Accreditation of Academic Programmes in Computing in South Africa

Aurona Gerber, *SMIEEE*, Saurabh Sinha, *SMIEEE*, Alta van der Merwe, *SMIEEE*
Moshe Kam, *FIEEE*.

***Abstract*— Over the past two decades, strong technical convergence has been observed between computing and engineering. Computing in this context includes Computer Engineering, Computer Science, Information Systems, Information Technology and Software Engineering. Within the traditional engineering disciplines (including Computer Engineering), academic programme accreditation is well established, but most academic computing programmes in South Africa are still unaccredited. Those that are accredited were reviewed by accreditation agencies from other countries (US, UK). The convergence between computing and engineering opened the debate and accentuated the need for accreditation within the wider computing profession in South Africa.**

IEEE, a transnational association with a range of activities in accreditation, believes that all engineering, computing, and engineering technology programmes leading to a first professional degree (such as 4 and 5-year Bachelor of Science and Bachelor of Engineering degrees) can and should be accredited. Accreditation should not hinge on, but rather be an input to, the determination of whether or not individuals who completed a programme are ready to practise, as well as at what level they can practise.

This paper provides the status quo of accreditation of computing programmes in South Africa, as well as the current thinking and initiatives for developing accreditation agencies and accreditation procedures in the future.

***Index Terms*— accreditation, computing, computer science accreditation, engineering accreditation, Seoul Accord, ECSA, ABET**

I. Introduction

The focus of this paper is on accreditation of academic programmes in Computing. Computing is defined here as "any goal-oriented activity requiring, benefiting from, or creating computers" [1]. The Computing Curricula we refer to include Computer Engineering, Computer Science, Information Systems, Information Technology and Software Engineering. IEEE [2,7,9], the largest professional association in engineering, technology and computing (ETC), believes that all ETC programmes leading to a first degree (e.g., most 4 and 5-year programmes leading to degrees such as Bachelor of Science and Bachelor of Engineering) can and should be accredited [7]. Accreditation should not hinge on, but rather be an input to, the determination of whether or not individuals who completed a programme are ready to practise, as well as at what level they can practise.

The objective of accreditation is to provide degree-granting academic programmes with a recognized credential. The accreditation credential should enable the general public, students, employers, industry and governmental bodies to ascertain that a programme satisfy certain standards. Thus these constituencies are able to assess to certain extent the suitability for practice of individuals who completed an accredited programme successfully. Accreditation often plays a role in decisions about enrolment in schools, hiring of employment seekers, and licensing of professionals by governmental bodies. Accreditation of a programme is sometimes used as an indicator that graduates of the programme received education that qualify them to be employed as professionals at a certain level (often entry level) or to become candidates for a professional license. Graduate schools often require that candidates for admission hold a degree from an accredited programme.

The value of the accreditation credential depends on the clarity of the description that defines what it ascertains, as well as the reputation and independence of the accrediting body, and the fairness and transparency of the process leading to credential granting.

II. Factors to Consider for Accreditation

Accreditation can be costly and intensive [7]. In this section we focus on some of the factors to consider during the establishment of accreditation agency/process. In South Africa, accreditation of academic programmes in Engineering (which is the closest discipline from which we can draw) is performed by the Engineering Council of South Africa, ECSA. ECSA is a statutory body established in

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Aurona Gerber is IEEE Chapter Chair-Elect, SMCS, IEEE South Africa Section. She is with the Center for Artificial Intelligence Research (CAIR), CSIR Meraka, as well as a Research Associate of the Department of Informatics, University of Pretoria, Pretoria, South Africa (email: agerber@ieee.org).

Saurabh Sinha is the Chair: IEEE Committee on Global Accreditation Activities (CGAA), Educational Activities Board (EAB). He is Group Head: Electronics & Microelectronics, Dept. of Electrical, Electronic & Computer Engineering, University of Pretoria, Pretoria, South Africa. (email: ssinha@ieee.org).

Alta van der Merwe is IEEE: Chapter Chair, SMCS, IEEE South Africa Section. She is HOD: Department of Informatics, University of Pretoria, Pretoria, South Africa (email: alta@up.ac.za).

Moshe Kam is Department Head and Robert Quinn Professor at the ECE Department, Drexel University, Philadelphia PA 19104, USA (email: m.kam@ieee.org).

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terms of the South African Engineering Profession Act, 2000 (Act No 46 of 2000) [6]. ECSA is one of the few bodies in the world where professional registration and accreditation are conducted by the same agency. It is a signatory of the Washington Accord [10] which establishes mutual recognition between accreditation agencies in engineering.

The accreditation of programmes in computing is not yet well established, and the few computing programmes that were accredited already were reviewed by agencies from other countries (ABET from the US and the BCS from the UK).

A. Why does Accreditation Matter?

1) Accreditation provides a baseline based on accepted standards and norms that enables stakeholders to evaluate a qualification provides by an academic programme. If a person attends an accredited programme for a qualification, this person could in general expect that employers, professional associations and other colleges and universities will recognize and value that qualification.
2) Accreditation protects potential students against wasting time and money at 'diploma' or 'degree' mills – bogus institutions that sell college diplomas of limited or no substance.
3) Programmes that undergo periodic accreditation are obligated to review their processes and methodology, often leading to continuous improvement of their quality.
4) Holders of diplomas from accredited programmes often find it easier to secure professional assignments in other countries, thereby enjoying higher mobility.
5) Accreditation procedures are often controlled in part by practitioners from the pertinent discipline, providing valuable input "from the field" into academic curricula.

B. Accreditation focus areas

In the view of IEEE, accreditation should be values-based, implying that core values, such as human rights, respect for diversity, and fair treatment for all constituencies must form the foundation of the accreditation process. The aims of a specific programme and cultural and economic environment wherein it operates play a legitimate role in goal setting and hence in accreditation. Diversity of aims and cultures should not, however, be used to justify the violation of human rights of members or prospective members of the learning community.

To evaluate academic degree programmes, the accreditation processes typically consider criteria centered on [2]:

- Curriculum content and length of the programme;
- Instructional resources and facilities;
- Admission and graduation requirements;
- Learning and exit-level outcomes;
- Equipment and supplies;
- Fiscal and administrative capacity;
- Student support services;
- Tuition and fees in relation to academic objectives and credit received; and
- Student achievement (job placement, state licensing exams, etc.).

C. Accreditation body

The evaluation of programmes during the accreditation process is performed by groups that constitute academics, industry practitioners, employers, and sometimes also representatives of governmental bodies, students, and representatives of the general public. Professional associations ought to play a major role in accreditation, and bring to the process the viewpoint and experience of the profession in a nonpartisan manner. The advantage of professional association participation lies in the experience that their members bring "from the field," as well as the human resources, mostly volunteers, that professional associations can mobilize.

In IEEE's experience [7], credentials provided by non-governmental bodies with a broad base of support by academia, professional associations, governmental agencies and industry tend to be more valuable than credentials granted by government-dominated bodies or bodies that are controlled by a single industry or a single corporation.

IEEE is a good example of a voluntary professional association that participated in accreditation. According to its position paper on the subject [7] IEEE seeks a leadership position in all accrediting bodies worldwide, which accredit programmes within its technical fields of interest. IEEE seeks to cooperate with other associations (both within and without these fields) in creating, maintaining, supporting, and expanding accrediting bodies for programmes in engineering, computing, and technology. It therefore provides advice, training and human resources to accrediting bodies in several countries. IEEE does not wish to become an accreditation agency. Rather it wishes to facilitate processes relating to accreditation by local and regional organizations, by playing the role of a voluntary association (VA) in founding and sustaining accreditation agencies.

D. Accreditation Processes

The steps used during the accreditation process usually include:

- Self-study by the programmes that are candidates for accreditation;
- Demonstration of adherence to criteria and processes required by the accrediting body (this demonstration is made through documentation of procedures, collection and analysis of data, and calculation of statistics);
- Communication between programme evaluators appointed by the accrediting body and the principals of the programme; and
- Site visits.

Most present accreditation processes are performed every few years (5-7) and are characterized by a short period of intense activity, often followed by several years of low-level

action (typically the routine collection of data about the programme and incremental changes). Ideally the period between accreditation visits would be used to plan and monitor progress and to ascertain periodically that the programme continues to satisfy the criteria on the basis of which it was accredited.

Most current accreditation processes are still relatively non-transparent. The complete process is conducted by a small group of programme evaluators and accrediting body officials in close cooperation with the candidate programme personnel but with very limited access by other parties. Often, the only outcome available to the public is the announcement that a credential was granted to a successful candidate programme in a given year.

E. Accreditation and the Law

IEEE does not favour the institutionalization of specific accreditation processes or specific accreditation credentials in the law. In South Africa, accreditation is not specified in the law directly, but the role of accreditation is indirectly linked to the process of professional registration as well as the identification of engineering work. These are specified through the Engineering Profession Act [No. 46 of 2000]. For a person to be registered as an Engineer in South Africa, he/she should be a graduate from an accredited programme. As indicated earlier, the same agency, ECSA is responsible for both accreditation and professional registration of engineers in South Africa.

F. Economical Operation and Workload

The accreditation process should be economical. Cost is often cited as an impediment to adoption of accreditation in some countries. Requirements imposed on programmes by accrediting bodies should be made with the conviction that they are really necessary. These requirements should be revisited from time to time to ensure that they still provide meaningful and needed input to the accrediting body and the programmes. The accreditation process should examine the primary issues and is not meant to be a complete, detailed and comprehensive inspection. It should be manageable and avoid placing an undue burden on an institution or programme.

G. Preference for local organizations

Wherever possible, the accreditation agency should be local or regional, thereby providing the advantage of local relevance and also reducing accreditation costs. Ideally such an agency should receive international recognition by way of being a signatory of an international accord that specifies mutual recognition of accreditation agencies (such as the Seoul accord [8], or the Washington accord [10]).

III. COMPUTING PROGRAMME ACCREDITATION IN SOUTH AFRICA

In the last ten years, the South African government was involved in large Information and Communications Technology (ICT) investments. Millions of Rands have been spent in government projects related to ICT for Health, eNatis and SANRAL, as well as ICT in education. The consensus is that the perceived benefits of these investments were not fully realized [3]. One of the reasons often cited for the perceived failure (or partial failure) of these investments, is the lack of skills by the groups that were supposed to implement the plans [4]. The lack of skills is related to a dearth of mechanisms to determine whether skilled employees are suited to the job requirements.

It is generally accepted that ICT is an enabler for economic growth, and spending in ICT infrastructure is regarded as a priority by both the government and private sector. Therefore, ensuring that enough people acquire the right qualifications and skills to develop and maintain the ICT infrastructure, as well as enabling employers and stakeholders to evaluate these qualifications, will become increasingly important.

We believe that the only way that South Africa can continue to invest purposefully in projects with significant ICT component is to adopt a model of coordinated quality control for the professionals involved in the development of these projects. Accreditation of computing programmes in South Africa is one essential ingredient of this model. International recognition of this accreditation process (through the Seoul Accord), is another.

Over the past two decades, strong technical convergence has been observed globally between computing and engineering. Within the engineering disciplines, accreditation is well established, and it stands to reason that the engineering/computing convergence process would spur the establishment of accreditation processes in computing as well. The discipline of computing, which has been recognized as a distinct academic specialization less than fifty years ago, is now reaching the same stage, in terms of theoretical depth, influence, impact and track record, that other academic disciplines have reached when they started establishing their own quality control and accreditation regimes.

IV. RESOURCES FOR ESTABLISHMENT OF ACCREDITATION OF COMPUTING PROGRAMMES IN SOUTH AFRICA

In South Africa, the Engineering Professions Act [5] specifies the following categories of professional registration:

- Professional Engineer (Pr Eng)
- Professional Engineering Technologist (Pr Tech Eng)
- Professional Certificated Engineer (Pr Cert Eng)
- Professional Engineering Technician (Pr Eng Techni)

ECSA [6] is a statutory body established under the referred Act (2000), and it engages in both accreditation and professional registration of engineers. The structure of ECSA and the legal infrastructure associated with its operation are important resources in creating an accreditation regime for computing in South Africa.

There are several non-governmental organizations and societies active in South Africa which may be able to serve as

the voluntary associations that drive the accreditation process. These include the IEEE South Africa Section (and the IEEE Computer Society South Africa Chapter), the Computer Society of South Africa, the Black IT Forum, and the South African Institute of Computer Scientists and Information Technologists.

The establishment of an accreditation agency and accreditation procedures for computing in South Africa can also benefit from the assistance of IEEE, which operates the Committee on Global Accreditation Activities (CGAA) [9]. CGAA assists IEEE volunteers worldwide in creating and sustaining accreditation agencies, and is known for its accreditation-related activities in the United States (as a founding member of ABET), China, India, Mexico (CACEI), Peru (ICACIT), and the Caribbean (CACET). CGAA has already initiated several meetings toward development of an accreditation agency for computing in South Africa, and has established a track record in founding several new accrediting agencies during the last decade.

V. Conclusion

We discussed the case for establishing accreditation of academic computing programmes in South Africa. We need to learn from established associations and investigate how we can leverage the knowledge that these associations accumulated in carrying out the task of accreditation. We should also investigate collaborative opportunities and harness the potential of voluntary associations, both inside and outside of South Africa, to launch this important effort and bring it to fruition in a framework of 4-6 years.

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