"Is it the mission of an accreditation and quality agency dedicated to engineering education to introduce criteria related to society?"
The experience of "Focuses" at Commission des Titres d'Ingénieur

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ABSTRACT

The role of quality agencies changes because quality of institutions increases thanks to the regular intervention of those agencies since a couple of years. We can observe that periodic evaluation has really upgraded quality of HEIs; but this quality increase can also be attributed to interventions of international organizations such as ENQA (European Network for Quality Assurance) or ENAEE (European Network for Accreditation of Engineering Education with EUR-Ace label) that work on the standards of quality assurance at the European level.

So new criteria arise, suggested by stakeholders or by members when members come from a socio-economic college for example. It is a new concept because in some cases we are far from considerations concerning the teaching of science and technology.

In this paper we will see how this phenomenon take place as well in generalist agencies as in an engineering education dedicated agency but very often, much more in those; the learning outcomes approach has also a strong role in this evolution.

Then we will present the devices that CTI (Commission des Titres d'Ingénieur: French Accreditation Agency for Engineering Education) has put in place in this frame in three specific domains: innovation, sustainable development and health and safety at work.

Conference Key Areas: Quality Assurance and Accreditation, Sustainability and Engineering Education, Ethics and Engineering Education

Keywords: accreditation agency, sustainable development, innovation, health and safety at work

INTRODUCTION

Even in the academic world, the definition of engineering is changing; in the last Global Engineering Dean Council forum, engineering was defined as a mean to increase the quality of life of people: it is not surprising that accreditation changes too.

Previously, experts of accreditation agencies were much more seen as « Constables » coming in the institutions to verify if everything was right, now they are very often considered either as prescriptions makers or counsellors on specific points, this shows that in the minds of the deans as well as in those of the members of those agencies things are changing. But this is not evident for all the deans because a few of them are always thinking that accreditation agencies should stay on fundamentals such as mathematics or physics and not go through all these "peripheral" matters.

The "Commission des Titres d'Ingénieur" is particularly concerned by this evolution because it includes both academic and socioeconomic members and those are directly concerned by economy and so by society. As we exist since 1934, and have defined periodic institution since 1997 (which is a rather long period of time) some questions are arising about simplification and evolution of the process and criteria of our audits; but the evolution of these criteria also appears as driven by quality considerations including ENQA's and ENAEE's (since 2007 when we decided to become member of ENQA and to conform our processes to its requirements).

These criteria linked to society can be of very different kinds according to the continents and even the countries, in this paper we will focus only on some of them.

1   THE FACTORS LINKED WITH THE KIND OF AGENCY

Depending on the country, engineering is evaluated by generalist agencies or engineering devoted, or both. It is interesting to compare the importance of societal criteria in both systems.

1.1   Generalist agencies

The number of quality agencies increases singularly since 10 years. In our country there are 2 agencies belonging to ENQA, one of them (HCERES) is generalist and the other one (CTI) dedicated to engineering education. Some of the engineering institutions are evaluated by both agencies.

If we compare the criteria of the two agencies, we see that, for example, for the moment, criteria such as Sustainable Development (SD) are not really taken into account in the generalist agency criteria.

There are several reasons for this:

-Sustainability is in fact taken into account by a law in France: "loi de Grenelle" that make mandatory the fact that universities deal with it, so the criteria of the generalist agency do not deal with mandatory things, even if this law is not really applied!

-There are many labels concerning SD that have been developed by private associations concerning either Universities or "Grandes Ecoles" or both and the fact that the HCERES deals as well of medicine, art, or engineering makes it not easy defining the good criteria linked to society concerning all fields of education.

It is the same for other criteria for example "health and security at work", however "innovation" which is a great consideration of French government and for which money is given to institutions to develop a device called PEPITE, is considered by HCERES. This shows however that those links between society and accreditation depend on the factors linking specifically politics of education and economy (money given for the PEPITE device for example).

HCERES considers more the research and education strategy of the institution and the opportunity of success that this strategy will have, than details: if a University thinks

that sustainable development or health and security at work is a strong differentiation point of its strategy, it can describe it in its Self-Evaluation Report.

If we have a glance on ESG proposed as reference by ENQA (generalist agency), we find that "according to the European desire to constitute a society based on knowledge, higher education is a basic point of the socio economic and cultural development". So, in ESG 1.9, we find the criterion:
"Institutions follow and evaluate periodically their programs so as to insure that they reach the aims they defined and that they answer to the needs of students and society. With the following guidelines:" The follow up, evaluation and periodic revision of programs aim to guarantee that the offer stays appropriate and to create an apprenticeship surrounding efficient for the students"; among the devices suggested to realize this criteria: "Taking account of the needs in constant evolution of the society".
Those guidelines let to the institution a very large opportunity to take into account the needs of society but, as they are guidelines and not criteria, it does not really make things mandatory for institutions.

1.2 Agencies dedicated to Engineering Education

If we have a look now on the agencies dealing with engineering education, we can compare for example EUR ACE criteria and other specific agency like CTI or ABET for example.

This comparison is very interesting: it shows that factors linked to society appear in both agencies but not at the same compulsory level.

ABET has among its criteria the following one: "a knowledge of contemporary issues", this can be applied to many fields [2].

EUR-ACE has defined criteria and guidelines: criteria are mandatory, guidelines can either be considered as explanations of criteria or possible ways to answer to the criteria, they are not mandatory. In EUR-Ace we find the criteria linked to society in the guidelines. ENAEE is a European agency and the state of development of society in not the same in every country, so ENAEE cannot oblige all European countries to have the same criteria linked to society and development. We can again notice that politic factors (for example human rights considerations and policy for sustainability) also intervene in this field.

2 THE FACTORS THAT CAN ALSO PLAY A PART IN THIS KIND OF POLICY

2.1 Accreditation agencies are not always seen as acting in good directions for the future of society

The paper recently published by MIT [1] about universities of the future shows that there is a tension between what engineering science professors want to teach engineers to do, so that they can become young scientists and PhD students and the needs of the government and society, which is to create engineers to contribute to economic development and growth.

The role of quality and accreditation agencies can be either to make this tension progress or resolve it in the future decades. At the same time people think that in countries like China, India, Brazil or Canada, the accreditation agencies leave little room for new ideas and experimentations, this means that it appears that accreditation agencies should better act in favour of needs of societies if we want that things change.

It is a very important question for the agencies, what is their precise role: we can answer that it depends on their statute: are they academy driven or government

driven? The good answer is in between and the necessity of independence given by ENQA could perhaps insure this good equilibrium.

However, for example, on questions linked to new pedagogies, things are not so evident because teacher's habits are strong, but money is often given by government and very often those new pedagogies are in relation with this policy (introduction of SD for example).

2.2 Basic accreditation or follow up?

Very often when an agency visits an institution for the first time, it concentrates on program contents in their technical aspect or in their pedagogy: number of hours of science teachings, good quality of staff…There are so many important criteria in engineering education today such as new pedagogies, internationalisation of students, numerical aspects of engineering and for some of them, we are quite in societal problematics (use of "Big Data" in society is a problem of ethics).

It is during following up visits that the agency begins to have a look everywhere and especially on criteria more specifically linked to society. It is completely normal that an institution that does not fulfil basic requirements concerning engineering education, even if criteria linked to society are fulfilled is not accredited because the agency is there at first to verify the quality of the institution.

However, the trend is now to have simplifications in the follow up audits: this is a danger that agencies that are taking into account society preoccupation do not take them into account them anymore.

2.3 Role of the socio economic member or experts

They are necessary

More and more quality agencies have socio economic members or experts in their audit panels because it is necessary to understand precise things about employability of the institution for example and that those people coming from society are qualified to deal with this part of the criteria. Either they are in their working position facing those debates or their company has realised studies on them [3].

But not sufficient

Employment of "socio economic" members can hide a great diversity among those people and some of them can be less conscious of a specific societal problem that sociology teachers for example. However, very often sociology teachers are not member of agencies! So this is not the unique solution: if people have no occasion to discuss together between academic and socioeconomic people, as well during CTI 's meetings (such as expert formation) as well as during audits, it is a pity so, it is a very important thing to have exchanges between different categories of members.

Very often, the agency employ specific experts on a specific field, for example in CTI we have experts in innovation, in SD and in health and security at work that help CTI in its demarches such as analysing the "focuses" that will be explained later on.

3   THE IMPORTANCE OF THE LEARNING OUTCOMES APPROACH

For some years, companies (such as Boeing in the early 90's [3]) and now many agencies ask the institutions to describe their programs in terms of learning outcomes, this is particularly specified in EAFGS [4] and in R&O [5] but also in CEAB [6].
A good comparison on those subjects by GEDC can be found in [7]. This presentation in terms of skills really allows preoccupations of the society to be taken into account.

3.1 It allows to take into account the needs of society as criteria

The learning outcome descriptions allows the introduction of specific skills expected from the graduates. For example, in CTI's learning outcomes (among 14 at the total), the second chapter concerns the adaptation of graduates to the constraints of companies and society:

1. The ability to take into account the issues of the companies

2. The ability to take into account the issues of relations at work, ethics, responsibility, safety and health at work

3. The ability to take into account environmental issues

4. The ability to take into account issues and needs of society

These demands are very clear and precise; they constitute a specific paragraph that completes two other ones: the first one concerns the acquisition of technical and scientific knowledge and the mastery of their implementation and the last one is about organizational, personal and cultural dimension of engineering education

3.2 This can be also done through guidelines

For criteria of agencies common to a set of countries, reasons may occur that make things not completely explicit. For example, the first look at learning outcomes in EAFSG shows nothing about preoccupations of society, we have very common basic engineering requirements:

Knowledge and understanding; Engineering Analysis; Engineering Design; Engineering Practice; Investigations; Making Judgments; Ability to engage in Lifelong Learning.

We discover that inside the detailed items (guidelines) that define a criterion, we can find societal preoccupations; we must carefully look to be sure of the content of those criteria in front of those of CTI [4].

Inside "Investigations" we find: "Ability to consult and apply codes of practice and safety regulations"

Inside "Engineering Practice" we find: "Critical awareness of economic organizational and managerial issues"

And Inside "Engineering Analysis": "Ability to identify formulate and solve complex problems"

It is clear that the problems of society are considered by EUR-Ace but not at the same intensity (only guidelines) as by CTI.

4 AS AN EXAMPLE: THE CASE OF CTI

4.1 The partner's context of CTI

ENQA asks all its members to make their requirements evolve through concertation with stakeholders. In the network of close partners of CTI, 3 organisms exist that have particular missions and preoccupations on some precise subjects linked to society:

CGE (Conférence des Grandes Ecoles) is an association of Schools of Management and Engineering. It has for many years created a commission on Sustainable development and Social responsibility, CTI members had meetings with this commission, in 2010 we first defined common principles that were not at this moment part of our criteria but only recommendations to schools. Then in 2014 they began part of the criteria.

INRS (Institut National sur les Risques et la Sécurité) is an organism linked with the French Public Welfare System, its role is to study risks in all professions. From about 10 years it intervenes in Engineering Education Institutions to explain risks, professional diseases (one of them being burn out), and their prevention. CTI has realized an enquiry on fresh graduates together with them. In 2016 criteria linked to Health and security at work were part of CTI's criteria.

The interest for innovation and entrepreneurship has been awaken in CTI through many influences: first the researchers in academic part, then the socioeconomic members but also the French Government with the PEPITE device. Some HEIs had a strong interest for it since a long time but the creation of PEPITE made things evolve massively.

These three points were considered by members of CTI as common strong and necessary points for education of engineers in link with evolution of society. So, in 2016 CTI decided they should become part of its criteria.

4.2 The criteria associated

CTI has evolved a lot in taking account society needs between 2006 and 2016: a recent comparison in [13] show a change of paradigm in the description of its criteria. In the learning outcomes approach main criteria are specified (they are developed in 2.1) but it is not sufficient. It is also necessary to insure that the management of institution is in conformity with the learning outcomes expected from graduates. This is very important because institution should be considered as a model by its students.

In February 2014, CTI, considering that teaching social responsibility to engineers was a critical aspect for society and a duty for engineering institutions, decided to include immediately SD not only in the intended learning outcomes but also in the description of the global policy of the institution: this was an important evolution of the accreditation criteria.

The strategic guidance document of the institution being evaluated must include the orientation chosen by the institution regarding SD and particularly the Green Plan that describes the institution's strategy and its implementation and evaluation. The strategic guidance document is an important part of the self-assessment report because the institution's administrative council votes it, and when this institution is part of a group of faculties the university council votes it too.

CTI wishes strongly that institutions really integrate SD through curricula in the education of engineers but also apply the principles of SD in their own management, working in an exemplary way.

When an institution is accredited or reaccredited, the implementation of Green Plan has to be explained within the quality process of the institution.

CTI has quoted 8 axes of operational actions to be verified during the evaluation process: strategy and governance, social management and local integration, environmental management, research, curricula, documentation, industrial rooting, quality management and continuous improvement

CTI also stresses that a specific innovative active pedagogy has to be put in place for SD: the pedagogy of action puts the engineering student in the situation of finding and building solutions to "real world" matters. CTI specifies that the recruitment of students must guarantee diversity according to a policy concerning chance equity [7].

4.3 The focuses

It is not easy to introduce new criteria in an old system of reference and to be sure that they will be taken into account.

We decided to create "focus", that is to say that in the self-evaluation report, the institution has to present in four pages one of these new specific points. In this way it is easier to convince those (members or institutions) reluctant to change and it will be also easy to publish a document showing the state on a subject inside institutions and giving ideas to institution that don't have: a best practice catalogue. So, this year CTI asked more information on those 3 points that seem important for society at this moment:

- Sustainable development and social responsibility

- Health and Safety at work

- Innovation and Entrepreneurship

Among the institutions that were concerned by periodic evaluation (about 30 this year) one third were submitted to the redaction of each focus. That is to say that we collected the view of 10 institutions on each subject. In February 2017 each of the focus was analyzed and the conclusion presented to all deans.

Institutions and CTI members found this exercise very interesting, a debate was hold at February 2017 conference and results published, then the members of CTI decided, on the same themes, to go on with these focuses to get a more important panel (there are 206 institutions for Engineering education in France).

So we think that those points can now really be considered as part of a quality system: accreditation system can help institution to progress on society subjects.

5 CONCLUSION

The point of introducing criteria linked to society is important but not so easy: it was possible in France because periodic evaluation took place already 3 times before (3 periods of 6 years since 1997) and quality of institution had increased; but now, we are trying to simplify accreditation procedure so "details" will be suppressed: it show the importance that these factors be considered inside criteria and not in guidelines.

Is it possible to define priorities into criteria? We observe that very often in many countries doors of the accreditation criteria are opening to society problems: the importance given now to soft skills and transversal skills is a good attempt.

However, we think that it strongly depends on the law of the country and on the political situation (emphasizing or not such or such problem), however, in this case, the public opinion has a role to play in the criteria chosen for education realising pressure on the agencies.

We can conclude saying that consideration of engineer's education preoccupations linked to society has much evolved since 10 years, because both of society and companies but this has still to progress in some countries. These preoccupations must be taken in consideration either in law or in another place, but accreditation agencies when existing stay a place very convenient for this.

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