Partnership in Engineering Education

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Abstract

Universities and industries traditionally maintained collaborations by including student internships, faculty exchanges, and industry design projects to complete a degree program. Universities gather insight into the real world problems and they are exposed to the industry practice. On the other hand, industries get introduced to the latest technology practiced in universities. Partnership between Educational Institution and Industry is not a new concept in fostering learning among students. However in this paper, the partnerships between Universities and Industries, and the partnerships among Universities, National Laboratories and the Schools are discussed by considering the different international as well as domestic case studies.

The University of Saskatchewan, Canada is actively participating in the Industrial Postgraduate Program. This program along with other forms of financial support, allows the university to offer funding to a number of graduate students who takes part in the University-Industry Partnership program. The Canada-China University-Industry Partnership Program (CCUIPP) is one of many new initiatives agreed to by the Canadian International Development Agency (CIDA) and the Chinese Ministry of Foreign Trade and Economic Cooperation (MoFTEC). The University-Industry Science Partnership (UNISPAR-Africa) program of the United Nations Education Scientific and Cultural Organization (UNESCO) shows how the program activities can facilitate university-industry cooperation for technology development.

Introduction

The purpose of this paper is to focus on industry and university partnership in enhancing engineering education. There are several case studies that primarily focus on the issue of partnership. The partnership among Canadian and Chinese universities along with some industries focuses on encouraging the development of bilateral trade relationships between these nations. The Tauber Manufacturing Institute(TMI) is founded at the University of Michigan. The TMI is an excellent example of partnerships between industry and University. The Faraday Plastics Center, United Kingdom (UK) will be run by the Warwick Manufacturing Group at the University of Warwick in partnership with Rapra Technology. The Rapra Technology is Europe's leading independent research and technology organization. They specialize in polymers, bringing the best of

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UK's industry and University research skills to develop the next generation of plastics and plastics handling.

The purpose of these partnerships is to meet the needs of industries, Governments, National Laboratories and the training needs of the University students. The National Institute of Standards and Technology (NIST) partnership helps in unifying the scientific talents of both NIST scientists, faculty and graduate students of University of Colorado (at Boulder) towards a common scientific accomplishment. The effective partnership between the University of Ottawa, Canada and its industry partners brings about 50% increases in student training capability.

Partnership between University and Industry

Case 1:

The Canada-China University-Industry Partnership Program (CCUIPP) is one of many new initiatives agreed to by the Canadian International Development Agency (CIDA) and the Chinese Ministry of Foreign Trade and Economic Cooperation (MoFTEC). The CCUIPP is funded by the State Education Commission of China, and by the Canadian Association of Graduate Management Schools (CAGMS). The program will develop three university-industry partnerships that focus on a specific economic sector recognized by China as being of national priority. These sectors include financial services, electric power, oil and gas, and telecommunications.

A partnership will be established by a group of enterprises, working with one or many universities, both Canadian and Chinese, to design, organize and deliver the project activities, while developing a close relationship with their counterpart in the process. Each one of the activities will be focused on encouraging the development of bilateral trade relationships and on developing human resources in universities to sustain them. Specific project activities will also include the development of training programs for Chinese executives; advanced seminars and workshops for Chinese faculty members; in-Canada internships for Chinese enterprise executives; executive exchanges in both countries; in-Canada services for the industry and applied research programs (Center for International Management Studies, 1999).

Case 2:

The University-Industry Science Partnership (UNISPAR-Africa) program of the United Nations Education Scientific and Cultural Organization (UNESCO) shows how the program activities can facilitate university-industry cooperation for technology development. To make the university-industry cooperation possible in Africa, the program adopted a three-phase approach. First, the organization examined the process of technological capacity building as well as the factors that constrain university-industry partnership. The results of this inquiry led to the identification of activities and domains of operation of this partnership. In the second stage, micro-projects were funded to test and evaluate the efficacy and usefulness of some of the prescribed activities for promoting university-industry cooperation for industrial development. The third and final tier in this approach is to collate and discuss these findings from the micro-projects with a view of developing a blueprint for technological capacity building through university-industry partnership. Alongside this approach, meetings were also held to identify modes for financing the activities of such partnership. The first stage has been completed and the second stage is now in progress (Massaquoi, 1999).

Case 3:

The Associates Program was created to enhance the mutually beneficial industry-university partnership that is the foundation on which TMI (Tauber Manufacturing Institute), University of Michigan is based. Associates Program participants enjoy early, ongoing, and increased access to TMI students for purposes of recruiting. They also have exceptional opportunities to interact with University of Michigan faculty associated with TMI. In addition, donors are recognized in a wide variety of publications and events targeted specifically to the TMI community of students, alumni, and faculty.

Participants in the Associates Program provide crucial financial support for scholarships, fellowships, research projects, multidisciplinary courses, and other program initiatives. Their annual gifts enable TMI to offer the high caliber multidisciplinary education required to maintain manufacturing excellence in American corporations (University of Michigan, 1999).

Case 4:

A new £5 million (approximately equivalent to US $ 7 million) research blitz on plastics began on Wednesday 28th June 2000 with Lord Sainsbury's (Science Minister in UK Government) announcement that the U.K Government is to fund a Faraday Plastics Center to be run in partnership between one of the UK's leading centers of applied academic research and a leading plastics research based company. The Faraday Plastics Center will be run by the Warwick Manufacturing Group at the University of Warwick in partnership with Rapra Technology Ltd, Europe's leading independent research and technology organization specializing in polymers, bringing together the best of UK industry and university research skills to develop on the next generation of plastics and plastics handling. £2.2 million of the funding will come from the Department of Trade and Industry (DTI) and Engineering and Physical Sciences Research Council (EPSRC). Further funding, from EU and other sources, will add a further £3 million to this total. Faraday Center is part of a new Government initiative to bring industry and academia closer together - to accelerate technology transfer and create a more competitive industrial base for the UK.

The new center will focus on four main themes of collaborative plastics research - design, processing, durability, and recycling of plastics. A concurrent program of Faraday Associate student fellowships will allow SMEs to involve undergraduate and postgraduate students in their R&D efforts. The Center will also provide a "help desk" website allowing SMEs to access the latest research and techniques (Kumar, 1999).

Case 5:

Faculty members and adjunct professors in many colleges at the University of Saskatchewan are engaged in research that receives funding from government or social agencies, affiliated institutes and private business or industry sources. This research often involves collaboration with researchers in government laboratories, affiliated institutes, the private sector or other locations. As an integral part of their academic program, graduate students in Master's or Ph.D. programs are frequently involved in such research and receive funding support through it as research assistants. Graduate student involvement in this research may also take the form of employment in the course of the academic program or subsequent to it.

Affiliated with the University are many research institutes and centers. Adjacent to the campus is Innovation Place, one of Canada's most successful research parks. In addition, many links have been formed with private companies who are interested in placements of graduate students with appropriate qualifications.

The University of Saskatchewan is an active participant in the NSERC Industrial Postgraduate Program. This program, along with other forms of financial support, allows the University to offer funding to a number of graduate students who participate in the University-Industry Partnership program. Interested students should inquire at the department in which they plan to register. In many cases cooperative research projects involving the participation and support of graduate students will begin with a formal agreement signed by all concerned parties. The agreement will specify the role and responsibilities of the graduate student researcher, will indicate financial and material support to be provided to them, and will provide a statement regarding the ownership of any intellectual property used while doing the research or resulting from it. In all cases, students' academic rights will be protected by such agreements (University of Saskatchewan, Office of the Registrar, 1999).

Case 6:

Technology Partnerships Program (TPP) supports partnerships between universities and small and medium-sized Canadian companies to develop university research to the point it can be exploited and commercialized by industry. The ultimate objective of the program is to create new and improved products and services as well as jobs for Canadians. The TPP is administered by NSERC (Natural Sciences and Engineering Research Council of Canada) through a Secretariat established at NSERC. A Management Committee representing the three councils, Industry Canada, and the National Research Council is responsible for the operational management of the program.

TPC (Technology Partnerships Canada), announced in the 1996 budget, is a new funding approach to help firms in Canada compete in high technology industries. Every investment was fully repayable and the government shared with the private sector both the risks and the rewards. In 1998-99, Technology Partnerships Canada invested $250 million annually. A key objective is to level the playing field with foreign competitors who are backed by their government's technology programs. The program focused on environmental technologies; on strategic 'enabling' technologies--those that, like biotechnology, make many industries more efficient and productive; and on the aerospace and defense industries, including defense conversion.

Technology Partnerships Canada targets technologies at the near-market end of the research and development cycle, such as demonstrations and related developments; high-quality companies with high-risk projects and identified market opportunities; companies that can generate lasting, quality jobs; successful, financially-sound small and medium-sized companies with opportunities for growth from all regions of the country; innovations that produce beneficial effects on productivity throughout the economy; technologies that will lead to greater innovation and spin offs in more than one industrial sector; and projects that result in a high technology product or process for sale in domestic and export markets (Industry Liaison Office, University of Manitoba, 1999).

Partnership among Universities, Industries and Schools

Case 1:

Industry, universities, and K-12 schools work together to help bridge the gap between the abilities of high school graduates, expectations of college faculty, and demands from employers. Partnerships, promoted by both academia and industry, are needed to assist these components to function as a

composite unit. The U.S. FIRST competition, started in 1992, is an ideal partnership program for universities. In this national program, high school students work with engineers to design and build a remotely controlled vehicle capable of playing against others in sports based competition. The U.S. FIRST competition engages university students in a challenging 'design-build-and test' project, while working side by side with industrial engineers and high school students. Through the competition, university students complete a demanding engineering project and motivate a new cadre of students to follow their career footsteps. Such linkages are the heart of the ASEE Engineering Deans Council recommendations to improve the engineering education system and thus involvement in the U.S. FIRST competition should be a priority for many engineering programs (Wilczynski, 1995).

National Laboratory-University Partnerships

Case 1:

There are examples of national laboratory-university partnerships that predate CRADAs (Cooperative Research and Development Agreement) by many years and which appear to have none of the difficulties associated with them. The example hereunder given is a great success story: the Joint Institute for Laboratory Astrophysics (JILA), a true partnership between the NIST (National Institute of Standards and Technology) and the University of Colorado at Boulder.

The basic concept is that NIST moved a half dozen of its senior scientists in the fields of atomic and molecular physics and astrophysics onto the Boulder campus of the University of Colorado, where they were joined by faculty and graduate students of several science departments of the university. The common scientific goal was the study of radiating hot gases far from states of thermodynamic equilibrium.

The civil servants from NIST held positions as adjunct faculty; the university's graduate students contributed to the NIST and CU faculty research. It is believed that there is much to be gained by seeking every opportunity to link the national laboratories with universities in this way, accelerating the diffusion of the government work to the private sector via the students who are trained. This is a much more natural and effective diffusion mechanism than the CRADA (Lewis, 2000).

Case 2:

In partnership with industry, the School of Information Technology Advanced Engineering Research Laboratories (SITADEL) will build a critical mass of researchers using the strengths of the School of Information Technology and Engineering (SITE) to establish a world-class research facility. The SITADEL will provide opportunities to further the dynamic relationships between the University of Ottawa, Canada and its industry partners. An additional advantage will be a 50 per cent increase in SITE's student training capability, responding to an urgent industry need for highly trained personnel in these areas.

The new facility will have four major research laboratories namely 1. Nortel Assert (An Advanced Software Engineering Research and Training Laboratory, 2. Bell Advanced Research Laboratory – Ottawa, 3. Distributed Collaborative Virtual Environments Research Laboratory, 4. Advanced Internet Applications and Systems Research Laboratory (Nicolas, 1999).

Conclusion

The case studies on partnerships discussed in this paper illustrated successful approaches in enhancing the Engineering Education. The outcomes of these partnerships are:

1. The Canada-China partnership offers training programs, advanced seminars for faculty members, and it also facilitates the exchange of professionals.

2. The Faraday Plastics Center was formed by bringing together the best of UK industry and University research skills to develop on the next generation of plastics and plastics handling.

3. By partnering with industry, government and private business, the University of Saskatchewan Canada, receives funding by conducting research.

4. In general, Canada through Technology Partnership program supports partnership between universities, small and medium sized Canadian companies to develop university research. The product resulted from research can be commercialized by industry.

5. The U.S First Competition, a partnership program for universities, engages university students in a challenging design-build-and test project, while working with industrial engineers and high school students at the same time.

6. The National Institute of Standards and Technology (NIST) partnership helps in unifying the scientific talents of both NIST scientists and University of Colorado (at Boulder) faculty and graduate students towards a common scientific accomplishment.

7. The dynamic relationship between the University of Ottawa, Canada and its industry partners brings about 50% increase in student training capability, responding to an urgent industry need for highly trained personnel in these areas.

Partnership will work well, if the needs of students, faculty and the industry professionals are met.

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