Global J. of Engng. Educ., Vol. 3, No.2
Printed in Australia
© 1999 UICEE

Cross-Border Engineering Practice*

Russel C. Jones
World Expertise LLC, Falls Church, Virginia, VA 22043-1761, United States of America

Engineering practice today is increasingly international, with cross-border practice of the profession becoming pervasive. Engineering education throughout the developed world has much in common, and provides the common element for effective practice of engineers across national boundaries. This paper explores the formation of engineers for international practice, quality assurance mechanisms for engineering education in the international arena, and a case study of one effort at formalising cross-border engineering practice.

EDUCATION FOR INTERNATIONAL PRACTICE

To prepare new engineering graduates adequately for effective careers in the international arena , engineering education today needs to have several dimensions in addition to the traditional maths and science application skills that have been the basis for past generations of graduates. The new requirements include:

- Foreign language proficiency, written and spoken, in at least one foreign language, preferably two.
- Cultural background development: education concerning the culture of peoples in regions of the world where engineers may practice.
- International business issues: competitiveness, free market developments, multinational companies, varying ethical norms, varying consumer protection mechanisms, etc.
- Technical issues: measurement systems, varying standards and codes, environmental concerns, etc.

These new elements must be woven into the education of engineers in ways that do not dilute the traditional mathematics, science and engineering studies that provide the technical base for a successful career in engineering practice [1].

QUALITY MEASURES

In several areas of the developed world, accreditation is utilised as the primary quality control mechanism for engineering education. Accreditation systems typically provide for the review of educational programmes by external examiners, against standards set by the profession that graduates are being prepared to enter. In the United States of America, for example, engineering programmes at colleges and universities are accredited by the Accreditation Board for Engineering and Technology (ABET). This system was put in place in the 1930s as several technical engineering societies banded together to develop and implement a quality review mechanism that would periodically evaluate each engineering programme in depth and accredit those found to meet standards of quality agreed to by the profession. ABET currently accredits essentially all engineering education programmes in the United States, providing minimum standards for quality by examining curriculum, faculty credentials, student quality, facilities, and other features. As a mature accreditation system with extensive experience over time, ABET is currently in the process of changing from technique specifications for quality control to outcome measures – its new Criteria 2000.

The Canadian Engineering Accreditation Board (CEAB) provides similar quality control for engineering education in Canada, utilising a system similar to ABET. Some dozen years ago, ABET and CEAB en-

* A revised and expanded keynote address presented at the *Global Congress on Engineering Education,* held between 6 and 11 September 1998, Cracow, Poland
* This paper was awarded the UICEE bronze award (equal fifth grade with one other paper), by popular vote of Congress participants, for the most significant contribution to the field of engineering education

tered into an agreement that mutually recognised the engineering graduates of colleges and universities in the two countries as substantially equivalent. This agreement provided for ready acceptance of engineering degree credentials between the United States and Canada and laid the foundation for cross-border mobility at the entry level of engineering practice. In particular, it certified graduates of accredited engineering programmes in each country as equivalent for purposes of entering the professional engineering licensure process.

EQUIVALENCY OF EDUCATION ACROSS BORDERS

In the late 1980s, a broader mutual recognition agreement was entered into by six countries with well-developed accreditation systems – the Washington Accord, signed by Australia, New Zealand, Canada, the United States of America, Ireland and the United Kingdom. This agreement was based upon exchange visits between each of the six countries to develop confidence that their engineering education systems were indeed substantially equivalent and that their accreditation systems were effective in providing quality assurance. The Washington Accord has recently been expanded to include two additional countries, Hong Kong and South Africa. The import of this agreement is that the educational credentials of engineering graduates from each of the countries are fully accepted in all of the other countries as if the education had been completed locally. This provides the basis for application for practice credentials, such as licensure.

In order to position themselves for similar educational equivalency arrangements, and/or eventual practice credential arrangements, other countries have been developing accreditation systems like those in Canada and the United States. Mexico, for example, is well along in developing its engineering accreditation system, with assistance having been provided by CEAB and ABET. This system is being utilised in a first round of accreditation evaluations at Mexican schools. The driving force for this development has been the North American Free Trade Agreement (NAFTA), which is intended to stimulate cross-border engineering practice among the countries of Mexico, Canada and the United States.

ENGINEERING PRACTICE CREDENTIALING

In the United States of America, engineers who offer their services directly to the public must be licensed to practise. The licensing jurisdiction is the individual state or territory, of which there are 55, rather than the Federal government. These 55 licensing boards have banded together in the National Council of Examiners for Engineering and Surveying (NCEES) in order to move toward common standards and common testing methodologies. Typical requirements today are graduation from an ABET accredited engineering curriculum, completion of two examinations of eight hours each – one on engineering fundamentals and one on engineering practice – and a minimum of four years of satisfactory engineering practice.

Canada has a similar system of licensure for engineers, operated at the level of its twelve provinces and territories. The Canadian Council of Professional Engineers (CCPE), which operates this system, has somewhat different criteria however. Graduation from a CEAB accredited engineering curriculum is required, but there is typically no further examination beyond the educational credential. Instead, four years of supervised practice, guided by already licensed professional engineers, is required to confirm the full license to practise. The Mexican system is different still, with engineering licensure granted at the Federal level, based on educational credentials alone.

NAFTA DEVELOPMENTS

In the mid 1990s the governments of Canada, the United States of America, and Mexico entered into a broad North American Free Trade Agreement (NAFTA), designed to lower national border constraints to the movement of both goods and services among the three countries. Among NAFTA's objectives was the lowering of trade in services barriers by discouraging citizenship and residency requirements as a precondition to professional licensure in the three countries. Within the national level agreement, each profession or other group that was involved in cross-border practice was asked to develop agreements for their particular segment of the economy. For engineering, the United States government recognised a newly formed entity, the United States Council for International Engineering Practice (USCIEP), which consisted of representatives of the National Society of Professional Engineers (NSPE), ABET and NCEES. ABET was included to work on educational credentials, NCEES to work on state licensure issues, and NSPE to work on professional practice issues. The Canadian engineering profession was represented by CCPE, and the Mexican profession by Comite Mexicano para Practica

International de la Ingenieria (COMPII). CCPE is an association of engineers, designated by the Canadian Government to negotiate the engineering cross-border arrangements, and COMPII is a quasi-governmental body incorporating the interests of the engineering profession in Mexico and its Federal government.

After several months of negotiation between CCPE, USCIEP and COMPII, a Mutual Recognition Document (MRD) was initialled in 1995, subject to full ratification by the governing boards of the several groups involved in the negotiations. The MRD was basically structured to recognise successful professional engineering practice in each country, as certified by that country's licensure system, and to allow engineers with a valid license in any of the three countries to be recognised to practise in the other two.

In Mexico the relevant authority was the Federal government, and it ratified the MRD. In Canada the CCPE Board first ratified the MRD at the national level and recommended that its member provinces and territories adopt it, then each of the twelve licensing units in turn ratified it. In the United States the NSPE Board fully ratified the MRD, and the ABET Board did also. The NCEES Board had more difficulty in accepting the MRD however, with many of its 55 member licensing jurisdictions being unwilling to accept the concept of mutual recognition of another country's licensing system. Many of the state licensing boards insisted that any applicant to practise in their jurisdictions must comply with exactly the same process that a resident of their state or another jurisdiction in the United States must follow – an ABET-accredited degree, two examinations, and four years of satisfactory practice. At the NCEES annual meeting in 1995, a provisional two year acceptance of the MRD was approved to allow states that wanted to pursue it to do so. Only one state, Texas, has accepted the MRD to date. At its 1997 annual meeting, the NCEES Board declined to extend its endorsement of the MRD, so that document now has questionable validity.

Since the appropriate Canadian and Mexican authorities have fully adopted the NAFTA MRD, cross-border engineering licensing and practice is occurring between those two countries. The southern border state of Texas in the United States is also moving rapidly toward cross-border licensing, particularly between engineers in Mexico and in Texas. Other states in the United States are considering whether to follow the path of Texas and to adopt the MRD in spite of the reluctance of NCEES as a whole to give it full recognition.

CROSS-BORDER PRACTICE BEYOND NORTH AMERICA

The group of countries that agreed to mutual educational equivalency in the Washington Accord have been pursuing the possibility of adding an agreement on cross-border practice, through licensure, on top of the educational agreement. This effort has met under the banner *Hong Kong Working Group* for the past several years. It includes representatives from the eight countries of the Washington Accord, plus delegates from the Federation of European National Engineering Associations (FEANI) and the Japan Consulting Engineers Association (JCEA).

In late 1997 this group organised more formally as the Engineers Mobility Forum (EMF). Its objective is to facilitate the cross-border mobility of experienced professional engineers by establishing a system of mutual recognition based on confidence in the integrity of national assessment systems, secured through continuing mutual inspection and evaluation of those systems.

COMMENTARY ON CURRENT STATUS

Cross-border practice of engineering is currently a well established fact. Many engineers who work for multinational industrial corporations move readily across borders in carrying out their work, essentially oblivious to national constraints due to the presence of their companies in the several countries within which they work.

Private practice engineers whose work is offered to the public, and thus typically involves the need to be licensed in the jurisdiction where work is to be performed, are subject to more constraints. In many cases a private practice firm will enter into a partnership with a local firm in the second country where work is to be performed, relying on the locally credentialed engineers to review and certify the engineering work done. Private practice engineers in small firms or working as individual practitioners, who cannot afford or cannot arrange for local engineering firm partnerships, often must seek licensing in the second country in order to practise there. In the latter case, cross-border educational equivalency and licensing arrangements are important. Even in the case where firms partner across national borders, there is frequently pressure for the engineers in the first country to be licensed in the second country as well.

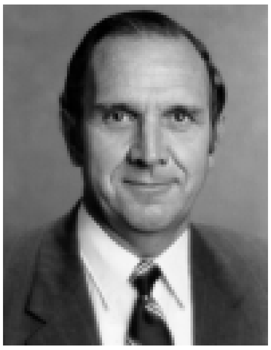
In its purest sense the licensure of engineers by appropriate professional and governmental bodies is intended to protect the life, safety, health and welfare of the public in the licensing jurisdiction. Unfortunately, considerations such as protection of the economic interests of locally credentialed engineers sometimes colour the willingness of local licensing jurisdictions to enter into open cross-border practice agreements.

Engineering is an international profession, based upon application of the same scientific, mathematical and technical foundations regardless of national borders. In this feature it is thus different than professional fields such as law and accounting. In the judgment of the author, the commonality of engineering education and practice across national borders should result in the free flow of engineering talent and practice across such borders, for the betterment of humankind and for the economic well-being of the societies that engineers serve. Thus developments such as the education of engineers for international practice, the accreditation of engineering education programmes to allow substantial equivalency agreements to be formed, and the mutual recognition of engineering licensing credentials across national borders must be pursued with deliberate speed.

REFERENCE

1. Jones, R.C., Formation of engineers for international practice. *Australasian J. of Engng. Educ.*, 6, **1**, 7-17 (1995).

BIOGRAPHY



Russel Jones is a private consultant working through World Expertise LLC to offer services to a select clientele. Until recently he served as Executive Director of the National Society of Professional Engineers. Dr Jones received his education at Carnegie Institute of Technology, earning degrees in civil engineering and materials science. He has spent much of his career as an educator, starting with engineering education and broadening to higher education as a whole. After completing his doctoral degree in 1963, he taught for eight years on the faculty of the Massachusetts Institute of Technology. He then served in a succession of administrative posts in higher education, for several years each: Chairman of Civil Engineering at Ohio State University, Dean of Engineering at the University of Massachusetts, Academic Vice President at Boston University, and President and University Research Professor at the University of Delaware.