Global Accreditation Trends

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Abstract — *Accreditation in engineering education is a mechanism to certify degree programs as meetings a certain set of standards. Around the world, globalization of the engineering profession has led to increased interest in accreditation – as a way to improve program quality, and as the building block upon which mutual recognition educational agreements and cross-border practice treaties can be based. This paper describes trends in the accreditation of engineering education around the world, cites international educational equivalency agreements and international practice agreements being built upon accreditation, and discusses issues and problems in engineering education that may be addressed by enhanced and expanded accreditation systems.*

Index Terms — *accreditation, engineering education, outcomes assessment, trends*

INTRODUCTION

Webster's dictionary gives the following several definitions of the verb *accredit*: 1) to bring into credit or favor, 2) to authorize, give credentials to, 3) to believe in, take as true, 4) to certify as meeting certain set standards, and 5) to attribute, credit. The associated noun *accreditation,* when applied to engineering education, has elements of all of those definitions – but primarily indicates certification that an educational program meets a certain set of standards agreed upon by an authorizing entity.

Globalization has increased the tendency of engineering practice to be international in scope, and thus has led to the need for the credentialing of graduate engineers who want to practice in venues other than the one in which they were educated and initially licensed. Accreditation of engineering education programs had evolved as the primary basis upon which mutual recognition across national borders is based – both for educational equivalency, and increasingly for practice mobility.

Accreditation is also increasingly seen as an appropriate means of enhancing the quality of engineering education in countries where major changes in the education pattern are occurring, and in developing countries where improvement in the quality of engineering graduates is seen as a major way of building an indigenous technological base upon which economic growth in the world marketplace can be achieved.

TRENDS IN ENGINEERING ACCREDITATION

A quick examination of developments in engineering accreditation in several countries around the world can illustrate various ways in which it is having major impacts upon engineering education.

Germany – In response to declining interest in engineering study by both natives and international students, and to pressures from the Bologna Declaration and other sources to harmonize its engineering programs with those of other developed countries, universities in Germany are developing new engineering education systems in the bachelors plus masters pattern. At present these new programs are being offered in parallel with the traditional long programs leading to the Diplom-Ingenieur, and students are given the choice of which pattern to pursue. To assist in the development of these new programs, and to evaluate and certify their quality, a new Accreditation Agency for Programs in Engineering and Computer Science (ASII) has been established.

Japan – In the recent past, graduates of engineering programs in Japan were readily hired by its major corporations, given significant additional training by those corporations both initially and throughout their careers to enable them to contribute effectively to the economic goals of their employers, and then almost guaranteed lifetime employment and security by those employers. But the economic downturn in recent years has made job security a thing of the past, and globalization has made it imperative that Japanese engineering graduates be prepared for more self directed career development, and that

they be prepared for practice in the global marketplace. A new Japan Accreditation Board for Engineering Education has been established to provide quality assurance as new engineering programs are developed and implemented.

Jordan – In many developing countries, public university engineering programs do not have sufficient capacity to educate all those students who want to prepare themselves for employment in hot technological areas such as information technology. Private universities – often of questionable quality – typically spring up to meet the demand. In Jordan, the government has taken two steps to meet these challenges – the establishment of a new engineering program at a new public university, and the establishment of a stringent accreditation system for private universities. The Council on Higher Education has developed and implemented detailed prescriptive specifications for areas such as faculty/student ratios, laboratory equipment and space, libraries, and financial stability in order to assure that quality is provided in private universities offering degree programs within its borders.

United States of America – The Accreditation Board for Engineering and Technology (ABET) has been the major quality assurance mechanism for engineering education in the US since the 1930's. It is mature, and covers essentially all of the engineering, technology, computer science, and related programs in the country. It also has served as a model for engineering accreditation developments in other countries, and it has developed major international thrusts such as substantial equivalency reviews of engineering programs in foreign countries where it has been invited. In the past several years, ABET has made a major change in its evaluation criteria – moving from technique specifications to outcomes assessment. Its 'Criteria 2000' is based upon institutional self study and goal setting against which it will be evaluated, continuous improvement requirements for accredited programs, and detailed assessment of the outcomes of the engineering programs as the fundamental criterion for accreditation.

Latin America – As engineering programs have developed in Latin American countries, several countries have moved toward the establishment of accreditation programs. Both ABET and the Canadian Engineering Accreditation Board (CEAB) have conducted workshops and training efforts in Latin America to assist in the development of engineering accreditation systems there. One major system recently developed is the Consejo de Acreditacion de la Ensenanza de la Ingenieria (CACEI) in Mexico, at least partially stimulated by the North American Free Trade Agreement. A new 'Western Hemisphere Initiative' has recently been announced by ABET, CEAB and CACEI – aimed at further assisting Latin American countries in the development of effective engineering accreditation systems, and furthering regional mutual recognition efforts.

OUTCOMES ASSESSMENT

Education as a whole, particularly in developed countries, has in recent years focused on outcomes assessment for quality assurance and evaluation of educational programs. This trend has been driven both by educators and by publics interested in quality education – parents, legislators, funding agencies, etc. In engineering education, ABET has been a leader in moving to outcomes assessment as the primary mechanism for accreditation of engineering programs, in its 'Criteria 2000'. The following statement of outcomes from the ABET criteria was developed with substantial input from employers of engineering graduates, and other organizations concerned with quality assurance in engineering education:

"Engineering programs must demonstrate that their graduates have:

a) an ability to apply knowledge of mathematics, science and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs
d) an ability to function on multi-disciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice"

These statements of desired outcome could serve in many engineering education venues.

INTERNATIONAL AGREEMENTS

International agreements on engineering education and practice have been developed in recent years, based upon engineering accreditation. One such agreement, establishing full reciprocity for engineering graduates between ABET in the US and the CEAB in Canada, has been in place for several decades. It is based upon essentially identical accreditation systems, and extensive reciprocal visits between them. A much broader mutual recognition agreement, the Washington Accord, was developed several years ago among several English speaking countries: Australia, New Zealand, Canada, the United States, Ireland, and the United Kingdom. While there are significant differences in the engineering accreditation systems in these countries, it was agreed – after extensive reciprocal visits – that the resulting engineering graduates were essentially equivalent. Thus graduates from each of the Washington Accord countries are accepted in all of the other countries as equivalent, for purposes such as graduate study and licensure applications. In recent years two additional countries have joined the Washington Accord – Hong Kong and South Africa – and several more have recently applied

Educational equivalency agreements can be the basis for cross-border practice agreements, and the group of countries involved in the Washington Accord have set in motion a parallel effort – the Engineers Mobility Forum – which is developing an international register of engineers approach. In Europe, the European Federation of National Engineering Associations (FEANI) has established an international practice system, based upon a seven year formation process for engineers, which leads to EurIng status. In North America, the three countries which have entered into the North American Free Trade Agreement (NAFTA) have attempted to develop a mechanism for the mobility of practicing engineers across their borders. Canada and Mexico have agreed on such a system of mobility, but efforts to include the United States have been stymied by licensure issues controlled at the state level by 55 separate jurisdictions. In the Asia-Pacific area, several countries have developed an agreement on engineering practice mobility, the APEC Engineer Register.

TRENDS AND ISSUES IN ENGINEERING EDUCATION TODAY

Accreditation trends are typically responsive to trends and issues in engineering education itself. Several current trends in engineering education can be identified as follows:

- Reform in engineering education
- Outcomes assessment
- Utilization of advanced technologies in education
- Mobility of students
- Harmonization of higher education patterns
- Increased utilization of distance education
- Cross border agreements
- Technical capacity building in developing countries
- Increased payment for education by students
- Inclusion of sustainable development concepts
- Electronic conferences for faculty members

In addition, several significant issues and problem areas that must be addressed by engineering educators and practitioners can be identified:

- Lockstep, intense engineering curriculum
- Status of the employed engineer
- Pipeline issues (falling enrollments, gender and race diversity)
- B.S. as the first professional degree, vs. M.S. requirement
- International experience for engineering students
- Digital divide (within a country, between countries)
- Funding for higher education
- Employer/industry involvement in engineering education
- Evaluation of distance education courses

Several of these issues and problems are of long standing, but continue to cry out for resolution.

CONCLUSIONS

Accreditation is an effective mechanism for effecting and assuring ongoing quality in engineering programs within a given country. When the quality of engineering programs in two or more countries has led to similar results in graduates, accreditation programs can provide the basis for mutual recognition of graduates across national borders. Mutual recognition of the quality of engineering programs across national borders can lead to cross-border practice agreements, enhancing the mobility of engineers in the global marketplace.

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