Moving Towards International Recognition of Computer Science and Information Technology University Programs Through Latin American Accreditation Bodies with the Seoul Accord: CONAIC a Mexico Case Study

Avanzando Hacia el Reconocimiento Internacional de los Programas Universitarios de Informática y Tecnología de la Información mediante los Organismos de Acreditación de América Latina con el Acuerdo de Seúl: CONAIC, un caso de estudio en México

Raul Valverde .[1].
[1] CONAIC & Concodia University

Resumen. Debido a las tendencias de globalización, los profesionales de informática y tecnología de la información exigen ser graduados de programas reconocidos internacionalmente, la necesidad de programas reconocidos internacionalmente ha sido reconocida por muchos países, que han firmado acuerdos internacionales para el reconocimiento mutuo, como el Acuerdo de Seúl que es un acuerdo de acreditación para los organismos profesionales de informática y tecnología de la información responsables de la acreditación en sus países signatarios. El artículo describe el Acuerdo de Seúl como un acuerdo que brinda movilidad a los profesionales de la tecnología de la información. Se presenta un caso de estudio en la región de América Latina con CONAIC en México, que recientemente se convirtió en signatario provisional y analiza los desafíos que representa convertirse en un miembro pleno del acuerdo.

Palabras Clave: Acreditación internacional, CONAIC, Acuerdo de Seúl, Licencias, movilidad internacional..

Summary. Due to globalization trends, computer science and information technology professionals demand to be graduates of internationally recognized programs, the need for international recognized programs has been acknowledge by many countries, which have signed international accords for mutual recognition such as the Seoul Accord that is an international accreditation agreement for professional computing and information technology bodies responsible for accreditation in its signatory countries. The article describes the Seoul Accord as an agreement that provides mobility of information technology professionals. A case study in the Latin American region is presented with CONAIC in Mexico that recently became a provisional signatory and discusses the challenges that represent to become a full signatory member of the accord.

Keywords: International accreditation, CONAIC, Seoul Accord, Licensing, international mobility.

1 Introduction

Due to globalization trends and the increase in multi-national computer technology projects, it is critical for the computer science and information technology professionals to be graduates of internationally recognized programs [1]. Many countries have established accrediting agencies for computer science and information technology programs, which permit graduates from these accredited programs to practice computer related careers at the in that country [2][3]. The need for international recognized programs has been acknowledge by many countries, which have signed international accords for mutual recognition. This is the case of the Seoul Accord that is an international accreditation agreement for professional computing and information technology academic degrees, between the bodies responsible for accreditation in its signatory countries. This agreement mutually recognizes tertiary level computing and IT qualifications between the signatory agencies. Graduates of accredited programs in any of the signatory countries are recognized by the other signatory countries as having met the academic requirements as IT professionals [4].

The article describes the Seoul Accord as an agreement that provides mobility of information technology professionals and then presents the case study of Mexico (CONAIC) that recently became a provisional signatory and discusses the challenges that represent to become a full signatory member of the accord.

1.1 Seoul Accord

The Seoul Accord is an international accreditation agreement for professional computing and information technology academic degrees, between the bodies responsible for accreditation in its signatory countries [5]. The Seoul Accord covers tertiary undergraduate computing degrees. Engineering and Engineering Technology programs are not covered by the Seoul accord, although some software engineering programs have dual accreditation with the Washington Accord [5]. The signatories as 2016 are described in table 1 [6]:

Table 1 Signatories of the Seoul Accord

The signatories as of 2016
Australia Computer Society (ACS)
Canadian Information Processing Society (CIPS)
Japan (JABEE)
South Korea (ABEEK)
British Computer Society (UK)
USA (ABET/CAC - IEEE-CS & ACM)
Chinese Taipei - (Institute of Engineering Education Taiwan)
Hong Kong China - (The Hong Kong Institution of Engineers)

The following are provisional signatories of the Seoul Accord, along with their respective countries and territories and years of admission [6]:

- Ireland - (Engineers Ireland)
- New Zealand - (Institute of IT Professionals)
- Philippines - (The Philippine Information and Computing Accreditation Board]
- Mexico (Consejo Nacional de Acreditación en Informática y Computación)

The Seoul Accord acts as a multi-lateral agreement among agencies responsible for accreditation or recognition of tertiary-level computing and IT-related qualifications [5]. These agencies have chosen to work collectively to:

- Assist the mobility of computing and IT-related professionals holding suitable qualifications and
- Improve the quality of tertiary-level computing and IT-related education.

The Seoul Accord provides curriculum requirement and outcomes that Information and Communications Technology (ICT) graduates should attain by the time of their graduation among others. The quality and mobility of ICT graduates can be facilitated through the accreditation of ICT programs [5].
The signatories have exchanged information on, and have examined, their respective processes, policies and procedures for granting accreditation to academic computing and IT-related programs, and have concluded that these are comparable. Through the Seoul Accord, the rules and procedures and the graduate attributes, the signatories recognise the equivalence of such programs in satisfying the academic requirements for preparation to enter computing or IT-related practice at the professional level [6].

The signatories therefore agree [6]:

a) That the criteria, policies, and procedures used by the signatories in accrediting academic computing and IT-related programs are comparable;
b) That the accreditation decisions rendered by one signatory are acceptable to the other signatories, and that those signatories will so indicate by publishing statements to that effect in an appropriate manner;
c) To identify, and to encourage the implementation of, best practice, as agreed from time to time amongst the signatories, for academic preparation for computing and IT-related practice at the professional level;
d) To continue mutual monitoring and information exchange by whatever means are considered most appropriate, including:
e) Regular communication and sharing of information concerning their accreditation criteria, systems, procedures, manuals, publications and lists of accredited programs;
   i. invitations to observe accreditation visits;
   ii. invitations to observe meetings of any boards and/or commissions responsible for implementing key aspects of the accreditation process, and meetings of the governing bodies of the signatories.

Each signatory makes every reasonable effort to ensure that any bodies responsible for registering or licensing computing and IT-related professionals to practice in its country or territory accept the equivalence of academic computing and IT-related programs accredited by the signatories to this agreement. The admission of new signatories to the Accord will require the approval of the existing signatories according to procedures specified in the Rules and Procedures of the Accord, and will be preceded by a prescribed period of provisional status, during which the accreditation criteria and procedures established by the applicant, and the manner in which those procedures and criteria are implemented, will be subject to comprehensive examination. The signatories agreed that appropriate rules and procedures for the Accord will be established by the signatories to ensure that this Agreement can be implemented in a satisfactory and expeditious manner [6].
The accord requires general meetings of the representatives of the signatories, as specified in the rules and procedures, to review the rules and procedures and other documents relative to the accord, effect such amendments as may be considered necessary to the documents, deal with applications for provisional status and for admission, and consider other matters relative to effective operation of the Accord in achieving its objectives. The administration of the accord is facilitated by a secretariat established and operated in accordance with the rules and procedures made under the provisions of this agreement. Any signatory wishing to withdraw from the Accord must give at least one year's notice to the secretariat. Removal of any

signatory may occur only as specified in the Rules of Procedure. The Accord will remain in effect for so long as it is acceptable and desirable to the signatories [6].

1.2 Mexico Accreditation for Computer Science and Information Technology programs

In Mexico, for computer science, software engineering, computer engineering and information technology programs, there are two types of accrediting bodies which (accreditation.org) are [7]:

- National: CACEI (Consejo de Acreditación de la Enseñanza de la Ingeniería), and CONAIC (Consejo Nacional de Acreditación en Informática y Computación)t hat is an organization focused on computing and information systems programs.

- Multinational: ABET (Accreditation Board for Engineering and Technology).

Table 2 show the number of programs accredited in Mexico by these three agencies [7].

Table 2 Accreditations Paths followed in Mexico

Path	# of Programs	%
National-Only	835 • CACEI: 773 • CONAIC: 62	97.8% • CACEI: 90.5% • CONAIC: 7.3%
National + ABET	17 • CACEI + ABET: 16 • CONAIC + ABET: 1	2.0% • CACEI + ABET: 1.9% • CONAIC + ABET: 0.1%
ABET-Only	11	1.3%
Total	854	

COPAES (Consejo para la Acreditación de la Educación Superior, A. C., the Council for the Accreditation of Higher Education) was established in 2000 by the Secretary of Education as a non-government umbrella organization for program accreditation in Mexico [8]. COPAES recognized CACEI (established in 1994) and CONAIC (established in 1995) as their affiliates for the accreditation of engineering programs and computer and information systems programs [7].

CONAIC outlines the metrics and standards of educational programs in computer and information technology given on campus and distance [9]. CONAIC promotes the internationalization of these programs by establishing links with international accrediting agencies and by promoting the adoption of international quality standards in order achieve the level of competitiveness required by globalization market trends in the IT industry [10]. Table 3 shows the programs accredited by CONAIC from 2010 to 2015 [11] .

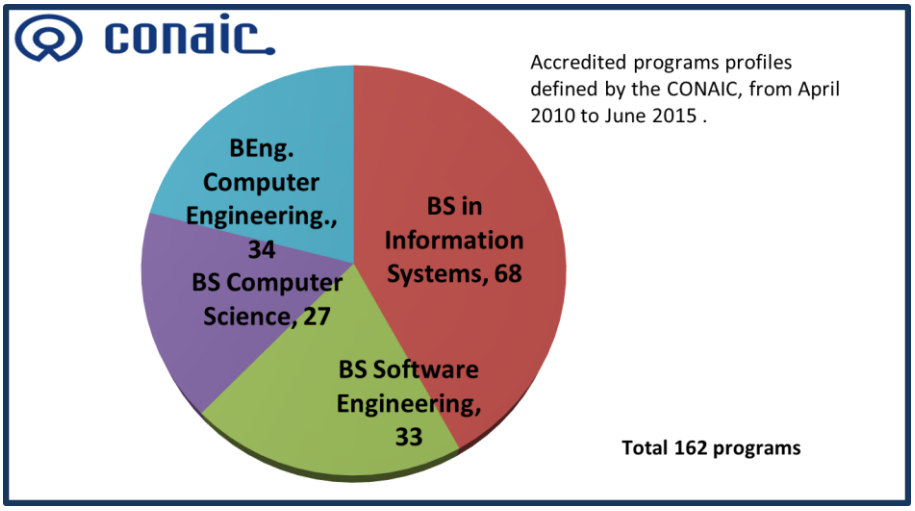

Figure 1 Accredited programs of CONAIC

Some Universities in Mexico opt for the hybrid path. This path involves both national accreditation (CACEI or CONAIC) and international accreditation (ABET). All of them had been granted national accreditation before seeking the ABET accreditation. A major deterrent for it might be the cost of accreditation and the effort required to achieve it. There is a growing interest in entering into this path, by programs subject to intense competition (such is the case of programs at private universities). The path is considered as a symbol of being a premium program as a program with an international quality. It provides mobility to those students seeking to get recognition in the USA market as many US employers require graduates from ABET accredited schools [7].

The number of accredited programs on the National-only path can be expected to keep on growing. Factors determining such a growth include:

i. The possibility that accreditation would eventually become required by the Secretary of Education.

ii. The need to provide a more recognized credential to prospect students so they can be more competitive not only in the national but international market.

CONAIC has taken since 2010 the initiative to approach international organizations such as the Accreditation Board for Engineering and Technology (ABET) and the Computing Sciences Accreditation Board (CSBA) for feedback of its accreditation standards that seeks improvements in order to be well positioned at the international level and be recognized at the same level as other well known international accreditation bodies. Participation as board members in evaluation committees for international accreditation associations (e.g. Seoul Accord) ensure that agreements with international organizations related to the area of information technology are met and spread across accredited members of CONAIC. CONAIC has established closer ties with European bodies such as the European Network for Accreditation of Engineering Education (ENAEE), who gives the EUR-ACE Framework Standards for the accreditation of Engineering programs in the European Union [12].

1.3 Seoul Accord requirements for accreditation

Prospect signature members of the Seoul Accord must send an application received by the Secretariat no later than 120 days before the commencement of a meeting of the Accord at which the application is to be considered. The application must be supported by two signature members of the Seoul Accord. The secretariat must distribute the application to all signatories no later than 90 days before the commencement of the Accord meeting at which the application will be considered. Any signatory may provide written questions to

the secretariat no later than 60 days before the Accord meeting, in which case the applicant has until 30 days prior to the meeting to provide written answers to the secretariat for distribution of both the questions and answers to all signatories so that they can be considered before the Accord meeting. An applicant's representative must appear in person at the Accord meeting to formally present the application and answer questions [6].

The Seoul Accord application should include the following points [6]:

I. ACCREDITING/RECOGNISING ORGANIZATION: The name of the organization. List the names of the officers of the organization with brief CVs. The applicable jurisdiction for the organization, and the affiliations of the organization with other computing and IT-related bodies, government, and industry within the jurisdiction.
II. INTRODUCTION: A general information about the jurisdiction and the context of computing and IT.
III. EDUCATION: A description of primary, secondary, and tertiary education. A description of the nature of programmes, including admission standards. The number and type of institutions offering computing and IT-related programmes indicating whether the institutions are public or private.
IV. STRUCTURE OF THE COMPUTING AND IT-RELATED COMMUNITY: Description of the context of computing and IT-related practice and the degree of regulation (i.e., registration or licensing). Description if there is a protected title and scope of practice. Description of any differing categories of computing and IT-related practitioners and their academic requirements. Description of the relationship of the organization to licensing, registration, or certifying agencies, and the extent to which the organization can influence the acceptance of accreditations/recognition by those agencies.
V. ROLE OF ACCREDITATION/RECOGNITION: Description of the role of accreditation/recognition within the jurisdiction. Given that accreditation is normally voluntary, description of the degree of participation.
VI. ACCREDITATION/RECOGNITION SYSTEM: Description of the development of the accreditation/recognition system and its maturity. A description of the accreditation/recognition board including its composition and authority. List the objectives of accreditation/recognition. The criteria for accreditation/recognition (general, program specific; curriculum content – technical and non-technical; incorporation of practical experience; length of the program; naming of the program; faculty requirements). Details for conducting the accreditation/recognition evaluation and making the accreditation/recognition decision; include relevant documentation (initiation of visit; self evaluation questionnaire; selection of evaluation team; organization of the visit; due process). A list of currently accredited/recognised programs and a schedule of upcoming evaluations. Description of the relationships with external computing and IT-related organizations including any agreements.

Provisional signatory membership is achieved upon assessment based on documentation. Full signatory membership can be achieved only through a detailed evaluation, including close interaction and planned visits to observe accreditation/recognition procedures. Applicants must also give the opportunity for the nominators, and some other signatories, to be present at key decision points where the quality of student learning is evaluated against accreditation/recognition criteria [6].

Ultimately, the applicant must demonstrate that the level and content of the studies of accredited/recognized programmes are equivalent to those of the current signatories in preparing graduates to enter a computing or IT-related profession. Therefore, the program must be offered at an appropriate tertiary-level institution. The duration of academic formation will normally be at least sixteen years [6].

Accreditation/recognition systems should adhere to the following general characteristics [6]:

1. The signatories to the Accord are authorities, agencies, or institutions that are representative of the computing and IT-related community and that have statutory powers or recognized professional authority for accrediting/recognition programs designed to satisfy the academic requirements for professional computing and IT-related practice within a defined jurisdiction (e.g. country, economy, geographic region).
2. Any such authority, agency or institution must be independent of the educational providers delivering accredited programs within their jurisdiction and should also be free from influence or control over accreditation/recognition decisions by other organizations.
3. An accreditation/recognition system must be in place with well-documented accreditation/recognition procedures and practices. Accreditation/recognition of programmes is expected to conform to generally accepted principles such as:
    a) The system must operate at all times in accordance with high standards of professionalism, ethics and objectivity;
    b) The process must be transparent and consistent and the activities in relation to individual programs must be conducted in confidence;
    c) Those involved in the accreditation/recognition process must have access to knowledge and competence in matters related to computing and IT-related accreditation/recognition, computing and IT-related education and computing and IT related practice.
    d) Accreditation/recognition is of individual programmes or of coordinated groups of programmes quality-assured as a whole.
    e) Evaluations of programs are conducted by peer reviewers and include a self-evaluation and site visit.
    f) The criteria for accreditation/recognition should include requirements for:
        i. A suitable environment to deliver the program;
        ii. Adequate leadership for the program;
        iii. Suitably qualified computing and IT-related professionals teaching in the program;
        iv. A curriculum providing a broad basis for computing and IT-related practice;
        v. Appropriate entry and progression standards;
        vi. Adequate human, physical and financial resources to support the program.
        vii. The process should include periodic re-evaluation to maintain accreditation/recognition status.

2 Research Methodology and Data Collection

This study used a case study research method, where data was collected from primary and secondary data sources. A case study "involves the investigation of a particular situation, problem, company or group of companies" [12]. Secondary data, or supporting data, was collected from related books, journals, on-line articles, and the Seoul Accord and CONAIC websites. The Case Study methodology has a history of success in Information Systems Research [14] [15]. The case study used for this research is the CONAIC accreditation body in Mexico. CONAIC is a good representation of the Latin American effort to create accreditation bodies for computing related programs. The research is based on the preparation of a document that is meant to meet the accreditation requirements for the Seoul Accord. The objective of this research is to show prospect accreditation bodies in Latin America the set of processes and governance required to meet the accreditation requirements of the Seoul Accord.

2.1 Case Study for Seoul Accreditation: CONAIC

This section describes the main points used to support the membership as a provisional signatory of CONAIC in the Seoul Accord.

The CONAIC is an umbrella organization recognized by the Council for Accreditation of Higher Education, AC (COPAES), thanks to its credibility, nationally and internationally, effective and efficient coverage, which makes evaluation processes programs and computing purposes accreditation, ensuring continuous improvement of academic processes of teaching and computing, with the participation of different sectors related to training and practicing professionals and computing in all fields. The creditor CONAIC is internationally recognized, being solely responsible in Mexico accreditation processes of software and IT Higher Education and Higher Media in different educational modalities body. The current president is Dr. Francisco Javier Álvarez Rodríguez and CEO is Dr. Alma Rosa García Gaona [10].

CONAIC's main mission is to support the quality of educational programs in the area of IT and computer science that are offered in public and private higher education institutions in Mexico and ensure their academic relevance in the national and international level, enabling society to clearly identify in them a certain set of standards and guidelines that ensure a high level of quality in their academic world. CONAIC is an organization recognized by the Council for the Accreditation of Higher education (COPAES). CONAIC is owner of international recognition, being the only organization in Mexico responsible for the accreditation process of Computer Science and IT programs in both higher and lower educational institutions in different education modalities. CONAIC's main objectives are to promote and to contribute for the improvement of the quality of training of professionals in the computing areas [10].

2.2 Education in Mexico

Education in Mexico is currently regulated by the Secretariat of Public Education (Spanish: Secretaría de Educación Pública) (SEP). Education standards are set by this Ministry at all levels except in "autonomous" universities chartered by the government (e.g., Universidad Nacional Autónoma de México). Accreditation of private schools is accomplished by a mandatory approval and registration with this institution. In Mexico, basic education is normally divided in three steps: primary school (primaria), comprising grades 1-6; junior high school (secundaria), comprising grades 7-9; and high school (preparatoria), comprising grades 10-12.

There are both public and private institutions of higher education. Higher education usually follows the US education model with an at least 4-year bachelor's degree undergraduate level (Licenciatura), and two

degrees at the postgraduate level, a 2-year Master's degree (Maestría), and a 3-year Doctoral degree (Doctorado). This structure of education very closely conforms to the Bologna Process started in Europe in 1999, allowing Mexican students to study abroad and pursue a master's degree after Licenciatura, or a Doctoral degree after Maestría.

Universities and other institutions of higher education in Mexico that are given autonomy to govern themselves by the government have the objective to educate, conduct research and promote culture respecting the principles of academic freedom. Institutions of higher education would be able to determine their admission standards, tenure of academic staff and management of their assets.

The different types of higher institution include:

- Federal public universities: This type of institutions not only have a teaching function but also have a wide spectrum of programs and research projects and promotion of culture. Mexico has currently 9 institutions of this type.
- State public universities: Institutions of higher education that were created by decree of local state authorities, under the jurisdiction of public organisms decentralized. These state institutions carry out the functions of teaching, generation and innovative application of knowledge and dissemination of culture. There are currently 34 institutions of this type.
- State Public universities with Solidarity Support: The State Public Universities with solidarity support are those that receive contributions from the budget program and whose funding comes primarily from the State Governments while the Federal Government contributes with solidarity support agreed with the respective state. As state public universities, they develop the functions of teaching, generation and innovative application of knowledge and extension and dissemination of culture. There are currently 23 State Public Universities with Solidarity Support.
- Technological Institutes: On July 23, 2014 it was published in the Official Gazette, the Presidential Decree for which it creates the largest institution of the country, the National Technology Institute of Mexico. According to the decree, the TecNM is founded as an agency of the Ministry of Education, which replaces the administrative unit in charge of coordinating this important higher education subsystem was made. There are currently 132 Technological institutes.
- Technological Universities: Technological Universities (UTs) offer students completing higher secondary education, intensive training that allows them to enter the market in a short period of time (after two years), to perform productive work or continue their studies to a degree level in other higher education institutions. The Educational Model of UTs is oriented learning as a process throughout life, focused on the analysis, interpretation and proper use of the information. There are currently 104 Technological Universities.
- Polytechnics Universities: These are an educational project created in 2001 to offer engineering degrees and postgraduate level of education. Their programs are designed based on the educational model based on competencies and are oriented applied research to technological development; while they are carrying close collaboration with the productive organizations, public and social sectors. There are currently 50 State Polytechnics Universities.
- Intercultural Universities: Their mission is to promote the training of professionals committed to economic, social and cultural development, particularly the indigenous peoples of the country and the surrounding world; revalue the knowledge of indigenous peoples and foster a process of synthesis with the progress of scientific knowledge; encourage the dissemination of the values of communities and open spaces to promote the revitalization, development and consolidation of native languages and cultures. There are currently 12 Intercultural Universities.
- Public Research Centers: Public Research Centers are comprised of Public Centers such as CONACYT (The National Council on Science and Technology), Research Centers of IPN (National Polytechnic Institute), as well as research centers from the states of Tamaulipas, Jalisco and Chihuahua respectively and the UNAM (national autonomous university of Mexico). Their main objectives include to disseminate science and technology; innovate in the generation, development, assimilation and application of knowledge of science and technology; integrate science and technology for the solution of problems in society and the productive sector and create and develop mechanisms and incentives that

encourage the contribution of the private sector in scientific and technological development, among others. There are currently 71 Public Research Centers

- Public Normal Schools: These are responsible for training teachers of elementary and secondary education. Work done through the normal network nationwide. Normal Schools of Higher Education offer, among others, degree programs in preschool, elementary, intercultural bilingual primary, secondary, special, initial physical and artistic education.
- Other Public Institutions: The system of public higher education in Mexico is diverse. Therefore, there are institutions that according to their characteristics are not possible to classify them in any of the above subsystems. There are currently 86 other public institutions.

2.3 Structure of the Computing and IT-related community

Mexico has many important research centers in the area of computer science and information technology. The most important research centers include: the Center for Research in Mathematics (CIMAT) based in the city of Guanajuato, the Computer Research Center (CIC) of the National Polytechnic Institute, the National Advanced Computer Laboratory (LANIA) In Xalapa, Veracruz; The National Institute of Astrophysics, Optics and Electronics (INAOE) and the Department of Computer Science of the Center for Scientific Research and Higher Education of Ensenada (CICESE).

In addition to CONAIC, there is another accreditation agency recognized by the federal government that accredits engineering programs that are related to IT including programs in electronics engineering and telecommunications. Universities that have computer engineering programs can be accredited by CONAIC and/or CACEI. This is the Accreditation Council for the Teaching of Higher Engineering, A.C. (CACEI) that is a non-profit civil association. Its primary objective is to ensure that higher education institutions (HEIs) offer quality education to future graduates through the accreditation of educational programs in this field of knowledge. CACEI is the first accrediting agency for undergraduate engineering degree programs in Mexico, internationally recognized by the Washington Accord as part of the International Engineering Alliance (IEA) and member of the Ibero-American Network for Quality Assurance for Higher Education (RIACES). Operates since July 1994 and is recognized by the Council for Accreditation of Higher Education, A.C; (Copaes).

A program recognized by CONAIC facilitates the process of acquiring a Mexican professional license granted by SEP (Mexican Professional Licensing Authority), although this license is not a prerequisite for professional, this is beneficial to provide proof of competency in the Mexican market. This provides mobility to those seeking employment in Mexico.

Mexican professional licenses are recognized for the purpose of NAFTA (North American Free trade agreement with USA and Canada) work permits. This provides an advantage to those seeking mobility in North America.

2.4 Role of accreditation and recognition

The National Council for Accreditation in Informatics and Computing (CONAIC) is responsible for carrying out the accreditation process, implement and enforce the policies set by this body. These processes and policies are based on standards, norms, processes and policies established by different assessment bodies, certifiers and accreditation bodies that are national and international; among which are:

- The Ministry of Public Education (SEP, Mexico);
- Inter - institutional Committees for the Evaluation of Higher Education (CIEES, Mexico);
- The Council for Accreditation of Engineering Education (CACEI, Mexico);
- The Computer Science Accreditation Board (CSAB, USA);
- The Accreditation Board for Engineering and Technology (ABET, USA);
- The Canadian Engineering Accreditation Board (CEAB, Canada);

The objectives pursued with the accreditation process are:

I. Accredit academic programs of Higher education in computer science and information technology that meet the quality standards set by the CONAIC;
II. Promote and contribute for the improvement of the quality of teaching of computer and information technology professionals enrolled in accredited programs;
III. Provide information about accredited programs to society (including applicants, educational institutions, professionals, scientific societies, potential employers and government agencies);
IV. Provide guidance and suggestions for the improvement of accredited academic programs and the design and development of future programs candidates for accreditation;
V. Promote the improvement of information technology and computer sciences at national level;
VI. Ensure that graduates of accredited academic programs have obtained a vast array of relevant knowledge in their areas of competence.

The accreditation process considers only those academic programs of Higher education at the university level in computer science and information technology within the 32 states of the Mexican Republic. These academic degree programs must have one of the following recognitions:

I. Recognition of Official Validity of Studies (RVOE) awarded by the SEP (or by the state government where the school is geographically located);
II. Being part of a public or private institution of higher education that has official recognition of educational autonomy;
III. Be incorporated into any public or private institution of higher education that has official recognition of educational autonomy.

Although the accreditation is voluntary, up to date 175 programs have been accredited by CONAIC (CONAIC 2018).

2.5 Accreditation process

The accreditation process includes two main methods of assessment, namely the application of questionnaires and the visit of a group of evaluators.

1. Questionnaires: An academic program of higher education in computer and informatics will be initially assessed on the basis of data provided by the institution that is captured in a self-assessment questionnaire; this questionnaire is based on the evaluation criteria defined by the CONAIC. It is suggested that in answering this questionnaire, the school involves the participation of administrators, academic staff and a select group of students. Academic programs that do not comply in a timely manner for this self-assessment will not be considered for the accreditation process. The information contained in these questionnaires will be verified by a group of evaluators in the visit to the academic institution. The evaluation criteria and their corresponding questionnaires are described in the document "Criteria for Accreditation" and "Questionnaire for self-evaluation" specific for each level of education (e.g. BS, MS, and PhD).

2. Visits: After the self-evaluation has been sent to the Accreditation Committee, a group of evaluators appointed by this Committee will visit the institution in order to evaluate on site the academic program into consideration. The visit primary purpose is:

    I. To evaluate factors that cannot be described adequately in the questionnaires. Some of these are intangible and difficult to evaluate. Some of these qualitative factors include: academic and intellectual atmosphere, the quality of both the academic staff and the student body and the nature of academic work

    II. To examine in detail the institutional material that includes:

        - Academic staff
        - Students
        - Curriculum
        - Learning Assessment
        - Integral formation
        - Support Services for Learning
        - Linking - Extension
        - Research
        - Infrastructure and Equipment
        - Administrative Management and Financing

In the accreditation process two primary entities are distinguished: The school and the Accreditation Committee. The interaction of these entities triggers a series of events that must be met in due dates previously stipulated by the Accreditation Committee. In turn, between two consecutive events, there are a number of processes that each entity must carry out in order to successfully complete the accreditation process.

The detailed description of the accreditation process is presented below in figure 2, 3 and 4. These figures specify the participating entities, three types of events are distinguished (before the visit during the visit and after the visit) and a brief description of the processes described below is provided.

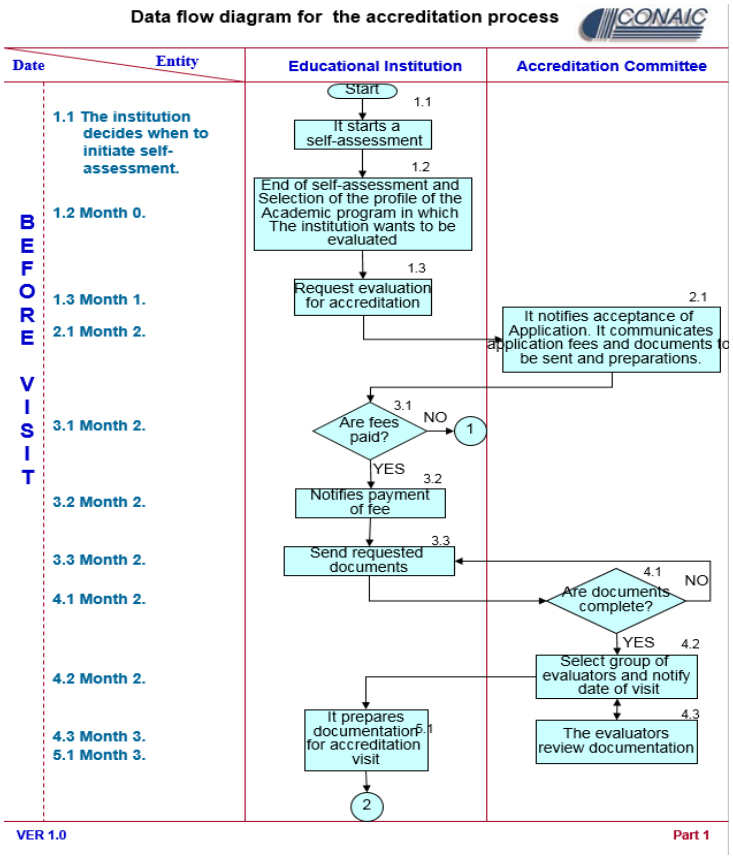

Figure 2 Data flow diagram for the accreditation process (part 1)

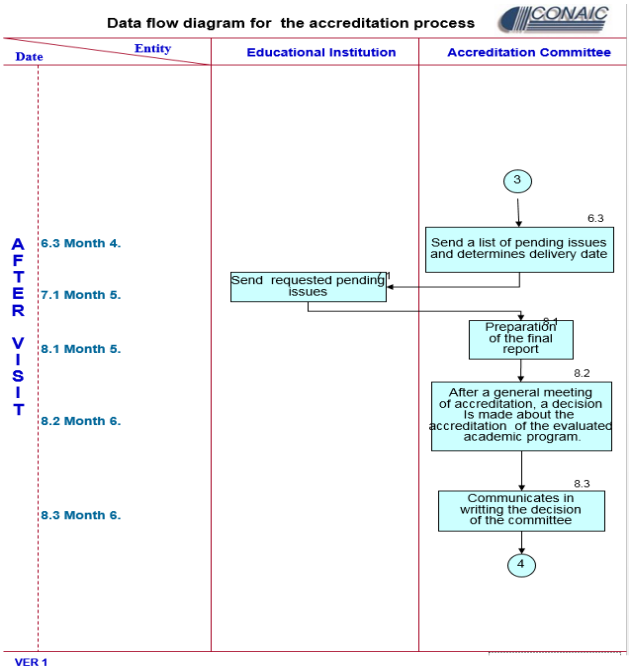

Figure 3 Data flow diagram for the accreditation process (part 2)

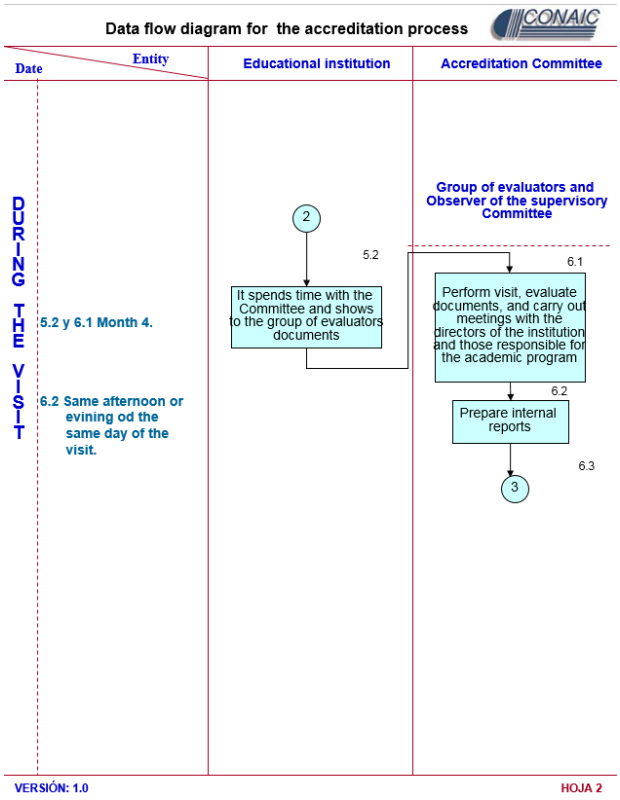

Figure 4 Data flow diagram for the accreditation process (part 3)

3 Future challenges for CONAIC

Although CONAIC is a provisional member of the Seoul Accord, it has to still pass an accreditation visit in order to become a full signatory of the accord. Below the main points to consider for the accreditation visit,

The evaluation focuses on three main points:

1. Accreditation processes and System
2. Substantial equivalence of programs to those of the Seoul accord:
3. Maturity and sustainability systems:
    a) How internal audits and sampling are done to ensure integrity in finances and processes
    b) How decisions are made
    c) Projections for the future regarding finances and budgets
    d) Consistency and scalability of the process in case of growth

Point 2 can be a challenge as this is something that could be subjective but the descriptions could be revised in order to detect possible deficiencies. In order to minimize the risk of failure, a mentor was requested to the Seoul accord that could help to review processes and documentation by observing a sample accreditation evaluation conducted by CONAIC in order to detect deficiencies before requesting an accreditation visit.

More general points to consider for the accreditation visit include:

1. Four programs and financial projections will be examined during the accreditation visit
2. A sample of program evaluators will be interviewed
3. Evaluation of how policies and evaluation decisions are made
4. Two visits will be made: Post-visit (check that the problems have been corrected) and pre-visit (detect possible problems)
5. A meeting will be convened to verify consistency, and give the results of the evaluations of various programs
6. Rules and regulations governing the CONAIC and affecting the accreditations will be verified

4. Conclusions

The article presents the Seoul Accord as an international effort to provide mobility to computing professionals around the world. A great interest of becoming a signatory is apparent in accreditation bodies in Latin America, although many Latin American educational institutions have opted for international accreditation recognition with bodies with global presence such as ABET, the membership with Seoul can be cost effective as one local body can accredit multiple local institutions that then can be grandfathered with international recognition due to the signatory status of the accreditation body in the Seoul Accord.

The article presented the membership of CONAIC with the Seoul Accord as key to help Mexican professionals for mobility of IT-related professionals with appropriate qualifications around the globe. This membership would also help to improve the quality of university-level computer education related to IT in Mexico. As CONAIC's mandate is to be an international accreditation body in Latin America, the Seoul Accord membership would help CONAIC to get credibility in Latin America with Universities interested in getting CONAIC's accreditation.

The article presented the case study of CONAIC Mexico, this could be used as a good example for other Latin American accreditation bodies due to the similarities in the Latin American regions. The paper presented the main points to support membership of CONAIC with the Seoul Accord and future challenges required to become a full member.

Referencias

1. Reif, H. L.; Mathieu, R. G: Global Trends in Computing Accreditation. Computer, vo. 42, no. 11, pp. 102-104 (2009).
2. McDonald, C. :. A design pattern for responsible information systems education. In ACIS 2012: Location, location, location: Proceedings of the 23rd Australasian Conference on Information Systems (2012) (pp. 1-8). ACIS.
3. Larrondo Petrie M. M:, "Moving Towards International Engineering Program Recognition and Accreditation for Latin America and the Caribbean", in Proceedings of the Latin American and Caribbean Conference for Engineering and Technology, LACCET'05, Cartagena de la India, Colombia, 8-10 June 2005, Latin American and Caribbean Consortium of Engineering Institution, (2005).
4. Marriott, A., ; Chomba, F. : Seoul accord iportfolio template for computing students. In Proceedings of eportfolios Australia Conference 2010 (pp. 113-14) (2010).
5. Goldweber, M.; Davoli, R.; Little, J. C.; Riedesel, C.; Walker, H.; Cross, G.; Von Konsky, B. R.: Enhancing the social issues components in our computing curriculum: computing for the social good. ACM Inroads, Vol. 2 No. 1, pp. 64-82 (2011).
6. Seoul Accord. Available from:http://www.abeek.or.kr/accord/contents.jsp?menu_l=85 [Accessed 11 July 2018
7. Fraser J; Teran A.; Thi Hoa P. : Paths to Accreditation. In proceedings of 121st ASEE Anual Conference & Exposition, Indianapolis, IN, USA (2014).
8. García Gaona, A. R. ; Sánchez Guerrero L.; Álvarez Rodríguez F. : Hacia la Internacionalización de la Acreditación de los Programas de Tecnologías de la Información y Computación. Noveno Foro de Evaluación Educativa. Oaxaca, México (2010).
9. García Gaona, A. R; Toscano de la Torre B.A.; Álvarez Rodríguez F. Acreditación y Certificación como Avales de calidad en México en Programas Educativos en TIC. El Profesional de TIC y la Transdisciplinariedad, México (2016)
10 CONAIC. Available at: http://www.conaic.net. [Accessed 11 July 2018].
11. De la Torre, B. A. T.; Rodríguez, F. J. Á.: Calidad en México de los Programas Educativos en TIC desde la Perspectiva del CONAIC. Revista Iberoamericana para la Investigación y el Desarrollo Educativo, Vol 10. (2015).
12. Hernández, C. C. O.; Baez, A. G., ; Reynoso, A. M. R : Acreditación CONAIC y ABET en Instituciones de Educación Superior IES. Accreditation CONAIC and ABET in Institutions of Higher Education, Tecnologia Educativa , Vol. 4, No. 3. pp. 6-16 (2017).
13. Dawson, C. : 'Project in Computing and Information Systems: A Student's Guide Second Edition'. Pierson Education Limited. Essex. (2009)
14. Valverde, R.: The ontological evaluation of the requirements model when shifting from a traditional to a component-based paradigm in information systems re-engineering. DBA Thesis, University of Southern Queensland (2009).
15. Valverde, R. ; Toleman, Mark; Cater-Steel, A.: A method for comparing traditional and component-based models in information systems re-engineering. Information Systems and e-Business Management, Vol 9, No 1. pp. 89-107 (2011).