advocacy priority for the ACCC. Over the past five years, ACCC has done a considerable amount of advocacy to increase the understanding of applied research in colleges and institutes and to voice the need for new federal research funding policies and programs to enable colleges and institutes to make a greater contribution to innovation in Canada. Some key measures have been taken:

- A national ACCC Task Group was created in 2002 to undertake advocacy activities to explore funding options for college and institute applied research. In 2004, a National Research Action Committee was created to move forward with the work of the Task Group.
- In 2002, ACCC administered a survey for the Industry Canada Policy Branch with its member colleges and institutes on applied research and development.
- Funding was provided to produce a report entitled *Innovation at Colleges and Institutes.* This report provides an overview of policies, programs, practices and administrative structures that exist to support innovation at colleges and institutes.
- A national applied research forum is held on an annual basis to encourage networking, share best practices, exchange on role of colleges and institutes in applied research and strengthen awareness with key stakeholders.
- On-going discussions with various government departments, NSERC, SSHRC, CIHR and PreCarn regarding enhancing college and institute involvement in the innovation agenda.
- ACCC mobilized colleges and institutes to respond to the Social Sciences and Humanities Research Council (SSHRC) consultation on the transformation of SSHRC.
- ACCC provided input to the Science and Engineering Research Council (NSERC) for the College and Community Innovation Pilot Program.

3. INTERNAL AND EXTERNAL POLICY ENVIRONMENTS OF COLLEGE AND INSTITUTE APPLIED RESEARCH ACTIVITIES

The survey results provide some perspectives on the external and internal policy environments within which colleges and institutes are carrying out applied research activities.

External Policy Environment

In terms of the external policy environment, colleges and institutes were asked whether their provincial/territorial government recognizes and supports college/institute research and development through provincial legislation, operating grants and actual research and development programs. Respondent colleges and institutes confirmed the following:

- **Recognition through Provincial Legislation:** 61 percent (36) of respondent colleges and institutes confirmed that they do have recognition through provincial/territorial legislation, 25 percent (15) indicated that they do not, and 10 percent (6) colleges indicated that legislation is in progress. The 36 institutions with legislative recognition are mostly concentrated in Ontario, Quebec and Alberta.
- **Operating Grants for Applied Research:** 47 percent (28) of respondent institutions indicated that they receive operating grants, 41 percent (24) confirmed they do not, and 10 percent (6) indicated a process is in progress to establish operating grants for applied research. The majority of institutions which receive operating grants from their provincial government are from Quebec, which is reflective of the extensive network of research and technology transfer centres which are attached to cégeps in this province.
- **Research and Development Programs:** Up to 75 percent (44) respondent institutions, the majority from Quebec and Ontario, confirmed that their provincial governments provide support for applied research through research and development programs. Colleges and institutes in provinces which do not have articulated recognition in legislation for applied research, do have access to research and development program funding, this includes institutions in provinces such as Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward Island.

Internal Policy Environment

In order to get a sense of how applied research activities are supported by college and institute internal policy environments, colleges and institutes were asked whether applied research is included in their mission statements and/or strategic plans as well as whether formal institutional policies have been developed.

College and Institute Mission Statements: Up to 71 percent of respondent institutions confirmed that research and development is included in their mission statements or strategic plans.

Formal Institutional Policies: Up to 58 percent (34) of respondent colleges and institutes confirmed that formal policies on applied research have been developed and implemented, and 47 percent (28) have developed and implemented formal policies on intellectual property.

4. COLLEGE AND INSTITUTE ADMINISTRATIVE STRUCTURES AND ORGANIZATION OF APPLIED RESEARCH

Colleges and institutes vary in how they are structured for the development, management and delivery of applied research initiatives. The survey results confirm the following:

- 51 percent (30) of participating colleges and institutes have an office or centre of applied research or innovation, and applied research and innovation activities most often fall under the responsibility of the Vice President Academic, and in some cases Vice-Presidents responsible for business development or corporate services.
- 58 percent (34) of respondent institutions have a designated administrative staff member responsible for managing applied research activities, such as a director or manager of applied research, and 55 percent (31) have a staff member who manages innovation activities in conjunction with other responsibilities such as contract training, institutional and market research.
- 59 percent (35) of respondent colleges and institutes have dedicated resources that support applied research grant application and administration, and 53 percent (29) of respondents confirmed they have staff members responsible for applied research contract negotiation and administration.
- 42 percent (25) of institutions confirmed they have a designated physical research facility to conduct applied research activities, with the most significant number in Quebec, which is not surprising given the centres of technology transfer, as well as Ontario and Alberta.

5. FACULTY AND STUDENT INVOLVEMENT IN RESEARCH AND INNOVATION

Respondent colleges and institutes provided some perspectives on faculty and student involvement in applied research and development.

Faculty

Almost one third of respondent institutions (18) confirmed that research experience is a requirement for hiring new faculty, 49 percent (29) of respondent institutions indicated that it is not a requirement and 20 percent (12) of institutions did not provide a response. Most of the colleges and institutes which confirmed that this is a prerequisite for faculty specified that this was for faculty:

- teaching in applied degree programs, mainly in Alberta and Ontario;
- working in centres of excellence or sector specific research centres.

In these cases, colleges and institutes are seeking faculty with advanced research credentials with doctorate or at minimum masters degrees. Although institutions also indicated that they may look for publication experience, applied research and industrial experience remains a key requirement.

Colleges and institutes also provided information on the proportion of full-time or part-time faculty who were provided with time and assistance to perform or manage applied research and development and/or supporting private sector technology adoption. Seventy-five percent (45) of respondents answered this question, and of those:

- 18 indicated that less than five percent of their faculty were provided with time and assistance for applied research or technology transfer activities;

- 13 indicated that between 5 and 10 percent of faculty were provided with time and assistance for applied research or technology transfer activities;
- 7 indicated that none of their faculty were provided this type of support; and
- 3 of centres of technology transfer from Quebec indicated 60 to 100 percent of their faculty is provided with time for applied research or technology transfer.

Students

Colleges and institutes are involving students in applied research activities primarily to enhance the learning experience for students. Respondent colleges and institutes identified and described the following three main approaches used to involve students in applied research activities:

- **Integration of research into the curriculum of college/institute programs:**
  One of the main ways of involving students in applied research is by enhancing the curriculum to include elements and activities which develop students' research, analytical and critical thinking skills. This is achieved by:
  - including project-based learning modules and/or delivery
  - providing equipment for classroom projects
  - providing incentives for applied research projects such as awards or prizes;
  - making senior year research projects a course requirement for some diploma and all applied degree programs.

- **Financial support for student research projects:**
  Some respondent institutions have established student research grants or have competitions with prizes as incentives for students to become engaged in applied research.

- **Student employment opportunities in research initiatives and projects:**
  Colleges and institutes are also providing students with opportunities to participate in applied research through research assistanceships either part-time during the academic year or full-time during the summer months. Workplace practicums, internships, directed field studies and/or co-op programs were also identified as a way of providing students with opportunities to become involved in community- or industry-based research initiatives.

6. FUNDING OF APPLIED RESEARCH ACTIVITIES

Forty-two percent (25) of respondent institutions provided information on the funding sources for their applied research activities from:

- federal, provincial, regional and municipal governments;
- firms and business associations;
- international organizations;
- other sources such as foundations and non-governmental organizations; and
- internal sources.

Respondent institutions identified a total of 166 initiatives active in 2005.

Colleges and institutes also provided estimates of the value of the grants and contracts accessed in 2005. These values vary significantly but provide an indication of the scope of applied research activity. Most initiatives fell within the 5,000 to 75,000 ranges, with a significant

number also in the $100,000 to $300,000 range. The grants and contracts over $500,000 are from federal and provincial government sources, largely supporting the more significant research facilities attached to some colleges and institutes.

Federal Government Departments, Granting Councils and Agencies
The combined contribution from federal government departments, agencies and granting councils constitute the most significant source of funding for college and institute applied research activities. The 25 institutions which responded to this question identified 40 research projects funded by 20 federal government departments, granting councils and agencies. The value of 2005 grants and contracts for these applied research projects funded from federal government sources is almost $28 million.

This survey asked colleges and institutes whether they have institutional eligibility to administer NSERC grants: 32 percent (19) of respondent colleges and institutes indicated that they have NSERC eligibility, 39 percent (23) do not, and 22 percent (13) have applications for NSERC eligibility in progress.

Provincial, Regional and Municipal Governments
After the federal government, provincial, regional and municipal governments are the next largest sources of funding for applied research activities at colleges and institutes. Respondent colleges and institutes identified 46 applied research projects active during 2005, funded by provincial, regional and municipal government sources through grants and contracts valued at over $13 million.

Firms and Business Associations
Colleges and institutes are also contracting with firms and businesses for applied research activities and respondent institutions identified 25 projects funded through private sector partnerships with firms and business in a variety of sectors including: agriculture, aquaculture, construction, energy, engineering, fisheries, information and communications technologies, media and communications, and natural resources. The 25 projects with firms and business associations have an overall value of up to $4.2 million.

Other Sources of Funding
Colleges and institutes identified up to 23 other sources of funding with a value of over $1.5 million. The main categories of these other sources of funding are private foundations, non-profit organizations and associations, economic development organizations, universities, professional associations, unions.

7. SECTORS OF INVOLVEMENT OF COLLEGE AND INSTITUTE APPLIED RESEARCH ACTIVITIES

Colleges and institutes are involved in applied research and development activities in many and diverse sectors. Based on the results from this question, the report provides an overview of the sectors of expertise of colleges and institutes, beginning with the sectors with the most college/institute involvement, as outlined below.

- Teaching and Learning
- Health and Life Sciences
- Environment
- Information and Communications Technology
- Manufacturing
- Humanities and Social Sciences
- Renewable Energy
- Multi-Media
- Agriculture
- Virtual Reality/Advanced Visualization
- Aerospace
- Marine and Aquaculture
- Textile Technologies
- Energy

In addition, the report identified the colleges and institutes involved in applied research and development in each sector, as well as some applied research success stories by sector.

8. IMPACTS AND OUTCOMES OF COLLEGE AND INSTITUTE APPLIED RESEARCH

The report provides some insights on the impacts and outcomes of college and institute applied research on local and regional economic and social development, with particular emphasis on how colleges and institutes are meeting the innovation, research and development needs of industry and community partners.

Colleges' and institutes' role in applied research is reflective of their mandate to contribute to community and regional development. As such, research is initiated and conducted in response to the needs of industry and community partners. The model on the last page of this summary provides a overview of the research, development and commercialization process and shows where colleges and institutes fit within this process. As this model shows, college and institute research is driven from market pull, or the demand side, from the users of technology or knowledge who need to improve, refine or adapt technology, or improve on procedures, policies or approaches to meet client needs. As a result, colleges and institutes are more at the development, commercialization and knowledge transfer stages of research. The ultimate impact of research is economic and social development within communities, regions and in some cases, there is even provincial or national impact.

College and Institute Applied Research Partnerships and Contribution to Local and Regional Development

Colleges and intitutes collaborate and partner with the following types of organizations:

- Most respondent institutions are partnering with the private sector, mostly with Small and Medium Enterprises 63 percent (37) of respondent institutions, and then Large Firms 54 percent (32) and Industry Associations 54 percent (32).
- Universities are also significant applied research partners identified by 47 percent (28) of respondent institutions, as well as other colleges and institutes identified by 46 percent (27) of respondents.
- 24 percent (14) of respondents are partnering with community groups and municipal governments.

Colleges and institutes are for the most part partnering with organizations located within 100 kilometres of their institutions. This is true for 147 (or 62%) of the 238 partnerships identified. Respondents identified up to 80 research partners located elsewhere in their province. This is

just over one third (34 percent) of the 238 partners identified by respondents. Respondent institutions also identified nine research partnerships elsewhere in Canada, and two in the United States.

The most common type of service offered to firms is employee training, followed by product development and testing; research; consultancy, mentoring, brokerage; and space and equipment. Some examples of the other types of services include: 3D visualizations, grant writing, microprocessing and development of business plans.

One important way colleges and institutes contribute to local and regional economic development is by working with local and regional economic development agencies. This survey confirms that 66 percent (39) of colleges and institutes indicated that they work with local and regional economic development agencies to support company growth, 56 percent (33) of respondent institutions work with these agencies to attract companies to their region, and 39 percent (23) of insitutions do so to help create new companies.

Outcomes of College and Institute Applied Research

Colleges and institutes identified the following outcomes and impacts of their applied research and development and technology transfer undertakings:

- 515 industrial and private sector projects realized in the last fiscal year;
- 90 prototypes were developed in the last fiscal year;
- 6 patents and 5 licences approved; and
- 14 spin-off companies, with 40 jobs (FTE) created in these spin-off companies.

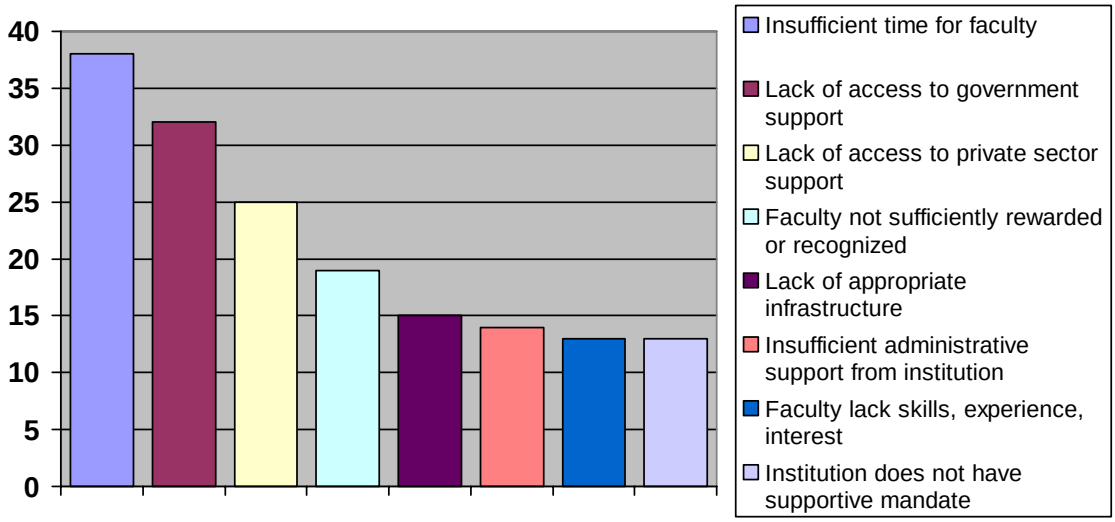
Quebec colleges reported the highest number of projects, prototypes, patents, licenses and spin-off companies, followed by Ontario.

The most common types of research facilities are: dedicated applied research centres and technology training centres, as well as by centres of excellence.

9. BARRIERS COLLEGES AND INSTITUTES FACE IN MOVING APPLIED RESEARCH INITIATIVES FORWARD

The following chart shows how respondent colleges and institutes ranked barriers which hinder or impede them from maximizing their potential to contribute to innovation in Canada through applied research and development. The barrier which was ranked as most important or important by the highest number of colleges and institutes (38 institutions or 64% of respondents) is that faculty and staff do not have sufficient time to lead and participate in applied research activities.

Barriers to Applied Research ranked Very Important/Important by Colleges and Institutes



These barriers provide some indication on where federal and provincial government programs and institutional policies need to focus in order to strengthen college and institute applied research efforts.

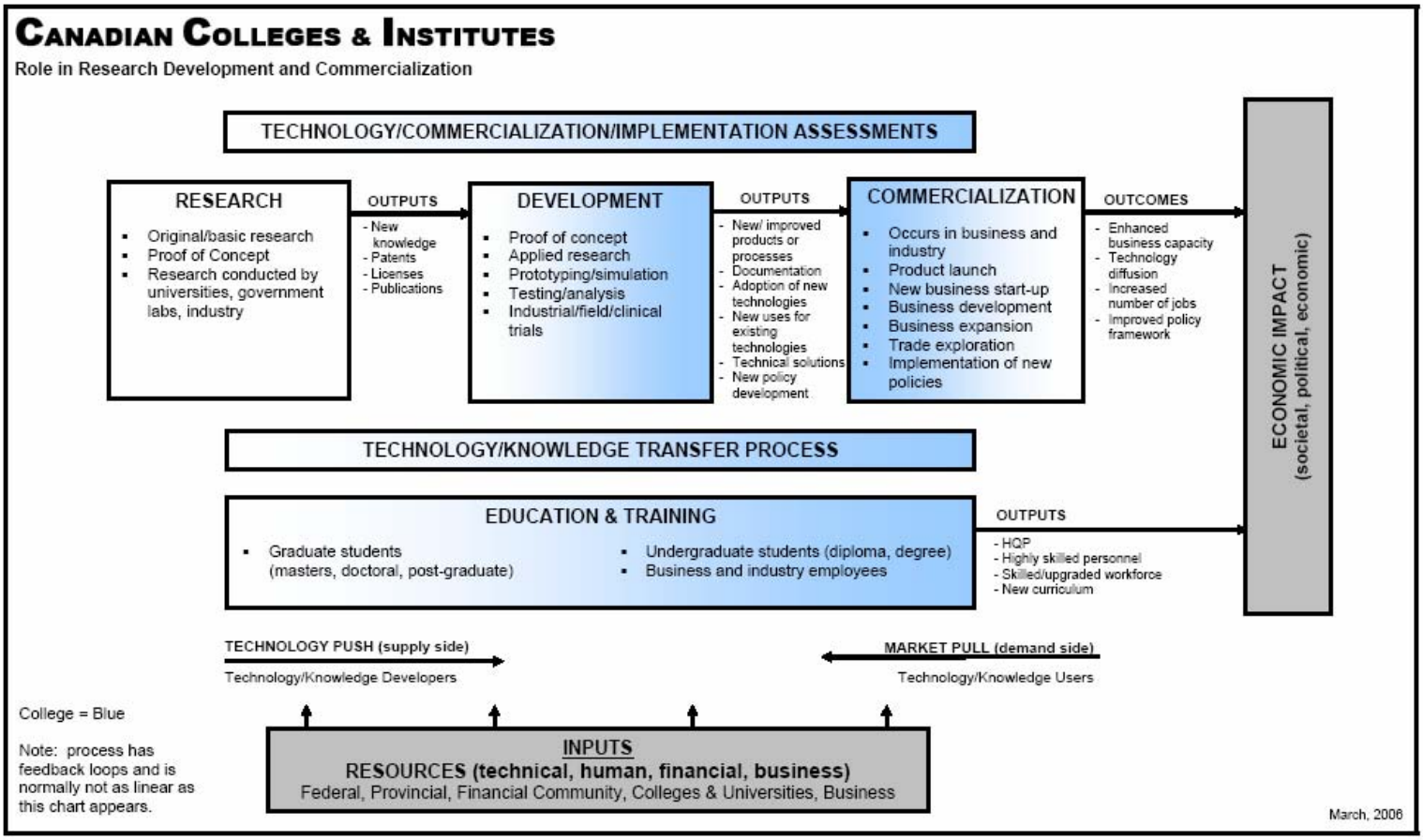
10. CAPACITY BUILDING NEEDS OF COLLEGES AND INSTITUTES IN THE AREA OF APPLIED RESEARCH

Almost all respondent colleges and institutes confirmed that they want to participate more fully in applied research and development activities, and the majority indicated that a mentoring or support system could assist them in further developing applied research and development capacity. Colleges and institutes provided some interesting suggestions on the type of support that would be most beneficial for the enhancement and strengthening of applied research capacity:

- **Recognition** for the role of colleges and institutes to undertake autonomous applied research activities, without being obligated to partner with universities.
- **Mentoring** between experienced and inexperienced colleges for administrators, faculty, staff and students in areas such as
    - set-up of an applied research infrastructure;
    - collaborative research project models;
    - stablishing eligibility to compete for national funding sources;
    - effective policies, processes, the creation of ethics review processes and committees;
    - faculty mentoring on designing and executing research projects; and
    - development of partnerships for applied research and development.
- **Sharing of exemplary practices** among colleges and institutes is viewed as particularly helpful . Smaller institutions also suggested that exemplary practices be organized or grouped according to institutions with similar sizes and mandates.
- **A resource document of funding opportunities** available to colleges and institutes for applied research would be beneficial.
- **Institutional structures and policies** to be enhanced to improve applied research capacity include:
    - full-time staff member responsible for overall management of applied research;

- an institutional framework for applied research services;
- standardized databases for recording research resources and expertise;
- involvement in regional or provincial applied research and innovation groups or clusters;
- Ethics Review Committee and an ethics review process;
- networking and marketing of applied research expertise of the college/institute.

- **Advocacy** efforts by ACCC and other organizations must be continued to induce policy changes at various levels of government and promote college and institute applied research in Canada. Some advocacy areas identified by respondent colleges and institutes include:
  - Applied Research Agency for Colleges and Institutes
  - Centres of Excellence within colleges and institutes to be established in collaboration with industry associations, municipal, provincial and federal governments.
  - Standardized financial collection and reporting methods among granting councils and federal and provincial programs which support applied research.
  - A mechanism for faculty release time within research funding programs for colleges and institutes.



1. Introduction

Canada has a national network of over 150 colleges and institutes in over 900 communities in all regions of the country. These institutions are closely connected with regional business and industry and community-based organizations, and form a direct link between university-based fundamental research and the application of this research by small-and medium-sized enterprises and communities. In this manner, colleges and institutes contribute significantly to social and economic development in their surrounding communities and regions.

To define and capture the level and scope of applied research activity that colleges and institutes are currently performing, the Association of Canadian Community Colleges (ACCC) led an on-line survey of member institutions in January - March 2006. In February 2002, ACCC administered a survey for Industry Canada on Canadian colleges' and institutes' contribution to research and development. The results of the 2002 survey have not been compared to the 2006 survey results because the 2006 instrument has changed from the 2002 version. In addition, the 2006 response rate is somewhat lower, 84 institutions responded in 2002 compared to 59 in 2006. This current survey results provide a snapshot of applied research at colleges and institutes and gives some indication of how applied research is evolving.

It is also important to highlight that the results of this survey are complementary to and substantiate the conclusions of two previous ACCC reports related to applied research: the *ACCC Final Consultation Report for the Consultation with Canadian Colleges and Institutes submitted to the Social Sciences and Humanities Research Council (SSHRC) (http://www.accc.ca/ftp/briefs-memoires/200410-shrc_consultation.pdf) in October 2004*; as well as the report prepared by Jim Madder, PhD entitled *Innovation at Canadian Colleges and Institutes (http://www.accc.ca/ftp/pubs/studies/200506innovationreport.pdf)* submitted to ACCC in June 2005. Both of these reports helped to characterize applied research at colleges and institutes in terms of the internal and external policy environments within which institutions are conducting applied research activities, the administrative structures institutions have or are putting in place, the involvement of faculty and students, and the challenges institutions are facing in the area of applied research.

The stated objective of the 2006 survey was to obtain information on the contribution that colleges and institutes are making to innovation in Canada by way of facilitating private sector development and adoption of new or improved products, services and processes. Although this objective puts emphasis on applied research and innovation which targets more technology-related fields, when colleges and institutes were also asked to identify their sectors of involvement, *Humanities/Social Sciences* and *Teaching/Learning* were included in the list of sectors. As such, respondent colleges and institutes have also provided some indication of their involvement in social sciences and humanities research, and identified a number of success stories of social sciences and humanities related research initiatives. The ACCC report prepared for the SSHRC consultation also confirmed that college and institute applied research offices are providing support to college faculty and staff involved in social sciences and humanities research. As a result, the scope of this survey report reaches beyond the stated objective of the survey to include college and institute involvement in applied research in both science and technology fields as well as the social sciences and humanities.

This report provides the key results and findings of the 2006 survey and is structured to provide an overview of the following:

- Internal and external policy environments of college and institute applied research activities;
- College and institute administrative structures and organization of applied research;
- Faculty and student involvement in research and innovation;
- Funding of applied research activities;
- Sectors of involvement of college and institute applied research activities;
- Impacts and outcomes of college and institute applied research activities, including the contribution to community and regional development;
- Barriers colleges and institutes face in moving applied research initiatives forward;
- Capacity building needs of colleges and institutes in the area of applied research.

2. Background

The recognition of the role of colleges and institutes in innovation, applied research and commercialization is a key advocacy priority for the ACCC. Over the past five years, ACCC has devoted a considerable amount of effort advocating for the need for new federal research funding policies and programs that would enable colleges and institutes to make a greater contribution to innovation in Canada.

To assist the federal government, granting councils and other key stakeholders to gain a better understanding of the breadth, depth and socio-economic impact of the applied research emanating from the college/institute system, a number of mechanisms were put in place:

- In 2002, a national Task Group was established by the Association of Canadian Community Colleges to undertake advocacy activities to explore new funding mechanisms, to encourage existing funding agencies to adapt their programs to include colleges and institutes and to expand their definition of research and development to include applied research. In 2004, a National Research Action Committee (NRAC) was created to continue the work of the Task Group, review progress to date and set some direction for the future.

- From April 2004 through March 2005, ACCC provided fiscal support for Jim Madder from Fleming College to take a professional development leave to undertake a national review of the current state of innovation at colleges and institutes in Canada. The report entitled *Innovation at Colleges and Institutes* provides an overview of the policies, programs practices and administrative structures that exist to support innovation at colleges and institutes as well as provide recommendations to further develop innovation within these institutions.

- To encourage networking, share best practices, exchange on role of colleges and institutes in applied research and strengthen awareness with key stakeholders, a national applied research forum is held on an annual basis. The two day activity brings together colleges and institutes from across Canada involved in applied research, government departments, granting research councils and other key stakeholders.

- On-going discussions with various government departments, NSERC, SSHRC, CIHR, PreCarn regarding enhancing college and institute involvement in the innovation agenda.

- In August 2004, the Social Sciences and Humanities Research Council (SSHRC) initiated a consultation process and focus group with twenty colleges and institutes from all regions of Canada to determine the level and depth of college/institute involvement in social sciences and humanities research. The process provided an overview of the strengths of colleges and institutes in applied research, the application and transfer of knowledge and the challenges and barriers these institutions are facing in initiating and participating in social sciences and humanities research.

- In collaboration with ACCC and the Canadian Manufacturers and Exporters, the Science and Engineering Research Council (NSERC) designed and implemented a pilot program dedicated to college/institute research. The College and Community Innovation Pilot Program provides colleges and institutes with the opportunity to support innovation at the community and/or regional level. Unfortunately, the limited funding dedicated to the pilot (3.6 million) allows only 6 projects out of 31 projects submitted to be supported.

- In 2002, in collaboration with Industry Canada Policy Branch, ACCC conducted an electronic survey with its member colleges and institutes across Canada to determine the level and scope of R&D activity that these institutions are performing and to identify the barriers that are preventing them from unleashing their full potential. The data collected was instrumental in supporting ACCC's advocacy role and in assisting Industry Canada gain a better understanding of college/institute capacity in innovation.

  To ensure that ACCC continues to capture the current level of applied research activity in colleges and institutes, a second survey was conducted in January - March 2006. This report reflects the results of this survey.

3. Survey Respondents

In January 2006, a communiqué was sent to 140 ACCC member institutions both to College/Institute CEOs' and the ACCC Applied Research Affinity Group inviting them to complete the survey on-line. A total of 59 (42%) colleges, institutes of technology, cégeps and university-colleges from the six regions of Canada completed the survey. Table 1 provides the list of participating colleges and institutes.

Respondent Colleges and Institutes

ACCC REGION	INSTITUTION
British Columbia/Yukon (6)	Camosun College Douglas College Justice Institute of British Columbia Kwantlen University College Selkirk College Langara College
Alberta/NWT (9)	Keyano College Lethbridge Community College Medicine Hat College NorQuest College Northern Alberta Institute of Technology (NAIT) Northern Lakes College Olds College Red Deer College SAIT Polytechnic
Saskatchewan/Manitoba/ Nunavut (5)	Assiniboine Community College North West Regional College Red River College of Applied Arts, Science & Technology Saskatchewan Institute of Applied Science and Technology University College of the North
Ontario (15)	Algonquin College of Applied Arts and Technology Cambrian College Canadore College of Applied Arts and Technology Centennial College of Applied Arts and Technology Conestoga College Institute of Technology & Advanced Learning Fanshawe College of Applied Arts and Technology Fleming College Georgian College of Applied Arts and Technology Humber Institute of Technology & Advanced Learning La Cité Collégiale The Michener Institute for Applied Health Sciences Niagara College of Applied Arts and Technology Seneca College of Applied Arts and Technology Sheridan Institute of Technology & Advanced Learning St. Lawrence College

ACCC REGION	INSTITUTION
Québec (19)	Cégep André-Laurendeau Cégep de Sainte-Foy Collège Marie-Victorin Cégep Saint-Jean-sur-Richelieu Cégep de Saint-Jérôme Centre Agroalimentaire (Cégep de Saint-Hyacinthe) Centre de productique intégrée du Québec (Collège de Sherbrooke) Centre d'innovation en microélectronique du Québec - Collège Lionel-Groulx) Centre collégial de transfert de technologie en biotechnologies - Cégep de Lévis Lauzon Centre de transfert technologique en écologie industrielle -Cégep Sorel-Tracy Centre d'études des procédés chimiques du Québec - Collège de Maisonneuve Centre de recherche en oléochimie industrielle - Cégep de Thetford Centre de transfert technologique en écologie industrielle – Cégep de Sorel-Tracy Centre technologique en aérospatiale -Collège Édouard-Montpetit Centre de référence pour les industries du bois et de l'ameublement au Québec -Cégep de Victoriaville Centre de robotique industrielle -Cégep de Lévis-Lauzon Centre d'aide technique et technologique EQMBO Entreprises - Cégep de Victoriaville Vanier College
Atlantic (5)	Collège communautaire du Nouveau-Brunswick (CCNB) College of the North Atlantic Holland College New Brunswick Community College (NBCC) Nova Scotia Community College

4. Internal and External Policy Environments of College and Institute Applied Research Activities

This section provides some perspectives on the policy environments within which colleges and institutes are carrying out applied research activities. This includes the external policy environment, namely the recognition and support by provincial and territorial governments, and the internal policy environment in terms of whether institutional mission statements and strategic plans refer to applied research and any institutional policies developed or implemented on applied research.

4.1 External Policy Environment

In order to acquire a sense of the external policy environment, colleges and institutes were asked whether their provincial/territorial government recognizes and supports college/institute research and development through provincial legislation, operating grants and actual research and development programs.

In terms of recognition and support for college and institute research and development in provincial or territorial legislation, 61 percent (36) of respondent colleges and institutes confirmed that they do have recognition through provincial/territorial legislation, 25 percent (15) indicated that they do not, and 10 percent (6) colleges indicated that legislation is in progress.

The 36 institutions with legislative recognition are mostly concentrated in Ontario, Quebec and Alberta. This is in line with a review of provincial and territorial legislation done for the 2005 report prepared for ACCC entitled *Innovation at Canadian Colleges and Institutes*, which confirmed that these three provinces have legislation which recognizes that applied research may be performed by colleges and institutes. The provincial legislations for the other provinces are silent on colleges' and institutes' role in applied research and this report points out that the absence of applied research in the legislation generally does not preclude colleges and institutes from initiating or becoming involved in applied research activities. In the case of the three territories, Yukon College is given support for research and development through its Northern Research Institute, the Nunavut "Public College Act" provides the authority to create the Nunavut Research Institute and thus recognizes and supports research, and the North West Territories "Public Colleges Act" provides the Aurora College Board of Governors the right to establish a science research institute within the college.

In terms of provincial or government support for applied research through the provision of operating grants to colleges and institutes, 47 percent (28) of respondent institutions indicated that they receive operating grants, 41 percent (24) confirmed they do not, and 10 percent (6) indicated a process is in progress to establish operating grants for applied research. The majority of institutions which receive operating grants from their provincial government are from Quebec, which is reflective of the extensive network of research and technology transfer centres which are attached to cégeps in this province. The three colleges from the Atlantic region, New Brunswick Community College, Nova Scotia Community College, and College of the North Atlantic, indicated that there is no recognition in provincial legislation, did confirm that they received support for applied research through operating grants.

Up to 75 percent of respondent institutions (44), the majority from Quebec and Ontario, confirmed that their provincial governments provide support for applied research through research and development programs. Colleges and institutes in provinces which do not have articulated recognition in legislation for applied research, do have access to research and development program funding, this includes institutions in provinces such as Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward Island. Ten institutions (17 percent) indicated they do not access such support and two confirmed that the development of this type of program is currently in progress.

These findings confirm that the vast majority of respondent colleges and institutes receive recognition and support for applied research. Although some provincial governments do not

recognize the role of colleges and institutes in legislation, support is offered either through operating grants for institutions or research and development programs.

4.2 Internal Policy Environment

In order to get a sense of how applied research activities are supported by college and institute internal policy environments, colleges and institutes were asked whether applied research is included in their mission statements and/or strategic plans as well as whether formal institutional policies have been developed.

4.2.1 College and Institute Mission and Strategic Plans

Up to 71 percent (42) of respondent institutions confirmed that research and development is included in their mission statements or strategic plans. As pointed out in the 2005 report prepared for ACCC entitled *Innovation at Canadian Colleges and Institutes*, acknowledgement of this role within mission statements or strategic plans has been relatively recent for most colleges and institutes. The Boards of Governors of institutions are typically responsible for deciding whether an institution will become formally engaged in research and development activities.

Although college and institute involvement in research and development is relatively recent, it is for the most part, larger institutions which acknowledge innovation as part of their role in local and regional development. In addition, colleges and institutes specialized in certain sectors, such as agriculture and fisheries, have had long standing applied research and technology transfer outreach programs for the benefit of their communities. These types of institutions are often funded through provincial ministries of agriculture or fisheries rather than ministries responsible for postsecondary education. It is also important to mention the significant network of 31 centres of technology transfer connected to cégeps in Quebec which were developed in 1983. These centres are mandated to focus on innovation activities in association with local and regional business and industry. Faculty are provided partial release time to participate in the centres' research and development activities. Since 1983, some of these centres have grown into major sites for innovation and business development. Of the 31 centres in Quebec, over one third (12) responded to this survey.

A number of institutions, largely in Ontario and Alberta, are using applied research in conjunction with a relatively new mandate to grant applied degrees to position themselves vis à vis other institutions. Within this context, research and development activities and degree granting status has provided institutions with a way of differentiating themselves.

4.2.2 Formal Institutional Policies

Well over half (58 percent) of respondent colleges and institutes (34) confirmed that formal policies on applied research have been developed and implemented, and 47 percent (28) have developed and implemented formal policies on intellectual property.

As pointed out in the 2005 ACCC report, the requirements of government funding agencies have significantly influenced colleges and institutes to develop policies on applied research. Although some institutions may have had generic policies in place, in order to meet the requirements of funders such as NSERC, specific policies are also sometimes required. The NSERC College and Community Pilot Program described in section 2 also provided a significant impetus for many colleges and institutes to modify existing policies or develop new policies required to gain NSERC eligibility. Some of the key elements which applied research policies typically include are:

- General support of research and development activities
- Research ethics and integrity, including ethics review processes
- Research involving human subjects
- Animal care and research
- Research involving biohazards and radioactive materials
- Conflict of interest
- Student rights in the conduct of research
- Confidentiality and publication of results
- Compensation and recognition of faculty conducting research activities
- Financial accountability and reporting.

5. College and Institute Administrative Structures and Organization of Applied Research

Fifty-one percent (30) of participating colleges and institutes have an office or centre of applied research or innovation. The survey responses confirm the conclusions of the 2005 ACCC report on innovation that applied research and innovation activities most often fall under the responsibility of the Vice President Academic, and in some cases Vice-Presidents responsible for business development or corporate services.

In addition, 58 percent of respondent institutions (34) have a designated administrative staff member responsible for managing applied research activities, such as a director or manager of applied research, and 55 percent (31) have a staff member who manages innovation activities in conjunction with other responsibilities such as contract training, institutional and market research.

The 2005 ACCC report on innovation also found that it is typically larger institutions which have a full time director of research and associated office support, and smaller institutions typically have applied research activities managed by individuals who have other responsibilities. This report also identified the key responsibilities of directors of research or staff members responsible for applied research including:

- The development and implementation of applied research policies, procedures and strategies;
- Promotion and marketing of the college/institute services in applied research, including partnership development;
- Knowledge and understanding of public and private funding sources, including the policies and practices of funding agencies;
- Coordination of the development and/or preparation of research proposals;

- Monitoring progress and coordination of and/or writing progress reports;
- Participation in the development of research-related communications including websites and annual reports to institutional leadership;
- Management of intellectual property related issues.

The survey also confirmed that 59 percent (35) colleges and institutes have dedicated resources that support applied research grant application and administration, and 53 percent (31) of respondents confirmed they have staff members responsible for applied research contract negotiation and administration. In some cases, the staff of the applied research office would lead the grant application and contract negotiation processes, in others they provide support to faculty who take the lead in preparing grant applications. As confirmed in the 2004 ACCC report to the Social Sciences and Humanities Research Council, faculty in colleges and institutes require support and guidance for the preparation of grant applications – given their heavy teaching loads they often do not have the time required to complete grant applications.

Colleges and institutes were also asked whether they have a designated physical research facility to conduct applied research activities. Twenty-five (25) respondent institutions (42 percent) confirmed they have such facilities, with the most significant number in Quebec, which is not surprising given the centres of technology transfer, as well as Ontario and Alberta.

6. Faculty and Student Involvement in Applied Research

This section provides some perspectives on faculty and student involvement in applied research based on the responses of participating colleges and institutes. The survey results will also be linked to the conclusions of the two most recent ACCC reports related to applied research.

6.1 Faculty

In terms of faculty involvement in applied research, colleges and institutes were asked whether applied research and development, and technology transfer experience are key requirements when hiring new faculty and staff.

Almost one third of respondent institutions (18) confirmed that research experience is a requirement for hiring new faculty, 49 percent (29) of institutions indicated that it is not a requirement and 20 percent of (12) institutions did not provide a response. Most of the colleges and institutes which confirmed that this is a prerequisite for faculty specified that this was for:

- faculty teaching in applied degree programs, focused mainly in Alberta and Ontario;
- faculty working in centres of excellence such as the Lethbridge Community College Aquaculture Centre of Excellence; and
- faculty working in sector specific research centres such as Quebec's technology transfer centres.

In these cases, colleges and institutes are seeking faculty with advanced research credentials with doctorate or at minimum masters degrees. Institutions also indicated that although they may look for publication experience, applied research and industrial experience is a key requirement. The respondents from Quebec technology transfer centres indicated that applied

research and technology transfer experience is essential when hiring new staff in order to be in line with the expectations and requirements of their industry and community partners and to give clients confidence in the centres' capacities. Another important criterion these centres look for is staff with an understanding of the commercial issues facing businesses.

Research experience is generally not a requirement for diploma and certificate programs, and not at all a requirement for trades and apprenticeship programs. However some respondents confirmed that research experience is emerging as a criterion and is viewed as an asset when recruiting new faculty particularly when such experience is aligned with the college's or institute's strategic research priorities. At the same time, a number of institutions emphasized that teaching and professional experience remains important for hiring faculty.

Colleges and institutes were also asked to identify the proportion of full-time or part-time faculty who were provided with time and assistance to perform or manage applied research and development and/or supporting private sector technology adoption. Forty-five respondents (75 percent) answered this question, and of those:

- 18 indicated that less than five percent of their faculty were provided with time and assistance for applied research or technology transfer activities;
- 13 indicated that between 5 and 10 percent of faculty were provided with time and assistance for applied research or technology transfer activities;
- 7 indicated that none of their faculty were provided this type of support; and
- 3 centres of technology transfer from Quebec indicated 60 to 100 percent of their faculty is provided with time for applied research or technology transfer.

In the case of faculty involved in social sciences and humanities research, the 2004 ACCC report submitted to SSHRC, confirmed that most faculty teaching in these areas do not have allocated time or resources for research activities. Some examples of teaching loads were provided in this report including Ontario college faculty which is teaching 34 weeks per year at 44 hours per week, and in Alberta where a 10 credit course requires 450 teaching hours per year. Colleges and institutes consulted indicated that often faculty do research ''underground'' and that generally faculty become involved in research because they view it as important and as a reflection of their values. Research is also viewed as a way to help college/institute faculty keep current, test theories in their fields and teach their subject matter more effectively.

6.2 Students

Given colleges' and institutes' focus on providing quality learning opportunities for students, institutions are involving students in applied research activities primarily to enhance the learning experience for students. Respondent colleges and institutes identified and described the following three main approaches used to involve students in applied research activities:

- integration of research into the curriculum of college/institute programs,
- financial support for student research projects, and
- student employment opportunities in research initiatives and projects.

These three approaches are described below, with some examples from respondent colleges and institutes.

- **Integration of Research into the Curriculum of College/Institute Programs**

  One of the main ways of involving students in applied research is by enhancing the curriculum to include elements and activities which develop students' research, analytical and critical thinking skills. Respondent colleges and institutes identified different ways this is achieved:
  - including project-based learning modules and/or delivery
  - providing equipment for classroom projects
  - providing incentives for applied research projects such as awards or prizes;
  - making senior year research projects a course requirement for some diploma and all applied degree programs.

  As explained in the ACCC report submitted to SSHRC, colleges and institutes consulted for the 2004 SSHRC consultation also confirmed that the acquisition of research-related skills is considered important for students' success in the labour force. Respondents from colleges and institutes indicated that employer representatives on their program advisory committees are increasingly requesting that research skills and capacity be included as program competencies. In addition, for colleges and institutes with university transfer or pre-university programs, such as the cégeps in Quebec, research skills are considered essential for the effective integration into university undergraduate programs.

  Some examples provided by respondent colleges and institutes on how research is integrated into curriculum are:
  - **Olds College** has a Director of Research Integration whose primary function is to find ways of integrating research into the curriculum. Some measures Olds College has already taken include:
    - provision of equipment for classroom projects;
    - a research fund to which students can apply for special class and individual projects;
    - sponsoring research seminars and presentations;
    - the School of Innovation sponsors class research projects for Applied Degree students in their Research Methodology Course and provides prizes for the presentation of these projects.
  - **Conestoga College** indicated that the curriculum includes project-based learning modules throughout and in the applied degree programs the college is moving towards a fourth-year capstone research project which students must develop themselves.
  - **Niagara College** confirmed that students in second and third year diploma programs, applied degree programs and post-graduate certificate programs normally have at least one course in which research projects are part of the curriculum and grade. Most students conduct research in several courses with some of the research requiring ethics reviews.

- **Financial Support for Student Research Projects**

Some respondent institutions have established student research grants or have competitions with prizes as incentives for students to become engaged in applied research. Some examples include:

- **Niagara College** has recently developed a new policy to support student applied research – the ''Student Applied Research Fellowship''. Students are required to complete an application for grant assistance with oversight by a faculty member and if approved, can conduct a specific short-term research project.
- **Nova Scotia Community College** provides research stipends for students.
- **Olds College** has an Annual Applied Research and Innovation Competition with prizes (1st - $2,000, 2nd - $1,500 and 3rd - $1,000). Students are required to have staff advisors and supervisors. Students' supervisors of winning projects receive similar prizes to support their research and classroom activities. Olds College also has an Applied Research and Innovation Award offered annually at the graduation ceremony to give prominence to students' applied research activities at the college.

- **Student Employment Opportunities in Research Projects**

A larger proportion of institutions responding to this question indicated that students have opportunities to participate in applied research through research assistanceships either part-time during the academic year or full-time during the summer months. Workplace practicums, internships, directed field studies and/or co-op programs were also identified as a way of providing students with opportunities to become involved in community- or industry-based research initiatives. The technology transfer centres in Quebec offer students opportunities for part-time and summer jobs in the centres during their studies at the cégep and then refer students to industry for employment opportunities after graduation.

7. Funding of Applied Research Activities

This section provides some insights into the types of funding sources colleges and institutes are accessing for their applied research activities. Colleges and institutes were asked to identify the sources of funding for projects for the period January to December 2005 namely:

- federal government granting councils and agencies;
- provincial, regional or municipal governments;
- firms and business associations;
- international organizations;
- other sources; and
- internal sources.

Colleges and institutes were also asked to confirm whether they are eligible to administer NSERC grants.

Forty-two percent (25) of respondent institutions provided information on the funding sources for their applied research activities, and identified a total of 166 initiatives active in 2005. Some institutions identified as many as 26 ongoing initiatives while others identified just a few.

Colleges and institutes were also asked to provide estimates of the value of the grants and contracts. The estimates provided by colleges and institutes of the value of the grants and contracts accessed in 2005 vary significantly but provide an indication of the scope of applied research activity, in particular for institutions which are well-established in the area of applied research. Table 2 below provides ranges of the values of the 170 research grants and contracts identified by respondent colleges and institutes, which are supporting over the 166 initiatives identified by respondents.

Value of College/Institute Research Grants and Contracts

Values of Research Grants and Contracts	Number of College/Institute Grants and Contracts
Less than $ 5,000	19
$5,000 to $20,000	39
$21,000 to $45,000	22
$46,000 to $75,000	21
$76,000 to $100,000	11
$101,000 to $300,000	31
$301,000 to $500,000	12
$501,000 to $1,000,000	3
Over $1,000,000	6
Over $2,000,000	2
Over $3,000,000	2
Over $4,000,000	1
Over $5,000,000	1

Most initiatives fell within the 5,000 to 75,000 ranges, with a significant number also in the $100,000 to $300,000 range. The grants and contracts over $500,000 are from federal and provincial government sources, largely supporting the more significant research facilities attached to some colleges and institutes. In some cases, there is more than one source of funding for larger projects, initiatives and facilities.

7.1 Federal Government Departments, Granting Councils and Agencies

The results of the survey confirm that the combined contribution from federal government departments, agencies and granting councils constitute the most significant source of funding for college and institute applied research activities. The 25 institutions which responded to this question identified 40 research projects funded by the 20 federal government departments, granting councils and agencies listed in the box below. The value of 2005 grants and contracts for these applied research projects funded by the 20 federal government departments is almost $28 million.

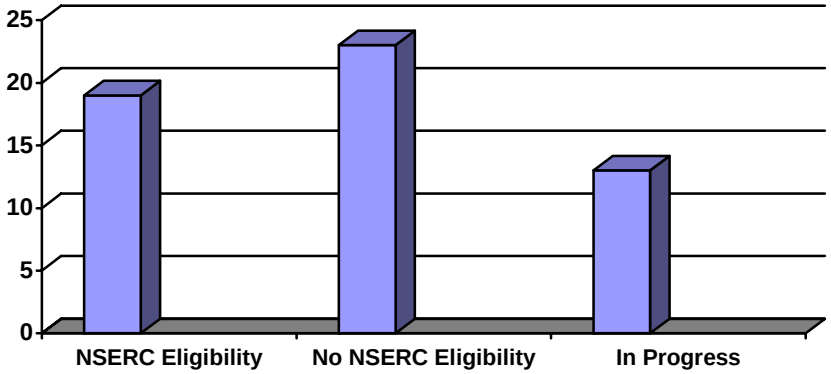
Federal Government Departments, Agencies and Granting Councils supporting College and Institute Applied Research

- Agriculture and Agri-Food Canada
- Agriculture & Food Council (AFC) – Canadian Adaptation and Rural Development Fund (CARD)
- Atlantic Canada Opportunities Agency
- Canada Economic Development for Quebec Regions
- Canada Foundation for Innovation
- Canadian Institutes for Health Research
- Canadian International Development Agency
- Citizenship and Immigration Canada
- Environment Canada
- Geological Survey of Canada
- Green Municipal Enabling Fund
- Health Canada
- Human Resources and Skills Development Canada
- National Literacy Secretariat
- National Research Council
- Natural Resources Canada
- National Science and Engineering Research Council
- Parks Canada
- Science Horizons
- Social Sciences and Humanities Research Council (SSHRC)
- Western Economic Diversification Canada (WD)

Colleges and institutes are also accessing SSHRC grants, as such SSHRC has been included in this list even though it was not identified by any survey respondents.

NSERC is a key source of funding for technological research. When colleges and institutes were initially identified for NSERC funding as co-applicants with universities, few colleges and institutes were applying for NSERC institutional eligibility because there was little incentive to do so. However, when NSERC launched the College Community Innovation Pilot Program, applications for NSERC eligibility increased. There was significant interest in this pilot program, with 31 projects submitted by 27 institutions. However, the funding available from NSERC only allowed 6 projects to be approved. This survey asked colleges and institutes whether they are eligible to administer NSERC grants. As shown in the chart below, to date 19 (32 percent) of respondent colleges and institutes indicated that they have NSERC eligibility, 23 (39 percent) do not, and 13 (22 percent) have applications for NSERC eligibility in progress.

Number of Respondent Colleges and Institutes with NSERC Eligibility



It is also important to note that institutions with NSERC eligibility are also eligible for grants from other granting councils given the Tri-Council Memorandum of Understanding that exists between NSERC, SSHRC and CIHR.

This MOU is particularly interesting for potential collaboration with CIHR since this institute has expressed interest in working more closely with colleges and institutes. The MOU does not directly affect colleges' and institutes' applications to SSHRC, since this research council does not have institutional eligibility requirements.

7.2 Provincial, Regional and Municipal Governments

After the federal government, provincial, regional and municipal governments are the next largest sources of funding for applied research activities at colleges and institutes. Respondent colleges and institutes from the following provinces identified provincial, regional and municipal funding sources for applied research activities: Alberta, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador. In all, these colleges and institutes identified 46 applied research projects active during 2005, funded by provincial, regional and municipal government sources through grants and contracts valued at over $13 million. The table below lists the main provincial, regional and municipal government departments and agencies identified by respondent institutions.

Provincial, Regional and Municipal Government Sources of Funding for Applied Research

Provincial Governments:

Government of Alberta:

- Alberta Advanced Education
- Alberta Agriculture, Food and Rural Development
- Alberta Ingenuity
- Alberta Innovation & Science
- Alberta Value Added Corporation
- Diversified Livestock Fund of Alberta

Government of Manitoba:

- Manitoba Economic Innovation & Technology Council (EITC)

Government of Ontario:

- Materials and Manufacturing Ontario
- Ontario Centres of Excellence Inc. (CITO)
- Ontario Innovation Trust

Government of Quebec:

- Fonds pour la formation de chercheurs et l'aide à la recherche
- Fonds québécoise de la recherche sur la nature et les technologies
- Ministère du Développement économique, de l'innovation et de l'exportation
- Ministère de l'Éducation, du Loisir et du Sport: Programme d'aide à la recherché sur l'enseignement et l'apprentissage (PAREA); Programme d'aide à la recherche technologique (PART)

Government of Nova Scotia:

- Department of Natural Resources
- Nova Scotia Office of Economic Development

Government of Newfoundland & Labrador:

- Department of Innovation, Trade & Rural Development

Regional Governments:

New Brunswick: Société de développement regional
Ontario: Niagara Training and Adjustment Board

Municipal Governments:

City of Lethbridge Environmental Services
City of Lethbridge Leisure Services

7.3 Firms and Business Associations

Colleges and institutes are also contracting with firms and businesses as part of their applied research activities. Colleges and institutes identified 25 projects funded through private sector partnerships with firms and business in a variety of sectors including: agriculture, aquaculture, construction, energy, engineering, fisheries, information and communications technologies, media and communications, and natural resources. The 25 projects with firms and business associations have an overall value of up to $4.2 million.

7.4 Other Sources of Funding

Colleges and institutes identified up to 23 other sources of funding with a value of over $1.5 million. The main categories of these other sources of funding are private foundations, non-profit organizations and associations, economic development organizations, universities, professional associations, unions. Some examples of these other sources of funding include:

- Alberta Agriculture Funding Consortium
- Alberta Aquaculture Association
- Alberta Conservation Association

- Alberta North American Waterfowl Management Plan/Ducks Unlimited
- Canadian Interdisciplinary Network for Complementary and Alternative Medicine Research
- Canadian Wildlife Services
- Change Foundation
- College of Massage Therapists of Ontario
- Columbia Basin Trust
- Dalhousie University
- Delta Waterfowl Foundation
- Economic Development Lethbridge
- Hecht Foundation
- Holistic Health Research Foundation of Canada
- Lawson Foundation
- Mersey Tobeatic Research Institute
- Nova Scotia Agriculture College
- Small Scale Applied Research Fund
- SW Nova Biosphere Reserve
- University of Regina

Selkirk College also identified an international funding source through a $50,000 grant from the Gatorade Sports Science Institute.

Two colleges also identified projects funded from internal college sources. The Centennial College Applied Research Fund invested $84,500 for grants to fund two projects related to health and on-line learning; and Niagara College invested $16,000 for an applied research project to support the college's winery and viticulture programs and facilities.

8. Sectors of Involvement of College and Institute Applied Research Activities

Colleges and institutes are involved in applied research and development activities in many and diverse sectors. Colleges and institutes were asked to identify their research and development sectors of expertise from a list of the following 14 sectors:

- Health and Life Sciences
- Environment
- Marine and Aquaculture
- Aerospace
- Renewable Energy
- Manufacturing
- Agriculture
- Textile Technologies
- Information and Communications Technology
- Virtual Reality/Advanced Visualization
- Energy
- Multi-Media
- Humanities and Social Sciences
- Teaching and Learning

Based on the results from this question, this section provides an overview of the sectors of expertise of colleges and institutes, beginning with the sectors with the most college/institute involvement, then identify the colleges and institutes involved in applied research and development in each sector. The survey also asked college and institutes to describe their applied research success stories. These are included in this section according to the sectors targeted.

8.1 Teaching and Learning

The sector with the most colleges and institutes with research and development expertise is teaching and learning, with 49 percent (29) of institutions. This is not surprising given the strong emphasis colleges and institutes place on teaching and learning. The results of the SSHRC consultation with ACCC and colleges and institutes also found that the scholarship of teaching and learning is a key area of research at colleges and institutes, as well as an area that colleges and institutes would like to pursue further. The success stories in teaching and learning research identified by survey respondents are described below. Some of the themes and areas addressed by research in this sector include:

- Factors for student success and persistence;
- Essential Skills;
- Internet-based in-service teacher training for secondary school teachers;
- Building of a learning objects repository;
- Adult learning transitions targeting youth at risk, high school leavers, the under-employed and unemployed;
- Use of a multi-media resource for English as a Second Language (ESL) programs for Adult Learners;
- Use of multi-media resources to support literacy development for deaf and hard of hearing adults;

The following table shows the institutions which identified teaching and learning as a sector of expertise for research and development.

Colleges and Institutes with Research Expertise in Teaching and Learning Research

British Columbia	**Saskatchewan**	**Quebec**
Langara College	Saskatchewan Institute of	Cégep André-Laurendeau
Justice Institute of B.C.	Applied Sciences and	Collège Lionel-Groulx
Selkirk College	Technology (SIAST)	Cégep de Sainte-Foy
Kwantlen University College		EQMBO entreprises (CCTT
Camosun College	**Manitoba**	
	Red River College	**New Brunswick**
Alberta		CCNB
Medicine Hat	**Ontario**	
Norquest College	Cambrian College	**Nova Scotia**
Northern Alberta Institute of	Centennial College	Nova Scotia Community
Technology (NAIT)	Fanshawe College	College
Northern Lakes College	Humber College	
Olds College	Niagara College	**Prince Edward Island**
Red Deer College	Seneca College	Holland College

Colleges and Institutes with Research Expertise in Teaching and Learning Research		
SAIT Polytechnic	St. Lawrence College	**Newfoundland and Labrador** College of the North Atlantic

Success Stories in Teaching and Learning Applied Research

- **The Northern Alberta Institute of Technology Distance Apprenticeship Training and Education Pilot Project** (NAIT DATE) is an applied research project to test the efficacy of using videoconference technologies to enable a new model for apprenticeship training. NAIT DATE seeks to reverse the traditional model of having students temporarily move to the location of the college or technical institute to attend theory courses. The project which is a first of its kind in Alberta, allows 21 apprentices to take the in-class portion of their training without having to leave their jobs, families or communities. This leading edge technology model allows NAIT to respond to the high demand for qualified trades persons by training more apprentices, which in turn, increases workplace productivity.

- **Holland College** in collaboration with the secondary school system in Prince Edward Island, the Department of Education and Services Canada as well as the private sector through Plato Learning Canada and the Spell Read Canada are developing a series of research projects to test the effectiveness of various strategies for enabling disengaged learners to make a successful transition to postsecondary training or the labour market. The target population for this research includes youth at risk, high school leavers, the under-employed and unemployed. Phase I of the research focused on developing a profile of low literacy adult learners and identification of the reasons as to their poor rates of participation in educational programs. Phase II of the project is presently underway and is assessing longitudinal retention of reading improvements and the impact of participation in the reading intervention on participant self-concept and employment enhancement. Phase III will focus on the impact of a phonetically based reading intervention, compared with a computer-assisted intervention, to advance GED preparation and attainment.

  Research to date has demonstrated that customized transitions services and programs can re-engage marginalized populations and that, with the right supports, a successful transition and a positive labour market outcome can be achieved. A more systematic and comprehensive approach to transitions programming could play a major role in moving the province into the new economy by ensuring that all available sources of labour supply have the skills required to move into jobs.

8.2 Health and Life Sciences

Given the extensive programming and community outreach in health and allied health fields, it is not surprising that 47 percent (28) of institutions identified health and life sciences as a sector of expertise for applied research and development activities. Health and life sciences research identified by colleges and institutes through this survey touch upon areas and themes such as:

- The effectiveness of innovative health care practices in specific regions;
- Bioinformatics – identification of disease markers; and
- Reduction of health care costs through “telehomecare” services.

The following table provides a list of the colleges and institutes which confirmed they have research and development experience in health-related sectors. This is followed by some health and life sciences success stories identified by respondent institutions.

Colleges and Institutes with Research Expertise in Health and Life Sciences Research		
British Columbia Camosun College Justice Institute of B.C Kwantlen University College Langara College Selkirk College **Alberta** Medicine Hat Norquest College Northern Alberta Institute of Technology (NAIT) Olds College Red Deer College SAIT Polytechnic **Saskatchewan** Saskatchewan Institute of Applied Sciences and Technology (SIAST)	**Manitoba** Red River College **Ontario** Algonquin College Cambrian College Centennial College Conestoga College Fanshawe College Fleming College Humber College St. Lawrence College Seneca College **Quebec** Collège Lionel-Groulx CEPROCQ TransBIOTech-Cégep Lévis-Lauzon	**Nova Scotia** Nova Scotia Community College **Prince Edward Island** Holland College **Newfoundland and Labrador** College of the North Atlantic

Success Stories in Health and Life Sciences Applied Research

Selkirk College

- Sport science has identified effective ways of developing strength and fitness, however, this knowledge has not generally been applied to the many workers chronically exposed to physical and/or mental stress. Encouraging the adoption of effective techniques for dealing with intensive work loads over an extended period of time may contribute to increasing productivity and avoid workplace injury. **The Occupational Injury Reduction and Performance Enhancement Project at Selkirk College** investigates the efficacy of task-specific fitness and dietary programs on workplace productivity, injury rates, and biochemical stress markers in tree-planters, an occupation with a high physical demand and a very high injury rate.

  Twenty matched tree-planters were assigned to each of 3 groups (training, carbohydrate-electrolyte drink, control). The pre-season training program was well tolerated by planters and resulted in reduced fatigue during planting. Trained planters were able to sustain a higher planting rate and experienced 40% fewer injuries or infections than the control group. The use of carbohydrate-electrolyte drink during planting was more effective in maintaining hydration and blood glucose levels when dietary intake was insufficient and was protective against muscle wasting and impaired immune function, as observed in the control group.

  This research has led to the development of training materials which were produced by students at Selkirk College and which have been distributed by Weyerhaeuser Forestlands Canada, the Western Silviculture Association, BC Safe Silviculture and the Forest Industry Safety Association. The program has been utilized by Weyerhaeuser preferred contractors for the past 5 years and has resulted in a ten-fold reduction in injury rates. Furthermore, the program has crossed industries and is being utilized by groups of wildland firefighters, timber harvesters and mountain guides.

Success Stories in Health and Life Sciences Applied Research

Centennial College

- In 2004, with the support of the Ontario Innovation Trust, **Centennial College** established the Centre for Applied Research in Health, Technology, and Education (CARHTE). CARHTE, which houses an active research team including a College Research Director and an Applied Research Coordinator in Health, Technology and Education and e-learning is currently involved in twelve active, externally funded research projects with funding from all three levels of government and various industry and community partners. In addition, the foundation laid by the OIT infrastructure grant enabled staff to develop a model of research support for Centennial College that continues to foster research literacy and capacity across all schools in the College and that could serve as a model for other educational institutions.

  Fostering an applied research culture at Centennial College is one of several keys to student success. The college focuses on applied research that helps it to deliver on job readiness and skills renewal, the development and application of innovative technologies and that creates and tests innovative educational models in inter-professional education and in bridging programs to help ensure that new comers and internationally trained individuals have equal opportunities to participate fully in the Canadian context. Research funding from the Ministry of Citizenship and Immigration Canada has enabled the Centre to create and test an enhanced language program utilizing the Canadian language benchmarks for internationally educated health professionals, in concert with bridging program funding from provincial health regulatory bodies such as the College of Massage Therapists of Ontario and from the Ontario government, Ministry of Citizenship and Immigration.

  Centennial College's applied research centre houses several large research studies in telehealth and telehomecare funded by OIT, the Ontario Ministry of Health and Long Term Care, and the Innukshuk Foundation to improve the lives of Ontarians living with chronic illness such as diabetes and stroke and to increase health care cost efficiencies. Some of these research initiatives include:

  - the creation of culturally intelligent online videos for patient education and self-care through the Patient Education Prescription Project (PEPTalk).
  - through Centennial's IDEAS Research Network, the Centre is researching actual emergency and disaster preparedness plans using high fidelity simulations and the development and testing of inter-professional curricula to breakdown professional silos and help health care workers provide better, more effective and collaborative, patient-centred care. A grant from Health Canada has enabled the Centre to conduct research on undergraduate curricula in inter professional collaborative patient-centered care in disaster and emergency prepardness in medicine, nursing and allied health in partnership with George Brown College, Ryerson University, University of Toronto and the Michner Institute;
  - through a research grant from the Hecht Foundation and in partnership with McGill University, the creation and testing of a database of research outcomes that measure wellness and healing; and,
  - with the support from the Canadian Health Research Institute (CIHR), conducting research to increase knowledge translation in complementary and alternative health care.

  The Centre is also working in externally funded applied health research studies for specific patient populations utilizing faculty or students from various health professions programs at Centennial College. For example, the college is providing massage therapy to hospitalized high risk pregnant women at Sunnybrook and Women's College Hospital in Toronto to reduce stress and anxiety for this patient population, and has recently applied for national funding to teach parents of children with cancer to massage their child, in order to reduce stress and anxiety in the parent and provide additional comfort and pain relief to their child.

8.3 Environment

Overall, 47 percent (28) of institutions also identified Environment as a sector of expertise in research and development activities. This is reflective of the significant programming in environment-related fields such as conservation, environmental management, geomatics, water and waste management etc. The following table lists the colleges and institutes with this research expertise, followed by some success stories in environmental research.

Colleges and Institutes with Research Expertise in Environment

British Columbia
Langara College
Kwantlen University College
Camosun College
Selkirk College

Alberta
Lethbridge Community College
Northern Alberta Institute of Technology (NAIT)
Olds College
Red Deer College
SAIT Polytechnic

Saskatchewan
Saskatchewan Institute of Applied Sciences and Technology (SIAST)

Manitoba
Red River College

Ontario
Algonquin College
Centennial College
Fanshawe College
Fleming College
Niagara College
Seneca College
St. Lawrence College

Quebec
Cégep de Sainte-Foy
Cégep de Saint-Jérome
CEPROCQ
CTTÉI, Cégep Sorel-Tracy
OLEOTEK
TransBIOTech-Cégep Lévis-Lauzon

New Brunswick
CCNB

Prince Edward Island
Holland College

Nova Scotia
Nova Scotia Community College

Newfoundland and Labrador
College of the North Atlantic

Success Stories in Environmental Applied Research

Nova Scotia Community College

- The Wireless Network for Environmental Monitoring Project – sponsored by **Nova Scotia Community College's Applied Geomatics Research Group (AGRG)** – is a major research initiative that focuses on the development of a wireless network of remote environmental monitoring stations in the Annapolis Valley in Nova Scotia. Researchers at the ARGR have installed a network of 14 meteorological stations and several loggers throughout the region. Adding wireless capabilities to the sensor network will allow researchers to access, process and integrate meteorological data with other information more efficiently.

  One of the goals of the three year AGRG Project is efficient, real-time environment data management. Once collected, the information can be used by meteorologists and others to help produce local weather forecasts, landscape descriptions or visual models for use by vineyard owners, farmers and others in the area. For example, grape growers could use the data to pinpoint optimal sites for future vineyards; help existing vineyards maximize their yield; and provide information on wind, temperature and infestation conditions.

Success Stories in Environmental Applied Research

Collège communautaire du Nouveau-Brunswick-Edmunston

- Currently, the bulk of ethanol in North America is produced from corn or barley. The Centre of Excellence in Agricultural and Biotechnological Sciences (CESAB) at the **Collège communautaire du Nouveau-Brunswick-Edmunston**, undertook a research project to determine the suitability of using potato waste from steam peel (McCains) and potato culls (non-saleable) for the production of bioethanol. The project also explored the value of the waste as a source of fermentable sugars (sugars to make alcohol) as well as the nutrient value of the stillage (residue left after ethanol production) as animal feed as compared to corn which is the industry standard.

  The outcome of the research is not only providing potential companies interested in building an ethanol facility with information required to make important business decisions, but is also providing the local potato industry with a place to dispose of their waste potatoes that could be used to produce a value-added product, instead of disposing of them in a land fill.

8.4 Information and Communications Technology

Colleges and institutes are also significant providers of education and training in the area of information and communications technology through diploma and certificate programs, continuing education and contract training for business, industry and employers within the communities and regions served. Many colleges and institutes also have extensive experience in adapting information and communications technologies to enhance the learning experience within college/institute programs or to make programs more accessible through distance education options. Applied research, development and commercialization in information and communications technology is therefore a natural extension of the extensive programming in these subject areas. In total, 41 percent (24) of colleges and institutes identified information and communications technology as sectors of expertise for applied research and development, listed in the table below.

Colleges and Institutes with Research Expertise in Information & Communication Technology		
British Columbia Kwantlen University College Langara College **Alberta** Medicine Hat Norquest College Northern Alberta Institute of Technology (NAIT) SAIT Polytechnic **Saskatchewan** Saskatchewan Institute of Applied Sciences and Technology (SIAST)	**Manitoba** Red River College **Ontario** Algonquin College Cambrian College Canadore College Centennial College Conestoga College ITAL Fanshawe College Niagara College Seneca College St. Lawrence College **Quebec** Cégep André-Laurendeau Centre d'innovation en microelectronique Centre de productique intégree du Quebec	**New Brunswick** CCNB **Prince Edward Island** Holland College **Nova Scotia** Nova Scotia Community College **Newfoundland and Labrador** College of the North Atlantic

Success Story in Information and Communications Technology Applied Research
Centre d'innovation en microélectronique du Québec (CIMEQ) - Collège Lionel-Groulx ➢ For the past 23 years, the **Centre d'innovation en microélectronique du Québec (CIMEQ)** at Collège Lionel-Groulx has been a leader in the global, multi-billion dollar building automation and Intelligent Transportation Systems (ITS) markets. ITS encompasses a broad range of wireless and wire-line communications-based information, control and electronics technologies. Small- and medium-sized enterprises are implementing ITS technologies because they enhance the supply chain management, monitor and manage goods while improving security and productivity. CIMEQ is a leader in ITS development in Quebec because it combines microcontrollers, Global Positioning Systems (GPS), wireless communications and CANbus™ technologies. Building automation relates to the optimization of processes and controls, such as heating, ventilation, air conditioning and lighting. Its objectives are to minimize energy consumption and enhance comfort for users. CIMRQ develops control modules that are embedded into its customers' solutions. Technologies such as 32-B ARM™ microcontrollers, Ethernet, fuzzy logic, neural networks, Echelon LonWorks™ and BacNet™ protocols are combined to provide powerful and cost-effective solutions. Over the past ten years, CIMEQ has assisted more than half a dozen companies with building controls and energy management.

8.5 Manufacturing

Manufacturing is a sector of expertise in research and development activities for 39 percent (23) of respondent institutions. The following table lists the colleges and institutes with this research

expertise. Some success stories in applied research in manufacturing are also provided to illustrate how colleges and institutes are contributing to innovation in this sector.

Colleges and Institutes with Research Expertise in Manufacturing

British Columbia
Camosun College
Selkirk College

Alberta
Norther Alberta Institute of Technology
SAIT Polytechnic

Manitoba
Red River College

Ontario
Algonquin College
Canadore College
Conestoga College ITAL
Fanshawe College
Humber College
Niagara College

Quebec
Cégep André-Laurendeau
Cégep de Saint-Jérome
Centre de productique intégree du Quebec
Centre de robotique industrielle inc.
Centre technologique en aérospatiale, Collège Édouard-Montpetit
CEPROCQ
EQMBO entreprises (CCTT)
OLEOTEK
TransBIOTech-Cégep Lévis-Lauzon

New Brunswick
CCNB

Prince Edward Island
Holland College

Newfoundland and Labrador
College of the North Atlantic

Success Stories in Manufacturing Applied Research

Cégep de Saint-Jérôme

- Cégep de Saint-Jérôme, in partnership with Feel Good Cars (Toronto, ON) developed six zero emission electric vehicle prototypes. The first step of this $200,000 project was to build an initial model by converting a diesel-powered European vehicle. The six prototypes were successfully delivered to the partner's sale and marketing branch. The partner then mandated the CÉGEP to transfer the development of the vehicle from the production stage to the industrial development stage. As a result of the region's unique expertise in electric vehicle engineering and manufacturing, the client decided to locate their assembly line in close proximity to the CÉGEP.

Georgian College

- The Industrial Research Development Institute (IRDI) is owned by Georgian College. Since 1995, the 55,000 square feet Institute, featuring stat-of-the-art labs and an industrial-scale shop floor, has provided a wide range of engineering services to the manufacturing sector. Most research challenges are brought to IRDI by specific manufacturers.

  IRDI offers five technology groups: metal stamping, plastics, machining, tribology (the science of friction, lubrication and wear) and hydroforming (a metal forming technique in which water is pumped into a metal tube that is inside a die or mould. The water, at high pressure, pushes the tube out against the mould, forcing it into the desired shape.

  In the area of hydroforming, IRDI is leading the way in the development of more powerful analytic tools. With tube hydroforming technology becoming very popular and widely used in the automotive industry, it has great potential to save money and improve product quality. Georgian's free expansion hydroforming test system has produced extraordinary results, enabling manufacturers to better understand the opportunities and challenges associated with this

technology.

IRDI is certified by the Fabricators & Manufacturers Association, International as an Education Centre, sharing expertise through a series of comprehensive workshops and seminars.

Researchers, technicians and technologists, and where possible students and faculty, can work together in value-creating groups to develop design solutions and prototypes.

Red River College

- Winnipeg's Conviron is a world leader in the design, manufacturing and installation of controlled environment systems for a wide range of scientific applications. Like many manufacturers, Conviron is embracing new management tools, particularly enterprise resource planning (ERP) and lean manufacturing techniques. In developing a management plan for ERP implementation, Conviron worked with a student from the Technology Management program at Red River College. The student's project was part of Red River College's new Leading Advancement Manufacturing Practices (LAMP) initiative funded under NSERC's recently launched College and Community Innovation Pilot Program. This demonstration project marries the concepts of technology management with advanced manufacturing practices and enables smaller Canadian companies to maintain competitive parity with off-shore manufacturers.

8.6 Humanities and Social Sciences

Humanities and Social Sciences is a sector of expertise for applied research for 36 percent (21) of respondent college and institutes. As explained in the ACCC report prepared for the SSHRC consultation, colleges and institutes are conducting humanities and social sciences research largely in response to the needs of community partners such as non-profit and voluntary organizations, business and industry. Colleges and institutes which responded to the SSHRC consultation also confirmed that there is high interest and capacity to initiate and participate in humanities and social sciences research, and increasing demand from social sciences and humanities faculty to become involved in research projects. Colleges and institutes identified up to 36 social sciences and humanities disciplines for current or potential college/institute research, listed in the following table.

Social Sciences and Humanities Disciplines for Current or Potential College/Institute Research	
o aboriginal issues	o journalism
o aboriginal languages	o justice
o aboriginal tourism	o information, communications, new media
o administration	o law, security and policing
o androgogy	o lifelong learning in remote areas
o anthropology	o literacy
o archeology	o literary analysis
o art and art history	o management and leadership
o business	o marketing
o correctional services	o mental illness
o demographic challenges	o nursing
o design and design history	o pedagogy
o diversity and globalization	o philosophy
o early childhood education	o political science
o economics	o psychology
o education, educational administration	o public relations
o effectiveness of health treatments	o scholarship of teaching and learning

Social Sciences and Humanities Disciplines for Current or Potential College/Institute Research	
o environment	o social impact of technology
o fine arts	o social services
o gerontology	o socio-economic issues
o global stewardship	o sociology
o health services in aboriginal communities	o theatre arts
o health studies history	o tourism
o holistic health	o voluntary sector
o human care services	o women's studies
o human factors in surviving avalanches	o youth programs

The following table identifies the colleges and institutes with research expertise in humanities and social sciences disciplines according to the results of this survey.

Colleges and Institutes with Research Expertise in the Humanities and Social Sciences		
British Columbia Camosun College Langara College Justice Institute of B.C. Selkirk College Kwantlen University College **Alberta** Fanshawe College Lethbridge Community College Medicine Hat Northern Lakes College Olds College SAIT Polytechnic Red Deer College	**Manitoba** Red River College **Ontario** Cambrian College Centennial College Niagara College Seneca College St. Lawrence College **Quebec** Collège Lionel-Groulx CTTÉI, Cégep Sorel-Tracy	**Newfoundland and Labrador** College of the North Atlantic

Success Story in Humanities and Social Sciences Applied Research
Justice Institute of BC ➢ Research on violence in the lives of sexually exploited youth and adult sex workers in British Columbia was conducted by three community based researchers and faculty members at the Justice Institute of BC on behalf of the provincial government's Assistant Deputy Minister's committee on social issues. The researchers visited five communities to learn more about the violence in the lives of sex workers residing and working there. Youth and adults were interviewed about their experiences as victims or witnesses of violence as well as front line workers, police, crown counsel and other members of the criminal justice system personnel who intervene with those who have been sexually exploited or work in the sex trade. Through an action research approach, the researchers have documented the emerging issues, identified common themes, described lessons learned at a community level and have presented some specific recommendations relevant to rural and remote communities faced with these issues.

8.7 Renewable Energy

Renewable Energy is a sector of expertise in research and development activities for 31 percent (18) of respondent institutions. The following table lists the colleges and institutes with this research expertise and the success stories in Renewable Energy Applied Research provide some examples on how colleges and institutes are working with industry to develop renewable energy technology.

Colleges and Institutes with Research Expertise in Renewable Energy		
British Columbia Camosun College **Alberta** Olds College SAIT Polytechnic **Saskatchewan** Saskatchewan Institute of Applied Sciences and Technology (SIAST) **Manitoba** Red River College	**Ontario** Cambrian College Centennial College Fanshawe College Humber College Seneca College St. Lawrence College **Quebec** Cégep de Saint-Jérome CEPROCQ OLEOTEK Centre technologique en aérospatiale, Collège Édouard-Montpetit	**Prince Edward Island** Holland College **Nova Scotia** Nova Scotia Community College **Newfoundland and Labrador** College of the North Atlantic

Success Stories in Renewable Energy Applied Research

College of the North Atlantic

- Many on-shore activities, such as aquaculture, heating, cooling, fire suppression and power generation require large volumes of water. The innovative Water Pump Technology Project developed by a dedicated team of researchers, managers and financers at the **College of the North Atlantic** harnesses the ocean wave energy into onshore commercial applications as a viable source of alternate energy in coastal areas. The "Burin Wave Pump" (trade name for the technology), is currently under patent protection and has received international acclaim for its ingenuity and cost effectiveness.

Olds College

- The Energy Production from Agricultural and Municipal Waste Project presently underway at the **Olds College School of Innovation (OCSI)** in Alberta is proving renewable energy can be produced from agricultural and municipal waste. The Biogas Project which was initiated one year ago, through funding from the Municipal Enabling Fund, Olds College, the Town of Olds and County of Mountain View is a project which aims to produce a high grade fuel from bacteria produced by bacteria during the breakdown of organic materials in an oxygen-free setting. The management of agricultural and municipal waste through a biogas facility could result in huge savings for the community, reduce the need for landfill and protect the environment.

8.8 Energy

Thirteen colleges and institutes (22 percent) identified Energy as a sector of expertise in applied research and development activities. The following table lists the colleges and institutes with this research expertise.

Colleges and Institutes with Research Expertise in Energy	
Alberta Olds College SAIT Polytechnic **Saskatchewan** Saskatchewant Institute of Applied Sciences and Technolgoy **Manitoba** Red River College **Ontario** Centennial College Fanshawe College Niagara College St. Lawrence College	**Quebec** OLEOTEK **Prince Edward Island** Holland College **Nova Scotia** Nova Scotia Community College **New Brunswick** CCNB **Newfoundland and Labrador** College of the North Atlantic

8.9 Multi-Media

Multi-Media is a sector of expertise in applied research and development activities for 20 percent (12) respondent institutions. The following table lists the colleges and institutes with this research expertise and the two success stories below show how colleges and institutes are helping to adapt and apply multi-media technologies to meet the needs of industry and community partners.

Colleges and Institutes with Research Expertise in Multi-Media	
British Columbia Selkirk College **Alberta** Norquest College Northern Alberta Institute of Techology SAIT Polytechnic **Manitoba** Red River College **Saskatchewan** Saskatchewan Institute of Applied Sciences and Technology	**Ontario** Centennial College Fanshawe College Humber College Seneca College **New Brunswick** College communautaire du Nouveau-Brunswick **Newfoundland and Labrador** College of the North Atlantic

Success Stories in Multi-Media Applied Research

Norquest College

- English literacy levels of many adult learners who are deaf are often below those of their hearing peers. In response to the need for resources that are appealing to this audience, Norquest College with the support of the National Literacy Secretariat developed two multimedia resources - Norquest Reader I and NorQuest II – to support literacy development for deaf and hard of hearing adults. Following the success of the award-winning NorQuest Reader I developed in 2003-2004, funding was successfully secured to create 25 additional stories including video clips of American Sign language, text and activities. Approximately 200 copies of NorQuest Reader I have been distributed to literacy programs that serve the deaf across Canada and NorQuest II Reader will be distributed once the project is completed in 2007.

Olds College

- Industry is seeking current, inexpensive digital imagery for monitoring land-based projects. As a result, the Olds College School of Innovation assembled airborne equipment that could be rapidly deployed from the back of an SUV. Recent advancements in electric powered, radio controlled aircraft, and digital cameras have made it possible to collect cost effective aerial data. Existing technologies from a variety of industries were combined and evaluated, resulting in the successful collection of data. Combinations of four categories of aerial platforms and two digital cameras were configured and compared for capability and limitations.

8.10 Agriculture

Ten (10) colleges and institutes (17 percent) identified Agriculture as a sector of expertise in applied research and development activities. The following table lists the colleges and institutes with this research expertise.

Colleges and Institutes with Research Expertise in Agriculture	
British Columbia Kwantlen University College **Alberta** Lethbridge Community College Olds College **Manitoba** Red River College **Ontario** Niagara College	**Quebec** Collège Lionel-Groulx OLEOTEK TransBIOTech-Cégep Lévis-Lauzon **Nova Scotia** Nova Scotia Community College **New Brunswick** CCNB **Newfoundland and Labrador** College of the North Atlantic

8.11 Virtual Reality and Advanced Visualization

Eight (8) colleges and institutes (14 percent) identified Virtual Reality and Advanced Visualization as a sector of expertise in applied research and development activities. The following table lists the colleges and institutes with this research expertise. This is followed by a success story for this sector which illustrates how this technology is adapted to meet the needs of business.

Colleges and Institutes with Research Expertise in Virtual Reality and Advanced Visualization
British Columbia Justice Institute of B.C. **Ontario** Algonquin College Humber College Niagara College Seneca College **Manitoba** Red River College **New Brunswick** College communautaire du Nouveau-Brunswick **Newfoundland and Labrador** College of the North Atlantic

Success Story in Virtual Reality/Visualization Applied Research

Niagara College

- **Niagara College's Centre for Advanced Visualization** has been a long-standing partner of a major multi-national engineering firm, Parsons Engineering. Parsons has worked with the College for over five years to develop visualization solutions for projects that Parsons is competing for and/or undertaking in land-use planning. Niagara has developed fifteen innovative 3D land use models for Parsons, including bridges, traffic simulations, buildings, and plazas. The models permit "fly-throughs" of the model, enabling a real-time "visual experience" of the planned use scenario. Recent initiatives have involved research development into greater and greater realism in 3 D models, in the areas of traffic simulation and lighting.

  The results of this collaboration has increased Parson's ability to compete and win new business as well as contribute to an increased understanding by the public of proposed land use solutions and their impact on the locales and their surroundings. The complex and specialized technology developed by Niagara College is being increasingly adopted by global innovators as an effective tool to design and communicate land use planning scenarios and will help business and municipal partners compete more effectively in a global arena.

8.12 Aerospace

Four (4) colleges and institutes (7 percent) identified Aerospace as a sector of expertise in applied research and development activities. The following table lists the colleges and institutes with this research expertise, and a success story is provided from Red River College.

Colleges and Institutes with Research Expertise in Aerospace

Manitoba
Red River College

Quebec
Centre technologique en aérospatiale, Collège Édouard-Montpetit

Nova Scotia
Nova Scotia Community College

Newfoundland and Labrador
College of the North Atlantic

Success Story in Aerospace Applied Research

Red River College

- The Stevenson Aviation and Aerospace Training Centre of Red River College delivers timely manufacturing training and research to Manitoba's growing aviation and aerospace industries.

  Ranging from value stream mapping, problem solving and future state in a simulated manufacturing plan lab to determining training requirements for any new applied composites technology, the Centre is a hub for applied research.

  Although the Centre's partners include major industry players such as Standard Aero, Bristol Aerospace and Boeing, small-and medium-sized enterprises are also attracted to the Centre to gain access to technology transfer and exposure to new developments, especially in the area of composites. Being lighter and stronger than conventional materials, composites are especially attractive to the aerospace industry and are becoming increasingly common in other industries such as sports equipment. Working with composites requires special techniques and equipment that many small-and medium-sized companies do not yet have. Bridging these types of in key technology and skills access and diffusion is key to the growth and competitiveness of the industry.

8.13 Marine and Aquaculture

Three (3) colleges and institutes identified Marine and Aquaculture as a sector of expertise in applied research and development activities. The following table lists the colleges and institutes with this research expertise, and a success story is provided from Lethbridge Community College.

Colleges and Institutes with Research Expertise in Marine and Aquaculture

Alberta
Lethbridge Community College

New Brunswick
College communautaire du Nouveau-Brunswick

Newfoundland and Labrador
College of the North Atlantic

Success Story in Aquaculture and Marine Applied Research

Lethbridge Community College

- Rooted aquatic weeds are a major nuisance in small ponds,, dugouts and lakes. The **Aquaculture Centre of Excellence at Lethbridge Community College** in partnership with Alberta Agriculture Food and Rural Development and Alberta Aquaculture has established itself as the sole source of triploid grass carp in Canada where these fish are raised for biological control of aquatic vegetation in irrigation canals, municipal ponds, small lakes and small reservoirs (dugouts). Grass carp play a significant role in rural areas where the sole source of domestic water is from dugouts filled with surface runoff where aquatic vegetation must be controlled. People who use this water usually prefer a biological control to the standard chemical control that has been used in the past.

The Aquaculture Centre of Excellence has a reliable, respectable means of spawning and producing triploid Grass carp and as a result, production capacities are being ramped up to keep pace with the growing demands. Guaranteeing fish sterility and completing pond inspections before Grass carp are introduced to water bodies is paramount to enhancing fish effectiveness, customer satisfaction, and controlling any negative ecological impacts, such as escapement and species population and establishment.

This expertise is now being commercialized and commercial fish farmers will be able to raise and sell these certified sterile fingerlings both inside and outside Alberta.

8.14 Textile Technologies

Two (2) colleges and institutes identified Textile Technologies as a sector of expertise in applied research and development activities. The following table lists the colleges and institutes with this research expertise.

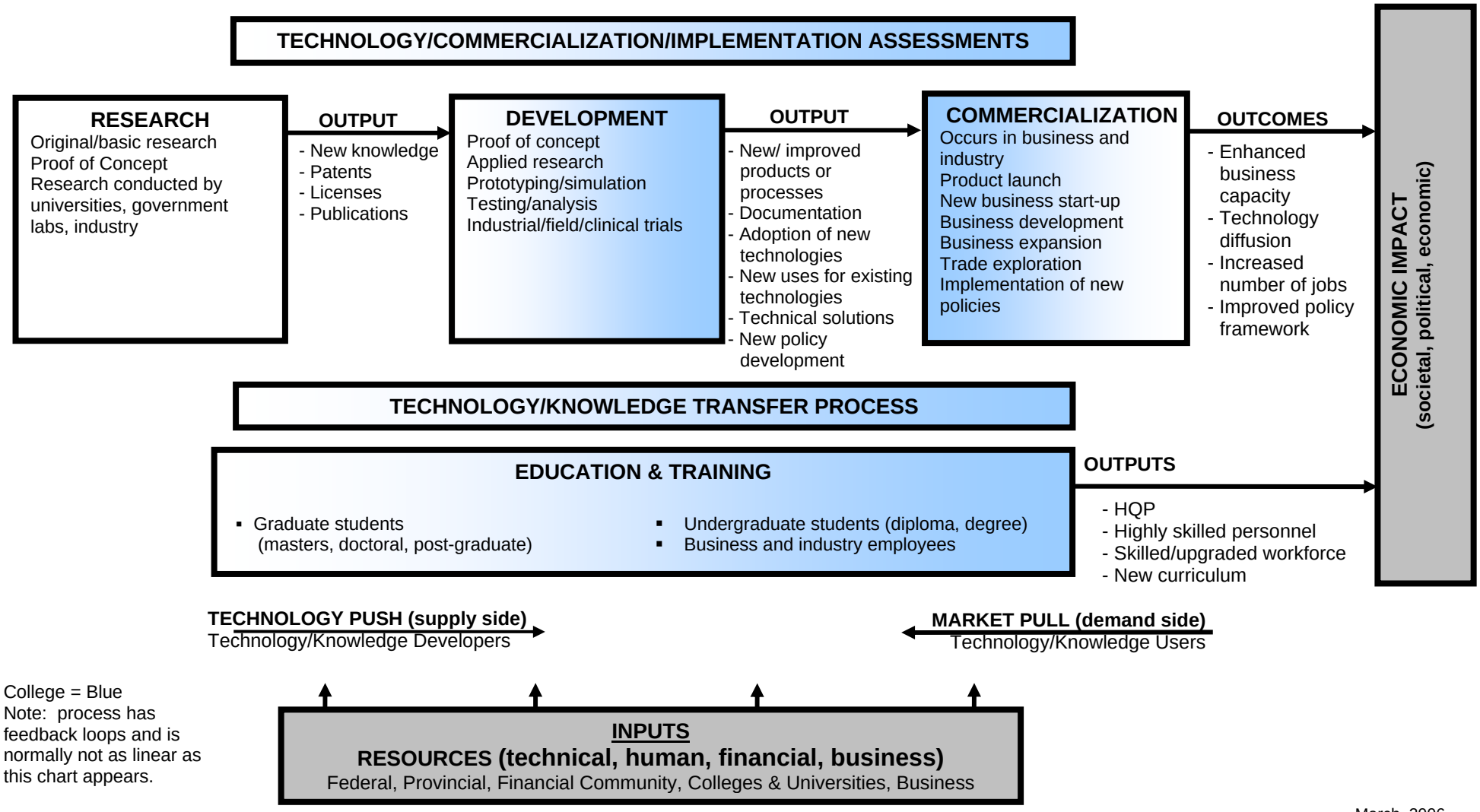
Colleges and Institutes with Research Expertise in Textile Technologies
Manitoba Red River College
Ontario Fanshawe College

9. Impacts and Outcomes of College and Institute Applied Research

Colleges and institutes are mandated to support the socio-economic development of the communites and regions they serve. To meet this mandate, colleges and institutes establish strong links and partnerships with business, industries, regional development agencies, employers, social service providers and community-based organizations. Colleges' and institutes' role in applied research, development and commercialization is reflective of this mandate in that research is initiated and conducted in response to the needs of industry and community partners. The model on the following page provides a overview of the research, development and commercialization process and shows where colleges and institutes fit within this process. As this model shows, college and institute research is driven from market pull, or the demand side, from the users of technology or knowledge who need to improve, refine or adapt technology, or improve on procedures, policies or approaches to meet client needs. As a result, colleges and institutes are more at the development, commercialization and knowledge transfer stages of research. The ultimate impact of research is economic and social development within communities, regions and in some cases, there is even provincial or national impact.

CANADIAN COLLEGES & INSTITUTES

Role in Research Development and Commercialization



College = Blue
Note: process has feedback loops and is normally not as linear as this chart appears.

March, 2006

This section offers some insights on the impacts and outcomes of college and institute applied research on local and regional economic and social development, with particular emphasis on how colleges and institutes are meeting the innovation, research and development needs of industry and community partners. To this end, the survey asked colleges and institutes to:
identify the types of organizations they are collaborating with for applied research;
confirm how they work with local economic development agencies;
identify the types of services offered to firms;
explain how their research and development activities support local and regional innovation; and identify the outcomes of their applied research and development and technology transfer initiatives in terms of the number of ongoing projects, patents, prototypes in development or approved, as well as the types of facilities and strucutres they have put in place.

9.1 College and Institute Applied Research Partnerships and Contribution to Local and Regional Development

In order to get a sense of the extent of the partnerships colleges and institutes are involved in for applied research and development activities, the survey asked institutions to identify the type of organizations with which they have collaborated and cooperated within the areas of applied research, commercialization and technology adoption. Colleges and institutes were also asked to specify the location of the organization, whether they be within 100 km of the college or institute, in the rest of the province or Canada, or in the US.

The table below shows the primary types of organizations colleges and institutes are partnering with and the locations of these partner organizations. The highest number of respondents are partnering with the private sector, mostly with Small and Medium Enterprises 63 percent (37) of respondent institutions, and then Large Firms 54 percent of respondent institutions (32) and Industry Associations 54 percent (32). Universities are also significant applied research partners identified by 47 percent (28) of respondent institutions, as well as other colleges and institutes identified by 46 percent (27) of respondents. Up to 24 percent (14) of respondents are partnering with community groups and municipal governments. Colleges and institutes are for the most part partnering with organizations located within 100 kilometres of their institutions. This is true for 147 (or 62%) of the 238 partnerships identified. Respondents identified up to 80 research partnerships with organizations located elsewhere in their province. This is just over one third (34 percent) of the 238 partnerships identified by respondents. Respondent institutions also indentified nine research partners elsewhere in Canada, and two in the United States.

College and Institute Applied Research Partners

Type of Organization	Within 100 km	In the rest of the province	In the rest of Canada	US	Total # of Respondent Institution
Small/Medium Enterprises	24	13			37
Large Firms	20	11	1		32
Industry Associations	23	8	1		32
Universities	16	9	2	1	28
Other Colleges and Institutes	8	18	1		27
High Schools	12	4	1		17
Community Groups	10	3	1		14
Municipal Governments	11	3			14
Federal Government Labs	5	6	2		13
Hosptial/Health Institute	11	1			12
Provincial Government Labs	6	3			9
Other	1	1		1	3
Total	147	80	9	2	238

The survey results confirm that industry and community partners seek out college and institute assistance and support in different ways:

- skilled work placement students and graduates
- applied research activities
- consulting
- business development support
- technical problem solving
- prototype development
- product testing
- process and product innovation
- identification of policy and practice issues that influence training and enhance policy development
- enhanced communication systems and processes
- support for writing grant application.

One important way colleges and institutes contribute to local and regional economic development is by working with local and regional economic development agencies. This survey confirms that 66 percent (39) of colleges and institutes indicated that they work with local and regional economic development agencies to support company growth, 56 percent (33) of respondent institutions work with these agencies to attract companies to their region, and 39 percent (23) of insitutions do so to help create new companies.

Colleges and institutes were also asked to confirm the type of services offered to firms. The following table shows the responses from participating institutions. The types of services offered to firms by most participating colleges are employee training; product development and testing; research; consultancy, mentoring, brokerage; and space and equipment. Some examples of the other types of services include: 3D visualizations, grant writing, microprocessing and development of business plans.

Services to Firms	Yes	No	No Response
Employee Training	40	6	13
Product Development and Testing	39	6	14
Research	38	8	13
Consultancy, Mentoring, Brokerage	33	13	13
Space and equipment	29	17	13
Administration	15	30	14
Other	9	6	44

The box below provides some examples of how colleges and institutes are collaborating and supporting industry and community partners through applied research and thus contributing to local and regional economic and social development.

Examples of College/Institute Collaboration with Industry and Community Partners

Olds College

Olds College has a research fund that enables the college to provide some degree of financial support to cover some of the applied R&D cost for SMEs that cannot pay for all research activities at the college. In addition the college provides incubation faciities for companies. At the community level, Olds College contributes to the promotion of applied research by providing support for innovation and science fairs, competitions for high schools in the region, and allowing high school students use the college research facilities for some of their special research projects.

Red Deer College

Red Deer College works with different community partners and industries including:

- the regional health authority on the promotion of evidence-based practice either through applied research or through advice on research methodology;
- Parks Canada on human/bear interaction studies.

In addition, the college is currently securing a provincial grant to establish a biolubricant development centre, and is planning to develop an innovation centre in manufacturing in partnership with local manufacturing companies and through a capital grant from the province.

Justice Institute of B.C.

The Justice Institute of B.C. is working with a number of community agencies and criminal justice programs to identify specific policy and practice issues that will influence training and further policy development.

Seneca College

Seneca College has a presence (3 FT employees) on site in the Innovation Synergy Cente in Markham (ISCM) which serve as the college's point of contact with SMEs. The professor who is the college liaison at ISCM has completed an inventory of Seneca College's service capacity and IP and aligns the needs of the client with the resources available at the college after conducting a comprehensive assessment. In addition, Seneca College is the lead in a consortium of 8 Ontario Colleges who are in the process of establishing a College Network for Industry Innovation, is an active partner and participant in the Local Regional Innovation Network (York BioTech RIN) and is represented on the boards of several industry based groups in York Region.

Niagara College

Niagara College supports innovation with regional industries and SMEs by providing services such as expert consulting, use of state-of-the-market equipment and labs, prototype development and

Examples of College/Institute Collaboration with Industry and Community Partners
simulations. The college provides an initial consulting session with industry representatives and college experts without charge to clarify the industry needs and determine whether and how the college can assist, whether the research is feasible and if the college and partners have the funds to support the research. The college sometimes recommends an assessment of commercial potential. The College contracts such assessments to a former College department, now a spin-off company, VISTA Science and Technology Inc.

9.2 Outcomes of College/Institute Applied Research

When asked to identify the outcomes and impacts of their applied research and development and technology transfer undertakings, colleges and institutes confirmed the following:

- 515 industrial and private sector projects realized in the last fiscal year;
- 90 prototypes were developed in the last fiscal year;
- 6 patents and 5 licences approved; and
- 14 spin-off companies, with 40 jobs (FTE) created in these spin-off companies.

It is important to note that Quebec colleges reported the highest number of projects, prototypes, patents, licenses and spin-off companies, followed by Ontario.

Colleges and institutes were also asked to confirm whether they own and/or operate one or more research parks, business incubators, applied research centres, centres of excellence, technology training centres or clusters. As shown in the table below, the most common types of facilities are dedicated applied research centres and technology training centres, followed by centres of excellence.

College and Institute Applied Research Facilities	Yes	No	In Progress	No Response
Research Parks • Olds College	1	40	7	11
Business Incubators • British Columbia: Langara College, Selkirk College • Alberta: NAIT, Olds College • Ontario: Algonquin College, Humber College, Niagara College • Quebec: Centre technologique en aérospatiale, Collège Édouard-Montpetit	8	32	7	12
Dedicated Applied Research Centres • Alberta: NAIT, Olds College, SAIT Polytechnic, Lethbridge Community College • British Columbia: Selkirk College • Ontario: Algonquin College, Centennial College, Conestoga College ITAL, Fleming College, Humber College, Niagara College, Seneca College • Quebec: TransBIOTech-Cégep Lévis-Lauzon, Cégep André-Laurendeau, Cégep Saint-Jérome, Cégep Saint-Foy, CTTÉI - Cégep Sorel-Tracy,	24	16	7	12

College and Institute Applied Research Facilities	Yes	No	In Progress	No Response
CEPROCQ, Centre technologique en aérospatiale - Collège Edouard-Montpetit, Centre d'innovation en microélectronique, OLEOTEK, Centre de productique intégrée du Québec • Nova Scotia: Nova Scotia Community College • Newfoundland and Labrador: College of the North Atlantic				
Centres of Excellence • British Columbia: Camosun College, Selkirk College • Alberta: NAIT, SAIT Polytechnic, Lethbridge Community College • Ontario: Georgian College, Humber College, Niagara College, Seneca College • Québec: Cégep André-Laurendeau, EQMBO • New Brunswick: CCNB • Prince Edward Island: Holland College • Nova Scotia: Nova Scotia Community College • Newfoundland and Labrador: College of the North Atlantic	15	27	7	10
Technology Training Centres • British Columbia: Camosun College, Langara College, Selkirk College • Alberta: NAIT, Olds College, Red Deer College, SAIT Polytechnic • Saskatchewan: SIAST • Manitoba: Red River College • Ontario: Algonquin College, Canadore College, Centenial College, Conestoga College ITAL, Georgian College, Humber College, Niagara College, Seneca College • Québec: Collège Lionel-Groux, Cégep de Sainte-Foy, CEPROCQ, Centre d'innovation en microélectronique • New Brunswick: CCNB • Prince Edward Island: Holland College • Nova Scotia: Nova Scotia Community College • Newfoundland and Labrador: College of the North Atlantic	24	17	7	11
Clusters • British Columbia: Langara College • Ontario: Seneca College • Québec: Centre d'innovation en microélectronique • Nova Scotia: Nova Scotia Community College	3	35	7	14

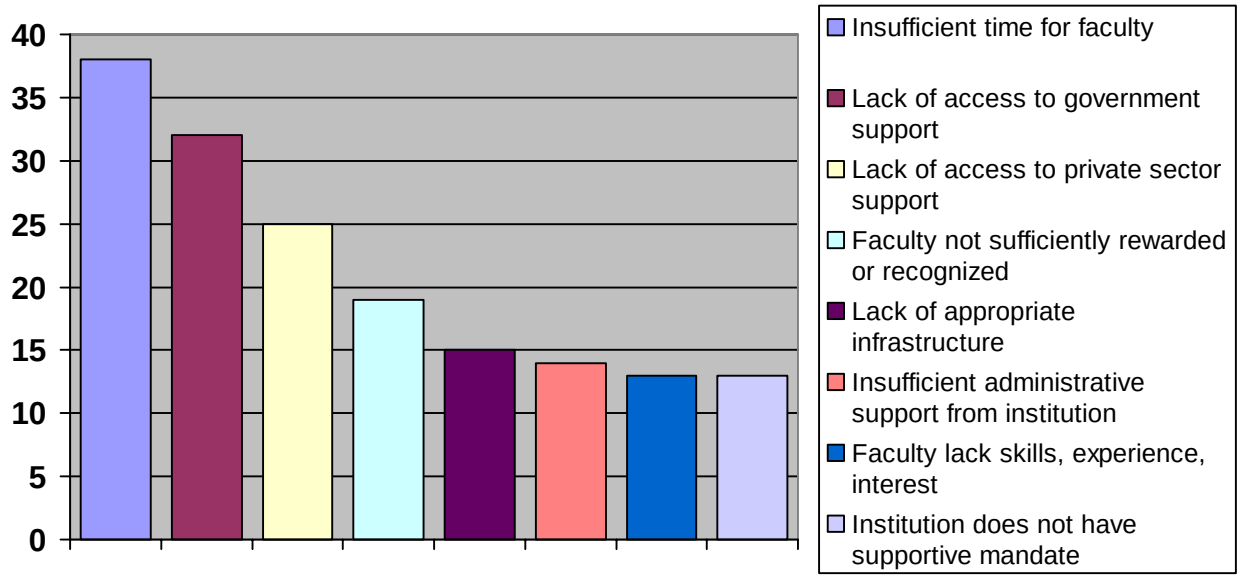
10. Barriers Colleges and Institutes face in moving Applied Research Initiatives Forward

Colleges and institutes were asked to identify and rank the barriers which hinder or impede them from maximizing their potential to contribute to innovation in Canada through applied research and development, technology and knowledge transfer. These barriers provide some indication on where federal and provincial government programs and institutional policies need to focus in order to strengthen college and institute applied research efforts.

As shown in the chart below, the barrier which was ranked as most important or important by the highest number of colleges and institutes (38 institutions or 64% of respondents) is that faculty and staff do not have sufficient time to lead and participate in applied research activities. This finding is in line with the conclusions of the ACCC – SSHRC consultation with colleges and institutes which found the most significant barrier for faculty is the lack of funding for release time which would lighten the teaching load for college/institute faculty when they are involved in research projects.

The lack of access to government support was also ranked as very important or important by more than half of respondent colleges and institutes (32 institutions or 54% of respondents). A lack of access to private sector support was considered a barrier for 25 (42%) of respondent institutions.

Barriers to Applied Research ranked Very Important/Important by Colleges and Institutes



In terms of other barriers at the institutional level, 35 percent (19) of respondent colleges and institutes identified “Faculty are not sufficiently rewarded or recognized” as a very important or important barrier which impacts on applied research activities. This is in line with the conclusions of the ACCC 2005 report *Innovation at Canadian Colleges & Institutes* which confirmed that

generally compensation packages for faculty involved in innovation activities do not exist as part of current collective agreements. This report also points out that given the nature of the work, it is often difficult to estimate the time required to complete research projects, and the time attributed to research activities in formal agreements often does not truly reflect the amount of time required to complete the research. As such, compensation is typically negotiated on an individual project basis. If the compensation and recognition for applied research activities is not deemed to be equitable and comparable to that provided for teaching, faculty will be more reluctant to become involved in applied research.

11. Capacity Building Needs of Colleges and Institutes in the Area of Applied Research

Almost all respondent colleges and institutes confirmed that they want to participate more fully in applied research and development activities, and the majority indicated that a mentoring or support system could assist them in further developing applied research and development capacity. Colleges and institutes also provided some interesting comments and suggestions on the type of support that would be most beneficial for the enhancement and strengthening of applied research capacity. These comments and suggestions are summarized in this section and provide some good insights into how provincial and federal government programs and college/institute leadership can help build college/institute capacity in the area of applied research and development. They also provide some clear directions for future ACCC advocacy efforts with key federal government departments, agencies and granting councils which fund applied research and development.

Recognition for the Role of Colleges and Institutes in Applied Research

There is a need for the federal and provincial governments to take into account the distinct status and role of colleges and institutes in applied research so that these institutions can access grants and funding that enables them to undertake autonomous applied research activities, without being obligated to partner with universities. This was particularly emphasized by cégeps in Quebec.

Mentoring between experienced and inexperienced colleges

Respondent colleges and institutes emphasized the need for more mentoring between and among colleges and institutes, both from more novice or emerging colleges and institutes looking for guidance and support, as well as from more experienced college and institutes which affirmed their willingness to mentor other ''novice'' institutions. Respondents confirmed that mentoring would be useful for administrators, faculty, staff and students. Some of the suggestions for mentoring approaches and areas of focus include:

- mentoring through set-up and early operation of an applied research infrastructure
- mentorship in collaborative research project models;
- mentorship and sharing on establishing eligibility to compete for national funding sources;
- mentorship and sharing for administrators on effective policies, processes, the creation of ethics review processes and committees, and to share what works well and what works less well;

- mentoring & support for developing applied research and development skills such as: project conceptualization, proposal development, skills development & experience across the applied R&D project management spectrum.
- faculty mentoring on designing and executing research projects;
- development of partnerships for applied research and development.

Share Exemplary Practices

Sharing of exemplary practices among colleges and institutes is also viewed as a useful way to meet the capacity building needs of colleges and institutes. Some respondents, particulary from smaller institutions also suggested that exemplary practices be organized or grouped according to institutions with similar sizes and mandates so that responsible college/institute staff can use examples of applied research to prompt and encourage faculty by demonstrating that research and development is possible even in smaller colleges.

Exemplary practices should cover different steps in developing applied research projects from identifying appropriate partners, to preparing proposals and grant applications. It would also be helpful if exemplary practices could provice examples of successful projects to explain how they were handled and to help encourage faculty to participate.

Support Specifically for Smaller Colleges and Institutes

There were some responses which focused more specifically on the capacity development needs of smaller colleges and institutes. These institutions are seeking capacity development in areas such as:

- Development of applied research polices and processes suitable to a small institution;
- Ideas on how to provide reasonable infrastructure and administrative support with limited resources;
- Development of an applied research culture within the institution that supports and enhances the learning environment.

Training and Support for the Preparation of Research Proposals and Grant Applications

Based on college and institute responses, there is clearly a need for more support and training on the preparation of research proposals and grant applications. Colleges and institutes affirmed that more faculty and staff would become invoved in research projects if they knew how to develop appropriate research proposals. Workshops to familiariaze faculty and staff with the development of proposals for research and development projects would be helpful. More experienced colleges and institutes confirmed a willingness to provide support to other institutions in this area. Colleges and institutes also expressed the need for more on-site campus visits or information sessions by granting counils specificially on the preparation of proposals and grant applications.

Provide Faculty and Staff with a List of Funding Opportunities

Colleges and institutes also expressed the need for a resource document which would regroup and list all the funding opportunities available to colleges and institutes for applied research. This could be a resource that could be made available to all colleges and institutes, perhaps via the ACCC website which administrators responsible for applied research can provide to faculty and staff interested in pursing applied research projects.

Institutional Policies and Structures

Colleges and institutes also identified ways that institutional structures and policies could be enhanced to improve applied research capacity. In order to maximize potential, the need for administrative support, including human and financial resources, for applied research activities was emphasized, in particular to provide leadership for grant applications, contract negotiations and administration of grants. The main approaches identified for enhancing institutional policies and structures are as follows:

- Designate a full-time staff member to explore opportunities, manage applied research projects and thus maximize the institution's potential to stimulate innovation in identified areas of focus.
- Develop an institutional framework for applied research services, as a useful initial step in particular for institutions in the early stages of establishing such services.
- Develop standardized databases for recording research resources and expertise including faculty, staff, equipment, space etc.
- Enhance institutional capacity to manage research contracts, including support for budget management for the granting councils.
- Become involved in regional or provincial applied research and innovation groups or clusters.
- Create an Ethics Review Committee and an ethics review process.
- Build capacity on research project design approaches, strategies, templates as well as options for applied research methodologies.
- Identify and attract applied research partners and build capacity for networking and marketing of applied research expertise at the college, provincial, national and even international levels.

Advocacy

Separate provincial and federal funding systems targeting college/institute applied research are fundamental to the growth of research and development in colleges and institutes. There is a need for continued and strong advocacy and lobbying support from ACCC and other organizations to induce policy changes at various levels of government and promote college and institute applied research in Canada. Some advocacy areas identified by respondent colleges and institutes include:

- **Applied Research Agency for Colleges and Institutes** to be created so that research policy and grant management could be done on behalf of all colleges and institutes.
- **Centres of Excellence within colleges and institutes** to be established in collaboration with industry associations, municipal, provincial and federal governments.
- **Standardized financial collection and reporting methods** among granting councils and federal and provincial programs which support applied research.
- **A mechanism for faculty release time** within research funding programs for colleges and institutes to enable faculty members to pursue research grants and conduct applied research, without compromising the quality of teaching and learning at colleges and institutes.

12. Conclusion

The results of this study clearly demonstrate that colleges and institutes have expertise, community, industry and business linkages and the responsiveness to shine in the area of applied research and innovation. Colleges and institutes are developing and implementing solutions in a wide variety of sectors ranging from health, environment, agriculture, renewable energy, manufacturing, information and communications technology, virtual reality and advanced visualization, multi-media, manufacturing, marine and aquaculture, teaching, humanities and social sciences.

Despite limited financial support from the two levels of government, colleges and institutes are going ahead and putting in place the necessary infrastructure and support mechanisms so that they can undertake applied research and respond more effectively to the full range of local business, industry and community needs. However, colleges and institutes are unable to expand their applied research and innovation activities to the degree necessary to meet increasing demands because they face systematic barriers to the number of faculty, facilities and institutional resources that they can allocate to applied research, innovation and commercialization activities.

The diversity of expertise developed by colleges and institutes as described in this report leads us to believe that the time has come for both the provincial and federal governments to support programs that will address the barriers preventing colleges and institutes from unleashing their full potential in applied research and innovation and hence maximize their contribution to the social and economic well-being of our country.

Annex 1: Questionnaire