AC 2010-2197: CREATION OF A GREATER CARIBBEAN REGIONAL ENGINEERING ACCREDITATION SYSTEM

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The Creation of the Greater Caribbean Region Engineering Accreditation System

Abstract

This paper describes the creation of a new Engineering program accreditation system for the Central America and Caribbean Region, called the Greater Caribbean Regional Engineering Accreditation System (GCREAS)[1]. This initiative was funded by the Inter American Development Bank through the efforts of the Engineering for the Americas (EftA) initiative[2], uniting representatives from international organizations, government agencies, professional organizations, accreditation bodies, universities and industries, and endorsed by the Organization of American States (OAS) in the Lima Declaration of 2004[3]. The outcomes of the first phase[4] of the GCREAS project are described, including a summary of an extensive comparative analysis conducted of different accreditation systems around the world, advances in creating and approving the standards, governance and operations. Quantitative data from the feasibility study are presented to help determine whether there is a critical mass to enable the implementation of a sustainable GCREAS system and to help scope the efforts to be undertaken within the framework of this project, aimed at building a model of engineering accreditation for the area.

Introduction

Engineering for the Americas (EftA)[2] started as a grass roots initiative uniting engineering education organizations, government agencies, professional organization, accreditation agencies, universities and industries, endorsed by the Organization of American States (OAS) in the Lima Declaration of 2004[3]. EftA is headquartered at the Organization of American States in Washington DC, USA. In 2004, in its *Science, Technology, engineering and Innovation for Development: A vision for the Americas in the Twenty First Century*[5], the OAS cited several times the usefulness of regional accreditation for the mobility of students. The OAS held the first Engineering for the Americas Symposium in Lima 2005, there was a call from the Caribbean delegation for a regional accreditation system for the Caribbean region. This region with its isolated islands, multiple languages and educational system based on the U.S., Spanish, French, British, and Deutsch systems, posed a particular challenge. EftA first initiative was to fund, together with industry, a consultant to write a grant proposal to the Interamerican Development Bank (IDB) to fund the effort, which was expanded to the Greater Caribbean Region Engineering Accreditation System (GCREAS)[1] to include Central America. The IDB funded the GCREAS proposal, as well as another for the creation of ACAAI (in English, the Central American Architecture and Engineering Accreditation Agency)[6]. ACAAI serves Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica and Panama, which all speak Spanish and who opted to follow the Canadian Engineering Accreditation Board standards. The GCREAS base study analyzed the feasibility of implementing a sustainable GCREAS system.

The GCREAS Base Study

A consultant conducted a base study to compare and contrast Engineering degree accreditation systems and models, and to propose a model and characteristics for the GCREAS operation and

governance. This included a study of the status of engineering in the region to gather a quantitative basis to answer whether there is a critical mass to enable the implementation of a sustainable GCREAS system.

Scope of the Base Study

The study included the following components:

- Analysis of the characteristics of internationally recognized accreditation systems.
- Analysis of the state of accreditation of the programs and higher education in the Greater Caribbean region.
- Proposal of a model for accreditation based on the analysis of the international engineering accreditation systems and the characteristic context of the region.

Comparative Analysis of the Engineering Accreditation Systems

A comparative study has been completed analyzing the characteristics of a group of engineering accreditation systems from different nations in the world. The criteria for inclusion in the base study were:

1. Engineering accreditation systems signatories of the Washington Accord (WA)[7].
2. Generic or engineering accreditation systems based in the Greater Caribbean region.
3. Accreditation systems for other professions in the Greater Caribbean region.

Washington Accord Signatories Studied

The WA signed in 1989 is an international agreement among bodies responsible for accrediting engineering degree program. Qualifications accredited or recognized by other signatories are recognized as being substantially equivalent to accredited or recognized qualifications within its own jurisdictions for entry to the practice of engineering. The WA was selected as the criterion because:

- The WA is a consortium of international recognized engineering accreditation systems.
- The WA upholds the highest requirements and standards of quality.
- The GCREAS has the goal of being accepted as a signatory of the WA.

The signatories of the WA are listed in Appendix A, note no Latin American nor Caribbean nation is represented. Five accrediting systems that have signed the WA have been analyzed and contrasted by the GCREAS base study:

- U.S. ABET[8] (formerly the Accreditation Board for Engineering and Technology)
- Engineers Canada's Canadian Engineering Accreditation Board (CEAB)[9]
- Institution of Engineers Singapore (IES)[10]
- Institute of Engineering Education Taiwan (IEET)[11]
- Engineers Australia[12]

Other Generic or Engineering Accreditation Systems in the Region included in the Study

Other accreditation systems in the Greater Caribbean Region were included in the study to provide a vision adjusted to the problems and characteristics of the social and economic context of the region. The systems included where:

- Mexico – CACEI (in Spanish: Consejo de Acreditación de la Enseñanza de la Ingeniería, in English: Engineering Education Accreditation Council)[13]
- Costa Rica – SINAES (in Spanish: Sistema Nacional de Acreditación de la Educación Superior; in English: National Accreditation System for Higher Education)[14]
- Central America – ACAAI[6]

Accreditation Systems in the Region for other Professions included in the Study

Also pertinent and included in the study were other accreditation system for professional programs in the region which had international recognition. The system selected was:

- Caribbean – CAAM-HP (the Caribbean Accreditation Authority for Education in Medicine and other Health Professions)[15]

The final base study document lists all accreditation systems that accredit university programs, and distinguishes between those specialized in engineering program y those that are generic, accrediting all types of programs in higher education.

Characterization of Accreditation Systems

According to the requirements of the International Steering Committee of the GCREAS Project, together with what the consulting team deemed relevant, each system was analyzed and compared according to the following characteristics:

- *Contextual Information*
  - Organization, geographical location, owners or proprietors, mission and vision.
- *Policies and Norms*
  - Specification of the policies of the system in relation to confidentiality, conflict of interest, and establishment of policies and procedures that are flexible, replicable and simple.
- *Organizational and Operational Structure*
- *Phases of the Accreditation Process*
- *Formation and Functions of the External Evaluation Team*
- *Corporate Image, Marketing Policies and Communication*
- *Relations with other National and International Institutions*
- *Focus of the Evaluation Model*
  - Oriented towards inputs or outputs.
  - Structure of the evaluation model.
- *Economic Aspects*
  - Sources of financing, fees, and costs.
- *Relation of accredited programs*

The contents of each section for each agency were based on material found on the agency's web page(s), on normative and operation documents of the agency, and on interviews with those with the agency responsible for development and operations.

The information obtained has been organized and analyzed in three distinct ways:

1. In a homogenized way and presented in a series of informative summary tables with the information specific to each system.
2. In tables where each aspect is analyzed for each system, describing the advantages and disadvantages.
3. In-depth analysis of the process of assessment for each system, detailing the different stages and presenting the corresponding flowcharts.

Also as part of the conclusions of this section of the study a quantitative analysis has been included, together with their corresponding graphic showing the presence of certain defining characteristics in each system (stages in the accreditation process, ranges of the external evaluation team composition, lengths of accreditation, etc). This collective presentation of information was a great help in making decisions about the new accreditation system being created.

One of the more problematic aspects in the implementation of an international system that deals with a highly sensitive social issue, such as the accreditation of training programs for engineers, is the legal validity of its resolutions, an taking into account national regulations. In this respect, the consultancy study also contains an analysis of viability in relation to regulations and the existing legal structure in the countries promoting action (Dominican Republic, Jamaica, Panama) and, additionally, Trinidad and Tobago.

Most Important Results and Conclusions

In making the comparison between the different accreditation systems, the base study concluded:

- Most of the engineering programs accreditation systems analyzed are newly created (under 21 years old) except CEAB established in 1932, and ABET established in 1965. The institution deemed to have the strongest experience in the field accreditation is ABET because it has more than 2,800 accredited programs in over 600 universities. CACEI is the first accreditation body established in Latin America.
- All systems are analyzed were voluntary systems and in most cases the professional program accredited is Engineering.
- Most of the accreditation systems analyzed specialize in the field of Engineering and were established within professional associations and professional schools.
- The organizational structure of the accreditation systems analyzed consists of a Council, an Executive Director and support staff. Some additionally have Accreditation Boards or Commissions charged with the implementation and assessment of the accreditation process.
- In most cases the evaluation team is composed of three members, and evaluators do not receive fees.
- Most of the systems analyzed have confidentiality and conflict of interest policies, and management gives special attention to these issues.
- In most of the cases, the estimated time it takes from submission of application to the accreditation decision is about a year.
- Most of the accreditation processes analyzed have similar stages and follow a simple, flexible approach, which is also replicable.

- The evaluation models of the systems in the Washington Accord are simple, flexible, and repeatable and focused on results. While the accreditation systems in Latin America and the Caribbean are focused on inputs and processes. In the particular cases of ACAAI and CACEI, their accreditation models have a complex approach, very detailed and structured.
- Referring to universities communicating status of accreditation their programs to avoid misunderstandings, in most cases, this is not standardized.
- Most of the accreditation systems analyzed are financed by its members and by fees for services they provide.
- In most cases the systems analyzed where with agencies, with member agencies of the Washington Accord, and with Latin America through international agreements.

Analysis of status of accreditation in the Greater Caribbean

It is important to note that no accrediting agency in Latin America or the Caribbean has signed the Washington Accord. Very few programs have been granted Substantial Equivalence, and this evaluation and designation is no longer available. In the Greater Caribbean region few engineering programs have been internationally accredited. These have been evaluated by the CEAB (in Costa Rica), by ABET (in Puerto Rico), by the UK Engineering Council (in Jamaica and Trinidad Tobago), and France (in the French Caribbean).

The base report also included a quantitative study conducted on the context and status of accreditation in the countries in the Greater Caribbean region. Information gathered from various international agencies, countries, and directors of university centers and government agencies were analyzed in order to determine both the variables defining the context and the current level of penetration of university accreditation activities in each country. This study is a useful tool for identifying strategies for the evolution and growth of the system.

The study results are presented in the following way:

- Basic fact on the social, educational and economic aspects of the country.
- Summary of the annual progress in the last five years, of higher education and of accreditation of higher education, in the country in general, and in particularly in the area of engineering degrees.
- Full breakdown, including results for each area of engineering discipline.

The base study includes a quantitative study that includes, among other variables, enrollment ratios and engineering programs in the region, which provide a quantitative point of view that allows a more accurate assessment of the situation in the region.

Most Important Results and Conclusions

The primary motivation and justification for a study like this is to have a data base of quantitative information to answer the question of whether there is a critical mass to enable the implementation of a sustainable GCREAS system. For this reason the information gathered should help to address adequately the efforts to be undertaken within the framework of this

project, aiming at building a model of engineering accreditation for the area. In this vein, the following conclusions should be highlighted:

- From the standpoint of the variables of interest that motivated the study (i.e, the characterization of the market analysis, and the characteristic aspects of accreditation of engineering programs in the region), the countries studied fall into three categories (see Table 1):
    - Group 1: Countries that, even having a solid and mature market of options for higher education in Engineering, have no options in their territories for the accreditation of programs (or those options are not developed and not fully operational).
    - Group 2: Countries that, having developed a mature market and training in engineering, have alternative operating options - either specific or generic also available, for the accreditation of engineering programs.
    - Group 3: Countries that do not have in their territories higher education institutions that offer Engineering programs. This latter group may pose a potential market that should be considered.
- There is a university that has an important role in the area of English-speaking Caribbean (UWI – University of West Indies). This public university has links with all countries of the region, and in some cases, governments of countries not only help financially to its maintenance but also subsidize its citizens' tuition costs. The engineering education is offered in only one of UWI campus.

Table 1. Accreditation Market Categories of Greater Caribbean Region Countries

Group 1	**Group 2**	**Group 3**
Panamá	Jamaica	Anguila
República Dominicana	Colombia	Antigua y Barbuda
Trinidad y Tobago	Costa Rica	Bahamas
Cuba	México	Barbados
El Salvador		Bermuda
Guatemala		Dominica
Haití		Granada
Honduras		Caimán Islands
Nicaragua		Islas Turcas y Caicos Islands
Venezuela		British Virgin Islands
Belice		Montserrat
Guayana		San Cristóbal y Nieves
Surinam		Saint Vincent and the Grenadines
		Santa Lucía

Some of the most relevant conclusions to be drawn from this study have to do with market considerations in terms of engineering and, therefore, demand for accreditation of programs. From this point of view, first it can be argued that the demand for engineering programs in the region will increase with time in a continuous and progressive manner. Figure 1 charts the percentage increase in the enrollment of first year engineering programs. Trinidad, Jamaica and Cuba have the largest increases. Honduras is the only country showing negative enrollment, which were due to the private universities not reporting their data and the public university instituting an entrance exam in 2007.

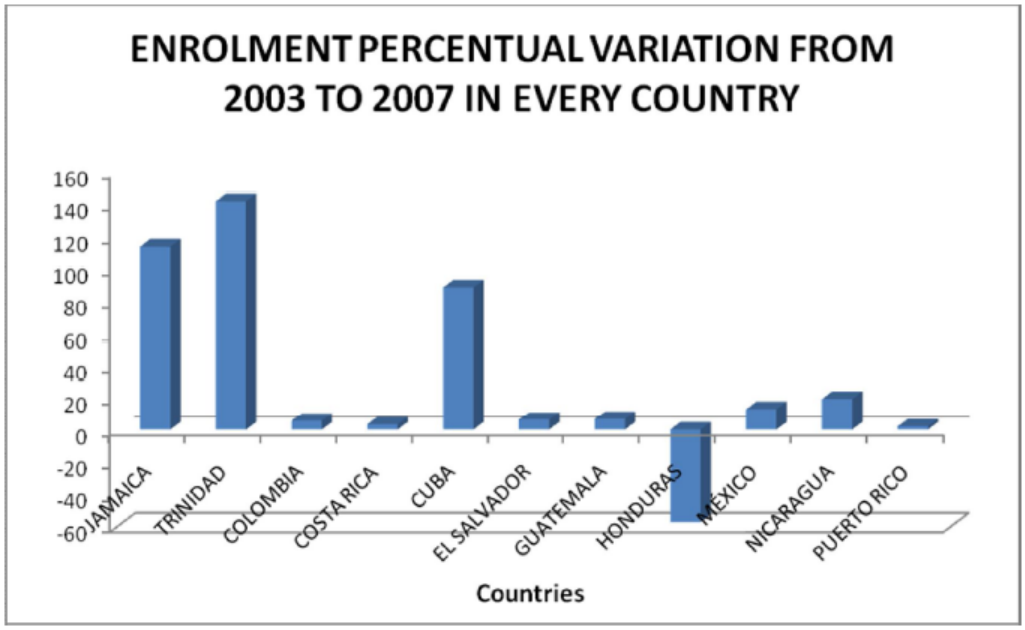

Figure 1. Increments as a percentage of enrollment in first year engineering programs

However, the mere fact that there is a growth in engineering programs in the region is not a particularly significant test of the growing popularity of studying in a country, which is why the base study defines two additional measures shown in Figures 2 and 3: Total enrollment in engineering per million population in the country, and the number of engineering programs per million inhabitants. The countries with the largest percentages of the populations going into engineering are Venezuela, Mexico, Colombia, El Salvador, Costa Rica, Puerto Rico and Panama, in that order. While Colombia, Costa Rica, Dominican Republic, El Salvador, Mexico, Panama offer the largest number of engineering programs (in order and with at least 10 programs per million inhabitants).

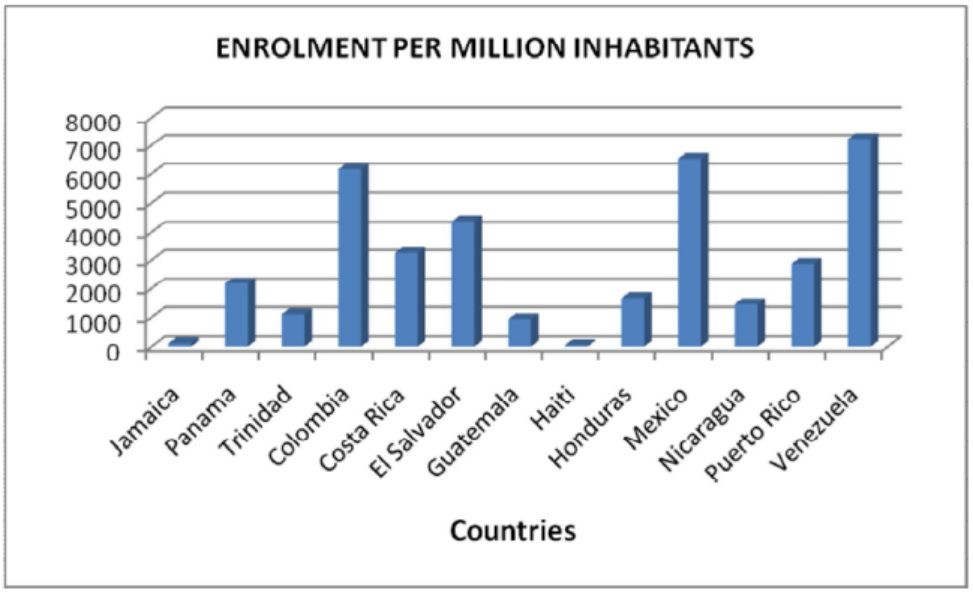

Figure 2. Enrollment in engineering per million inhabitants

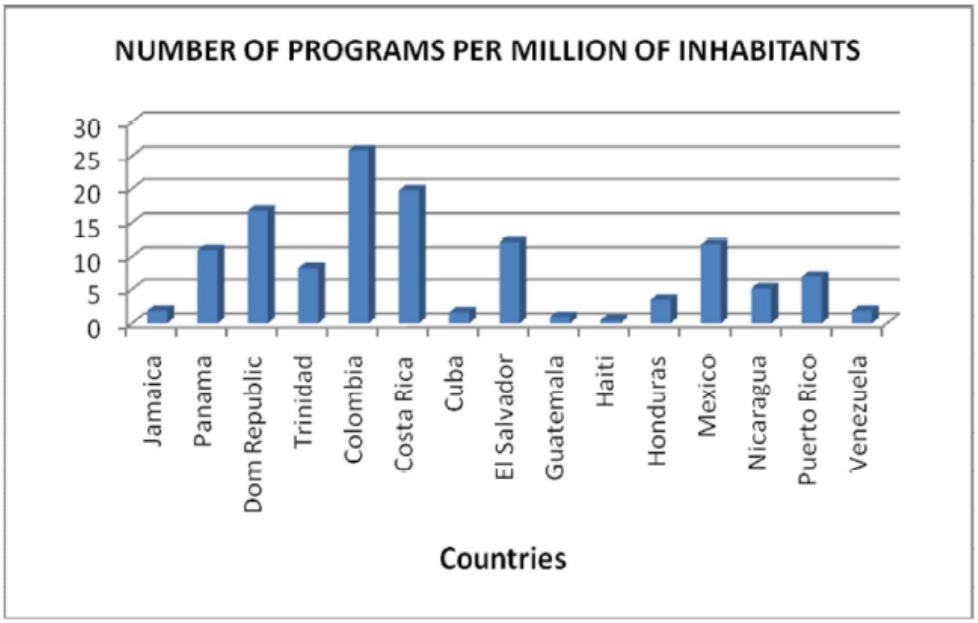

Figure 3. Number of engineering programs per million inhabitants

Another aspect that we believe deserves to be highlighted is the role of private universities. In almost all countries surveyed, there is a significant number of private universities and they outnumber the public universities. In this regard, and in summary of the specific information for each country are presented in the report, Figure 4 is a graph showing the number of public institutions vs. private universities in the total universities analyzed.

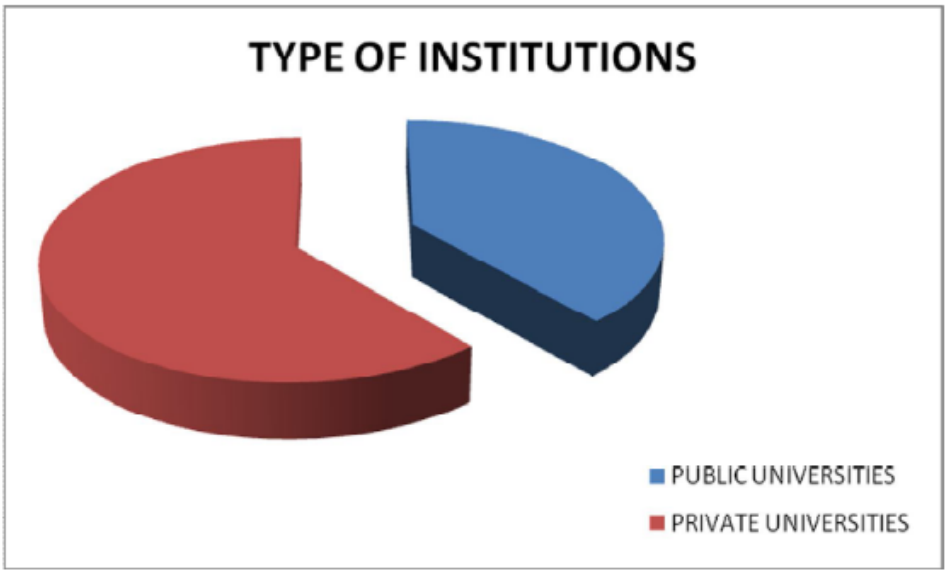

Figure 4. Comparison of Public (blue – on right) vs. Private (red)

Due to the already mentioned absence of systems of accreditation for programs in several of the countries examined, coupled with the fact that, given the different strategy employed by private universities, as opposed to the public. Having GCREAS offer an engineering program accreditation system that will seek international recognition, as GCREAS intends to do, may be of strategic interest to the private institutions.

One aspect that has surfaced on several occasions during the exchange of information during the writing of the base study is the fact that, in many cases, institutions are trying to carry out reform processes and reorganization of the university system. For example, Honduras sees accreditation as a desirable process that is placed as the last item in a series of restructuring measures. From that standpoint, GCREAS can use, both strategically and in marketing, the design of the program accreditation process, not only as an end in itself, but as a useful tool for the reorganization and improvement of operating higher education systems.

Finally, it is noteworthy that the current international situation in general and particularly in the area under study, may also make especially attractive possibility of an accreditation system for programs that give an international perspective to training like the Engineer.

Proposed accreditation model for the Greater Caribbean region

Based on the analysis of strengths and weaknesses of different accreditation systems, analysis of the context of the Greater Caribbean region, the feedback of stakeholders in the region, and taking as main reference information the accreditation systems ABET and CEAB, at the request of Steering Committee of GCREAS, a proposal was developed for the GCREAS accreditation system.

The proposal includes:

- A summary table that defines the best practices for each aspect of the system, referring to CEAB and ABET as reference systems, as well as contributions from other systems that have been analyzed and considered valuable.
- An explanatory outline of the proposal before the Committee for each of the topics.
- An organizational structure and operational leadership proposal, explaining the roles of different positions.
- Details of each stage of the accreditation process, with a description of the relationship between them by means of a flowchart.
- Description of the proposed model for the system, with a detailed statement of content and method of evaluation of each of the criteria.

The proposal by the consultant team to GCREAS is that it create a system that accredits professional degrees in engineering and recommends that engineering program accreditation be voluntary. Once the system has gained a level of maturity and has become established internally, it can then expand its reach to accredit technology degrees.

GCREAS owners shall be representatives of different sectors (professional, industry, government and academia). The organization shall have a simple structure with a Council, an Executive Director, staff support and advisory councils in the engineering disciplines. This was established to involve the different stakeholders and establish a streamlined form of government with a simple structure.

In order to have a framework to guide the actions of GCREAS, policies will be establish to address confidentiality, conflict of interest, flexibility, simplicity and replicability.

The proposed system also seeks to encourage innovation and continuous improvement of the programs, so the model proposed is simple, flexible and focused on results. Its structure and content has many similarities with other system signatories of the Washington Accord (analyzed in this study), especially with the U.S. ABET model and the Canadian CEAB model. This was established considering the interests of stakeholders to facilitate the future incorporation into the Washington Accord. Also noted is the importance of simplicity and the focus on results in the Washington Accord member schemes.

The proposed evaluation procedure contains the minimum steps required for a process of accreditation in all cases studied, but also incorporates a stage prior to review self-assessment report, and an accreditation recommendation stage by advisory councils. The preliminary review stage of the self-assessment report was established to facilitate the external evaluation process and have sufficient and complete documentation provided by the program. The accreditation recommendation stage by advisory councils is important as an intermediate step that will be useful to ensure objectivity and consistency in decision making by the Council. The following diagram summarizes the approach of the proposed procedure for implementing the model.

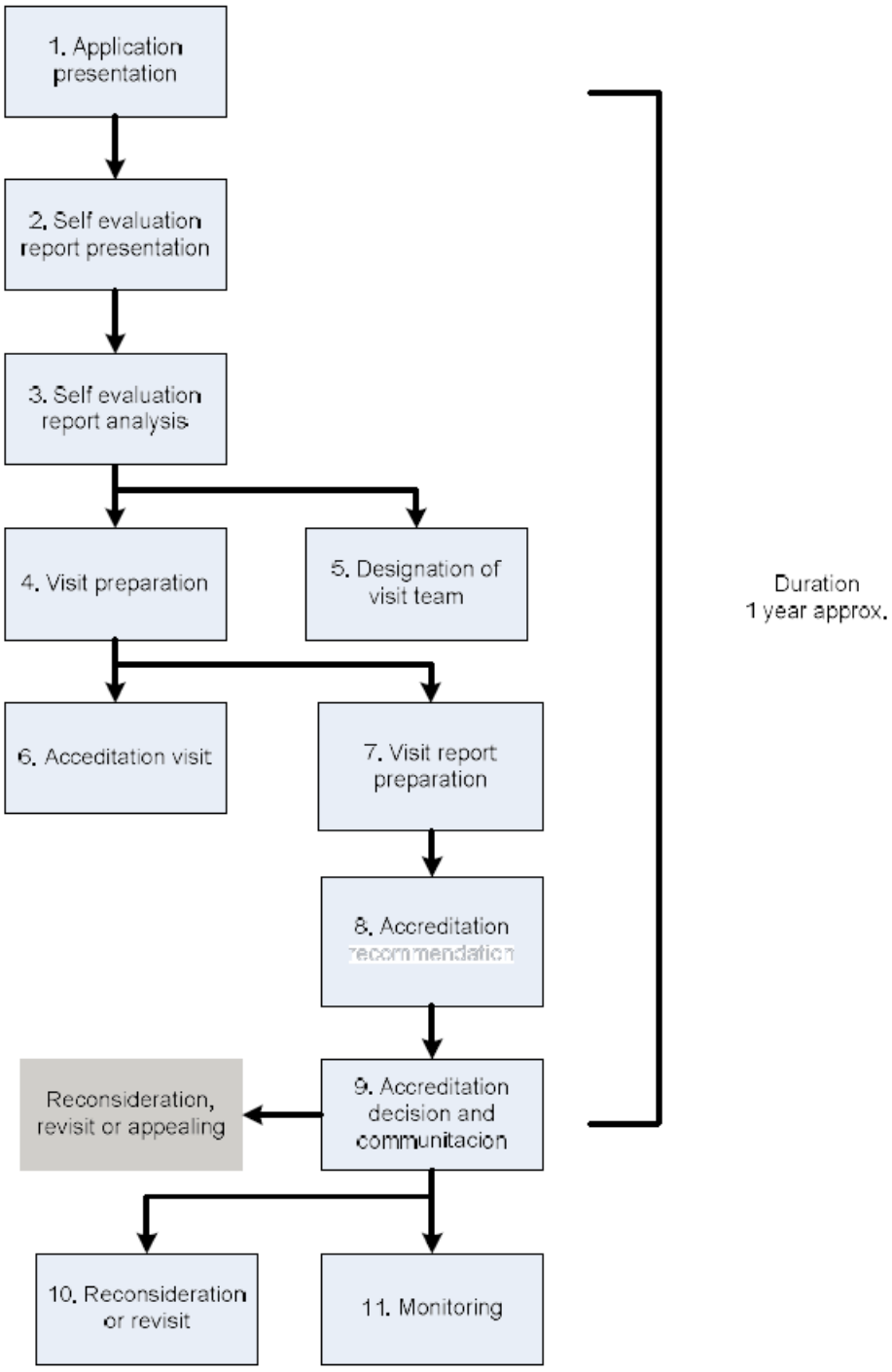

Figure 5. The GCREAS Accreditation Process Steps – duration is approximately one year from application to decision

The assessment team proposed is composed of three members from academia and industry. The inclusion of representatives of both sectors is particularly important for a system that evaluates the quality of engineering careers and results in achieving the required expertise in these

professionals. One of the team members must be from the same country as the institution being evaluated to ensure that the contextualization of the national situation and thus the objectivity in applying the model to the realities of different countries.

The proposal indicates that GCREAS should have various funding sources and establish an accreditation fee to ensure its basic sustainability. The fees established will cover most of the direct costs of the process, though not all administrative costs and normal system operation. This does not preclude considering the characteristics of an educational institution, and having the ability of awarding subsidies or additional help the institution to complete the process.

GCREAS need to establish as its goal attaining international recognition and linkages to national accreditation systems. Therefore it is important to establish international agreements that promote mutual recognition, the linkage and cooperation.

Details of the complete report can be found at the GCREAS website: www.caribengine.org

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[13] CACEI – Consejo de Acreditación de la Enseñanza de Ingeniería, Mexico http://www.cacei.org/

[14] SINAES – Sistema Nacional de Acreditación de la Educación Superior. http://www.sinaes.ac.cr

[15] CAAM-HP - Caribbean Accreditation Authority for Education in Medicine and Other Health Professions. http://caam-hp.org/

Appendix A: Washington Accord Signatories

The Washington Accord[7] signatories (year signed) are:

- Australia - Represented by Engineers Australia (*1989*)
- Canada - Represented by Engineers Canada (*1989*)
- Chinese Taipei - Represented by Institute of Engineering Education Taiwan (*2007*)
- Hong Kong China - Represented by The Hong Kong Institution of Engineers (*1995*)
- Ireland - Represented by Engineers Ireland (*1989*)
- Japan - Represented by Japan Accreditation Board for Engineering Education (*2005*)
- Korea - Represented by Accreditation Board for Engineering Education of Korea (*2007*)
- Malaysia - Represented by Board of Engineers Malaysia (*2009*)
- New Zealand - Represented by Institution of Professional Engineers NZ (*1989*)
- Singapore - Represented by Institution of Engineers Singapore (*2006*)
- South Africa - Represented by Engineering Council of South Africa (*1999*)
- United Kingdom - Represented by Engineering Council UK (*1989*)
- United States - Represented by Accreditation Board for Engineering and Technology (*1989*)

Provisional signatories to the Washington Accord include:

- Germany - Represented by German Accreditation Agency for Study Programs in Engineering and Informatics
- India - Represented by National Board of Accreditation of All India Council for Technical Education
- Russia - Represented by Russian Association for Engineering Education
- Sri Lanka - Represented by Institution of Engineers Sri Lanka