Sustainable development in Engineering Universities: how accreditation agencies can help them in this demarche? The case of French HEIs

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Conference Topic: Sustainability in Engineering Education

INTRODUCTION

Since the emergence of the concept of Sustainable Development (SD), HEIs (Higher Education Institutions) took different strategies to include it in their missions. Concerning Engineering Universities, because of their field of activities, the ecology was directly in relation with their teaching and/or research fields and they became very soon concerned. It is at the same time a good and a bad thing for Engineering Education Institutions because at the contrary of multidisciplinary institutions, some of them stayed on this restrictive view of SD.

Nowadays, the integration of SD in its three components in the whole strategy of the institution is far from being of the same level everywhere, even in Europe. It is the reason why some accreditation or evaluation agencies decided to put an emphasis on SD in their evaluation. Amongst others, the French CTI (Commission des Titres d'Ingénieur) did it last February.

In this paper we present the requirements of the French agency in relationship with the other European and French systems concerning SD management and how the institutions act in front of them. It is a good point to integrate SD in the criteria of accreditation, if the way on how reach the target is let under the control of the institution (for CTI it is a frame derived from Green Plan), because it is perhaps the only way the increase the speed of turning towards sustainability everywhere in engineering education institutions.

1 HISTORICAL POINT OF VIEW

1.1 How institutions came to SD

The concept of Sustainable Development was employed first by Brundtland in 1986. Many educative activities linked with technology and energy appeared very quickly in the institutions concerned by the preoccupations underlined by SD, which induced very soon technological researches: HEI that developed researches either in ecology or chemistry or energy were concerned immediately, and for some of them included in their programs at the end of 90s-beginning of the 2000 some teachings for example concerning Eco design.

The first global teachings covering the 3 points of SD (Society, Economy, and Ecology) inside engineering universities can be considered as realised in 2002 in TU Delft [1].

Then, the Barcelona declaration (fig 1), in 2004, came to consolidate the points that should be important in such education and this helped some institutions to progress in a more global view and strategy towards SD.

We declare that

Today's engineers must be able to:

- Understand how their work interacts with society and the environment, locally and globally, in order to identify potential challenges, risks and impacts.
- Understand the contribution of their work in different cultural, social and political contexts and take those differences into account.
- Work in multidisciplinary teams, in order to adapt current technology to the demands imposed by sustainable lifestyles, resource efficiency, pollution prevention and waste management.
- Apply a holistic and systemic approach to solving problems and the ability to move beyond the tradition of breaking reality down into disconnected parts.
- Participate actively in the discussion and definition of economic, social and technological policies, to help redirect society towards more sustainable development.
- Apply professional knowledge according to deontological principles and universal values and ethics.
- Listen closely to the demands of citizens and other stakeholders and let them have a say in the development of new technologies and infrastructures.

Engineering education, with the support of the university community as well as the wider engineering and science community, must:

- Have an integrated approach to knowledge, attitudes, skills and values in teaching
- Incorporate disciplines of the social sciences and humanities
- Promote multidisciplinary teamwork.
- Stimulate creativity and critical thinking.
- Foster reflection and self-learning
- Strengthen systemic thinking and a holistic approach
- Train people who are motivated to participate and who are able to take responsible decisions.
- Raise awareness for the challenges posed by globalisation.

Figure 1

In order to achieve the Barcelona declaration, the following aspects of educational process must be reviewed according to the EESD (Engineering Education for Sustainable Development) Observatory 2006 [2]: links between all the different levels of the educational system, content of courses, teaching strategies in the classroom, teaching and learning techniques, research methods, training of trainers, evaluation and assessment techniques, participation of external bodies in developing and evaluating the curriculum, quality control system

We can point out that many of those points are very often the points evaluated by quality agencies in Europe.

Some surveys have been made in Europe concerning SD and higher education institutions for example those by the EESD Observatory in 2006 and 2008 [3].

In 2006, 55 European Universities joined the survey: amongst them 16 are identified as reaching their targets. Most of these universities were from the North of Europe. For EESD, the premises leading to target included:

-Stated policy and action plans on engineering for sustainability in research, education and the campus environment

-Dedicated undergraduate courses in the area of sustainability for engineers. This includes both holistic overview of ESD and specialized courses on specific aspects of sustainability

-Identified postgraduate programs that provide a possibility for specialization or continuation for all engineering students

In 2008, the questionnaire reached more than 400 institutions across Europe; on the 55 universities of technology ranked, 21 universities could be considered as reaching target, and 17 of them were even considered as key references by their peers.

1.2 The great diversity in the reality of institutions

Last September, during an "open working group session" of the Working Group "Sustainability in Engineering" of SEFI, it appeared that some European Engineering Institutions were, concerning SD preoccupations, still very far from the universities answering the EESD enquiries: in fact some of them were still trying to know what to do so as to begin in this way!

In 2012 and 2013, during the BEST Event on Education that was devoted to SD too, it was clear through the reaction of students that not all the engineering universities in Europe had already taken the way to SD! This discovery was far from being pleasant but it was quite pragmatic!

The preoccupation of SD really needs to be shared by all students and all universities of technology; so the question is "what to do?" When you have a look to labels and surveys you always see the same "good universities" and if individual people feel concerned in an institution where the governance of the whole institution thinks that SD is not a strategic point, what can he do?

According to the Rio+20 [4] conference that took place in 2012, HEIs have and should play an increasing awareness of sustainability challenge for graduates. In the HESI (Higher Education Sustainable Initiative, launched in Rio+20), Chancellors, Presidents, Rectors, Deans and leaders of HEI acknowledged the responsibility that they bear in the international pursuit of SD. They agreed to teach SD concepts, encourage research on SD issues, green their campuses, support sustainability efforts in the communities in which they reside and engage and share results through international frameworks. But in HESI, we find again the same "exemplary universities"!!!

Even if labels are important things, one can wonder whether an accreditation procedure making things mandatory is not a good way to proceed: in several European evaluation agency where SD is part of the criteria of the evaluation as well as a policy of the institution as a component of learning outcomes, SD is described in the self-evaluation report and really visible during the audits.

2   EXISTING SYSTEMS IN FRANCE

2.1 Many organisations

In France the facts concerning SD have been taken in interest as well by students, by organizations of deans (Conférence des Grandes Ecoles-CGE) and by ministries, some of them trying to act as pressure groups in the good sense of the word.

 The ministries put in place surveys and questionnaires such as MEEDAT in France in 2008 [5] that identified more 300 curricula in SD (60 general universities, 37 technical universities) and put in evidence an interesting difference between the general universities concerned by a theoretical and conceptual reflexion on gouvernance and political point of view and the technical universities that hade a more pragmatic approach based on energy, resources and Eco design; this report schematically opposes a top down approach in general universities and a bottom up approach in technical universities: in those conditions how can we work in a multidisciplinary way necessary for development of SD? It was a problem debated with CDEFI (Conference of the French Deans of Engineering Universities)

The network of French students for SD (REFEDD) realised in 2007-2008 an enquiry [6] amongst the students (15 000 of them gave their opinion about SD and SD education) so as to be able to make propositions resulting from these statements and expectations. The statement was that teaching of SD was either absent or very specialised. The students hoped more active pedagogies in link with real world. One of the propositions was to make campuses exemplary and to define a minimal curricula that should be taught to everybody. However, due to the autonomy of universities, it was very difficult for this group to oblige institutions to evolve quickly.

 A first attempt to evolve more quickly has been the Green Plan, perhaps because it is linked to a law but certainly because it includes many of the aspects considered in the previous attempts in Europe; we will describe it more specifically because it is one premise of CTI demarche.

2.2 The "Green Plan" and the "Green Plan Reference"

According to a French law (Loi de Grenelle", 2009), the institutions of higher education have to elaborate a Green Plan (Plan Vert) which is a plan for sustainable development with not only environmental preoccupations but also social and economic ones. In 2012, 100 institutions (amongst them 40% are engineering education institutions, that is to say 40 on the 200 French Engineering Education Institutions) had initiated this demarche and with their experience we discovered that the success of Plan Vert needs that:

-the SD strategy be elaborated in accordance with the stakeholders and supported by the management of the institution in the frame of a long term vision

-the institution must mission a person responsible for the animation, the setting and the evaluation of the SD demarche; this person must have human and financial resources

A frame of work had been defined after promulgation of Loi de Grenelle it has been called Green Plan Reference system [7]: it is a toolbox helping to define a SD strategy, its steering and self-evaluation.

5 axes are considered:

-Strategy and governance

-Teaching and education

-Research

-Environmental management

-Social policy and territorial management

With a sharper view it reveals to be a specific application of ISO 26 000, with considerations of: accountability, transparency, ethical behaviour, respect of laws, recognition of the interests of stakeholders, account being taken of international norms of behaviour, respect of human rights. The communication around such a tool is quite strong, it is realised amongst other ways by associations of deans and presidents of universities, and it is difficult to imagine that institutions could not have heard about it. Furthermore, for HEI that want to go further this legal basis, many associations develop labels, test or other actions

2.3 Labels and tests

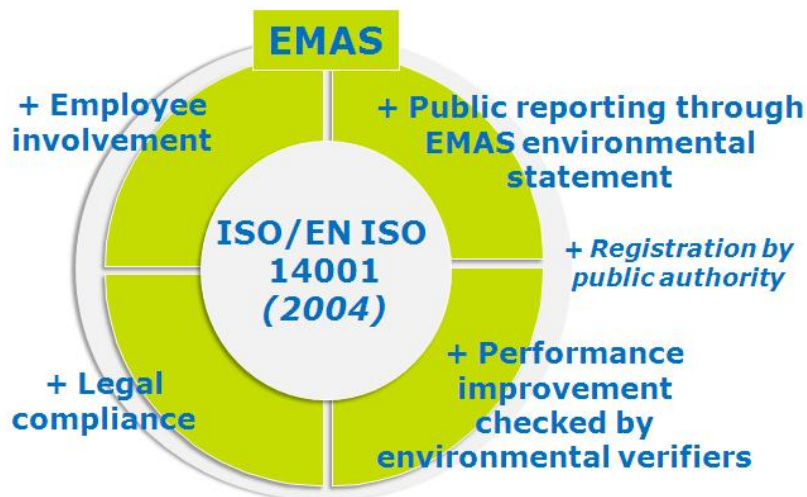Many approaches can be found in the literature from the more sophisticated labels to the minimal indicators.

Figure 2

EMAS [8] has been created in 1995 by European Union, it is more demanding than ISO 14 001 (figure2), many German universities have this label and some French too, it is difficult to obtain the exact number of institutions concerned. EMAS's distinctive key elements are performance, credibility and transparency. To receive EMAS registration, an organisation must: conduct an environmental review, adopt an environmental policy, develop an environmental program, establish an effective environmental management system, carry out an environmental audit, and provide an environmental statement. This system is not specific to HEIs but HEI is there considered as a particular case of organisation; it is also a global approach of SD.

During SEFI Conference 2013 in Leuven the QUESTE-SI label was presented [9], it results for the QUESTE-SI LLP Erasmus European Project. This project was led by the European Foundation for Management Development (EFMD): several sustainability dimensions are considered during a cross evaluation audit: institution policy and strategy, social responsibility sustainable engineering education (SRSE) and curriculum, student involvement and cultural development in SRSE, research and innovation. Apart from the score and ranking results, thanks to the evaluation, the audit preparation, reporting and process allows the institution evaluated to engage itself in a beneficial reflection.

In April 2014 the Sustainability Literacy Test [10] was launched in France, it is a consequence of the HESI engagement after the Rio+ 20 conference: it is a tool to verify the sustainability literacy of the HEI'S student when they graduate. It assesses the minimum level knowledge in economic, social and environmental responsibility for higher education students, applicable all over the world in any kind of HEI. The actors, in France, are the conference of deans and universities presidents and a network of students. 2/3 of the questions are the same all over the world and 1/3 is specific to the French problematic concerning SD. At the opposite of labels, this test evaluates minimum knowledge level, it could, for example, as English language test for French Engineers be a mandatory step to be graduated.

Even if those initiatives are not concerning every students and institutions, they have a great advantage: they are transnational. The test it is open through the world and will allow a comparison between countries and, concerning the label it is audited by multinational team and spread all over Europe. That seems to be something very important because while SD implies a notion of global vision, initiatives are very often national. It is why the demarche of CTI that we will expose next is interesting but only if the agencies like ENQA that evaluate national accreditation agency include also SD in their criteria! ESG are in evolution we will see soon what happens!

3   VISION OF CTI ON SD

3.1 Preliminary meetings

According to ENQA considerations, quality agencies must take into account their stake holders for the evolution of their strategies of evaluation. In CTI this criterion is successfully filled because informal meetings with stakeholders take place regularly on all subjects that concern the heart of evaluation: inside engineering education institutions, many fields are in great evolution concerning as well learning outcomes as strategies of teaching.

Amongst the fields of evolution of the education of engineers, social responsibility of engineers was an important point of discussion; CTI had already introduced some prospective elements in a document since 2009, this document was not mandatory for the institutions.

In December 2012, a meeting took place with CGE, the benefits of Green Plan Reference on institutions were debated, and benefits for the institutions were clear. At the end of the meeting it was decided to write immediately a new prospective document based on the Green plan reference that can be in France considered as the norm in the domain. This prospective document was submitted to the organisations of students and then one year later, everything being ok for them, it was decided to change some of the criteria corresponding in the accreditation items.

The idea to start from an existing reference (Green Plan) was intended not to penalise institutions having already begun their demarche towards SD and because it was also on a national standard with general universities.

3.2 Decision to go

Usually criteria [11] for French Engineering Institutions accreditation are changed only every 3 years, it should have been in February 2015, but in February 2014, CTI, considering that education to social responsibility of engineers was a critical aspect for society and a duty for engineering institutions, decided to include immediately SD not only in the expected learning outcomes as it was previously but also in the description of the global policy of the institution: this is an important evolution of the criteria for accreditation.

The strategic guidance note of the institution being evaluated must include the orientation chosen by the institution concerning SD and particularly the Green Plan: what is the strategy of the institution, how this strategy will be translated in actions, how the actions will be evaluated? The strategic guidance note is an important part of a self-assessment report because it is voted by the administrative council of the institution and when this institution is part of a set of faculties it is also voted by the university council.

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 validation implementation of Green Plan has to be explained within the quality demarche of the institution.

The 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 anchoring

-quality management and continuous improvement

CTI specifies that a specific innovative active pedagogy has to be put in place for SD, the pedagogy of action can put the student in engineering in the situation of finding and building solutions to real world problems. CTI specifies also that the recruitment of students must guarantee diversity according to a policy concerning equality of chances.

3.3 Remarks

The way CTI make SD mandatory is a bit like ISO in front of EFQM: ISO 9000 does not mean excellence it means only a standard necessary level.
We observe that even if the items do not appear in the same orders, the global considerations are the same as other systems described before because all of them have something to do with ISO norms concerning SD.
The first accreditation on this frame will take place from September. We will be in position to observe the endeavours already made by schools, and concerning the institutions that follow the Green Plan since its beginning, their evolutions all along the time.

4   EXAMPLES OF APPLICATION

4.1 Example of Polytech Orleans

In June 2013, Polytech Orleans, as a member of the Conference des Grandes Ecoles, began, with its specificities and those of its territory to engage in its Green Plan. All the people working for Polytech were invited for a presentation of the national and local Agendas 21 and of the Green Plan Reference System.

The first step was to realise an inventory of fixtures before analysing one's strong and weak points. This allow to define the specific strategy of the institution concerning SD in coherence with the global

strategy of the institution. This strategy leads to an action plan and then, as in a PDMA demarche, the institution has to put its plan in actions, evaluate and develop a process of continuous improvement.

Before this public meeting, the management team had given commitments for the integration of SD in the activities of the institution:

1-elaborate an Agenda 21 specific for the school

2-Realise an audit of the environmental impact of the activities of the school

3-Organise information and awareness campaigns concerning SD for students and employees

4-Integrate the concepts of SD in pedagogic activities

5-Measure fluids consumed (water, electricity, heating) and then reduce them by 10%

6-Reduce by 10% the printing expanses of the school

7-identify all the recyclable product and recycle them

8-realise an audit of the means of transport between house and work for students and employees

9-try to eliminate use of toxic products

These points reflect some local interest (means of transport for example are part of the local Agenda 21). They are also linked with the specific activity of the school, which has teaching and research concerning chemistry. All this point can be positioned inside Green Plan Reference in the following way:

A: Points 2, 5, 6, 9, 7 concern sustainable consumption and production

B: Points 3 and 4 concern education

C: Point 1 concerns governance

D: Point 8 concerns sustainable transport and mobility

4.2 Planning

After defining the points of effort, it is necessary to define responsibles for each domain (A to D) and a calendar:

-responsible are volunteers among the employees of the school, they will have to work both with students, teachers, and staff

-one year is necessary to establish the inventory of fixtures

-one more year will be necessary to put in place priority actions

The CTI will come in the school in September, it is clear that we will be able to show only the premises of the demarche. Other institutions are in the demarche since a longer time.

4.3 Application in other schools

For Montpellier Supagro [12], the choice has been to imply as many people as possible, the five themes of progress have been chosen by all of the employees: incitation and facilitation of the use of bicycles, reduction and waste sorting, teleworking, management of the car pool, biodiversity. They decided also to put in evidence the already existing actions before going to the Green Plan.
In Telecom Bretagne, since 2010, a self-assessment is realised each year on the SD demarche. After the audit Queste in 2012, the employees and student have had an external vision of their demarche.
In ENSCM (Ecole de Chimie Montpellier), Green plan is led by the students instead of the staff.
These examples show us that with the same frame we can observe in the same country very different ways to progress depending of the culture, the history and field of activities of the institutions

5   CONCLUSION

From the origins of the development of SD in Engineering education, a great diversity of ways to proceed can be observed but the premises always require some basic and global expectations, most of them issued from the application of ISO norms to education.

The decision to include the SD demarche as a mandatory one reveals to be necessary to really increase sustainability in all institutions, it also satisfies the necessity to give examples to those that are not on the way actually; but in fact it has no sense if the management staff, being interested in the demarche because of accreditation, do not become really convinced because the governance will have to lead the whole institution in the demarche which is a global one. In a way we can say that the accreditation demarche must be a kind of starter and initiator for institutions that thought previously that they had "more important thing" to do;

Criteria issued for civil society (Green Plan) or organisations (Emas) can be a good thing for preparation of our students to the transposition of those concepts in their future life of citizen and employees.

In addition to the real adhesion of the governing staff of the institution, two points are however important if we hope a real success:

the possibility of a great diversity of demarches fitted to the institution

the importance of international confrontations.

Many reports and paper point out the necessity of a fitted pedagogy, this shows that going to sustainability needs really a global point of view as quality process does.

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