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Engineering Accreditation in Mexico*

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Stimulated by the desire to enhance the quality of engineering education in Mexico, and the need to enter effectively into cross-border practice negotiations, Mexico has established an accreditation system for engineering education – Consejo de Accreditacion de la Ensenanza de la Ingenieria (CACEI). This paper describes the rationale for the development of this engineering education accreditation system, lists its objectives, and describes how it is being implemented. International ramifications of the Mexican development of an engineering education accreditation system are also described.

RATIONALE FOR QUALITY ASSURANCE

OVER RECENT years the evaluation and accreditation processes in Latin American Countries have had as a goal the improvement of the level of quality of higher education. These processes also respond to the demand of having more competitive professionals as they play a relevant role in Society, just as the Canadian Engineering Accreditation Board (CEAB) has determined in a document concerning the functions of engineers:

> As dreamers, builders and creators, engineers contribute to economical advancement, wealth generation and improvement in the human condition through the creative application of science and technology in a local, national and global context.

A scheme followed by the Mexican government to certify the quality of educational programs was adopted some years ago and worked acceptably for the initial conditions in which it was established. But with time, the expansion of educational systems and their increasing complexity gave occasion for the establishment of accreditation systems that respond in an efficient way to the current educational requirements and thus to a different certification than the one used by the government.

That is how, in a collaborative way in the middle of the 1970s, the Minister of Education (Secretaría de Educación Pública-SEP), and presidents of higher education institutions, made the important decision of establishing an organism that would help higher educational institutions in planning processes: The National Coordination for Planing Higher Education (Coordinación Nacional para la Planeación de la Educación Superior-CONPES). Subsequently, by the end of the 1980's, the need to establish the evaluation and accreditation processes as mechanisms to improve the quality of higher education appeared. As a result, the National Commission for Evaluation of Higher Education (Comisión Nacional para la Evaluación de la Educación Superior-CONAEVA) was created with three different functions:

1. Institutional self-evaluation.
2. Evaluation of the educational system.
3. Inter-institutional evaluation.

DEVELOPMENT OF AN ENGINEERING ACCREDITATION SYSTEM

Initially accreditation was the responsibility of the 'Inter-institutional Committees for the Evaluation of Higher Education' (Comités Interinstitucionales para la Evaluación de la Educación Superior – CIEES), a program founded in 1991. But experiences in other countries – such as the US Accreditation Board for Engineering and Technology (ABET) and the Canadian Engineering Accreditation Board (CEAB) – showed the importance of the participation of different sectors related to the professionals of engineering (professional associations), also the government and representatives of the industry sector. This constituted a reason to put in operation a civil association whose main objective is the accreditation of engineering programs. This civil association, called the Engineering Education Accreditation Board (Consejo de Acreditación de la Enseñanza de la Ingeniería – CACEI), was granted legal status on the fifth of July in 1994, and consequently it is a legally recognized organization.

Before CACEI was established, a document stating the purpose of its creation was developed: a declaration from the National Association of Schools of Engineering (Asociación Nacional de Facultades y Escuelas de Ingeniería – ANFEI) related to the importance and necessity of establishing a Mexican System of Accreditation in Engineering. In addition, workshops sponsored by ABET were conducted to promote the establishment and experiences of inter-institutional evaluation.

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Below is transcribed the text of the declaration:

> Considering the importance of reaching excellence levels in the preparation of graduates of engineering schools in Mexico that can successfully complete with the new global economy, the General Assembly of the ANFEI proposed the creation of a Mexican System of Engineering Program Accreditation that identifies those engineering programs that fulfill the minimum quality criteria so it will aid and promote the continuous improvement of engineering education in benefit of the society in general. This system must reach a level to justify the mutual recognition of similar systems in other countries with which there will be a great international exchange of professionals, for example, the United States and Canada. It is proposed that in the creation and operation of this System of Accreditation, schools and associations of professionals in the different engineering areas, together with the active participation of CIEES and ANFEI, be the organizations that together define the minimum criteria every program shall fulfill in order to be accredited, as well as the operative practices of National Accreditation System, using for that propose the experience acquired by accreditation systems in other countries.

OBJECTIVES OF CACEI

There are several important and interesting aspects which should be mentioned regarding CACEI:

- The way which it is structured as its members are representatives of the different sectors related to the formation and professional practice of engineers.
- The participation of ANFEI and the engineers' guilds through the association of professionals of different specialties.

The Association objectives are:

- To contribute to the knowledge and improvement of the quality of engineering education in the public and private educational institutions in the country, following a model that responds to the needs of Mexico and to the engineering practice conditions in the nation.
- To contribute to the establishment of paradigms and engineering teaching models according to scientific advances and the resources of professional practice, proceeding both from the needs of the society and those of future professionals.
- To contribute to the improvement of the quality of professional engineering practice.
- To inform educational institutions, students, parents, employers and those interested in public and private bodies, about quality of engineering education conditions in different schools of engineering in the country.

The first step, after the legal requirements to establish the Association, was to develop a methodology. In this aspect, the previous experiences in other countries, supported by ABET and its interest in the development of accreditation outside of the United States, were very important elements to successfully reach this goal.

IMPLEMENTATION OF ACCREDITATION

In 1996 CACEI published the first version of its Manual and in 1998 a second edition appeared, in which additional elements are incorporated in the methodology of the processes. Some of the most relevant aspects contained in this Manual can be pointed out as follows:

- *Antecedents:* regard the relative aspects to the creation of CACEI, which are previously mentioned.
- *Structure and members of CACEI:* contemplates the way in which the association is constituted and it includes a list of the people that collaborate with it.
- *Methodology:* concepts of quality and accreditation:
- *Quality:* property or group of properties inherent to a thing, better or worse that an established model.
- *Accreditation:* ascribed to school, division, center or any similar academy entity, is defined as the acknowledgment to the satisfaction of a group of norms, and minimum good quality standards, previously established, in such a way that it permits an efficient process of teaching and learning and the formation of high quality professionals.
- *The category of analysis:* elements with common characteristics, to which a group of criteria for the issuing of judgment valued is applied, taking into account, among other things, that they embrace a service of parameters and standards.

For the evaluation of an engineering program, with the aims of accreditation, the categories of analysis that are considered, are the following:

1. Characteristic of programs
2. Faculty
3. Students
4. Curriculum
5. Teaching/learning process
6. Infrastructure
7. Research and technological development
8. Extension, diffusion of knowledge and relationship
9. Administration of the program
10. Results and impact.

Essential requirements for accreditation

All the requirements have an essential character in the process of the granting of accreditation, and they are divided in two categories:

- *Minimum:* those for which satisfaction is indispensable so that the program can receive the accreditation, and they are marked with the help of a group of indicators and their respective

standards and parameters in the document 'Minimum Requirements for the Accreditation'
- *Complementary:* those that constitute important elements of the quality of a program, and that in a complementary way with minimum requirements integrate the conditions for the granting of the accreditation of a program. The indicators and their respective parameters and standards are derived from the 'Reference Frame for the Evaluation' of the Engineering and Technology Committee of the CIEES.

Procedures for the accreditation

The procedures describe the way in which the process is realized. The document that the program has to fulfill with the information related to its self-evaluation; a guide to realize this process, and the form of the report that the Evaluation Committee elaborates as part of the process.

CACEI's purposes, objectives, policies, methods of evaluation, criteria and procedures, are similar to those of ABET.

For example, take the IVC.3.1. from ABET General Criteria:

- 'One year of an appropriate combination of mathematics and basic sciences': CACEI requirements 4.10 (curriculum).
- 'Subjects must be covered in a minimum of theoretical and laboratory teaching class hours, according to the following chart': basic sciences and mathematics – 800 hours.

One of the important activities that CACEI has been conducting is the organization of workshops for the training of evaluators. The main objective is to train engineers who, fulfilling the profile of the evaluator that CACEI has established, subsequently are listed in the respective Register of the Association (Padrón de Evaluadores) to form part of the Evaluation Committees. Likewise, these workshops have as an objective to give a diffusion of the accreditation processes, so that engineers who will not be listed as evaluators of CACEI are invited to participate in them as well as professionals of other disciplines.

CACAEI has given seven open workshops to all institutions, for the training of evaluators, and numerous events of the same nature given on demand at schools of engineering.

INTERNATIONAL ASPECTS

Another important aspect of CACEI is its participation in the North American Free Trade Agreement (NAFTA) negotiations. The Mutual Recognition of Registered Licensed Engineers by Jurisdictions of Canada, the United States of America and the United Mexican States Document, a memorandum of understanding signed at Washington, DC the 5th of July, 1995, recognized CACEI as an official body for engineering accreditation programs in Mexico. The Memorandum of Understanding document also states that a 'substantially equivalent engineering program' means an engineering program which has been recognized by the CEAB of CCPE, or ABET or CACEI.

Regarding Latin American countries, CACEI has been collaborating with most of them in several ways: dictating conferences, as well as imparting courses and workshops related to evaluation and accreditation processes of programs in Argentina, Bolivia, Chile, Colombia, Guatemala, Costa Rica, El Salvador and Panama, collaborating with the processes for the establishment of accreditation organizations of engineering programs in some of them and receiving observers of some of these countries in the accreditation processes that are taking place in Mexico.

CURRENT STATUS

At the present time, thirty three programs of engineering education have been submitted to the accreditation process from institutions that took measures to improve to level of quality as their academy duty. The institutions have sought to satisfy the essential requirements to obtain accreditation, recognizing that improvement occurs with those programs that are getting prepared to ask for accreditation.

In 2000 thirty two more programs are being subjected to the accreditation process. The fulfillment of these processes, besides giving recognition to the accredited programs, provided them with several elements through the recommendations that are included in the reports to improve their quality. In addition they gain valuable experience regarding the processes and they contribute to the formation of profiles of evaluators that the processes require.

The specific benefits that will result from the accreditation system in Latin America countries can be summarized as follows:

- Support the changes demanded by engineering practice, nationally and internationally.
- Involve industry and academic engineers in the processes.
- Identification of engineering programs which currently have a good quality education standard.
- Providing international recognition of engineering education credentials which improve the mobility of engineers.
- Increase the collaboration amongst engineering organizations throughout America.

Finally, as already mentioned, the action of establishing an accreditation system for engineering education, has a direct effect on the quality of the programs, and consequently on their professional performance.

In the case of engineering, better program quality will result in direct benefits for the manufacturing and service sectors, given that professional

engineers graduating from accredited programs will generally perform more efficiently than those who graduate from non-accredited programs. This also contributes to an improvement of the manufacturing systems, by increasing the efficiency of the operating systems of businesses, and in general by increasing the quality of a group of elements that form part of a company's activities producing goods and services, making them more competitive with better financial and operating conditions, as well as providing greater benefits to society.

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