ISSUES OF SUSTAINABLE DEVELOPMENT IN CIVIL ENGINEERING IN PORTUGAL

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Summary

There are, in Portugal, nine universities with degree programs of civil engineering accredited by the Ordem dos Engenheiros (Engineering Professional Body). However, none of them present disciplines expressly dedicated to teach or to learn SD in the study plan. In the two last years of the five year study plan, generally in the fourth year of degree, most of the courses of civil engineering introduces SD in an implicit way. It is for instance associated to studies of town planning and of evaluation of environmental impacts. Of the nine degree programs of civil engineering analyzed, in the option of building construction, only two present disciplines that are optional and are directly associated with sustainable construction. Six present disciplines of evaluation of environmental impact and of town planning. The importance of SD in a degree program of civil engineering is unquestionable. Some of the issues like building maintenance and management represent a large impact on energy spending and on pollution of the atmosphere and of the earth. Another area of civil engineering that is important for SD is hydraulics and the water, river and sea management. A very important area is the cycle and recycle of construction materials with the creation of by-products that are one of the main sources of environment contamination. There are many other areas of civil engineering where SD is very important like transportation, planning and industrial construction. The adaptation of civil engineering disciplines of the SD principles and theories will prepare the future civil engineers to address their profession with SD as a major concern and beacon. The continuing education and professional development activities and courses will have a quicker impact on the transformation of the actions of the current civil engineers.

Mission of universities

Traditionally, universities were the place of research and production of knowledge almost apart from societal needs. In fact, universities were the leaders in knowledge that shaped the societal course of development. However, the significant changes that have taken place in the last 20 years of the 20th century have challenged this traditional view; nowadays universities and tertiary education, in general, are expected to broaden their perspectives and activities so as to respond to societal needs. Of course, the concept of societal needs is very broad and often is perceived as equivalent to economic priorities and research geared to the needs of the market. However, it also involves lifelong education, services to disabled students, connection with local communities, and widening access to higher education for disadvantaged and under-represented groups, as well as developing specialized services and model practices for coping with the problems of disadvantaged and marginalized groups in society. This broad conception of the rela-

tions of higher education with the society calls for a reconsideration of the role of universities and tertiary education in modern societies as active agents and partners in social change. Whether such a social role of universities is within their mission and what it entails for their functioning is an issue for debate [1].

Some issues that are important for the third mission of universities are the role of universities and tertiary education in modern society; the implications of higher education assuming a social role; the active presence in the communities so as to widen the access of disadvantaged and under-represented groups to higher education; steering research, curricula, teaching methods, and of services so that they meet emerging societal needs as well as of groups with special educational needs such as disabled students, foreign and international students, immigrants, etc.; partnership with local communities so that innovative ideas and practices for the solution of local problems are provided; meeting the challenges of multi-cultural societies and globalization.

There are several ways to address this increasingly important share of universities role and there are also different levels of political importance within universities. Since the goal of the analysis aims at defining the proper strategy to engage the universities in this third mission the paper evaluates current activities in this area and their contribution to the third mission; it considers future needs and adequate procedures to adapt the universities; it evaluates the direct and indirect benefits of these activities for universities and for society. For instance this is particularly important in engineering and technology where there is a significant impact in the knowledge economy. It is researched the right degree of independence of universities within this framework but involving the stakeholders in these joint actions. For that purpose the CEE activities and the internationalization of studies and of research represent areas that may be crucial to identify the practices and case studies that can lead to an efficient and successful strategy [2].

Knowledge management takes different forms within the evolving society and it is necessary to study the efficient contribution of universities. This third mission derives from the increasing importance of the social contract of universities with direct effects on transparency and accountability of the public institutions. It is however a strategic area for the development of universities and of society. It is important that evidence is produced that there is value for financing spent in universities. The universities economic and social impact on society can be evaluated and they are crucial to understand what a modern university should be. The knowledge is currently distributed among different partners and it is no longer an exclusive property of universities. There are informal responses of universities that have somehow adapted to this new pattern.

Sustainable development

Sustainable development is an incoming concern among society and especially within the academic community. Sustainable development is an eclectic

concept, as a wide array of views fall under its umbrella. The concept has included notions of weak sustainability, strong sustainability and deep ecology. Different conceptions also reveal a strong tension between ecocentrism and anthropocentrism. Thus, the concept remains weakly defined and contains a large amount of debate as to its precise definition. During the last ten years, different organizations have tried to measure and monitor the proximity to what they consider sustainability by implementing what has been called sustainability metric and indices [3].

In fact it is not easy to define and to limit the use and applications that constitute the area of Sustainable Development. It is a major concept that abridges several ideas that have been borne out of the concerns about the future. Engineers and civil engineers, in particular, create great transformations of our environment. It is therefore expected that the performance of civil engineers is also a measure of the possible sustainability of their designs. Questions like energy consumption, reusability of materials, recycling, level of production of CO2 and durability of by-products of construction are emerging issues in civil engineering acts. Education and training are essential to transform and adapt the habits and rules of civil engineers to consider their influence in the sustainability of the development they create.

Role of Continuing Engineering Education

Continuing Engineering Education has been considered in many universities as a source of funding for other activities. These funds are either obtained through private investment or through social subsidies. A clear example of the questions related with the financing of CEE is shown on the reports and workshops made by the Working Group of CEE of SEFI (Société Européenne pour la Formation des Ingénieurs – *www.sefi.be*) in the last decade. These activities range from marketing activities to quality benchmarking of the CEE centers. Considering CEE as a profit activity is probably a common situation among the CEE community around the world. However there are cases where CEE is considered involved in the third mission of universities. This option of embedding CEE within the third mission of universities is justified due to the social and collateral benefits it may cause to universities.

Analyzing the social benefits of CEE implies measuring the consequences of economic growth and direct development created by the qualification and improvement of the engineering and technical community. In fact the standards of development are simultaneous with the degree of qualification of the engineering and technological human resources according to the OECD reports on Continuing Education and economic development. It seems natural that the inclusion of CEE as a third mission activity seems natural from the point of view of contributing directly and indirectly to the level of societal economic and civilization growth and expansion.

The funding and promotion of CEE through third mission activities is also indirectly represented in the other effects. These are the transfer of knowledge directly to the courses participants, the acquaintance between teachers and active professionals, the participation of academics in practical sessions with industry applications and understanding of the economic use of academic and research results. In fact the dynamic interaction is fundamental to knowledge transfer allowing the flows of information between academia and industry. In fact the survey presented in the IACEE of the Working Group on University-Industry Relationship points out the following reasons for the role of CEE [4]:

a) CEE is envisaged as strategic by the firms management boards and needs are identified, actions planned and budget allocated.
b) 60 % of the firms have a Human Resource department that is in charge of CEE.
c) The goals of CEE are to improve professional skills (96 %), increase production (73 %) and career management (33 %)
d) Lifelong learning is unavoidable but the motives for CEE are the impact of ICT (72 %), transfer of technology (71 %) and reengineering (64 %)
e) The most important points for CEE are content (88 %) and course logistics (63 %).
f) The keyword for CEE is flexibility with tailor made courses (80 %) and face to face events (65 %) being other relevant factors.
g) The more important areas are Organizational Behavior, Management, Information Technologies, Quality and Environment
h) The suggestions to improve cooperation are to personalize the relationship, efficient internal structures of CEE providers, design of tailor made courses and market adequately the CEE actions.

Education and Training for SD

The courses of bachelors and masters, first and second cycles, in civil engineering have some part of the curriculum that is dedicated to SD and was, most of the times, recently incorporated. However, the issue of developing SD practices and rules is urgent and the impact that the young or future engineers will have on SD has a medium or long term effect. It is therefore important to retrain and update the active civil engineers so the consequences have a more immediate effect in the society. These courses must have the capacity to bring the new topics into the daily preoccupations and orientations of the active civil engineers at all levels of decision. It is important that the training courses are designed in such format that will enable the civil engineers to attend and to learn from these courses. These courses can be carried out on live sessions or using some kind of distance learning mode. The latter format will possible abridge the opportunity for those civil engineers that are busy to attend the end of the working day sessions or of the weekend courses.

The courses could have a content that could comprise the following subjects: environment contamination, energy consumption and pollution of construction technologies, transports and alternatives in energy and pollution, consumption and production of ecological materials, conservation and management of natural constructions, public health and safety, recycling of construction materials and reusability of construction materials. It is not an exhaustive list but it contains important and relevant subjects for SD. These courses can be designed to incorporate multidisciplinary views on these subjects and therefore enrich the quality and accuracy of the training. It is also important to have institutional cooperation at national and international levels to increase the level of globalization of these courses.

References

[1] MOLAS-GALLART, J., SALTER, A., PATEL, P., SCOTT, A., DURAN, X., Measuring Third Stream Activities: Final Report to the Russell Group of Universities, *Science and Policy Research Unit*, University of Sussex, April 2002, website, 10 March 2006, *www.clo.cam.ac.uk/documents/final_russell_report.pdf*

[2] WURZBURG, G., Sustainable Investment in Lifelong Learning: the Pivotal Role of ICT, Senior Economist – Education Directorate, *OECD*, EDEN, Helsinki, 2005.

[3] Council of the European Union, Review of the EU Sustainable Development Strategy, DG I, 10917/06, Brussels, 26 Jun 2006.

[4] SOEIRO, A., TAKEUCHI, Y., University - Industry Cooperation in CEE, 9TH WCCEE, *IACEE Working Group Report*, Tokyo, 2004, *www.iacee.org*