CHALLENGING TIME FOR ENGINEERING

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Challenging Time for Engineering

Abstract

Engineering plays an important role in this "brave new world" and it is in fact crucial for the development of science and technology. More importantly, it is responsible for the delivery of such technologies on the service of the betterment of humanity. Engineering must be aware of not only environmental but also social impacts of the outcomes of projects. Looking closer to the training of engineers, there is still a prevalence of good technical training without considering a broader knowledge achievement. This broader achievement is not a recent idea; the French School of Engineering implemented under Napoleon governance formed the "Mr. Engineer" that prepared leaders with high profile of technical knowledge. Even after the globalization phenomenon, with all the discussions about introducing humanistic courses in engineering programs, the results are humble. There is still a difficulty for engineers to address technology to solve social issues rather than to apply technology regardless social needs. The other point is that, currently, the design of a project for the "informed society" has to take the social as well as the environmental impacts into account. So the question is: how should the engineering school prepare the future engineer to perform in the new challenging social environment? If it is possible to suggest some actions, the key is to prepare the future engineers to learn how to work close to communities and governments, addressing the outcomes of the projects to solve socio-technological problems.

1. Introduction

The present world, full of challenges and crises of deep consequences to society as well to the environment, has a strong incidence in terms of decision making in any field. It means that it is becoming more and more complex and difficult to take decisions due to the fact that the implications are felt in a faster way and in a larger community. For engineers, the decision process is even more complex once the implications have serious impact not only to the target customers but also to the society as a whole and to the environment. This is an aspect that shows the necessity for engineers to search for the acquisition of an ability to respond to social necessities having in mind the cultural aspects when developing a project.

The effects of this aspect in engineering formation implies a different approach providing the future engineers a notion about policy, ethics and social sciences, which are so important to prepare them to the future work market that will require the respect and promotion of society and environment as assets[1].

Most of social groups have ambiguous understanding about science and technology; some understand it as responsible for the environmental deterioration and the voracious capitalism and others as the ones responsible for the better quality of life with the improvement of health systems, agricultural production and other accomplishments. Both perceptions are not far from

the reality. In any case, the impacts can be seen along the history and more recently with the sophistication of the so called "information society". This particular "information society" shows how strong the impact of any technology introduced in the society can be. Real time communication and brutal amount of information available have changed drastically how people relate, make business and study[2].

The proposal of COPEC - Science and Education Research Council for next five years is the offering of MBA by Distance Learning due to the new global education demand. The new programs will be delivered in Portuguese in a first moment, for all Countries of CPLP - Portuguese Language Countries Community. The idea is to cover these countries that also are seeking for opportunities, as the majority of them are growing and very rich Countries. The first group of programs is: MBA in Social Engineering and MBA in International Engineering Educator, both with International Recognition.

2. Recognition of Science, Technology and Engineering in Present World

Many Countries in the world have recognized the importance of engineering in world scenery. Therefore, they have been working to get the competitiveness of national goods and services by means of incentive to create projects of qualification of professionals through lifelong education, for example, and others. Leaderships, many representative groups, and agencies have been implementing programs to prepare engineers to increase the efficiency of the research system, experimental development, engineering, producing system and the market[3].

All these efforts have been having a kind of smooth effect once it is one of the most difficult and expensive programs of College level, which does not help with the inclusion policy. However, some Colleges have opted for a softer engineering program offering them in the evening. These programs are lighter, more focused in technical knowledge, and less focused in basic sciences. The students in general work all day and choose engineering programs because it is a way to be promoted at work[4].

A third degree diploma opens some doors. It means not only the possibility of earning more money but also to reach an upper status, socially speaking. It is a fact that even being a lighter program for the students it is very demanding and in general it takes them more than five years to complete. The diploma has the same value of a program that prepares engineers of conception. In a certain way, it helps the inclusion policy of education although the number of engineers has been decreasing considerably in the last 10 years[5].

3. The Formation of the Engineer seen by COPEC

As an organization that works for the future of education, COPEC has established some guidelines to be applied on the design of engineering programs. The guidelines are the result of researches as well experience designing and implementing engineering programs[6].

- The programs should be flexible;
- Have more practical activities;
- Internships as a way to provide real experience in engineering.

The formation of the engineer must consider above all the strong basis in basic sciences and basic sciences of engineering and the programs should instigate the students to be willing to develop some skills such as showed below:

Basic Sciences
+
Basic Sciences of Engineering
+

- Aptitude to conduct and implement projects
- Responsibilities for actions and results
- Creativity and innovation potential
- Mastering technologies' evolution
- Positive attitudes and behaviors
- The willing to learn all life long
- International experience
- Entrepreneurial mind
- Respect towards diversity
- Communication skills
- Team work
- Strong ethics.

These capabilities can be instigated in the students by means of new education proposals, exchanging programs, international experiences, double diplomas, internships, technological initiation and other feasible implementation in the engineering programs[7].

4. The Social Engineering Program – MBA offered by COPEC

In a global world, engineers should be aware of the responsibility to society as they contribute to its development. They need to be aware of not only environmental but also social impacts of the outcomes of projects. Looking closer to the training of engineers, there is still a prevalence of good technical formation without thinking of a broader knowledge achievement.

This broader formation is not a new idea; under Napoleon governance the French School of Engineering formed the "Engineer" that used to prepare the nation's leaders with a high profile of technical knowledge. After the globalization with all the discussions about introducing humanistic courses in engineering programs, the results have been humble. Nowadays it is difficult for engineers to address technology to solve social issues rather than to apply technology regardless social needs[8].

The design of a project now requires knowledge about the social as well as the environmental impacts, so engineers should be capable to learn how to work close to governments and communities, addressing the results of the projects to solve social problems or at least to prevent new ones.

In response to this necessity COPEC - Science and Education Research Council has developed a MBA in Social Engineering. It is an MBA program offered by distance that fulfills the urban demand of engineers to solve social problems that are outcomes of urbanization and environmental issues in cities.

Specialists in all areas of social science and engineering are extremely interesting to any enterprise of construction. It is a very wide field covering most national and international construction industry. There is also an increased demand for consultants with specialist knowledge in public economic system, scientific writing, venture capital and marketing, expertise for governmental bodies, city planning and authorities, as well as a large demand for PhDs within the area.

The program is directed to engineers interested in acting in this field-offering consultancy for construction companies, industrial enterprises, city halls and governmental housing organizations, etc. It is a transdisciplinary program that prepares engineers to work in projects dealing with the social aspects of projects.

5. Admission Requirements

The basic candidate requirement for admission is:

To have a bachelor's degree in civil engineering. However, the program encourages applicants from diverse backgrounds, including (but not limited to) engineering, environmental science, management and economy. Applicants may need to complete prerequisite courses. A faculty advisor will determine the specific requirements on an individual basis depending on the student's educational background and work experience[9].

6. Candidate Profile

- Taste for related themes to the sciences of mathematics and physics and technological ones of civil engineering.
- Interest in solving problems in engineering in coastal and estuary environment principally the ones that involves the coast and constructions.
- Capability of questioning.
- Affinity and discipline for the activity of research.

7. Program Outline

The two-year program (120 ECTS) consists of courses amounting to 90 ECTS, followed by a Degree project (30 ECTS). The system is compatible with ECTS credits. It is a Distance Learning study program and the language of instruction is Portuguese. The program includes the courses as follows:

- Analysis of Social System;
- Applied Mathematical Methods for Social Issues;
- Game Theory;

- Public Economic System;
- Macro and Micro Economics;
- Public and Private Policies Aspects;
- Environmental Economics and Public Policies Generalities;
- Introductory City Planning;
- Aspects of National and Regional Planning;
- Housing and Land Policy Analysis;
- Design Theory of Public System;
- Basic of Law Systems.

At this level it is important to propose and develop a serious project of investigation that includes the method of solving the social problem, which is the subject of the study. The degree project amounts to one semester (30 ECTS) of full time work and is undertaken during the second year. The thesis topic may be chosen from a list of topics suggested by the teachers, generally carried out in the area defined by the courses taken during the first year of the program. The project may be carried out either in the industry, or in another university or research institute, anywhere in the world[10].

The number of possibilities is vast once the dynamic society in which man lives nowadays is more and more complex and mutant. It is an aspect that leads to the necessity of an investigation about an issue that is real and which solutions are feasible and in a short time. The most important aspect of such program might be the social analysis of a real problem, which demands a certain amount of efforts in the search of economically sustainable ways of solving it.

The program is developed in modules: two modules per semester. The scores and the final project presentation on line establish the final approval of a student. A chat with students provides teaching and guiding the development of projects in a broader perspective.

The MBA is taught almost using case studies—whereby students discuss real dilemmas faced by actual companies. The debates are online and last for three or four days. The professor opens up by asking questions and the students then begin discussing the case.

As the target audience is spread in different continents, the cases are discussed in an Internet forum. Students enter the discussion at the time that is best for them. It can be early in the morning before going to work, sometimes in the evening or even late at night. Usually they will be involved for two or three hours every day. The choice of asynchronous learning mode of delivery is due to the fact that so participants access course materials on their own schedule and so it is more flexible[11]. However, there is the possibility of a present module for pertinent seminars and visits to companies and sites with the goal to enhance the acquisition of knowledge and experience in the field.

8. Evaluation Process

The evaluation of learning is continuous, prioritizing qualitative aspects related to the process of learning and student development observed during the conduct of the proposed activities,

individual and / or group, such as surveys, reports of activities and visits, diagnostic case study or prognosis of work situations and also developed projects.

The observation should be based on criteria and performance indicators, as it is considered that each expertise brings in itself certain degree of experience cognitive, behavioral and evaluative, which can be translated into performance. Thus one may say that the student acquired specific competence when the performance expresses this level of qualitative requirement.

To guide the evaluation process, make it transparent, able to contribute to the promotion and regulation of learning, it is necessary that the performance indicators are defined in terms of teaching, explained and negotiated with students from the beginning of the course, order directing all efforts of the technical staff, teachers and students themselves to achieve the desired performance.

Thus, it is expected to enhance learning and reduce or eliminate the failure, since education competency involves ensuring conditions for the student to overcome learning difficulties diagnosed during the educational process. The self-assessment will be fostered and developed through procedures that allow students to monitor their progress, as well as the identification of points to improve, practice deemed essential to learning autonomously[12].

The result of the evaluation process will be expressed in words:

- Optimal: able to play, highlighting the competencies required by the profile professional conclusion;
- Good: able to perform to the satisfaction, the skills required by the professional profile completion;
- Insufficient: still not able to play at least the required skills the professional profile of completion.

The endorsement will be awarded per module, considering the criteria and indicators performance related to the powers provided in each, which integrate professional competencies described in the profile completion below.

9. Professional Profile – Expected Outcomes of the Program

- Search constant updating and self-development through study and research, to propose innovations, identify and incorporate with criticism, new methods, techniques and technologies to their actions and respond to everyday situations and with unprecedented flexibility, creativity, resourcefulness as well as social and cultural.
- Taking professional attitude consistent with the principles governing the work area, working in multidisciplinary teams and relating appropriately with other professionals, clients and suppliers.
- Manage the career with initiative and in an entrepreneurial way, to provide services or organizations to conduct own business.

- Acting responsibly, committing to the principles of ethics, environmental sustainability, the preservation of health and social development, directing its activities to the values expressed in the professional ethos, which results in quality and commitment with work well done.

10. Objectives of Program

The main objectives of this social engineering graduation program are:

- to prepare engineering researchers and professionals in administrative positions who work in areas related to policy to design and implement in national territory socio-economic systems and to develop the integrated theories and methods of these areas;
- to increase logical thinking, sense of social ethics, social assessment capability;
- to start thinking without any preconceived notions;
- to look for innovative problem solving .

11. Final Discussions

Distance learning is not for everyone. It is very difficult to juggle work, family and study. Plenty of self-discipline is necessary. However, the idea to study at any time any place that suits the students best is very enticing.

Another aspect is that it gives an opportunity for bright students in different remote parts of the world to access a top-quality education program, which would otherwise be unavailable to them. Distance-learning students tend to apply what they have learnt immediately in their work making their studies more practical.

Competitive modern marketplace demands rapid change and innovation, for which distance education programs can act as a catalyst. It is a lifelong learning environment once it provides the students the opportunity to receive equal education regardless of income status, area of residence, gender, race, age, or cost per student.

The proposed program delivered by COPEC constitutes another opportunity for engineers to acquire knowledge in their fields of expertise to defeat social problems mainly faced by urban agglomerations.

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