

Actes du Congrès  
**COLLÈGES CÉLÉBRATIONS 92**  
Conference Proceedings



MONTRÉAL MAY 24 25 26 27 MAI 1992

**Applied Research at the B.C. Institute of Technology**

par

Norman STREAT,  
director  
British Columbia Institute of Technology  
(Colombie-Britannique)

*Atelier 2C33*

*Collèges  
créateurs d'avenir*

*Colleges  
creators of the future*



Association des collèges  
communautaires du Canada



Association québécoise de  
pédagogie collégiale

## APPLIED RESEARCH AT THE B.C. INSTITUTE OF TECHNOLOGY

Norman Streat  
 Director, Technology Centre  
 British Columbia Institute of Technology  
 Burnaby, B.C.

### THEME

In January 1990, the ACCC made a submission to the Standing Committee on Industry, Science and Technology, Regional and Northern Development titled "*Our Futures in Technology*". Among the issues discussed was "*What support should the federal government provide for basic and applied research?*"

The paper argued that Canada's community colleges represent a huge concentration of equipment and relevant expertise available to support applied research and product development, and that the federal government should establish a new funding program to develop this resource and thereby enhance Canada's competitiveness in the world marketplace.

The proposal for a new funding program did not receive support from the federal government, yet the arguments made in the paper were sound. Community colleges, if given the opportunity, can indeed be a valuable resource capable of providing significant assistance to Canada's industries, both in their traditional role of providing trained people, and also as a provider of technology.

The following presentation is a case study that answers the question, "What happens when an established teaching Institute receives a new mandate to become involved in applied research to support industrial development?"

In 1988 the British Columbia Institute of Technology's mandate underwent such a change. In 1989, BCIT created an office with the specific goal of fostering applied research, technology transfer and other related activities, called the BCIT Technology Centre.

Some of the benefits which were foreseen by the authors of "*Our Futures in Technology*" have indeed been achieved. As may be expected, there continue to be challenges which need to be overcome.

### BCIT'S MANDATE

The impact of BCIT's new mandate, given in 1988, has been profound and continues to be felt. It states that:

*"The British Columbia Institute of Technology will be an innovative and flexible advanced technology enterprise which will focus on those activities that increase the level of entrepreneurial activity within the province. Specifically, BCIT will:*

- *establish expertise in specific technological areas and develop applications for British Columbia business and industry;*
- *facilitate technology transfer by providing innovation, industrial assistance and contracted applied research; and,*
- *provide a highly trained workforce vital to the establishment and continuance of advanced technology in British Columbia."*

The mandate clearly calls upon BCIT to embark on a new role in *technology transfer* and *applied research*. These activities have become parallel in importance to BCIT's traditional role, that of providing training for the workforce.

BCIT was specifically mandated to become involved in *applied* research to assist the growth of B.C. industry. Thus BCIT does not engage in basic or curiosity-driven research.

### FUNDING FOR THE APPLIED RESEARCH MANDATE

At universities each faculty member is required to conduct scholarly research as well as teach. At BCIT and community colleges, instructors are only required to teach. Accordingly, the teaching load on instructors is about double that expected of university

professors. The provincial education funding formula also takes this difference into account. Universities receive base funding to support research, while community colleges do not.

BCIT's new mandate did not result in any fundamental change in *required* faculty duties. There was certainly no expectation that *all* BCIT faculty should engage in research activities, nor was BCIT's funding formula changed to allow for such activities on a broad scale.

Instead, the BCIT Technology Centre receives an annual grant from the education budget of the B.C. Ministry of Advanced Education. This grant is selectively distributed by the Technology Centre to a limited number of applied research initiatives that meet its prescribed goals. These projects may be undertaken by the Technology Centre's full time research staff or by teaching faculty. In the latter case, faculty members may propose the research activities they wish to undertake, subject to the Technology Centre's approval. Funds are used to pay for teaching release for the duration of the approved projects. When the projects are complete, faculty return to full time teaching.

To supplement the Ministry grant, the Technology Centre actively seeks other sources of research funding, including government grants, industry contracts, and joint ventures.

## OTHER IMPLICATIONS OF THE NEW MANDATE

BCIT has recently initiated a proposal to grant its own Technology Degrees in response to a generally accepted need for much larger numbers of degree level graduates than the universities can currently supply. The proposal discusses the type of graduates that would best meet the economic needs of the province of B.C. and concludes that BCIT, as an Advanced Technology Institution, should evolve as a degree granting institution, while maintaining its diploma programs.

The applied research aspects of the mandate offer an opportunity for BCIT to demonstrate a level of scholarship consistent with the Institute's degree granting aspirations.

## THE BCIT TECHNOLOGY CENTRE

The Technology Centre was established in 1989 by amalgamating a number of small areas, previously established at BCIT, that had already begun to engage in industrial assistance activities. A Technology Centre Director was hired, with an industrial R&D background, reporting to the VP Education.

At a relatively early stage the Technology Centre established its mission, goals and strategies. Its mission is:

*"to significantly expand and enhance BCIT's role in innovation, entrepreneurship and economic development in B.C. by establishing and fostering contracted applied research projects, industrial assistance projects, and technology transfer activities"*

Its goals are to:

- *Provide industry with access to the Institute's technical expertise and facilities.*
- *Encourage and support applied research initiated by BCIT faculty and students.*
- *Collaborate with industry on applied research projects.*
- *Create new ventures and promote entrepreneurship.*
- *Establish networks, alliances and joint ventures with other organizations that share similar goals.*

The five points above are the formal goals the Centre has adopted. Informally, other goals have been added, for example:

- *To achieve a reasonable level of external funding (approx. 35% of total expenditures).*
- *Not to make a profit.*
- *To avoid competing with private sector companies.*

The Technology Centre has adopted the following general strategies:

- *encouraging applied research in specific niche areas, particularly those which are industry-related and for the most part, industry sponsored;*
- *building a climate within BCIT that encourages instructors, staff and students to show initiative in applied research;*
- *building strategic alliances with other organizations that share similar goals; and using the funds of the Technology Centre as leverage to encourage co-funding from other organizations, thus creating partnerships.*

It should be noted that BCIT's Technology Centre concentrates on aspects of technology transfer that are *not* directly related to training, and in this respect its emphasis differs from the Advanced Technology Centres (ATCs) at U.S. Community Colleges.

## ORGANIZATION OF THE TECHNOLOGY CENTRE

The Technology Centre employs a full time staff of about 23 at the present time, of which 6 are managers (including the Director), 4 are support staff and the remainder are dedicated R&D project staff (i.e. they are dedicated to applied research duties - they do not have parallel teaching responsibilities).

### Dedicated R&D Staff

The Technology Centre consists of a Director and, at present, four R&D managers reporting to the Director. The R&D Managers, as well as the Director, each have a primary area of technical responsibility (e.g. engineering, health, information technology, etc.) plus responsibility for a number of full time R&D staff. These staff have been drawn from a variety of sources - including some who were previously employed in industrial and government research laboratories. Many of the staff are recent BCIT graduates. The full time R&D staff form a core that is capable of performing work to the level of professionalism and timeliness demanded by industry.

### Applied Research done by Teaching Faculty and Students

Faculty may become involved with applied research projects either through a request from industry, or as

a result of the faculty member requesting support to conduct applied research in his/her own field of interest. In the latter case the Technology Centre requests a written proposal from the faculty member, and the proposal is assessed for technical merit and economic potential prior to approval being given. Normally the faculty member is given full or partial teaching release to conduct the project. Faculty who act on their own initiative are usually encouraged to seek industry partners and/or apply for government grants.

R&D managers also become responsible for overseeing projects being undertaken by teaching faculty, and occasionally by students.

### NRC-Industrial Research Assistance Program (IRAP)

BCIT, in common with many Canadian community colleges, is an associate of the NRC-IRAP program and hosts two Industrial Technology Advisors (ITAs).

A unique feature of our relationship with IRAP is that the Technology Centre contributes 50% towards the cost of one of these ITAs. This co-funded ITA position is rotated among interested BCIT instructors as a professional development experience, normally for a period of 12 months. So far all schools at BCIT - Business, Health, Engineering and Trades have contributed one of their teaching faculty to this experience, and the individuals have returned to teaching at the end of their 12 month term.

All instructors who have participated have described this experience as extremely valuable in terms of increasing their professional currency. As an ITA they visit a wide variety of companies and become closely involved with providing either direct technical assistance or helping the companies apply for government funding to support the development of new technology.

NRC-IRAP's goal of providing small and medium sized Canadian businesses with access to new technology closely matches the Technology Centre's mission.

### Entrepreneurship

The Technology Centre is responsible for one educational program - a program for training entrepreneurs that we have called the "Venture Program". This is an intensive 12 week course

which instructs people on the basics of running their own enterprise, including market assessment and financial management (in particular, cash flow management). Students are provided with office facilities that allow them to continue to conduct their business while taking the course. At the conclusion, students make a formal presentation of their business plan to a panel of volunteers from the business community.

The Venture Program has run twice a year for the past three years and has graduated approximately 70 entrepreneurs, so far. Of these, approximately half have succeeded in establishing and maintaining their businesses.

It was initially hoped that the Venture Program at BCIT would attract technology-based enterprises, providing a link with the applied research activities of the Technology Centre. While some of the Venture Program participants have indeed started technology-based businesses, the majority have not. The program was opened to all types of business ventures because there was not sufficient demand for an entrepreneurship program exclusively aimed at start-up technology-based businesses.

**Advice to inventors**

The BCIT Technology Centre is open to individual inventors, to whom we provide technical and business advice on a one-to-one basis. It is clear from the level of demand that this is a needed service. We are associated with, and encourage the use of the services of the Canadian Industrial Innovation Centre in Waterloo, Ontario.

This service to inventors occasionally leads to opportunities for student projects.

**HOW DO WE MEASURE OUR SUCCESS?**

The Technology Centre measures its success against the five goals which were listed earlier. We are concerned with:

- the number and size of projects being undertaken;
- the number of projects that receive external funding;
- the number of projects that involve

collaboration with industry or other organizations;

- the number of faculty and students that are involved in these activities;
- the number of new business ventures that are created;
- the number of alliances with other organizations (such as NRC-IRAP) that share similar goals.

Naturally, we are concerned with revenue and expenses, and revenue is looked at as one measure of success. At present, the Technology Centre is able to earn revenues that cover approximately one third of its operating costs. It should be noted that the terms of reference of the BCIT Technology Centre do not include a requirement that it should be financially self sufficient.

Based on 3 years experience at BCIT, I believe that it would not be possible to meet such a self sufficiency requirement as well as carry out the range of activities I have outlined. If self sufficiency became a necessity, the emphasis would shift heavily towards contract research done by full time R&D employees - in essence, the creation of a consulting company. If this were to happen the benefits of interaction with the educational community would be lost, and a negative reaction from the private sector would doubtless be provoked.

**NICHE AREAS - EXAMPLES OF SOME PROJECTS**

The following have emerged as niche areas where we feel we have the facilities, the people and a track record of accomplishment that allows us to undertake projects funded by industry or granting agencies.

- Computer applications: in particular, development of prototypes for proof of concept, marketing demonstrations etc., software conversion, and software testing and verification.
- Development of expert systems, e.g. simulation of control systems, intelligent scheduling systems ((e.g. nurse and train crew scheduling), rotating machinery diagnostics.

- Development of multimedia training materials, e.g. interactive videodisc applications, fire fighting simulation, aircraft simulation.
- Development of medical devices, e.g. prosthetics and orthotics, brain mapping, surgical devices.
- Development of automation and robotics applications for manufacturing, e.g. robot for transplanting tree embryos.
- Chemical engineering projects related to waste treatment and other environmental issues, e.g. photofinishing effluent treatment.
- Biotechnology applications, e.g. DNA fingerprinting for wildlife identification.

New areas are presently emerging in manufacturing, quality assurance, food technology and others.

## **INDUSTRY SPONSORED STUDENT PROJECTS**

Industry sponsored student projects have emerged as one of the most successful technology transfer initiatives.

In 1989/90, in response to the new mandate, the School of Engineering Technology made a concerted effort to encourage industry sponsored projects for students in their final term (term 4 of a 2 year program, or term 2 of a 1 year advanced diploma program). Some industry sponsored student projects had been undertaken previously, but there had been no organized effort to promote this activity.

While industry sponsored student projects at BCIT have some similar features to cooperative education, but they are not precisely the same as the classical cooperative education model. The major emphasis of the student projects is not to provide practical training in the work environment, but the development of teamwork and problem solving skills by addressing a real-world problem.

The method of encouraging the growth of industry sponsored student projects was to offer awards to the top rated projects - \$500 per student up to a maximum of \$1,500 per project. Evaluation of the projects for these awards is based primarily on

industry's assessment, rather than the instructor's assessment. In the first year of the program \$13,000 was distributed in award money, and more recently this amount has been increased. Additional support has been provided through a full time student projects coordinator and a budget of \$75,000 per year to pay for infrastructure (materials, supplies, specialized equipment, etc.). The Technology Centre provides most of these special funds.

In the School of Engineering Technology, there have been between 145 and 180 industry sponsored student projects in each of the last 3 years, involving approximately 330 students each year. The number of projects nominated for awards has been approximately 50 each year, of which somewhat less than half actually receive awards.

The awards program has created a great deal of interest among students and faculty, and it is gratifying to see that many faculty who have not otherwise shown interest in becoming involved directly with the Technology Centre are keenly involved with these student projects.

From the industry perspective the program has been very successful. Experience has shown that many of these projects make a valuable contribution to the sponsoring company (especially small companies with limited resources), and thereby promote economic development. Feedback from the sponsor's evaluation forms showed that industry estimated a value of between \$250,000 - \$500,000 for the projects completed in 1991.

The Technology Centre is currently expanding its support for industry sponsored student projects to BCIT's School of Business, where approximately 200 projects are done each year. The School of Health Sciences is also planning to introduce a similar program.

## **RESPONSE TO BCIT'S NEW ROLE**

### **Industry response**

It has not been difficult to sell BCIT's new role to the industrial community in B.C. The Institute has an excellent reputation among employers and when they learn about the Institute's new mandate many are willing to consider working with BCIT.

Organizations that have few resources are generally

the most interested, however, many of these find it difficult to raise the funds that are needed. Through our alliance with NRC-IRAP we can direct them to the potential sources of funding, and occasionally we have agreed to undertake a project as a joint venture. In these cases we keep a share of the technology developed and negotiate for future royalties.

We have performed projects for several larger organizations, often in cooperation with the companies' own R&D staff. Projects with larger organizations tend to be less problematic on most counts, especially in terms of funding.

However, we continue to seek projects from the smaller companies because it is now well established that the small business sector is by far the largest creator of new jobs, and we feel this is the community that BCIT is particularly well suited to assist.

#### Faculty response

As has been noted earlier, BCIT faculty are selected mainly on the basis of a strong practical knowledge of their technology, gained through industrial experience. Teaching ability is highly valued.

Professionalism among BCIT faculty is based on technical currency and teaching ability, in contrast to a university, where publication and research are valued far more highly than teaching. Professional development is encouraged. Faculty usually undertake professional development activities that involve returning to industry for a given period to maintain their professional currency. The research mandate has introduced a new element. Involvement in applied research is voluntary, but is now available to faculty as a further route towards professional development.

Acceptance of this opportunity is growing slowly but steadily. Most of those who have so far taken advantage of the opportunity are younger faculty, many of whom have advanced degrees. Nonetheless, the Technology Centre continues to emphasize that its opportunities are available to *all* faculty, not just those with advanced degrees.

The number of faculty who have become involved with Technology Centre activities since 1989 is approximately 50 (about 10%), and there are about 28 faculty involved (about 5%) at the present time. For comparison, the level of involvement in 1989,

when the Technology Centre was established, was about 5 faculty (1%).

#### Full Time R&D Staff vs. Teaching Faculty

The most successful R&D ventures have tended to be those undertaken by the Technology Centre's core of full time R&D staff. Soliciting R&D contracts from industry requires an ability to respond in a professional and timely manner, and experience has shown that the full time staff are most capable in this regard.

In contrast, teaching faculty who undertake R&D projects on essentially a part time basis, often find it difficult to respond in the timely manner that industry contracts demand. R&D managers within the Technology Centre have learned to accept that the number one priority for faculty is teaching, not research, and have learned to educate clients that projects undertaken by faculty (and students) can be of excellent technical quality, but may not always be timely.

#### Response from Universities and Granting Agencies

Technology Centre staff have actively sought opportunities to collaborate with the Universities in B.C. and to date two collaborative projects have been established with UBC, one involving the development of a simulator to test disabled drivers, and the other involving the development of an upper limb orthosis.

University researchers have not tended to consider partnerships with BCIT in the past, but they too actively pursue applied research opportunities. We anticipate that the number of collaborative projects with the universities will grow in future as they become more aware of the range of BCIT's capabilities.

Technology Centre staff and other BCIT staff actively participate in the activities of the Science Council of B.C., in the many volunteer peer review committees for Science Council grants and in the strategic planning committees (SPARK). The Science Council of B.C. distributes approximately \$10 million per year in grants for applied research to industry and to post secondary institutions. Before 1989 BCIT had won one these grants - since then we have won five.

The Technology Centre actively pursues grant funding for its projects from other government agencies, including NRC-IRAP and ISTC. Such

funds are available to the industry sponsor of the project, who may then subcontract to BCIT.

Unfortunately BCIT is not eligible for Canada's largest engineering research grant fund - NSERC (Natural Sciences and Engineering Research Council), notwithstanding this organization's recent efforts to encourage collaborative applied research for industry.

## **OTHER TECHNOLOGY TRANSFER CONSIDERATIONS**

### **Technology Commercialization**

In addition to its activities in securing applied research projects the BCIT Technology Centre becomes involved in a range of technology commercialization issues. These include protecting client confidentiality, protecting intellectual property through patents, and commercializing technology through licensing agreements. The Technology Centre has licensed one technology (nurse scheduling software - developed in partnership with the Kelowna General Hospital) which has generated some royalty revenue.

### **Intellectual Property Policy**

Following a study of intellectual property policies at several Canadian universities an Intellectual Property Policy for BCIT Employees has been drafted and is presently being examined by the various levels within the Institute prior to adoption. BCIT's draft policy has been strongly influenced by the policy currently in place at the University of Waterloo. It has become evident that in addition to a policy for employees, a policy dealing with student inventions would also be desirable.

### **Ethical Review Policy**

A process has also been initiated to establish an Ethical Review Committee to review issues relating to projects in the field of Health Care.

## **SUMMARY**

The experience at BCIT has shown that it is possible to harness the resources of this institution to support economic development through applied research and technology transfer. Benefits are gained by the

business community and by faculty and students.

While faculty may initially regard the introduction of applied research into a teaching institution with some caution, the concerns gradually diminish as they become aware of successful experiences.

Thus, the advice we would give to others who might wish to establish a similar role is:

- Ensure that your institution is strongly committed to such a mission.
- Build a strong relationship with industry.
- Maintain a core of dedicated R&D staff as well as encouraging applied research done by teaching faculty and students. Both these elements are essential.
- Develop strategic alliances with other organizations such as NRC-IRAP.
- Always be concerned about earning sufficient revenues, but avoid the requirement to be 100% self sufficient. There is no ideal ratio between revenues and expenditure that can reasonably be expected. It depends on the type of programs that are undertaken.
- Encourage industry sponsored student projects.
- Encourage collaboration with universities.
- Be aware of the need to develop technology commercialization skills and appropriate policies.