Paths to Accreditation

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Paths to Accreditation

Accreditation of an engineering program provides a public assurance of the quality of a program and thus of its graduates. Many countries and program see the importance of such accreditation; 66 countries have at least one accredited engineering program and 48 countries have created a national accrediting body for engineering programs (Appendix 1 shows a list of accrediting bodies in each country).

As countries increasingly recognize the importance of quality and of quality assurance in higher education.[12] a country without an existing national engineering accrediting body faces the decision of whether to develop such a body or to encourage engineering programs in the country to seek accreditation by international engineering accrediting bodies such as ABET (US), ASIIN e. V. (Germany), or EUR-ACE (Europe). An engineering program faces a similar decision. From which engineering accrediting body should it seek accreditation: a national body (if one exists), one of the international bodies, or a combination of a national and an international body? The term "accreditation path" is used in this document to represent the decision followed by an engineering program with regard to the selection of accrediting bodies.

As shown in Appendix 1 and Tables 1-6, we found that the accreditation paths differ significantly from region to region and from country to country and that accreditation involves difficult decisions for emerging countries and for programs in such countries. In order to gain better insight on the process a program might follow to decide among these paths, based on its specific circumstances, we examined two emerging countries as case studies.

We first discuss existing engineering accrediting bodies around the world, and then present the two case studies of Mexico and Vietnam. Finally we describe the factors that have and should influence the country's decision and the program's decision.

This study is in its initial stage and further research is to be pursued. As an in-process study, more questions than answers are provided. The contributions of this paper are the assembling of international data on engineering accreditation and the presentation of preliminary conclusions concerning the implications of these data for engineering programs.

Engineering accreditation

Accreditation accomplishes two purposes for engineering degree programs. First, accreditation improves the quality of programs. Second, accreditation certifies the quality of programs. Both purposes support the goals of students by ensuring high quality education and by ensuring the ability of students to use their degree to obtain employment as an engineer, entrance to a graduate program, and eventually the ability to become a licensed engineer. Both purposes also support the public goals of having high quality programs and making information about quality available.

The website accreditation.org "is intended to be the preferred resource for all information on Engineering, Technology and Computing (ETC) accreditation globally."[1] It contains information on accrediting bodies by country and information on accords involving mutual recognition

agreements, as well as information on why accreditation is important and information on engineering and engineering careers. It also has a search engine allowing search for an accredited program by degree, country, or university name. Like the accreditation.org website, we focus on accrediting bodies for engineering programs, not on more general accrediting bodies that accredit institutions as a whole.

For example, for Argentina, the website provides this information:

> The National Commission for University Evaluation and Accreditation (CONEAU) is a decentralized agency at the Argentina's Ministry of Education, Science and Technology. It is the only government agency for university evaluation and accreditation and it started operating in 1996. CONEAU was established to foster improvements of the university education in Argentina. CONEAU is in charge of the following functions: external evaluation universities; accreditation of government regulated undergraduate and graduate programs; and issuance of recommendations on institutional projects for new public universities. CONEAU also processes provisional and final applications for authorization of private institutions. It is also responsible for providing recognition to private agencies for university evaluation and accreditation. CONEAU grants accreditation to undergraduate programs issuing degrees for government regulated professions, whose exercise could endanger the health, safety, rights, property or education of the country's inhabitants. The Ministry of Education, upon recommendation of the University Council, defines which professions fall within these categories and are subjected to the CONEAU accreditation process. In these cases the Higher Education Act No. 24.521 establishes the accreditation as a pre-requisite to grant validity to degrees for a maximum period of six years. This process of accreditation of undergraduate degree courses is applicable not only to current degree courses but also applies to new degree courses.[1]

The website lists 64 universities with engineering programs accredited by CONEAU, all in Argentina. All accredited engineering programs in Argentina are accredited by CONEAU.

Among countries in South America, the accreditation situation varies. Two accrediting bodies are listed for Brazil, one for undergraduate programs and one for postgraduate programs; all accredited engineering programs in Brazil are accredited by one of those bodies. In Columbia, three universities have accredited engineering programs, and all are accredited by the US engineering accrediting body, ABET. Chile has one accredited program, accredited by ABET. In Peru, engineering programs are accredited by ICACIT (Peru), ABET (US), ASIIN (Germany), and EUR-ACE (Europe). Some programs in Peru are accredited by multiple bodies, with three engineering programs accredited by all four accreditation bodies. No accreditation bodies or accredited programs are listed for Bolivia, Ecuador, Paraguay, Uruguay, or Venezuela.

Such differences in South America are mirrored around the world, with some countries having strong national accreditation bodies, some using accreditation by bodies in other countries, and some having no accredited engineering programs.

Tables 1 through 6 show the number of programs accredited in each country, organized by region: Europe, Middle East, The Americas, Central Asia, Far East, Southeast Asia/Oceania.

Table 1: Europe. Table created from information at accreditation.org.

Country	National	ABET	EC/ UK	ASIIN e. V./ Germany	CTI/ France	Russian	EUR-ACE	Australia	Total
Austria	23								23
Belgium	64				1		1		66
Bulgaria					3		3		6
Croatia				1			1		2
Denmark	?								0
Finland				3			3		6
France	558						267		825
Germany	859						227		1086
Greece			1						1
Hungary	39		1						40
Iceland	20								20
Ireland	119		4				15		138
Italy	?								0
Netherlands	135		1						136
Norway	?								0
Poland	12								12
Portugal	94						16		110
Russia	78						68		146
Spain	1	1	?		1		1		4
Sweden	1								1
Switzerland	25			4	13		17		59
Ukraine			4						4
United Kingdom	1698?						16		16
Total:	2028	1	11	8	18	0	635	0	2701

Table 2: Middle East. Table created from information at accreditation.org.

Country	National	ABET	EC/UK	ASIINe. V./Ger	CTI/Fra	Russian	EUR-ACE	Australia	Total
Bahrain		8							8
Egypt	?	11	6						17
Israel	90								90
Jordan		3							3
Kuwait		7						1	8
Lebanon		10							10
Oman		4							4
Qatar		11							11
Saudi Arabia		53							53
Turkey	110	50					103		263
United Arab Emirates	137	31	4					3	175
Total:	337	188	10	0	0	0	103	4	642

Table 3: The Americas. Table created from information at accreditation.org.

Country	National	ABET	EC/UK	ASIINe. V./Ger	CTI/Fra	Russian	EUR-ACE	Australia	Total
Argentina	227								227
Brazil	380								380
Canada	275								275
	36								36
Chile		5							5
Colombia		15							15
Mexico	789	29							818
	63								63
Peru	25	17		4			4		50
Trinidad and Tobago			13						13
United States	2582								2582
Total:	4377	66	13	4	0	0	4	0	4464

Table 4: Central Asia. Table created from information at accreditation.org.

Country	National	ABET	EC/UK	ASIINe. V./Ger	CTI/Fra	Russian	EUR-ACE	Australia	Total
Bangladesh	15								15
India	2202	5							2207
Kazakhstan		2		8		24	34		68
Macau			1						1
Pakistan	169								169
Sri Lanka	1								1
Total:	2387	7	1	8	0	24	34	0	2461

Table 5: Far East. Table created from information at accreditation.org.

Country	National	ABET	EC/UK	ASIINe. V./Ger	CTI/Fra	Russian	EUR-ACE	Australia	Total
Hong Kong China	95		15					1	111
Japan	390								390
People's Republic of China	?		5		1		1		7
Taiwan	475								475
Total:	960	0	20	0	1	0	1	1	983

Table 6: Southeast Asia and Oceania. Table created from information at accreditation.org.

Country	National	ABET	EC/UK	ASIINe. V./Ger	CTI/Fra	Russian	EUR-ACE	Australia	Total
Australia	142		36						178
Indonesia	22	4							26
Malaysia	209		5					14	228
Philippines	157	9							166
Singapore	25	1	4					7	37
Thailand	187								187
Vietnam					12		12		24
Total:	742	14	45	0	12	0	12	21	846

European countries show a strong preference for national accrediting bodies over international bodies and a lack of interest in non-European bodies (US or Australian). Russian programs seek national accreditation and EUR-ACE accreditation in almost equal numbers, and UK programs do not seem to care about being European. In the Middle East, the largest number of accredited programs are in Turkey and the UAE and both those countries have many programs accredited by the national body, but also a substantial number accredited by other bodies (ABET and EUR-ACE in Turkey, ABET in the UAE). As noted already, South American countries have a diverse pattern. Overwhelmingly, most programs are in countries using national accrediting bodies. India has a strong preference for its national accreditation, with an almost complete absence of international organization. Kazakhstan is very interesting because of the presence of a variety of accreditation paths. The Far East shows a strong preference for national accrediting bodies and

an absence of ABET accredited programs. Finally, Southeast Asia and Oceania are dominated by national bodies, with Britain and Australia also playing significant roles.

Changes are underway that will make these tables obsolete. For example, Pirela *et al.*[13] describe the GCREAS project, (see http://www.caribengine.org/) and propose the creation of accrediting body for the Caribbean region. They note that "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 national accrediting bodies in each country are shown in Appendix 1. The 48 national accrediting bodies differ in two ways. First, some are independent bodies while others are government related. Most independent bodies are associated with professional societies. Countries with government related bodies include Argentina, Austria, Bangladesh, Denmark, Egypt, Iceland, Israel, Norway, Sweden and the United Arab Emirates. The second difference among accrediting bodies is in the number of countries covered. We classify the bodies as native country only, transnational, or multinational (established by agreement between two or more countries). The transnational bodies include ABET (USA), Engineering Council (UK), Russian Association for Engineering Education (RAEE), Engineers Australia, Australian Computer Society, Commission des Titres d'Ingénieur (France), and ASIIN e. V. (Germany). The two multinational bodies are EUR-ACE (EURopean ACcredited Engineer), set up by the European Network for Accreditation of Engineering Education (ENAEE), which awards the EUR-ACE (EURopean ACcredited Engineer label); and NVAO, the Accreditation Organisation of the Netherlands and Flanders created by Netherlands and Belgium.

Sixty six countries have at least one accredited engineering program, and 48 of those countries have a national accrediting body, but that leaves a significant number of countries that are not in these tables, or that do not have a national body. For example, in South America, Chile and Columbia only have programs accredited by ABET and Bolivia, Ecuador, Paraguay, Uruguay, and Venezuela have no accredited engineering programs.

One other feature of engineering accreditation around the world is the existence of mutual recognition agreements between engineering accrediting bodies. At the web page http://www.accreditation.org/accords/mutual-recognition-agreements, accreditation.org lists 16 such accords or conferences. Through the Washington Accord, accrediting bodies in 15 countries recognize "the substantial equivalency of programs accredited by those bodies and recommends that graduates of programs accredited by any of the signatory bodies be recognized by the other bodies as having met the academic requirements for entry to the practice of engineering."[1] Through an ongoing series of meetings and declarations called the Bologna process, European countries are working to harmonize higher education programs in all fields, not just engineering.

In the face of such variety, how should a country or a program decide on an accreditation path? Should a country develop its own accrediting body, work with other countries toward a regional accrediting body, or urge its engineering programs to seek accreditation from bodies in other countries? Similar questions arise for a program. These questions are especially acute in the case

of emerging countries. To understand better the issues that face a country and an engineering program, we now describe two case studies.

Case study: Mexico

The total enrollment in 4-year college programs in Mexico is around 2.6 million students with 70% of the students in public universities and the remaining 30% in private universities. Of the total enrollment, 35% of the students attend one of the 3,856 Engineering and Technology programs existing in the country.[2]

All of the Mexican educational programs (from pre-school to higher education levels) are required to be registered with the (federal) Secretary of Education, known by its acronym in Spanish: SEP. However, accreditation is not compulsory.

Pioneering efforts for engineering program accreditation started in Mexico in 1994, with the establishment of CACEI (Consejo de Acreditación de la Enseñanza de la Ingeniería), the accreditation organization for engineering programs.[3] There are now a total of 854 accredited engineering and technology programs distributed in a total of 225 universities. The percentage of engineering and technology programs covered by some sort of accreditation is 22%.

The two types of accrediting bodies used in Mexico (accreditation.org) are:

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

Using information from accreditation.org, Table 7 shows the three accreditation paths found for the 854 accredited programs: (1) national-only, (2) hybrid (national + international), and (3) international-only.

Table 7: Accreditation 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	

As seen in Table 7, the two accreditation paths involving a multinational organization go only through a US-based organization, ABET. The lack of presence of a non-US organization might be attributed to a set of factors that define the historical and economic orientation of Mexico toward the US. These factors include: (1) a strong economic and cultural interrelationship exists between Mexico and the US, (2) a good deal of Mexican engineering programs were created and are currently following an US model, and (3) many Mexican faculty leaders have degrees from the US.

National-OnlyPath

COPAES (Consejo para la Acreditaciónde 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.[14] This event started the momentum for program accreditation in Mexican universities. 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, respectively. The number of accredited engineering programs (and requests for accreditation) has been steadily growing since 2000, now including 22% of engineering programs.

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

- The suspicion of some university authorities that accreditation would eventually become required by the Secretary of Education. This is an idea that has been talked about to one of this document's coauthor mainly by faculty in public engineering programs.
- The need to: (1) "provide credentials" to constituents (i.e., prospective students) and (2) not to seem to be lagging behind competitor programs. This is a common issue for programs facing intense competition, mainly private universities programs.

Hybrid Path

This path involves both national accreditation (CACEI or CONAIC) and international accreditation (ABET). Programs in this path are characterized by:

- All of them had been granted national accreditation before seeking the ABET accreditation.
- Eight of them had been recognized by ABET as being substantially equivalent before ABET started accrediting international programs (2006).

The above seems to indicate that a previous accreditation experience can lead a program to attempt entering into this path. A major deterrent for it might be the cost of accreditation and the effort required to achieve it.

As witnessed by one of the coauthors, 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, allowing it to "provide credentials" to constituents (i.e., prospective students) as a program with an international quality.

International-Only Path

This path is taken by the 11 ABET-Only accredited programs. Three different types of majors can be found to follow this path: Ingeniería Mecatrónica (Mechatronics Engineering), accounting for two programs, Civil Engineering, two programs, and "International Programs," involving seven out of the eleven ABET-only programs.

The programs involving Mechatronics Engineering – an emerging engineering field in Mexico – and Civil Engineering are in universities with a large number of faculty members educated in the US, which then might be deemed as major reason for pursuing this path.

The case of "International Programs" can be found in several campuses of ITESM (also known as "Monterrey Tec," a private university with 33 campuses across Mexico). This type of major responds to an internationalization strategy followed by ITESM. They can be distinguished because the major name is in English instead of Spanish. In most cases, the same major is offered by the same campus under two versions: national (in Spanish), and international (in English).

A remarkable feature of ITESM International Programs is that they are focused in two types of constituents: prospective Mexican students seeking a strong global component and Mexican-American "dreamers" (young persons living in United States, whose condition of being undocumented limits their opportunity to study a professional career).[4]

The establishment of International Programs can lead to a variety of accreditation paths within the same university. As an example, Table 8 shows the accreditation paths found in ITESM, Monterrey Campus.

Table 8 shows:

- Three international programs (all of them with the program name in English, and ABET-Only accreditation).
- A double version of a same major (international and Mexican): Computer Science and Technology-Ingeniero en Tecnologías de Información y Comunicaciones.

Table 8: Accreditation Paths in ITESM/Monterrey

Program	National Only	ABET	National + ABET
Computer Science and Technology		1	
Engineering Physics		1	
Food Engineering		1	
Ingeniería Biomédica	1		
Ingeniería Biotecnología	1		
Ingeniería Civil			1
Ingeniería en Industrias Alimentarias	1		
Ingeniería en Tecnológía Electrónica	1		
Ingeniería en Tecnologías Computacionales	1		
Ingeniería Física Industrial	1		
Ingeniería Mecánica Administrativa			1
Ingeniería Mecánica Electricista			1
Ingeniería Mecatrónica			1
Ingeniería Química Administrativa			1
Ingeniería Química y en Sistemas			1
Ingeniero en Tecnologías de Información y Comunicaciones	1		
Ingeniero Industrial y de Sistemas			1

Case study: Vietnam

The population of Vietnam is around 90 million people. Currently, the "non-public" universities and colleges account for 13% of the overall enrollment ("non-public" institutions receive no direct financial support from the government, and students attend them on a full-fee paying basis).[7] In 2010, Harman reported the existence of 368 higher education institutions providing for over 1.5 million students and in 2013, Nguyen *et al* .report 419 institutions enrolling 2.2 million students, reflecting the large growth in higher education occurring in Vietnam.[11]

The country is undergoing a social and economic planned transformation, and like China, is forging its own path in the development and application of a "socialist-oriented market mechanism." The higher education system is under a major structural and policy reform, moving Vietnam from a Soviet model of higher education towards a western-styled system. The reform is being planned in the Vietnam's Higher Education Reform Agenda (HERA), a plan approved

by the Government of Vietnam in 2005 for the comprehensive reform of the higher education system by 2020.[7]

HERA's main elements are:[7]

- A sizable expansion of enrollment in higher education: the gross enrollment rate is to be increased by 2020 to about 45% (three times its present level).
- The development of an enrollment profile by 2020 whereby 20% of students attend selective research-oriented institutions while the rest attend institutions providing professionally oriented training programs.
- A great expansion of enrollment at "non-public" universities and colleges to account for 40% of all higher education enrollments by 2020 (up from about 13%at present).
- A comprehensive reform of governance and management arrangements, with ministry control of public higher education institutions to be replaced by a system of governance within which these institutions have legal autonomy and greater rights in relation to their training programs, research agendas, human resource management practices, and budget plans;
- The renewal, restructuring, and internationalization of the higher education curriculum.
- The development of a more internationally integrated higher education system, involving more international commitments and agreements and improvements in the teaching and learning of foreign languages (especially English).

The reforms will have major implications both for the characteristics and for the size of the system, which will have 4.5 million students by 2020 and as many as 900 higher education institutions.

Vietnam has a long history of relations with many other countries. Engineering faculty members in Vietnam receive their PhD degrees from universities in China, Japan, Australia, France, the United States, Germany, Russia, Thailand, and others. Vietnamese faculty members are exposed to teaching methods and engineering practice in many countries and try to combine the best of these traditions in a way that can best benefit Vietnam. Some Vietnamese universities have established twinning programs where students study for two years at a Vietnamese institution and then study for two years at a partner institution, receiving a degree from the partner. For example, the School of Electrical Engineering at Vietnam National University-International University has such twinning programs in England, Australia, the US, Thailand, and New Zealand.

The Vietnam labor force is mostly employed (86.3%) in non-state-owned companies, but some of these companies have state investment. Another 10.4% of the labor force is employed in state-owned companies, and only 3.3% work in foreign-invested companies.[17] The largest companies in Vietnam include PetroVienam and Petrolimex (both in the oil and gas industry), VNPT and Viettell Group (two telecommunications companies), Samsung Electronics Vietnam, Saigon Jewelry Company, Vietnam Electricity, Vincomin (a mining company) and Agribank (finance). All but one of these companies are state owned or have state investment.[9] Foreign investment is increasing in Vietnam; in 2013 the largest foreign investments were from Japan, Singapore, South Korea, and China.

Accreditation Paths

The Ministry of Education and Training (MOET) is responsible for accreditation and in 2005 issued the first standards, which apply to accreditation of institutions, but only 40 institutions have obtained such accreditation; another 112 are awaiting results. Financial constraints have caused the delay and MOET urges programs to apply for international accreditation.[11] The new higher education law that went into effect in January 2013 allows higher education institutions to choose an accrediting body from a list of accreditation agencies approved by MOET (Vietnam's Law on Higher Education, AEI Hanoi, February 2013). Universities are learning about quality assurance through participation in networks such as AUN (ASEAN University Network), APQN (Asia Pacific Quality Network), or INQAAHE (International Network for Quality Assurance Agencies in Higher Education).[11]

The development of accreditation in Vietnam is still in its early stages, having started only in 2001. The document "Assurance and Accreditation Quality Education In Vietnam" by Trần Đình Thám (in Vietnamese) states that the development has many influences including the quality assurance model of the United States and the countries of North America and the quality assurance model of European countries, and is particularly influenced by countries in the Asia - Pacific region due to the many similarities in culture making it easy to share and exchange experiences and practices. The document also lists as influences and sources of support various international organizations, particularly the World Bank, Asia Pacific Quality Network (APQN), and SEAMEO, and some countries such as the United States, Australia, and the Netherlands.

Table 9 shows the list of accredited programs in Vietnam. Table 9 shows that accreditation is incipient in Vietnam. The list shows some possible trends for the accreditation paths:

- Not all of the programs are intended to follow the national accreditation (CET-QA is present only in 3 of the 19 programs with some accreditation).
- An international accreditation path goes through either a European accrediting body (10 of the 16 programs with an international accreditation) or a regional accrediting organization (6 of the 16 programs with an international accreditation are accredited by the accrediting body of the Association of South East Asian Nations).

Table 9 Accredited Programs in Vietnam

University	Program	AccreditingBody			AccreditingYear	Ref.
		AUN-QA	EUR-ACE	CET-QA		
Ho Chi Minh City University of Technology	Electronic& Tele-communication	1			2009	HCMUT, 2013
	MechanicalEngineering		1		2010	
	ElectricalEngineering		1		2010	
	Civil Engineering		1		2010	
	ManufacturingEngineering	1			2011	
	ChemicalEngineering			1	2011	
	Civil & Industrial Structure			1	2012	
	Control Engineering and Automatic control			1	2012	
International University	Biotechnology	1			2011	HCMIU, 2011 (a, b, c)
	InformationTechnology	1			2009	
	ElectricalEngineering	1			2009	
Hochiminh City University of Science	Information Technology	1			2009	Information from website http://cete.vnuhcm.edu.vn
College of Civil Engineering	Hydraulic Engineering		1		2010	ENAEE Database of EUR-ACE Labelled Programmes (enaee.eu)
	Urban Engineering		1		2010	
	Infrastructures Transport		1		2010	
College of Technology Da Nang	Mechanical Engineering		1		2010	
	Electrical Engineering		1		2010	
Ha Noi University of Technology	Electrical Engineering		1		2010	
	Mechannical Engineering		1		2010	

AUN-QA: ASEAN University Network- Quality Assurance
EUR-ACE: European Accreditation of Engineer
CET-QA: Vietnam Center for Educational Testing and Quality Assessment

Nguyen *et al*. state that programs at the University of Da Nang, the International University of the National University of Ho Chi Minh City, FPT University and Duy Tan University are currently applying for ABET accreditation.[11] The authors also have knowledge of other engineering programs seeking AUN-QA accreditation.

Vietnamese engineering programs take advantage of all opportunities for accreditation and select the one appropriate for that program. For example, at Ho Chi Minh City University of Technology, recent accreditations have been obtained from three different engineering accreditation bodies, as shown in Table 10.

Table 10: HCMUT accreditation.

Year	Program	Assessed/Accredited by
2009	Electronic & Tele-communication	AUN-QA
2010	Mechanical Engineering Electrical Engineering Civil Engineering	EUR-ACE
2011	Manufacturing Engineering Chemical Engineering	AUN-QA CET-QA
2012	Civil & Industrial Structure Control engineering and Automatic Control	CET-QA

In a review of the role of internationally funded projects on the deployment of quality assurance in 10 Vietnamese universities, Tram Nguyen concluded "It is apparent that international projects play a role as an advisor and Vietnam needs to take ownership of its strategy and policy."[15]

Factors that influence the decision

A program considering accreditation should consider factors such as the following in deciding from which body to seek accreditation.

- The relative costs and benefits of accreditation by different bodies.
- The specific requirements for accreditation by each of the bodies.
- The relative strengths of each accrediting body in providing national and international opportunities for engineering graduates.
- The familiarity of faculty with the language and traditions of the country of a multinational or transnational accrediting body. This factor will affect the ease with which the faculty can prepare required documents.
- The relative strengths of each approach in attracting students to study engineering and in attracting students to study at that institution or in that program. A program must remain competitive with other engineering programs in order to attract students. The program should consider the effects on recruitment of national and international students.
- Government requirements for accreditation, including which accrediting bodies are approved. A program may make a selection based on its prediction of future government requirements.

As shown by the case study of Vietnam, different programs within one institution might pursue accreditation from different bodies. While each accreditation has additional costs in time and money, a program may consider pursuing accreditation from several accrediting bodies, usually sequentially.

While a program faces the selection of an accrediting body, the educational leaders in a country face the decision of whether to encourage programs to seek outside accreditation or whether to develop a national accrediting body. Factors to be considered in that decision include:

- The country's historical orientation toward some specific county, through colonization or education. For example, many Mexican faculty members have degrees from the US while faculty members in Vietnam have degrees from many countries.

- Other cultural traditions regarding education, engineering, and nationalism.
- The relative costs and benefits of the two approaches. ABET accreditation is costly, but developing an accrediting body is a long, and perhaps costly, path also.
- The relative strengths of each approach in providing national and international opportunities for engineering graduates.
- The relative strengths of each approach in attracting students to study engineering. Most countries are seeking to increase the enrollment in engineering programs.
- The importance of establishing an engineering infrastructure in the country. A national accrediting body usually works closely with engineering societies, which, in turn, provide other sorts of support for growing the engineering profession and for growing the national economy.
- The likelihood that the new accrediting body could eventually join a regional accreditation network or an existing multilateral agreement, such as the Washington Accord.

Conclusions

Accreditation is playing an increasingly relevant role for quality assurance in higher education. This paper has assembled information on accrediting bodies and accredited programs around the world. The contributions of this paper are the assembling of international data on engineering accreditation and the presentation of preliminary conclusions concerning the implications of these data for engineering programs.

A wide variety of manners in which engineering programs face accreditation can be found. Differences can be seen from country to country, and within a given country among programs. From an exploration of the way accreditation is usually done in different world regions and countries, and from the analysis of two cases (Mexico and Vietnam), a set of factors that influence the decision to be made by an engineering program on the accreditation path to follow were presented.

Many questions still remain. For example, the existence of international accords recognizing the equivalence of different national accreditations may imply that the differences among accreditation rules and processes are small. Are there big differences among the requirements? Do the differences have implications for the practice of engineering education in different countries? This study is in its initial stage and further research is to be pursued.

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Appendix 1: National Accrediting Organizations

Country	AccreditingOrganization
Argentina	Comisión Nacional de Evaluación y Acreditación Universitaria
Australia	Engineers Australia
	Australian Computer Society
Austria	Agency for Quality Assurance and Accreditation Austria
Bangladesh	Board of Accreditation for Engineering and Technical Education (BAETE)
Belgium	NVAO - Accreditation Organisation of the Netherlands and Flanders
Brazil	Ministério da Educação - Comissão De Especialistas De Ensino De Engenharia
Canada	Canadian Engineering Accreditation Board of Engineers Canada/
	CIPS (Canada's Association of Information Technology Professionals)
Denmark	ACE Denmark
Egypt	National Authority for Quality Assurance and Accreditation of Education
Finland	Finnish Higher Education Evaluation Council (FINHEEC)
France	Commission des Titresd'Ingénieur
Germany	ASIIN e. V.
Hong Kong China	Hong Kong Institution of Engineers
Hungary	Hungarian Accreditation Committee
Iceland	Iceland Ministry of Education, Science and Culture
India	National Board of Accreditation (NBA)
Indonesia	National Accreditation Agency for Higher Education
Ireland	Engineers Ireland
Israel	Israel Council for Higher Education
Italy	Agenzia QUACING
Japan	Japan Accreditation Board for Engineering Education (JABEE)
Malaysia	Board of Engineers Malaysia (BEM)
Mexico	Consejo de Acreditación de la Enseñanza de la Ingeniería (CACEI)
	Consejo Nacional de Acreditación en Informática y Computación (CONAIC)
Netherlands	NVAO - Accreditation Organisation of the Netherlands and Flanders
New Zealand	The Institution of Professional Engineers of New Zealand
Norway	Norwegian Agency for Quality Assurance in Education (NOKUT)
Pakistan	Pakistan Engineering Council
People's Republic of China	China Association for Science and Technology (CAST)

Peru	Instituto de Calidad y Acreditación de Carreras Profesionales de Ingeniería y Tecnología (ICACIT)
Philippines	Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)
Poland	PolandKomisjaAkredytacyjnaUczelniTechnicznych
Portugal	Ordem dos Engenheiros
Russia	Russian Association for Engineering Education (RAEE)
Singapore	The Institution of Engineers, Singapore
South Africa	Engineering Council of South Africa (ECSA)
Spain	Spain National Agency for Quality Assessment and Accreditation (ANECA)
Sri Lanka	Engineering Council
Sweden	Swedish Higher Education Authority
Switzerland	Center of Accreditation and Quality Assurance of the Swiss Universities (OAQ)
Taiwan	Institute of Engineering Education Taiwan - Taiwan
Thailand	The Council of Engineers (Thailand)
Turkey	MÜDEK: Engineering Accreditation Board
United Arab Emirates	Commission for Academic Accreditation
United Kingdom	Engineering Council
United States	ABET
Total:	48