COLLABORATIVE RESEARCH BETWEEN COLLEGES AND UNIVERSITIES: A SUCCESS STORY

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Abstract – Since their inception over 65 years ago, the primary mandate for over 150 Canadian colleges, situated across nearly 1000 communities, has been restricted to teaching and training. In 2002, the Ontario ministry of higher education expanded college mandates, elevating applied research to the strategic level. Accordingly, college missions recognized the importance of engaging with community partners to solve problems, commercialize products and provide support services. Concomitantly, various government agencies stepped forward with increasing amounts of support and funding for college applied research initiatives. NSERC's College and Community Innovation (CCI) Program, among others, was expressly designed to support such activity.

This paper discusses the partnership between McMaster University and Mohawk College which dates back to 1997, a collaboration that provides students of varied academic backgrounds the opportunity to work together in solving real world problems. The paper addresses benefits realized and lessons learned including the challenges faced by both institutions in integrating the applied research program.

Keywords: Applied research, college-university partnership, innovation, research and development.

1. INTRODUCTION

Over the years, it has been broadly acknowledged that innovation is the most critical component for business success, economic growth and societal prosperity. Today, technology represents a key factor contributing to the level of wealth and welfare within a society. A recent study by the Canadian Manufacturers and Exporters indicates “that Canada lags behind the United States and other countries with respect to both innovation and productivity growth” [1], with another report grading Canada ‘D’ in innovation [2]. This refrain, expressed in many other quarters, suggests that any response short of aggressively redressing this deteriorating competitive situation foreshadows a steep decline in Canada’s standard of living.

Canadian universities have traditionally conducted research with the main focus being on basic science. According to David Naylor, outgoing president of the University of Toronto, research funding has been shifting for a generation in the direction of match-funded, industry-facing research with an applied orientation (applied research) as shown in Figure 1.

Figure 1 – NSERC Funding (Fettered & Unfettered)

Conversely, the Canadian college system was established placing teaching as the primary activity, with little time for research of any kind on the part of faculty. A 2006 study by the Association of Community Colleges in Canada (ACCC) identified a number of challenges that limit colleges from participating in the research process and provided solutions to improve colleges’ applied research profiles [3]. A 2010 Conference Board report [4] argued that university and college collaborations are poised to make significant contributions to innovation in Canada, as evidenced by the University of Western Ontario and Fanshawe College hurricane resilient housing project among many others [5]. Other studies have shown that collaborative applied research delivers tangible benefits including: providing students with pathways, broadening skill sets at both institutions, solving real world problems, enhancing lab facilities and strengthening faculty research resources.

Increasingly, colleges have been participating in applied research initiatives as a means of enhancing faculty relevance, maintaining curriculum currency and assisting local, small to medium size companies (SMEs)

with innovation and product/service commercialization [6]. The Honourable Gary Goodyear, Minister of State for Science and Technology echoed these sentiments. At a recent 2013 ACCC applied research symposium, he observed that rebalancing of the entire spectrum of research, from basic to applied, is critical to keep Canada competitive in a global economy [7]. A member of the Jenkins panel reported on a number of applied research success stories demonstrating concretely how Canada's under-tapped colleges are contributing to innovation success in meaningful ways. Colleges help SMEs solve a variety of challenges, from the design and prototype stages of new products to their commercialization. The Jenkins report put it succinctly when it argued that while universities perform the great majority of basic research, basic and applied research activities are increasingly intertwined [8] (see Figure 2). Hence, it appears Colleges have a significant role to play relating to applied research and increasingly so into the future.

Figure 2 – Basic vs. Applied Research to Economic Impact

2. PROGRESS TO DATE

From basic and humble beginnings, colleges have made significant contributions to innovation and productivity gains over the years. Colleges and institutes (including polytechnics) are contributing to innovation in Canada through enhanced institutional research infrastructure, involvement of faculty and students, and expanded industry and social innovation partnerships. The Government of Canada more than doubled its investments over the past year and is the largest source of external funding for applied research, with a total of \$72 million contributed. Private sector investments continue to increase significantly, with an 18% increase from 2010-11 [9]. The 2013 ACCC report catalogues the spectrum of applied research works that have been successfully implemented across Canada. Resorting to any number of measures, the ACCC concludes that colleges have made significant contribution towards the well being of businesses and society at large [10].

3. GRANT TYPES AVAILABLE

A host of different funding programs have been made available for colleges under the College and Community Innovation Program (CCI). A brief summary of each grant type under the CCI program is provided in Table 1.

GRANT	PURPOSE	LIMITS
Innovation Enhancement (IE)	Enhance innovation at the community and/or regional level by enabling colleges to increase their capacity to work with SMEs.	Two years is up to \$100,000 per year (per project) and for subsequent years is up to \$500,000.
Applied Research and Development (ARD)	Provide companies access to the knowledge, expertise and capabilities available at colleges and train students in essential technical skills required by companies.	The three levels of funding under ARD grants are: under \$25,000; up to \$75,000; and more than \$75,000 to a maximum of \$150,000.
Applied Research Tools and Instruments	Support the purchase of research equipment and installations to enhance the ability of colleges to undertake applied research and training for local companies	These grants were one-year awards to assist in buying applied research equipment costing between \$7,000 and \$150,000.
Technology Access Centre (TAC)	Provide funding for the core operations of centers that address the applied research needs of SMEs.	Five-year, renewable funding of up to \$350,000 per year.
Industrial Research Chairs for Colleges (IRCC)	Support for 30 new Industrial Research Chairs at colleges will accelerate applied research where there is an important industrial need.	The program begins with a \$3 million allocation in 2011-12 and \$5 million per year on a permanent basis starting in 2012-13.
College-University Idea to Innovation (CU-I2I)	Support joint college-university R&D projects with promising commercialization potential, with \$12 million over five years starting in 2011-12.	

Table 1 – CCI Funding Programs

4. BENEFITS

Where two institutions collaborate on applied research, there must be perceived and real benefits attached to such a partnership. While collaborative, applied research initiatives are mutually beneficial, both colleges and universities take away different paybacks from the enterprise.

4.1. Benefits for the College

In conducting applied research, colleges are permitted to realize a research profile, thus improving image and general standing in the community. Moreover, applied research brings new knowledge into the curriculum, encourages faculty to elevate credentials, leads to the development of new/improved lab facilities and exposes students to cutting-edge technologies and concepts, encouraging them to pursue to higher education.

4.2. Benefits for the University

Applied research provides university students and faculty with exposure to application-oriented, real world problem solving opportunities as a useful compliment to theoretical research/education. As a result of relationships built with colleges, universities are able to gain access to college facilities in order to take advantage of existing technologist / technician staff as well as physical resources (such as industry-focused lab space). In addition, potential connections can be made between employers and university students seeking work-placements for co-op terms and can encourage access to external research facilities.

4.3. Benefits for Partners

With access to a pool of students/faculty from both colleges (hands-on) and universities (theoretical), industry partners are provided with a single point of contact for both real world and theoretical problem solving.

5. MOHAWK-McMASTER RESEARCH MODEL

The Mohawk-McMaster applied research model began with a faculty member (Dr. Nafia Al-Mutawaly) seeking seed money to move forward with a research initiative. A search for funding avenues revealed the existence of a number of sectors that government felt was important to the future of Canada [9]:

- Natural Resources and Energy
- Environmental Science and Technology
- Health, Medical and Life Sciences
- Information and Communication Technology
- Manufacturing
- Building Technology

As research programs were considered, selection criteria included:

- Identification of an issue that is in demand and critical to Canadian society

- Alignment with the department goals/directions and college strategic plans
- Degree of interest to the research champion
- Correlation with academic credentials and work experience of the faculty member
- Quality of industry/sector contacts and their association with the university
- Strength of contacts within relevant industry
- Benefit to students and other faculty (labs, curricula, publications)

The outgrowth of applying the above factors resulted in narrowing the research domain and identifying the suitable pool of funds to underwrite the research. One can anticipate that this solitary activity can exceed a year in duration. The area chosen in the immediate case (energy) showed promise in terms of growth, societal relevance, and industry interest. The research program described herein involves power protection/control and power quality. These areas were of interest as Ontario's aging power system is undergoing significant upgrades to accommodate new loads, generating sources and a continued growth in power demand. With these anticipated changes to both grid structure and requirements, the research focuses on system integration and mass-customization through device interoperability.

A serendipitous element to the research program being described is the addition of a world class researcher at McMaster University. Dr. Ali Emadi, holder of the Canada Excellence Research Chair in Hybrid Powertrain, joined McMaster in 2011 and is conducting research into electric vehicles, renewable energy, power trains, and smart grid technologies. Given the research interests of both Dr. Al-Mutawaly and Dr. Emadi, a considerable amount of complimentary research is taking place.

6. DEVELOPMENT

To date, government funding totals \$3.6 million (IRCC, ARTI, IE, see Table 2) for the energy research program, while industry contributions (both dollars and in-kind) total \$1.2 million. Four labs have been built to date: two substation automation labs (one at Mohawk, one at McMaster), power protection lab (at McMaster), power quality and electric vehicle labs (at Mohawk).

Applied research completed includes:

1. Impacts of electric vehicles on Ontario's power grid (in partnership with Hydro One)_
2. A test bed for feeder automation systems (in partnership with Siemens Canada)

In progress projects include:

1. Collaboration with local distribution companies (Norfolk Power, Horizon Utilities and Hydro One) examining the impact of power quality for distributed generation (DG) on distribution systems
2. Power protection and control system interoperability (in partnership with Siemens, SEL, Ruggedcom, Schneider)
3. Testing multi media for communication among substations and control centers (in partnership with Ruggedcom, Hydro One, Horizon Utilities, Norfolk Power)

Expected outcomes from the energy research include:

- Training students in power quality and power grid protection and control
- Improving curriculum (college and university)
- Constructing state-of-the-art lab facilities (college and university)
- Validating current industry protocols and procedures
- Creating databases and performance profiles of smart grid components
- Developing new products and procedures for industry
- Evaluating recommendations and knowledge transfer to industry and other academic institutions

7. CONCLUSIONS

Calls for colleges to participate in and contribute to applied research in Canada have been heralded for over a decade. Considerable progress has been made, yet as a matter of national competitiveness, an urgency remains in terms of tapping into this vital resource. This paper has attempted to set out a case experience that continues to unfold at Mohawk College/McMaster University. Findings indicate that there are concrete, actionable strategies that must be planned and executed to ensure a successful cross-college/university applied research program. Recommendations include: selecting an area of interest from the federal/provincial sectoral lists, identifying an intrapreneurially oriented post-graduate trained individual to champion the research initiative, aligning the College with a University partner, establishing applied research programs within the confines of the college's mission and strategic directions. All of the identified activities should be coordinated through a college's office of applied research, to ensure a single point of contact for all stakeholders.

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