

Results of the Second International Symposium for Engineering Deans and Industry Leaders*

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A successful International Symposium for Engineering Deans and Industry Leaders, held in 1989 with the sponsorship of UNESCO and the Ohio State University, focused on the strengthening of engineering colleges in Third World countries as a key mechanism for economic development there. A second symposium was held in July 1991, with the primary objective of designing action-oriented programs aimed at enhancing engineering education, technically oriented industry and thus economic development in such developing countries. The 1991 symposium was held at UNESCO Headquarters in Paris, with some 200 participants from some 50 countries, and many additional co-sponsoring organizations.

The program of the 1991 meeting was organized around action-oriented projects, including:

- *Development of sister university programs, pairing appropriate engineering schools in developing and developed countries for interchange programs.*
- *Development of mechanisms for industry–university interaction, particularly in developing countries.*
- *Development and maintenance of a comprehensive and accurate database on engineering education internationally (e.g. worldwide list of engineering schools, current leaders, enrollments, etc.).*
- *Development and maintenance of information clearing-house in teaching equipment, course-ware, etc. utilized in engineering education.*
- *Development of programs to promote completion of education (to doctorate in most countries) of faculty at engineering schools in developing countries.*
- *Promotion of educational equivalency recognition agreements, accreditation mechanisms, curricular standards, etc.*
- *Use of satellite information technology in delivering engineering education.*
- *Strengthening cooperation between engineering deans and industry leaders on a worldwide basis (e.g. development of an ongoing worldwide organization of engineering deans).*

Participants in the 1991 Symposium were leaders in engineering education, and industry leaders concerned about university interactions and about technology in developing countries.

This paper summarizes the discussions at the 1991 Symposium and reports on actions recommended for ongoing programs.

INTRODUCTION

THE Second International Symposium for Engineering Deans and Industry Leaders was a successful forum for interchange of ideas and networking of those concerned with the improvement of engineering education worldwide. Engineering and technology are fundamental to meeting major human needs—including sustainable development and environmental protection. High quality engineering education is essential for the effectiveness of the practice of engineering. New mechanisms must be found to enhance engineering education programs, particularly in developing countries, in order to allow all peoples to benefit from advanced engineering and technology.

UNESCO, a key intergovernmental organization for the enhancement of engineering education, sponsored the Second International Symposium for Engineering Deans and Industry Leaders in Paris in July 1991. As the second in a series of meetings focused on engineering education worldwide, the 1991 symposium concentrated on designing action-oriented programs aimed at enhancing engineering education, technically oriented industry, and thus economic development in developing countries.

One of the major ways in which Third World countries can be assisted in necessary and desirable economic development is through the formation or enhancement of an effective technical personnel base, upon which technically oriented industry can be established and grow. Key to such development is the strengthening of colleges of engineering in Third World countries, and the resulting flow of qualified engineering graduates into the technical manpower pool. With such a manpower base,

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technically based industry—both locally initiated and that stimulated as a portion of multinational corporation activity—can be effectively sustained, with resulting economic gain for Third World countries.

Recognizing the potential of such an approach, UNESCO and a group of co-sponsors organized the Second International Symposium for Engineering Deans and Industry Leaders around a series of action-oriented projects in the areas of sister university programs, industry–university interaction, database on engineering education internationally, information clearing-house on equipment and courseware, programs to promote completion of education of faculty from developing countries, promotion of curricular standards and equivalency agreements, use of satellite information technology, and development of an ongoing worldwide organization of engineering deans. The following is a summary of each of these areas as they evolved during the July 1991 meeting.

SISTER UNIVERSITY PROGRAMS

The working group on 'Development of Sister University Programs, Pairing Appropriate Engineering Schools in Developing and Developed Countries for Interchange Programs' was chaired by Dean Ke-Yang Li of National Cheng Kung University in Taiwan. The group began its deliberations by recognizing the value and need for the establishment of sister university arrangements between engineering schools in developing and developed countries, but pointed out that such arrangements should be on an equal basis, with mutual interests and benefits for both partners.

In addition to specific sister relationships between individual universities, the working group suggested consideration of regional programs where groups of schools in the developing and developed world might collaborate with one another. It was pointed out that the individual needs of each institution would still have to be met, but that synergy might occur in such regional or even global sister university consortia.

This working group suggested that UNESCO might serve as a stimulus and clearing-house for the development of sister university relationships. It was felt that UNESCO could serve as a catalyst for pairing appropriate engineering schools in developed and developing countries, and also as a reference point for connecting such academic institutions with other appropriate entities including government groups, development banks, and other intergovernmental agencies.

UNIVERSITY-INDUSTRY COOPERATION

The working group sessions on 'Development of Mechanisms for Industry–University Interaction, Particularly in Developing Countries' were chaired by Rector Hans Peter Jensen of the Technical

University of Denmark. This group began with the observation that future symposia in this series should be rotated between different geographical locations, with some of the meetings held in developing countries so that participants might gain first-hand experience with problems and opportunities in engineering education there.

The working group also pointed out that basic needs in university–industry cooperation are different in various developing countries, and need to be carefully analyzed and defined before action is taken. A partial listing of categories which might be considered in such an analysis would include lack of human resources, lack of appropriate learning materials, lack of laboratory facilities, lack of technical assistance, and lack of financial support.

The working group suggested that a follow-up effort be conducted under the auspices of UNESCO, on the basis of identified needs and generally accepted benefits of university–industry cooperation. It was suggested that such an effort might concentrate on a feasibility study to be conducted in three or four specific settings in the developing world (e.g. Africa, Latin America, the Arab region, East Asia).

It was suggested that the concept of 'Developing Centers' could be valuable in creating interfaces between universities and industry in developing countries. It was observed that in developed countries this is done through research parks or science centers. In developing countries, however, it was suggested that a less structured approach be taken. The 'Developing Center' approach might have the following dimensions:

- With respect to universities, stimulate academic units to market themselves and make cooperation rewarding for departments and professors. Also, stimulate universities to understand the culture of and the working conditions in local industry. Further, help universities in developing business plans, providing mechanisms for graduates to initiate new companies based on their academic or research work, and promote consultancy by university professors.
- From the company point of view, a 'Developing Center' should set up networks between the university and industry, contact appropriate organizations to bring together appropriate members from universities and companies, and in the long term persuade companies to provide financial assistance for appropriate activities at universities. In addition, companies might promote cooperative education opportunities where students spend time and earn both academic credit and salaries by working at companies during a portion of their educational experience.

The working group pointed out that multinational companies should be urged to extend relationships to appropriate universities in developing countries as are currently in place in developed countries. The group also pointed out that curri-

cula and university-industry relationships in developing countries should not simply be copies of those in developed countries, but should reflect the needs and environmental conditions of the particular countries in which they are developed.

DATABASE ON ENGINEERING EDUCATION

The working group on 'Development and Maintenance of a Comprehensive and Accurate Database on Engineering Education Internationally' was chaired by President Miguel Angel Yadarola of the WFEO Committee on Education and Training. The group concluded that it was necessary to establish paths for cooperation between engineering schools in Third World countries and those in currently developed countries, as well as to provide ways for cooperation between engineering schools and technically based industries.

As a necessary precursor to illuminating such paths for cooperation, the group recommended that it is necessary to have substantial information available on engineering schools throughout the world. It particularly recommended the creation of a permanent international database on engineering education, and the periodic updating of that database. Such a database would include a worldwide list of engineering schools, current leadership at those schools, enrollment information, degree levels, staff information, descriptions of activities, data on placement of graduates, etc.

This working group recommended that an advisory committee be established, perhaps under the sponsorship of UNESCO, WFEO, and UATI, to determine what information should be collected for a database, and how both an initial and ongoing effort at gathering such information and making it available might be organized and funded. The group recommended that currently existing international bodies such as FEANI, SEFI, ABET, and ASEE would provide an appropriate source of information for institutions in Europe and North America. The group also recommended possible funding sources for such an effort, and described the characteristics and tasks of the Secretariat which might carry out the work. It further recommended that the database be developed in English, although it might be translated into other languages at a later time as appropriate. The data should also be stored in the native language of each country to allow for future correlations of information.

CLEARING-HOUSE ON EQUIPMENT AND COURSEWARE

The working group on 'Development and Maintenance of Information Clearing-house on Teaching Equipment, Courseware, etc., Utilized in Engineering Education' was chaired by Executive Director Zenon J. Pudlowski of the Australasian Association for Engineering Education. The group

focused on creation of a framework for the support of transfer of engineering courseware, software, equipment, and teaching methodologies between nations.

Specific action proposals were recommended. One was a pilot project concerning investigation of the applicability of existing materials from developed countries for possible transfer to developing countries—particularly in the areas of context-dependent and problem-oriented education of engineers. After such a pilot project, a more broadly based project concerning the implementation of problem-oriented education methods suitable for developing countries would be highly desirable and beneficial.

As a matter of urgency, the working group recommended that a clearing-house on teaching equipment, courseware, software, and methodology of training utilized in engineering education should be established to carry out and supervise the suggested projects. Such a clearing-house or center would facilitate the collection, description, and storage of information, and also develop suitable methods for the subsequent dissemination of the collected and digested information. The working group recommended that the clearing-house be established at an institution of higher education, with external funding (e.g. from development banks and intergovernmental agencies) to carry out the recommended clearing-house functions.

COMPLETION OF DEGREES

The working group session on 'Development of Programs to Promote Completion of Education (to Doctorate) of Faculty at Engineering Schools in Developing Countries' was chaired by Director Jacques Levy of the Ecole des Mines des Paris. This group's discussions started with the general question of how to train faculty members in developing countries, then moved on to the secondary question of how to promote research programs in engineering in a developing country.

The working group pointed out that the situation with regard to preparation of faculty members is very specific to each developing country or region of the world, and that it may change considerably over a period of time. It was observed that in many effective institutions, research activities by faculty members must be promoted in addition to teaching activities. The question of appropriate research projects relevant to the country of origin of students needs to be addressed in the preparation of faculty members who travel to developed countries for their education. It was pointed out that when relevant research projects are defined, they should be funded for sustained effort over a period of several years, including the period after the faculty member returns to the country of origin.

This working group also recognized the importance of the relation of faculty members in engineering schools in developing countries to local

industry. It was strongly recommended that returned faculty members be stimulated to pursue areas of mutual interest with industry, including research and development interests and the placement of appropriate graduates.

It was recommended that UNESCO stimulates activity in this area, for example in designing mechanisms for the support of relevant cooperative research programs, promoting interchange mechanisms between engineering faculty members in developed and developing countries, and promoting local cooperation between industry, engineering colleges and their faculty members.

EDUCATIONAL STANDARDS/ EQUIVALENCY

The working group on 'Promotion of Educational Equivalency Agreements, Accreditation Mechanisms, Curricular Standards, etc.' was chaired by Executive Director David R. Reyes-Guerra of the Accreditation Board for Engineering and Technology in the United States. The group reviewed accreditation mechanisms for engineering programs which are currently in place, reviewed proposed accreditation systems currently under development, discussed the need for evaluation systems for education and their desirable characteristics, and then made a series of recommendations.

One recommendation was that a base general criterion for engineering studies be prepared, and submitted for worldwide discussion and possible adoption. A committee to develop such a general criterion for a first professional engineering degree might consist of representatives of organizations currently concerned with accreditation, engineering education, and engineering practice. It was recommended that the basic criterion should be kept general, but allow provision to introduce special disciplinary criteria beyond the basic common areas. It was also pointed out that secondary school preparation should be held responsible for proper backgrounds in mathematics and science of their university-bound graduates.

It was suggested that a coordinating body such as UNESCO should establish a project office to bring together the organizations to develop and promulgate these general criteria, and also to provide assistance in carrying out experiments on accreditation and evaluation in countries which currently do not have such mechanisms in place. Finally it was pointed out that engineering technology and engineering technician programs might also profit from such an activity, and that a parallel effort geared toward their needs may be desirable at some point in time.

After a mechanism to develop base criteria and seek acceptance of those criteria on a broad worldwide basis has been established, UNESCO might also serve as a meeting place for those developing educational equivalency recognition agreements.

USE OF SATELLITE TECHNOLOGY

The working group on 'Use of Satellite Information Technology in Engineering Education' was chaired by President Lionel Baldwin of the National Technological University in the United States. The group observed that instructional television effectively links students with exceptional teachers for distance learning, and pointed out that current applications in developed countries include enriching programs of study for campus students, and providing career-long education to engineers currently working. It was observed that the evolution of technology, such as new digital video transmission which will significantly enhance the use of today's geo-stationary satellites, provides even greater opportunity for the use of satellite information technology in engineering education.

The working group also observed that electronic networking provides opportunities for communication worldwide which can underpin collaboration and resource sharing in engineering education. Such technologies as low orbit satellite information systems may readily meet the needs of developing countries. The group noted that early demonstration projects in this area are encouraging, and that UNESCO might be effective in developing an action plan for extension of such systems.

This group recommended that an appropriate mechanism under the umbrella of UNESCO be developed to coordinate efforts in educational technology, such as satellite information systems, to provide access and enhance engineering education worldwide.

WORLDWIDE ORGANIZATION

The session on 'Strengthening Cooperation Between Engineering Deans and Industry Leaders on a Worldwide Basis, Including the Possible Development of an Ongoing Worldwide Organization of Engineering Deans', was chaired by Vice President Donald Glower of the Ohio State University in the United States. As a capstone group, this action plan sub-unit reiterated the fundamental goal of strengthening cooperation among appropriate groups to improve the prosperity of peoples in all countries, through

1. Improvement of each country's technical infrastructure
2. Enhancing relevant engineering education
3. Industry's use of the graduates and other products from the educational system.

The working group recommended that a steering committee composed of individuals who are champions of this goal be established immediately by UNESCO. The activities of the steering committee would include establishment of an international network of engineering deans/rectors and industry leaders to bring engineering education worldwide to a uniformly high level of usefulness to industry, to organize local, national and international meet-

ings to carry out the work of this network, to seek appropriate funding for its activities, and to pursue the other action plans developed by the seven working groups detailed above.

SUMMARY AND CONCLUSIONS

At the final plenary session of the Second International Symposium for Engineering Deans and Industry Leaders, the assembled participants unanimously adopted a resolution summarizing the impact of that Symposium, and setting directions for future action. That resolution follows, as a most appropriate way of capturing the momentum of this important international symposium.

Whereas technically based industry, built upon graduates from engineering schools, can be a major contributor to economic enhancement in developing countries; and

Whereas networking between leaders of engineering education and technically based industry, between developed and developing countries, can lead to collaborations which positively impact engineering schools in the developing countries; and

Whereas two International Symposia for Engineering Deans and Industry Leaders have been conducted to effect such networking (at Ohio State University in 1989, and at UNESCO in 1991);

Therefore, be it resolved that the organizers of the two Symposia continue the efforts at effective networking of Engineering Deans and Industry Leaders between developed and developing countries; and

Be it further resolved that such networking build upon the strengths and activities of current organizations concerned with the enhancement of engineering education, particularly in developing countries, and with university-industry interactions; and

Be it further resolved that the action program of this network include, but not necessarily be limited to, the following efforts:

1. Development of sister university programs, pairing appropriate engineering schools in developing and developed countries for interchange programs.
2. Development of mechanisms for industry-university interaction, particularly in developing countries.
3. Development and maintenance of a compre-

hensive and accurate database engineering education internationally.

4. Development and maintenance of an information clearinghouse on teaching equipment, courseware, etc., utilized in engineering education.
5. Development of programs to promote completion of education of faculty at engineering schools in developing countries.
6. Promotion of educational engineering agreements, accreditation mechanisms, curricular standards, etc.
7. Promotion of the use of educational technology, such as satellite delivery of video courses, in engineering education.

and, be it further resolved that a steering committee be established to pursue the development of this network and its activities, and to continue this series of Symposia as appropriate.

ACKNOWLEDGEMENTS

In the final plenary session, the Symposium participants also adopted a Resolution of Appreciation, recognizing the effective efforts of the organizers and supporters of the conference. That resolution follows, as an appropriate way to acknowledge the work of the individuals and groups who contributed to the success of this Symposium.

Whereas the Second International Symposium for Engineering Deans and Industry Leaders has been a successful forum for interchange of ideas and networking of those concerned with the improvement of engineering education worldwide; and

Whereas many groups and individuals contributed to the development and execution of this Symposium;

Therefore it be resolved that the assembled participants, on this 20th day of July 1991, express appreciation to:

The major sponsors—UNESCO, Joint Executive Committee UATI/WFEO, Ohio State University, and AT&T.

The collaborating societies—AAEE, ABET, AAES, ASEE, CCPE, FEANI, SEFI, IGIP, and UPADI.

The organizing committee: Russel C. Jones and Boris Berkovski, Co-chairmen; Donald Glower, Curtis Tompkins, David Reyes-Guerra, Dueb Lakhder, and Richard Hseih.

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