

# Viewpoint: Perspectives for University Engagement in Continuing Engineering Education (CEE)

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*The current and potential role of universities in CEE is presented and discussed. The growing importance of vocational and training systems in Europe, as they challenge the current structure of the traditional higher education system, is also considered, as well as the capacity and willingness of universities to change, and the relevance and alternatives to that change. Finally, this communication looks into CEE development and its most important factors, and proposes a possible strategy for contributing to the build up of a future European system for CEE.*

## INTRODUCTION

I ASSUME we all accept that human resources are the most valuable asset in our society. There is also a general feeling, shared by individuals and most of our institutions and leaders, of expectations for a better quality of life. Following that path, industry and technology strongly push their products into the market, for global consumption. These are some of the facts that clearly show a large knowledge deficit in our present society. I also believe, as a major and basic principle, that the structure of a democratic system would work much better if more and more people were increasingly more knowledgeable.

I am also aware that the control of power has always been, and still is, the control of access to knowledge and its practical application.

As such, those who believe in the importance of a mass dissemination of knowledge, in all its forms, must work for the adaptation of the current higher education system to new ways of teaching. New systems should be able to provide learning opportunities any time, anywhere.

Finally, it is clear to me that the growing tendency for giving more direct responsibility to civilian society will develop even further, covering most of the fields where the state used to play the only or the major role. As in social security or healthcare, education will be more open to the initiative of new consortia.

My understanding is that we are starting a process of preparing a major change in our society's education and training structure, in order to facilitate mass and lifelong higher continuing education.

## THE ROLE OF THE UNIVERSITY ITS CURRENT CEE INVOLVEMENT

In almost every country of the European Union, primary and secondary education takes 12 or 13 years and starts at the age of five or six. The post-secondary level is so-called higher education, where universities have had a particularly important role. National educational systems are more complex than this, but for the sake of this presentation and concerning engineering, these are the most relevant facts.

In Europe there are mainly two types of engineering degrees: a short one, typically three years; and a long one of four to six years. Most EU countries have both. Universities with their engineering faculties, polytechnics, higher education institutes, Grandes Écoles and Fachhochschulen are typical schools where degrees or parts of degrees in engineering are provided. Besides the two types of undergraduate degree, there are also Masters and Ph.D.s in engineering.

All higher educational institutions—whether private or public—depend upon ministries of education. The state accredits all higher education degrees. The professional qualifications are in most cases automatic, which means that the academic degree also confers this. In some exceptional cases, like in the UK and Portugal, the state delegates that capacity to professional engineering organizations.

It is common in Europe for the state to subsidize all or most higher education for Engineers, both in public and in private schools. It is very uncommon, unlike in the USA, for industry to fund and influence engineering schools.

In parallel with state budget reductions for higher education, a large number of universities in Europe have developed more links with industry and increased their funding for R&D activities. Research and industrial parks and spin-off com-



panies have grown like mushrooms in every European country. Links with industry increased substantially all over. For a similar reason universities have engaged in continuing education activities during the past ten years. This has been done using mainly two different strategies: (i) on their own initiative, and taking full responsibility, they created 'departments' of continuing education that organized courses of different types; (ii) by associating with industry and not-for-profit organizations, they created interface institutions, where continuing education could be organized.

Other types of higher education institutions have only seldom created similar joint-venture initiatives for vocational education and/or continuing professional training. This has been an effort running in parallel, with very little, if any, contact with universities.

During the last decade, continuing education provided by higher education institutions has remained approximately stable or increased slightly, while continuing education supplied by the new emerging vocational and professional systems has doubled in the same period.

The most important aspects I would like to note from the above are as follows:

- The university as an institution has changed, maintaining a strong role in fundamental research and developing stronger links with industry and services for developing and prototyping products. It has also engaged in some form of continuing engineering education, or at least has considered doing so.
- CEE is being strongly developed, by national interface institutions, transnational consortia, private training companies' initiatives, large companies' training departments and engineers' professional organizations.

#### NEW TRAINING AND VOCATIONAL SYSTEMS

The traditional higher education system has been a national issue and is part of the cultural tradition of each country. The Treaty of Rome never allowed the European Community to interfere directly at that level.

Higher education was, nevertheless, a very important and relevant issue for the European development. As such, means were found to overcome that bureaucratic difficulty, and enormous amounts of European money have been poured into it. This has been done in several ways, the most important strategy being the development of a parallel 'educational' system, typically independent of ministries of education, and mostly dependent on ministries of labour. This system was called vocational education, professional training, continuing education, etc., and it would begin at the level of the last years of traditional secondary education, linking and continuing, in several countries, the so-called technical education.

This was, in my view, a reaction of both national and international industrial forces to the difficulty that most of our universities showed in adapting quickly enough to the new and immediate needs of industry and the society as a whole.

The growth rate of student enrolment during the 1980s in Europe, was larger in the vocational higher education system than in universities. These vocational systems have shown lower drop-out rates, seem to be more efficient and their costs per student are much lower. They have been developed with an objective of transnationality, with common creditation procedures and an accreditation system accepted by all countries. Up to now, this has been done at the administrative level and not all European directives have been translated into national law; however, this shows a powerful involvement of member states with a common and structured system of training that could respond quickly to industrial needs. Today, it is estimated that 20% of the active population in Europe receive some form of continuing education, typically one to two weeks per year.

Therefore a vocational or professional training system—credited and accredited at transnational level and structured in a way that may easily integrate a continuing professional training as a logical extension—already exists, or is in the process of being organized. In my view, it is important that we keep this new system independent of what we mention here as CEE.

#### THE NEED TO ADJUST THE EDUCATIONAL SYSTEM

As in many areas of our society, the educational system is developing into a more complex and sophisticated service. More information, as we have available today, triggers more knowledge, which will facilitate the task of dealing with more complex social models. My feeling is that we have to prepare ourselves for dealing with and managing a greater variety of higher education institutions with different aims and objectives, possibly with shorter lifetimes than universities. And how can we do that? The process of quality assurance and certification seems to be the way to proceed to achieve that.

In the last century, human industrial needs were, as seen from today, quite clear and simple. However, in our world, industry is a very complex system, so large and diversified that to understand it we need a number of experts, possibly from a number of different countries. The need for human resources changes with a number of very different types of factors, and changes rapidly. It is a very dynamic system, constantly adapting to ever new circumstances.

It is absolutely true that a rapid response to industrial needs is important and desirable, and this supports the urgency of organizing our educational system in such a way that makes it possible.



On the other hand, we should not forget that industry is not the only force driving society, which may resist an overdependence on technology push as there are obvious signs of fatigue caused by the successive and disruptive ups and downs of industry.

All societies automatically, yet unconsciously, build mechanisms to balance natural cycles—as in physics, these are a sort of inertia system. They typically respond slowly to changing system parameters and ensure medium- and long-term objectives. It is important to be aware that these mechanisms have a crucial role to play, and I would add that they are as important as the fast responses. One such inertia system has been the universities. Not all, not in every country, but as a whole I think this is mainly true.

It is easy to understand that a university with a five year engineering degree cannot respond quickly to the immediate needs of industry. A curriculum reform, from initial studies to the feedback of first graduates, takes at least ten years. Within this time, industry may go through a full expansion and recession cycle. For example, in 1985 and 1989 industry was claiming to need a 20% increase in electrical engineers in telecommunications and informatics. Between 1990 and 1993, this figure went back to the 20-year average of 1.5–2%. It would have been a disaster if universities had followed industry's claims at the time.

Furthermore, university teaching and fundamental research (as well as R&D) are inextricably linked, and so at least a part of the university must be absolutely independent of industry, in order to concentrate on long-term objectives, developing concepts and ideas that industry will use in 10 or 20 years time.

CEE is an absolute necessity from the technical and professional point of view. It is a part of the life-long learning perspective of our society, for every and all of its members, from the youngest to the oldest. As such, the need to adjust the educational system must have this as the main final objective, and should then:

- consider and involve the best we have now;
- encourage changes to adapt some institutions to the new needs;
- promote new institutions that may perform what has to be done in a better way.

In my view, I would not like to force universities to change too much. First, they have already changed to a certain degree; second, their inertia minimizes the risk of changing into the wrong direction; and third, because universities, in order to perform their role of higher education and fundamental and applied research, must keep a certain distance from the rest of society and always aim at medium- and long-term objectives.

As the short term must also be considered, which is also extremely important, it is desirable that some higher education institutions take this role for themselves, with closer links with industry, faster

and more flexible curricula with contents more attuned to immediate necessities.

Both types of institutions must include forms of CEE in their activity. Furthermore, new institutions should be born, perhaps specialized in CEE, aggregating the most important actors in this field and creating as such the needed synergy to be active and efficient in this new area of lifelong education.

### THE RELEVANT ACTORS FOR CEE

Industry and services, individuals, universities and other higher education institutions and, finally, engineering professional organizations are the main actors for CEE. Directly or indirectly, they should contribute to it explicitly. It is difficult to envisage that CEE could be structured without them.

The following points list the most relevant reasons why CEE is important for those actors and hence why CEE should be structured with their contribution.

#### *Importance of CEE to industry*

For industry, CEE must be an increasingly significant factor since for a company its work force represents its most important asset.

Employers should encourage their employees to embrace CEE and provide financial support to underpin this activity if necessary because of the resulting benefits to the company. They should be encouraged to accept responsibility for providing efficient short- and long-term development programmes to all their employees.

#### *Importance of CEE to individuals*

CEE is primarily about realizing the potential in individuals by a structured approach to the identification and implementation of a programme of continued learning to optimize the contribution that each individual engineer can make.

With a properly chosen and implemented programme of CEE, the engineer becomes a more skilful and rounded professional, able to contribute more effectively to his or her company's performance and to undertake a wider range of employment opportunities.

CEE may need to be undertaken, at least in part, in the engineer's leisure time.

#### *Importance of CEE to universities*

CEE represents an as-yet undeveloped opportunity for universities to provide education and training to a range of 'customers' rather different from their pre-career clients. There is a growing realization that education has now become a life-long process; throughout their lives engineers will require continual updating. One aspect of this process can be provided by courses and other activities offered by academic departments.



Universities have some unique advantages as providers of CEE:

- Universities have the trained staff, lecture facilities, R&D labs and support systems to be natural providers of in-service education and training. They are a repository of knowledge and their staff—researchers and professors—are most probably in the front line of science. Moreover, many graduates feel an emotional link to the institution where they obtained their first degree.
- Universities in recent years have developed much stronger links with industry and many now have a very clear idea of what education and training is required. Because of the financial constraints under which many university departments now operate, most of them are willing to develop courses and other activities to match specific customer requirements.
- Universities may be able to play a coordinating role for CEE activities.

The general requirement for universities, all over Europe, to use staff and facilities more effectively complements the developing interest in and need for CEE provision.

#### *Importance of CEE to professional organizations*

Professional organizations have for many years been involved in a range of continuing education activities—lectures, colloquia, conferences, vacation schools, etc. Most institutions that have become actively involved in a formal CEE programme have done so as a service to members, seeing a need to provide advice on career development and to give support for logical implementation of a CEE programme.

A number of professional institutions regard CEE as follows:

- as an activity which it is right to promote strongly to members;
- as a complex series of choices on which members should be guided and their progress then recorded;
- as a mechanism for enhancing professional competence of members, leading to increased respect within society and hence enhanced status.

It should also be noted that some professional organizations have a formal qualifying role and hence may be better placed to persuade their registrants to undertake a structured CEE programme.

### **QUALITY CRITERIA**

Quality certification, accreditation and credit transfer are the most important aspects to building CEE in Europe. Without this common ground a European CEE system is out of question. The basis of all of them is an appropriate quality criterion.

Quality criteria have to be arranged by looking at the specific needs of the main CEE actors. It is also necessary to remember that 'initial conditions' (i.e. the background of continuing education students) include a variety of different degrees and different ways of learning. Definition of quality criteria must be more user oriented than absolutely defined.

Ideas have been mooted in Europe about applying the standard series ISO 9000–9004 (EN 29000–29004) to continuing education. It is necessary to clarify to what extent the ISO 9000 series is actually suitable for continuing education and whether such an application is sensible or indeed desirable.

Transferred to the field of continuing education, the ISO 9000 series regulates only the formal procedures to be followed. Such formal procedures are, for example, CEE course programmes and announcements, costs, documents and certificates for the participants. Criteria for the quality of the CEE content are not fixed by ISO 9000 series, even if some guidance is provided in the ISO 9004/Part 2.

If incorrectly applied, certification to the standards of the ISO 9000 series may cause a large amount of bureaucracy, combined with high costs. Even in the classical fields of production, there are many calls for EN 29000 to be made more user friendly and cost effective.

Great care must therefore be exercised in trying to apply EN 29000 to CEE.

### **STRATEGY FOR A EUROPEAN CREDITATION AND ACCREDITATION SYSTEM FOR CEE**

Developing a top-down system seems a gigantic and impossible task, leading to a rigid structure that would be incompatible with the EU principle of subsidiarity and current practice. Engineering education varies from one European country to another, with specific legislation, and it has not proved possible to implement a unified European system. The chances of achieving that objective for CEE must be even more remote.

A bottom-up approach should instead be envisaged. National CEE quality systems may be developed, perhaps considering engineering sector by sector, and proposed to the CEE market by a relevant organization or a consortium of relevant organizations. If and when the market accepts those proposed standards, then transnational bilateral and trilateral agreements could be worked out. That small group could be the seed for a future European equivalence network system for CEE. This approach is being followed by the IEE in the UK, with the CPD initiative and by the INAFE project in Portugal.

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