

## **AC 2008-511: ADVANCING STRATEGIES FOR ENGINEERING ACCREDITATION IN LATIN AMERICA AND THE CARIBBEAN**

### **Maria M. Larrondo Petrie, Florida Atlantic University**

Maria M. Larrondo Petrie, is a Professor of Computer Engineering and the Associate Dean of Academic and International Affairs in the College of Engineering and Computer Science at Florida Atlantic University, Boca Raton, Florida, USA. She is Executive Director of the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI). In ASEE she is on the boards of the Minorities in Engineering Division and the Women in Engineering Division, and the Web Master and past Secretary Treasurer of the International Division. She is Vice President of the International Federation of Engineering Education Societies (IFEES), and Co-Chair of the IFEES Global Engineering Education Summit that will be held in Cape Town, South Africa October 19-20, 2008. She was a past President and an Executive Council member of the Upsilon Pi Epsilon International Honor Society for the Computing and Information Disciplines, and a past Education Board member of the Association for Computing Machinery (ACM) Special Interest Group for Graphics (SIGGRAPH). Her current research interests are in the areas of Global Engineering Education, Complex Systems Modeling, and Secure Systems Development. She has written more than 150 refereed publications with over 100 citations, and has received funding for 21 grants and contracts totaling over \$2,700,000. Her email is [petrie@fau.edu](mailto:petrie@fau.edu).

### **Gisela Coto Quintana, SINAES - Costa Rica**

Gisela Coto Quintana earned her Bachelor degree in Industrial Engineering at the University of Costa Rica and a Master's degree in "Prevención de Riesgos Laborales" (in English: Prevention of Occupational Risks) and a Ph degree from the department of Industrial Engineering in Universidad da Coruña. She is presently the "Coordinadora de Calidad Interna" (in English: Head of quality system) at SINAES (Sistema Nacional de Acreditación de la Educación Superior-in English: National System of the Accreditation of Higher Education) and Head of the Accreditation Taskforce of LACCEI. She also represents the SINAES in the technical committee for the development of procedures and criteria for the accreditation of Engineering degrees and has experience in researching on Accreditation for higher education in engineering degrees. She has also developed professional activities in project management for environmental and renewable energy sources projects, and she participated in implementation processes for system integration (quality, environment and occupational risks).

### **Jaime Salazar Contreras, Ibero-American Association of Engineering Education (ASIBEI)**

Jaime Salazar Contreras is Executive Secretary of ASIBEI (the Iberoamerican Society of Engineering Institutions) and is on the faculty of the Universidad Nacional de Colombia in Bogota, Colombia. He has authored several pedagogical books published by ASIBEI dealing with Iberoamerican engineering education and faculty development.

### **Jorge Ignacio Velez Munera, Universidad Sergio Arboleda, ACOFI**

Jorge Ignacio Velez Munera is Dean of Engineering at the Universidad Sergio Arboleda in Colombia, a representative of ACOFI, the Colombian Engineering Education Society, and an officer of LACCEI (Latin American and Caribbean Consortium of Engineering Institution).

# **Advancing Strategies for Engineering Accreditation in Latin America and the Caribbean**

## **Abstract**

Graduating from international recognized (accredited or substantially equivalent) engineering programs is growing in importance as demand for global engineers increases and engineering jobs are being outsourced and are becoming more mobile. This places at a disadvantage engineers that graduate from nations that do not have an internationally recognized engineering program accrediting agency. No Latin American or Caribbean (LAC) nation has signed the Washington, Dublin or Sydney Accords, which grant international mutual recognition of accreditation. Few engineering programs from LAC institutions have sought substantial equivalence. This is to deep concern for the region.

The Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) organized two workshops to advance strategies for increasing the number of accredited engineering programs in the region. The workshops were sponsored by the Organization of American States (OAS), and brought together 40 deans and rectors from the region and societies that have initiatives. These organizations included the Iberoamerican Science and Technology Education Consortium (ISTEC), the Asociación Iberoamericana de Instituciones de Enseñanza de la Ingeniería (ASIBEI – in English: Iberoamerican Association of Engineering Education Institutions) and Engineering for the Americas (EftA).

This paper describes the different declarations, accords, studies and initiatives discussed at the 2007 workshop, strategies that were proposed, and plans for organizations and institutions to collaborate to advance and promote engineering program accreditation in the region.

## **Introduction**

An accredited degree program is defined as one that has attained the approval of an internationally-recognized, national or extra-national quality assurance system that is independent from the system that offers the program and to which the degree granting system has voluntarily submitted the program for review. To facilitate mobility and international recognition of degrees, countries with national accreditation agencies need to sign agreements of mutual recognition. The Washington Accord was signed for that reason in 1989 by the following countries: Australia, Canada, Hong Kong, Ireland, Japan, New Zealand, South Africa, United Kingdom and United States of America, and other countries joined as provisional signatories. Note that no Latin American or Caribbean country has signed the Washington Accord. Likewise, the Dublin and Sydney Accords were signed in 2002 and 2001 for similar mutual recognition of Technology Degrees and again no Latin American or Caribbean country has signed. An engineering program in a country not in these accords that wants to seek international recognition for their degrees, needs to go through a process similar to accreditation with an accrediting agency from another country to seek “substantial equivalence” to an international accredited engineering degree.

There are few engineering degree programs in Latin America and the Caribbean that have sought substantial equivalence from Washington Accord signatories. Some Latin-American countries, such as Mexico and Peru, have signed memorandums of understanding between themselves or with agencies of other such countries as ABET and CEAB in order to obtain substantial equivalences of their engineering quality assurance and accreditation systems.

This puts engineers educated in this region at a disadvantage in terms of mobility and competitiveness.

This paper examines some of the efforts carried out in 2007 to strengthen engineering programs in the Latin American and Caribbean (LAC) region and to increase their recognition and accreditation. It focuses on initiatives by the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI), a non-profit organization formed in 2002 by institutions seeking to improve collaborations with and recognition of engineering programs in this region.

Three LACCEI initiatives aim to improve international recognition of LAC engineering programs by increasing the number of these programs that attains internationally recognized accreditation. In 2004, the Accreditation Committee of LACCEI proposed a five-level model for educational program process assessment that measures the capability of an engineering education program to achieve repeatable results. This model, called the *Engineering Education Capability Maturity Model*, could be used as a blueprint for engineering programs to move systematically towards program accreditation. In 2006 y 2007, LACCEI and the Organization of American States (OAS) co-sponsored two workshops, in Puerto Rico and in Mexico, to formulate strategies to improve the number of LAC engineering programs accredited. The recommendations received at these workshops were gathered in two documents called The *Turabo Declaration* and the *Tampico Declaration*. In 2006, LACCEI initiated an agreement signed by six multinational organizations to advance LAC strategies.

In the next section, we examine the state of national engineering accreditation systems and engineering program degree recognition and accreditation in the LAC region.

### **State of Accreditation and Program Recognition in Latin America and the Caribbean**

Degree recognition begins with an internationally-recognized national accrediting agency. Many countries in Latin American and the Caribbean may not have accrediting agencies for higher education, or may have not taken the necessary steps to get international recognition for their accrediting agencies.

Most of the systems of accreditation of Latin America and the Caribbean are of general nature consequently they are not specialized for areas of knowledge such Engineering. Table 1 lists engineering program accrediting agencies recognized by the International Network for Quality Assurance Agencies in Higher Education, INQAAHE<sup>4</sup> that internationally-recognizes accrediting agencies. Again the list does not include any agencies in the LAC region.

**Table 1. Recognized National Accrediting Bodies for Engineering Programs**

<b>COUNTRY</b>	<b>ACCREDITING AGENCY</b>
<b>Australia</b>	<u>The Institution of Engineers, Australia</u> – Signatory Washington & Sydney Accords, APEC Engineers Register, Engineers Mobility Forum (IRoPE)
<b>Bangladesh</b>	<u>Institution of Engineers Bangladesh</u> - Provisional signatory to Engineers Mobility Forum (IRoPE)
<b>Canada</b>	<u>The Canadian Council of Professional Engineers</u> - Signatory Washington Accord, APEC Engineers Register, Engineers Mobility Forum (International Register of Professional Engineers). <u>The Canadian Council of Technicians and Technologists</u> - Signatory Sydney Accord. Provincial member organizations.
<b>France</b>	<u>Conseil National des Ingenieurs et des Scientifiques de France</u> - French prof. engineers org. <u>Commission des Titres D'Ingenieur</u> - French engineering courses accreditation body
<b>Germany</b>	<u>Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences, and Mathematics (ASIIN)</u> - Provisional signatory to Washington Accord <u>Verein Deutscher Ingenieure (VDI)</u> - The Association of Engineers <u>Verband der Elektrotechnik Elektronik Informationstechnik (VDE)</u>
<b>Hong Kong-China</b>	<u>The Hong Kong Institution of Engineers</u> - Signatory Washington & Sydney Accords, APEC Engineers Register, Engineers Mobility Forum (International Register of Professional Engineers)
<b>India</b>	<u>National Board of Accreditation</u> - Indian technical subjects accreditation body <u>Institution of Engineers of India</u> - Provisional signatory [with Engineering Council India] to Engineers Mobility Forum (IRoPE)
<b>Indonesia</b>	<u>The Institution of Engineers, Indonesia</u> - Signatory to APEC Engineers Register
<b>Ireland</b>	<u>The Institution of Engineers of Ireland</u> - Signatory to Washington, Sydney & Dublin Accords, and Engineers Mobility Forum (IRoPE); member of FEANI
<b>Italy</b>	<u>Consiglio Nazionale Ingegneri</u> - Member of FEANI
<b>Japan</b>	<u>Japan Accreditation Board for Engineering Education</u> - Signatory Washington Accord <u>Institution of Professional Engineers Japan</u> - Signatory to APEC Engineers Register and Engineers Mobility Forum (IRoPE)
<b>Korea</b>	<u>Korean Professional Engineers Association</u> - Signatory to APEC Engineers Register and Engineers Mobility Forum (IRoPE)
<b>Malaysia</b>	<u>Board of Engineers Malaysia</u> - Provisional signatory to Washington Accord <u>Institution of Engineers Malaysia</u> - Professional engineering institution
<b>New Zealand</b>	<u>The Institution of Professional Engineers, New Zealand</u> - Signatory Washington & Sydney Accords, APEC Engineers Register, Engineers Mobility Forum (IRoPE)
<b>Pakistan</b>	<u>Pakistan Engineering Council</u>
<b>Russia</b>	<u>Russian Association for Engineering Education Accreditation Board</u>
<b>Singapore</b>	<u>Institution of Engineers Singapore</u> - Provisional signatory to Washington Accord <u>Professional Engineers Board</u> - Professional Engineers registration body
<b>South Africa</b>	<u>The Engineering Council of South Africa</u> - Signatory to Washington, Sydney & Dublin Accords, and Engineers Mobility Forum (IRoPE). Provincial Member Organizations
<b>Sri Lanka</b>	<u>Institution of Engineers Sri Lanka</u>
<b>Thailand</b>	<u>Thai Professional Engineering Board</u> - Signatory to APEC Engineers Register
<b>UK</b>	<u>Engineering Council of the United Kingdom (ECUK)</u> - Signatory Washington & Sydney Accords
<b>USA</b>	<u>The Accreditation Board for Engineering &amp; Technology</u> - Signatory to Washington Accord <u>National Council of Examiners for Engineering and Surveying</u> - Licensure Exams, State Licensure Boards <u>United States Council for International Engineering Practice</u> - Signatory to APEC Engineers Register and Engineers Mobility Forum (IRoPE)
<b>OTHER ENGINEERING FEDERATION ORGANIZATIONS</b>	
<b>Europe</b>	<u>FEANI</u> - Pan-European Federation of National Engineering Associations (25 national members) <u>EurEta</u> - The European Higher Engineering and Technical Professionals Association <u>SEFI</u> - European Society for Engineering Education
<b>Outside Europe</b>	<u>APEC</u> - Asia Pacific Economic Cooperation <u>CEC</u> - Commonwealth Engineers Council <u>Washington Accord</u> - International mutual recognition agreement of accredited professional engineering programs <u>WFEO</u> - World Federation of Engineering Organisations

Note: IRoPE = International Registry of Professional Engineers

Mercosur created an experimental mechanism of professional title recognition, called MEXA (Mecanismo Experimental de Carreras, in English: Experimental Mechanism for Professional Programs), for recognizing degrees from academic programs in member countries and associates of Mercosur, in the fields of agronomy, engineering and medicine. Twenty seven engineering programs have attained MEXA accreditation.<sup>5</sup>

In 2001, the *Declaración de Monte Alban*<sup>6</sup> was signed in Oaxaca, Mexico by representatives of engineering education in Argentina, Bolivia, Chile, Colombia, Costa Rica, El Salvador, Mexico, Paraguay, and Spain.

In 2002, Mexico's Consejo de Acreditación de la Enseñanza de la Ingeniería (CACEI, in English: The Mexican Engineering Education Accreditation Council) signed with ABET and CEAB/CCPE a Memorandum of Understanding, titled the *Western Hemisphere Initiative*<sup>7</sup>, where they agree to collaborate in building regional capacity in the western hemisphere that fosters the establishment of sustainable national quality assurance systems, and to promote mutual recognition of educational quality assurance systems among nations in the Western Hemisphere. Three countries (Mexico, Argentina and Peru) have signed Memorandum of Understanding with ABET to have ABET recognize the programs accredited by their respective national engineering accrediting bodies.

Accreditation agencies, such as CACEI in Mexico, CONEAU in Argentina and Peru's ICASIT (Instituto de la Calidad en la Acreditación de las Carreras de Ingeniería y Tecnología; in English: Institute for Accreditation Quality of Engineering and Technology Degrees) have realized accreditations of engineering degrees, but have not signed the Washington Accord.

In 2003, UNESCO's International Institute for Higher Education in Latin America and the Caribbean (IESALC - Instituto Internacional para la Educación Superior en América Latina y el Caribe) helped establish the Ibero-American Network for the Evaluation and Accreditation of Quality of Higher Education (RIACES<sup>8</sup> - Red Iberoamericana para la Acreditación de la Calidad de la Educación Superior) to assist LAC nations with their evaluation and accreditation systems.

Table 2 lists LAC engineering programs that are deemed Substantially Equivalent or been accredited by ABET. Table 3 shows those LAC engineering programs deemed Substantially Equivalent by CEAB. Note all seven programs listed are in Costa Rica. The Engineering Council UK (EC<sup>UK</sup>) also has accredited LAC programs, such as the University of West Indies – Trinidad & Tobago, but a complete list of the EC<sup>UK</sup> Substantially Equivalent engineering programs was not readily available online. A research on the Web revealed only thirteen LAC institutions that had successfully attained Substantial Equivalence for engineering programs.

The next section describes two LACCEI initiatives that focus on increasing the number of LAC engineering programs that attain international recognition and accreditation.

**Table 2. Latin American and Caribbean Engineering Programs Accredited\* or deemed Substantially Equivalent by ABET**

COUNTRY	INSTITUTION & PROGRAM [year of accreditation]
<b>Chile</b>	<p><b>Pontificia Universidad Católica de Chile</b>, Santiago, Chile            Chemical Engineering [2003]            Civil Engineering [2003]            Computer Engineering [2003]            Electrical Engineering [2003]            Mechanical Engineering [2003]</p>
<b>México</b>	<p><b>Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)</b>  <b>ITESM – Campus Monterrey</b>, Monterrey, México            Chemical &amp; Industrial Engineering [1992]            Chemical &amp; Systems Engineering [1992]            Civil Engineering [1992]            Computer Systems Engineering [2001]            Electronics &amp; Communications Engineering [1992]            Industrial &amp; Systems Engineering [1992]            Mechanical &amp; Electrical Engineering [1992]            Mechanical &amp; Industrial Engineering [1992]  <b>ITESM – Campus Ciudad México</b>, México D.F., México            Electronics &amp; Communications Engineering [2003]            Industrial &amp; Systems Engineering [2003]            Mechanical Engineering [2003]  <b>ITESM – Campus Estado de México</b>, México D.F., México            Electronics &amp; Communications Engineering [2002]            Electronics &amp; Computer Engineering [2002]            Industrial &amp; Systems Engineering [2002]            Mechanical Engineering [2002]  <b>ITESM – Campus Querétaro</b>, Querétaro, México            Computer Systems Engineering [1993]            Electronic Systems Engineering [1993]            Electronics &amp; Communications Engineering [1993]            Industrial &amp; Systems Engineering [1993]            Mechanical &amp; Industrial Engineering [1993]  <b>ITESM – Campus San Luis Potosí</b>, San Luis Potosí, México            Industrial and Systems Engineering [2004]  <b>Universidad Autónoma de Nuevo León</b>, San Nicolás de los Garza, México            Civil Engineering [2004]</p>
<b>Puerto Rico</b>	<p><b>Universidad de Puerto Rico – Mayagüez</b>, Mayagüez, Puerto Rico            Chemical Engineering [1970]*            Civil Engineering [1960]*            Computer Engineering [1994]*            Electrical Engineering [1960]*            Industrial Engineering [1970]*            Mechanical Engineering [1960]*  <b>Universidad del Turabo</b>, Gurabo, Puerto Rico            Mechanical Engineering [2005]*  <b>Universidad Politécnica de Puerto Rico</b>, San Juan, Puerto Rico            Civil Engineering [1996]*            Electrical Engineering [1996]*            Environmental Engineering [2002]*            Industrial Engineering [1996]*            Mechanical Engineering [1996]*</p>

**Table 3. CEAB Substantial Equivalent Latin American and Caribbean Engineering Programs**

COUNTRY	INSTITUTION AND PROGRAM [year of accreditation]
<b>Costa Rica</b>	<p><b>Universidad de Costa Rica – San José</b>            Ingeniería Civil [1999]            Ingeniería Industrial [2000]            Ingeniería Eléctrica [2000]</p> <p><b>Instituto Tecnológico de Costa Rica - Cartago</b>            Ingeniería de Construcción [2001]            Ingeniería Electronica [2004]            Ingeniería de Industrial de Mantenimiento [2001]            Ingeniería Industrial de Producción [2004]</p>

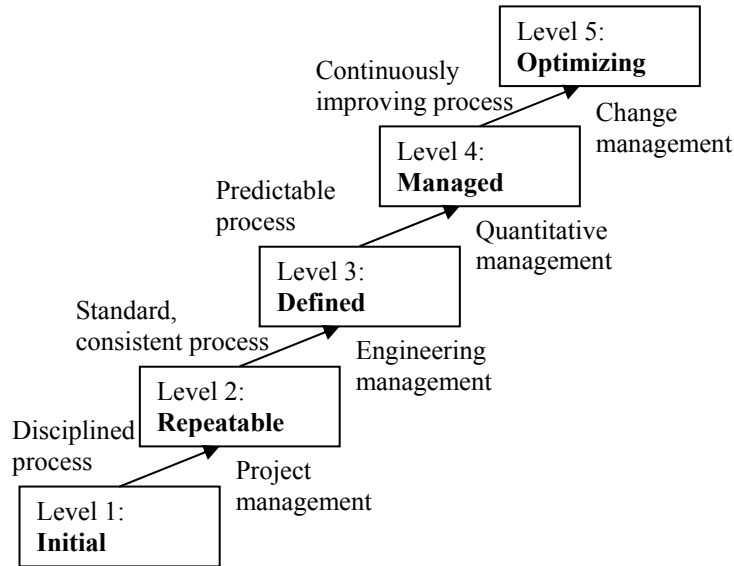
**LACCEI 2007 Initiatives for Recognition and Accreditation of LAC Engineering Programs**

The Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) is a non-profit organization formed in 2002 by institutions and organizations seeking to improve collaborations with and recognition of engineering programs in Latin America and the Caribbean. Three LACCEI initiatives seek to improve international recognition of Latin America and Caribbean engineering programs by increasing the number of these programs that attain internationally recognized accreditation. In 2004, the Accreditation Committee of LACCEI proposed a five-level model for educational program process assessment that measures the capability of an engineering education program to achieve repeatable results. This model, called the Engineering Education Capability Maturity Model<sup>13</sup>, could be used as a blueprint for engineering programs to move systematically towards program accreditation. In 2006 y 2007, LACCEI and the Organization of American States co-sponsored two workshops in Puerto Rico and México to formulate strategies to improve the number of LAC engineering programs accredited by international-recognized systems. In the following sections we describe the model and the results of the workshop especially ones in the year 2006 and 2007.

**Engineering Education Capability Maturity Model<sup>13</sup>**

Current accreditation processes are binary, the program either gets accredited or not. A multi-level model to facilitate the process of going through accreditation and to help find peers could increase the number of LAC programs that seek accreditation. The proposed model is based on a five-level process improvement model proposed in 1995 at Carnegie Mellon University, called the Capability Maturity Model (CMM)<sup>9</sup>. The CMM measures an organization’s *process capability*, i.e. the inherent ability of a process to produce planned results. As the process capability increases, the results become predictable and measurable, and the most significant causes of poor quality and productivity are controlled or eliminated. The multiple levels, success in implementation, acceptance and maturation of the CMM made it attractive for application to improve the process of preparing for engineering program accreditation.

In the CMM Model, shown in Figure 1, principles and practices that lead to better outcomes are organized in five levels, giving a path to incremental adoption of best practices, more process visibility and control, and improved outcomes. Each level forms a foundation from which to achieve the next level, so trying to skip maturity levels could be counterproductive. An organization can adopt specific process improvements at any time; however, processes without proper foundation fail under stress. Following the CMM framework tends to produce stability in process improvement since the required foundations have been successfully institutionalized.



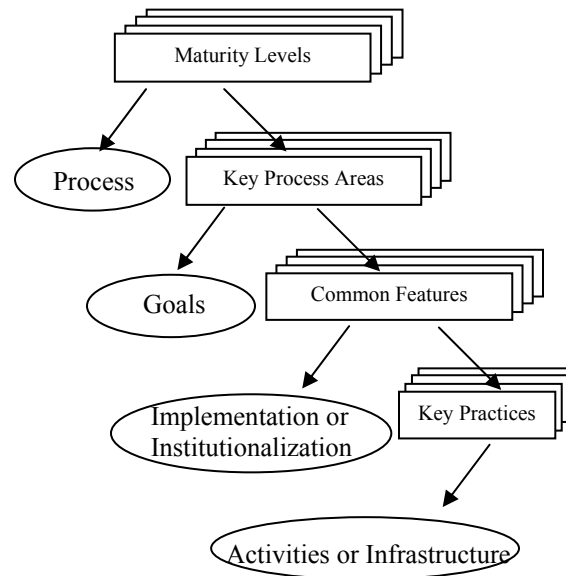
**Figure 1: The Five Stages or Maturity Levels of the Capability Maturity Model<sup>9</sup>**

Except for Level 1, each maturity level has the internal structure shown in Figure 2. A maturity level indicates a capability to perform a process with predictable results and is associated with a set of key process areas on which an organization should focus as part of its improvement effort in order to achieve their goals. Each key process area is organized into five sections called common features:

- *Commitment to perform* – the policies, leadership practices and actions that ensure that the establishment and continued use of the process
- *Ability to perform* –the practices that address resources, training, orientation, tools, and organizational structure that ensure that the organization is capable of implementing the process.
- *Activities performed* – the practices that address plans, procedures, the work performed, corrective action, and tracking.
- *Measurement and analysis* – the process measurement and analysis practices that ensure that procedures are in place to measure the process and analyze the measurements.
- *Verifying implementation* – the management reviews and audits practices that ensure that activities comply with the established process.



These common features specify the key practices described by activities or infrastructure that, when collectively addressed, accomplish the goals of the key process area. An organization satisfies a key process area when the process area is both implemented and institutionalized.



**Figure 2. The Internal Structure of the Maturity Levels in Capability Maturity Model<sup>9</sup>**

The proposed model, called *Engineering Education Capability Maturity Model* (EE-CMM) uses the same framework of the CMM when describing the capability maturity of an engineering or technology program using the same levels of process capability maturity described in Figure 1. The activities required to be documented for ABET accreditation were identified and mapped to the appropriate capability maturity level. The descriptions of each level were adapted to reflect the educational context and ABET accreditation requirements, resulting in the specialized EE-CMM.

These five levels and the key process areas that have been identified with each level are a beginning towards building an Engineering Education Capability Maturity Model<sup>10-11</sup>. Accreditation agencies, such as ABET tend to accredit institutions that are at level 5 in our model. The proposed model gives institutions that have not been accredited a framework that could yield the necessary process definition, implementation, assessment and improvement to eventually attain accreditation. The model provides a common language to discuss progress in process improvement and a logical progression in achieving higher capability maturity levels. Once the engineering program has attained Level 5 then the program is ready to undergo accreditation and “substantial equivalency” evaluation.

The EE-CMM model was presented at the Engineering for the Americas Symposium in Lima, Peru in October 2005<sup>10</sup>. This Summit was co-sponsored by the Organization for American States and Engineering for the Americas (EftA). There were some discussions of the possibility of using the EE-CMM<sup>11</sup> as an alternative multi-level accreditation standard, e.g., deeming a program as “competent” when it reaches Level 3 and deeming it as “competitive” when it

reaches Level 5. Some participants felt strongly against using it in this manner, others felt this would be helpful in countries where no engineering program is accredited to help students find programs that meet at least minimal acceptable levels. Most thought it was very appropriate for self-evaluation and to assist in moving towards accreditation. One Caribbean engineering institution decided to adopt the EE-CMM to work towards ABET accreditation. The Caribbean delegation at the Engineering for the Americas Symposium voiced a strong desire to begin designing an engineering accreditation system for their region, and offered to organize a workshop in conjunction with the LACCEI conference in June 2006. The Organization of American States offered to co-sponsor the workshop. Thus the second LACCEI initiative began.

### **The Turabo Declaration**

In 2006, LACCEI and the Organization of American States co-sponsored the workshop in San Juan, Puerto Rico, as part of LACCEI's conference. The workshop organizers were Dr. Clement Sankat, Dean of Engineering at the University of West Indies – Trinidad Tobago; Dr. Roberto Lorán, Vice Rector of the Universidad del Turabo – Puerto Rico; and Dr. Maria Larrondo Petrie, Executive Vice President of LACCEI. Dr. Saul Hahn of the OAS Department of Science and Technology opened the workshop presenting the OAS perspective and the importance of engineering for economic and social development. This was followed by a panel of representatives from recognized accrediting agencies that have accredited or evaluated engineering programs in the LAC region for Substantial Equivalence: ABET, CEAB, EC<sup>UK</sup>, and CACEI. A panel of LAC organizations of engineering directors presented challenges and experiences: ASIBEI (Ibero America), ANFEI (Mexico), ACOFI (Colombia), CONFINI (Peru). The participants and panelists then broke into regional Round Tables to discuss strategies to advance toward engineering program recognition and accreditation in the LAC region. Fifty participants representing thirteen countries participated: Argentina, Canada, Colombia, Dominican Republic, Ecuador, Honduras, Jamaica, Mexico, Peru, Puerto Rico, Spain, Trinidad Tobago, United States, and Venezuela. Each table was given five questions to guide their discussions:

1. Is the ABET model (or other existing accreditation model) adequate for the engineering programs in the Latin America and the Caribbean region?
2. What would be the added value of the Latin America and the Caribbean region having its own accreditation organization?
3. What would be the next steps in developing an accreditation system for Latin America and the Caribbean?
4. Do we wish to develop an accreditation system for Latin America and the Caribbean?

The consensus was that wholesale adoption of accreditation (ABET) would not be appropriate. Instead, best practices should be implemented, and differences rationalized. For example, consider the experience in Argentina: it is the only mandatory process in Latin America (so far as is known). It started with a self-evaluation, which was initially optional. Budgeting was based on objectives, rather than historical trends. Early data showed poor use of national scientific funding; the process triggered changes in personnel to improve this. A model was developed to track and finance students.

The participants agreed on the following list of observations.

1. There are national systems and nationally external ones.
2. There are optional systems, and mandatory ones.
3. There are systems that accredit institutions and others that accredit programs.
4. Some systems emphasize individual certification; others emphasize institutional improvement.
5. There is both developmental and punitive use of accreditation information; local laws often govern this.
6. There may be a conflict between a local/national accrediting agency, and a regional/international one.
7. There is a possibility of resistance to foreign scrutiny.
8. There is consensus that accreditation should allow mobility. There are various mechanisms for this, including signatory status of the Washington Accord.
9. There are two alternatives for achieving global recognition:
  - a. Develop a national/regional accreditation system, and then sign an accord - agreement?,
  - b. Adopt an existing accreditation system (e.g. British or American)
10. There is a possibility of incest in national accreditation systems, especially in small countries.
11. There is a certain degree of difficulty in joining consortia such as the Washington Accord; even more so for individual countries.
12. Various groups need to be educated on these issues.

After a day of discussion, a document called *The Turabo Declaration*<sup>12</sup> was created that summarized the conclusions of the participants:

“Whereas there is a need for Quality, Consistency and Mobility among Engineers educated in the Region, we recommend to LACCEI the appointment of a Task Force to draft a first principles document of a *Latin American and Caribbean Engineering Accreditation Agency (LACCEAA)*. Some first principles for design of this:

- a. Engineering Mobility (to be defined)
- b. Draw from best practices and current activities of all mature accreditation agencies
- c. Develop guiding principles of engineering education in the region, including enough? sufficient flexibility of the guiding principles to accommodate the needs of individual nations in the region, enhancing but not suppressing their existing national accreditation systems.

The Task Force shall formulate a strategic plan and milestones for the establishment of this new Regional Accreditation Agency.”

The declaration was presented to the LACCEI Extended Governing Board and the LACCEI conference participants. The recommendation to create a new regional accrediting agency for Latin America and the Caribbean was found to be controversial and required further discussion and inclusion of more stakeholders.

LACCEI also determined that collaboration agreements were needed with multi-national and national organizations to undertake this effort and fund initiatives of this magnitude and importance. At this point the third initiative was started.

### **Engineering Collaboration for the Americas**

LACCEI organized a multilateral Engineering Collaboration for the Americas agreement in Rio de Janeiro on October 2006 that was signed by seven multi-national organizations: the newly created International Federation of Engineering Education Societies (IFEES), the Organization of American States (OAS), the American Society of Engineering Education (ASEE), Engineering for the Americas (EftA), the Asociación Iberoamericana de Instituciones de Enseñanza de Ingeniería (ASIBEI), Ibero-American Science and Technology Education Consortium (ISTEC) and LACCEI. The document formed a partnership to work toward the following agreed upon goals:

- to promote the professional educational and research development of world class engineers,
- to enhance engineering education and to support engineering academia under global quality assurance and program accreditation processes,
- to promote and develop continuing education programs, extension services, and lifelong learning activities to support lifelong productivity enhancement to strengthen enterprise competitiveness,
- to work toward meeting world demand for global engineers committed to solving problems of society,
- to build bridges for networking and resource sharing between industry, professionals, governments, academia and the civil society to meet the challenges for developing global engineers to impact worldwide economic development,
- to promote sustainability values and proactive actions on behalf of forthcoming generations,
- to envision and carry out collaborative efforts and activities for the benefit of all,
- to help enhance social, political and professional equity, justice and welfare and provide opportunities for those underrepresented in the global engineering community,
- to promote job creation and alleviate poverty,
- to jointly seek funding to support all activities related to engineering, and
- to broadly disseminate worldwide the agreement and attract other interested partners into this partnership.

### **Final Report of Accreditation Workshop (Tampico, México) <sup>15</sup>**

During the accreditation workshop celebrated as part of the 2007 Conference of the Latin American and Caribbean Consortium for Engineering Institutions (LACCEI), the Turabo Declaration (created in 2006 as part of the quality assurance in engineering education in Latin America and the Caribbean initiative) was reviewed as the base document for the development of the strategic plan for the year 2007 initiative, called the Tampico Declaration.

This declaration establishes that considering the need of uniformity and recognizing that each nation is autonomous and has different languages, traditions and values, the committee proposed to designate a taskforce that will identify and write the basic principles of an accreditation agency for Latin America and the Caribbean.

For the designed proposal the following aspects must be considered:

- Mobility of students and professionals
- Adoption of better practices of existent agencies already consolidated.
- Aligning of the accreditation of the engineering institutions of the region, emphasizing but not eliminating the already existing national accreditation systems.

### Issues Raised

After a discussion of the Turabo Declaration during the pre-conference workshop, the participants raised some questions and comments:

1. The proposal is to create an Accreditation Agency or a System be created?
2. Up to what point the committee can work toward the goal of an accreditation system or agency for the region?
3. What should the objectives be?
4. Is the organization looking for a global reference or an agreement like the Washington Accord?
5. Should the evaluators be from the region?
6. What regional agreements should be established?
7. Is the final object mobility or the education recognition?

### Brainstorming

As a result of the pre-conference workshop, it was proposed that from the Turabo Declaration a committee be created to develop the accreditation theme and strategies in LACCEI. A taskforce of 21 professionals, including deans, authorities and representatives of careers of Engineering disciplines, organizations and agencies of accreditation agencies from Latin American and Caribbean countries.

The taskforce decided that one of the first objectives should be to have conceptual clarity and define the principles over which the system or systems will be developed, and determine what the final outcomes should be.

With this objective in the taskforce defined the following:

### Vision

To produce engineers for the Americas that are creative, ethical, flexible, competent, innovative, interdisciplinary, exchangeable (mobility), sensible, multicultural, socially and environmentally responsible and who can integrate with the culture wherever he/she goes without losing his/her values and culture.

## Mission

Create a space where the criteria can be harmonized to achieve general and transversals competences of the professional Engineering of the Americas.

## General Objectives

- Define the universe of values of the Engineering of the Americas
- Define basic references of quality for the Engineering of the Americas
- Identify strategies and mechanism directed toward the definition of the quality culture that will take into consideration the different constituents (academia, industries, government and community)

The following action plan was developed and the committee expects to disseminate initial results at the Latin American and Caribbean Consortium for Engineering Institutions (LACCEI) 2008 conference. Responsibilities were assigned in every action.

1. Creation of a Forum for discussion. The University of Puerto Rico - Mayaguez is creating a BLOG for LACCEI for the LAC Accreditation initiative.
2. Investigation of different models. Comparison of different standards, models and systems. Select models of interest for the America and European region.
3. Establish the links with the academia, industry, government and the community to harmonize the criteria of Engineering of the Americas and the context in which this criteria will be applied. Also the committee will establish contacts with RIACES, for example through CONEAU, Argentina, to perform joint actions and participate in the harmonization of the criterias for engineering agencies that are already achieved in Latin America.
4. Data collection and analysis of the following:
  - a. RIACES Glossary (incorporation of new terms or comments of the already existent within the context of LACCEI and the Global Engineering).
  - b. The proposed Engineering Education Capability Maturity Model.
  - c. Mobility Concept. Define the kind of mobilities (professional, students, regional, etc) considering the minimum cost and maximum impact.
  - d. Andres Bello Agreement.
  - e. Universe of values of the Engineer. Identify the values of the Latin American Engineer, identify the shared values, and identify the essential values to guarantee mobility. Also develop an outline based on the existing values.
  - f. Summarize results and disseminate.
  - g. Define the scope of work
  - h. Proposal for harmonizing the criteria of the Engineer of the Americas and the context in which will be applied.
  - i. Establishment of regional agreements related to the criteria for the accreditation procedures.
  - j. Proposal to guarantee the quality of engineering education

- i. Definition of quality criteria's on a common space for Latin Americans and Caribbean Constituents
  - ii. When the accreditation criteria's are being defined, we will need to consider not establishing a standard but a ranking. Also established basic criteria with out leaving a reference for the quality guarantee.
  - iii. Defining basic criteria supporting for the programs that already have submitted their programs to accreditation process and that can aspire to another accreditations.
- k. Presentation of a progress report and proposal.

### **The Tampico Declaration**

Initiatives of accreditation exist in diverse nations and regions of the world. In this sense, the initiative LACCEI rather than establishing an Agency of Accreditation at Latin-American level and of the Caribbean, should strive from the onset to research accreditation results and practices to support new or harmonizing with existing initiatives.

To that end a taskforce has been formed to pursue the achievement of the vision, mission and objectives defined previously.

### **Conclusions and Future Directions**

Three LACCEI initiatives have been presented and they are directed to improving engineering program accreditation and program recognition in the Latin American and Caribbean region.

The first initiative is to develop the five-level Engineering Education Capability Maturity Model (EE-CMM), designed to facilitate and organize the process of seeking accreditation by mapping the activities required for ABET accreditation to the appropriate level of capability maturity needed to implement and sustain the activities. Engineering programs can use the model for self-assessment and to track their progress towards accreditation. It was suggested that the capability maturity levels can be used to define a multi-tier accreditation system, e.g. deeming those that reach level 3 as being “competent” engineering programs and those that reach level 5 “competitive” engineering programs, but this may be controversial. If used, best practices of moving through each level can be documented and disseminated as part of the framework. Institutional and faculty commitment, in terms of effort and budget, are easier to obtain to pursue smaller incremental steps toward accreditation than to pursue the monumental task of accreditation or substantial equivalence. The model will hopefully facilitate moving towards an engineering program accreditation mechanism to recognize and license engineers throughout Latin American and the Caribbean, the Americas and, ultimately, globally. Comments and assistance in developing a more detailed and complete model is sought, as well as mapping it to other accreditation systems besides ABET.

The second initiative started with a workshop that began exploring whether it is feasible and desirable to create an engineering program accrediting agency for the Latin American and

Caribbean region that could eventually sign the Washington Accord. The third initiative continues the dialogue initiated in 2006 and expand the list of participants.

The LACCEI Accreditation Committee needs to incorporate into its three accreditation initiatives, ideas being proposed by existing projects that seek to form regional engineering accreditation, such as MEXA – the Mercosur Experimental Accreditation Project, the European Commission's EURACE Project and RIACES. RIACES is developing a proposal of accreditation for Engineering degrees. The work developed implied the participation of the Latin-American countries members of RIACES for the harmonization of accreditation criteria. At present it is at a proposal of model of evaluation that will apply at beginning of 2007 for careers of Engineering in the frame of a pilot plan.

To follow-up on the ideas in the EE-CMM, The Turabo Declaration and The Tampico Declaration, LACCEI recognized that a deeper collaboration with other organizations was needed. This will be facilitated by means of the Engineering Collaboration for the Americas agreement, signed by 7 multinational organizations to advance initiatives and efforts in the Western Hemisphere and globally. LACCEI also plans to sign agreements with national Latin American and Caribbean engineering or accreditation organizations this year.

LACCEI welcomes comments and collaboration on these initiatives.

## References

1. IROPE: International Register of Professional Engineers. Europe's Engineers Mobility Forum, Europe's Engineering Technologists Mobility Forum, Europe. <http://www.engc.org.uk/international/irpe.asp>
2. Draft of EUR-ACE Standards and Procedures for the Accreditation of Engineering Programmes. EUR-ACE Accreditation of European Engineering Programmes and Graduates, December 3, 2004. [http://www.engc.org.uk/documents/EURACE\\_First\\_Framework\\_1204.pdf](http://www.engc.org.uk/documents/EURACE_First_Framework_1204.pdf)
3. Eurace Accreditation Framework. <http://www.engc.org.uk/international/eurace.aspx>
4. INQAAHE: International Network for Quality Assurance Agencies in Higher Education. List of Members. <http://www.inqaahe.org/generic.cfm?mID=8&sID=16>
5. "La experiencia del Mexa (Mecanismo experimental de acreditación regional de carreras de grado para el reconocimiento de los títulos)". CONEAU, Argentina, 2007.
6. Declaración de Monte Alban, signed by Domingo Martin Gandolfo (Federación Argentina de la Ingeniería Civil), Mario Virreira Iporre (Comité Ejecutivo de la Universidad Boliviana), Daniel Vargas Muñoz (Consejo de Decanos de Facultades de Ingeniería de las Universidades Chilenas), Jaime Salazar Contreras (Asociación Colombiana de Facultades de Ingeniería ACOFI), Roberto Trejos Dent (Colegio Federado de Ingenieros y de Arquitectos de Costa Rica), Dorothy Mases MENA (Comisión de Acreditación de la Calidad de las Instituciones de Educación Superior, El Salvador), Cristina Santamarina Siurana (Universidad Politécnica de Valencia España), Fernando Ocampo Canibal, (Consejo de Acreditación de la Enseñanza de Ingeniería, Mexico), Carlos Alberto Sánchez León (Universidad Católica "Nuestra Señora de la Asunción, Paraguay), Oaxaca, México, 6 September 2001. <http://www.cacei.org/monte.html>
7. Western Hemisphere Initiative Memorandum of Understanding: signed by George D. Peterson (ABET), Fernando Ocampo Canabal (CACEI) and Marie Lemay (CCPE), 1 November 2002. <http://www.cacei.org/hemis.html>
8. RIACES: Red Iberoamericana para la Acreditación de la Calidad de la Educación Superior. <http://www.riaces.org>



9. SEI (1995). Carnegie Mellon University, Software Engineering Institute (Principal Contributors and Editors: M. C. Paulk, B. Curtis, M.B. Chrissis), The Capability Maturity Model: Guidelines for Improving the Software Process, Reading, MA: Addison-Wesley, 1995.
10. Larrondo Petrie, M. M. "Engineering for the Americas: The Role of LACCEI", Organization of American States Engineering for the Americas Symposium, 29 November – 2 December, 2005, Lima, Peru, 2005  
<http://www.oest.oas.org/engineering/ingles/documentos/ppt/Maria%20LarrondoPetrie.ppt>
11. Larrondo Petrie, M. M. "An Engineering Education Capability Maturity Model" in Proceedings of the ASEE 2006 Conference and Exposition, Chicago, Illinois, USA, American Society of Engineering Education, June 2006.
12. "The Turabo Declaration" in Proceedings of the 4th LACCEI Latin American and Caribbean Conference on Engineering and Technology, Mayagüez, Puerto Rico, June 2006.
13. Larrondo Petrie, M. M. "The Turabo Declaration and the Engineering Education Capability Maturity Model: LACCEI initiatives to improve Latin American and Caribbean engineering program accreditation and recognition" in Proceedings of the Conference ASEE 2007.
14. "The Tampico Declaration" in Proceedings of the 5th LACCEI Latin American and Caribbean Conference on Engineering and Technology, Tampico, México, Mayo 2007.