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FOSTERING ENGINEERING EDUCATION FOR A SMART ECONOMIC GROWTH IN ROMANIA

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Abstract: *The article aims to analyse the engineering education landscape in Romania and presents measures to foster its attractiveness for young talented people. Engineering is considered to be a promoter of creativity, innovation and entrepreneurship that will assist Romania recover from the present crisis, but, in order to be able to do this, a reevaluation is recommended.*
Key words: *engineering education, quality in higher education*

1. INTRODUCTION

Education, especially higher education, represents an important investment for the future of individuals, providing them with knowledge, skills and competencies that will determine positive impacts on individual development but also on national economies and societies at large. Higher education insures better employability and reduces unemployment and poverty. The present economic crisis is a new driver of change and many countries should review and revalue their higher education systems, especially technical. The most recent strategy launched by the European Union (EU) seeks to counterattack the crisis by recommending the promotion of higher education and especially the sufficient supply of graduates in science & technology, engineering and mathematics (STEM) (EU strategy, 2010). These actions are seen as promoters of the desired creativity, innovation and entrepreneurship that will assist EU exit the present crisis. Moreover, in the United States of America (USA) the importance of STEM graduates was recently recognized (Obama, 2009) and a joint program destined to inspire students to pursue carriers in science and engineering was launched in February 2010 by the Department of Energy and National Science Foundation. Similar to all developed nations, Romania depends on technically skilled workforce that is required for economic recovery and sustainable growth, but the Government was unable so far to take appropriate actions. Unfortunately, in Romania there is a lack of awareness of the career opportunities in engineering, especially in some areas like chemical engineering. Therefore, young people must be appealed by appropriate measures that studying for an engineering degree will enable them to tackle modern and compelling issues like sustainable development and climate change, renewable energy, modern drugs, smart and high-performance materials, biomaterials and nanotechnology.

2. CONCISE ANALYSIS OF THE ROMANIAN ENGINEERING EDUCATION LANDSCAPE

The population of Romania is rapidly ageing, while the fertility rate continues to remain low, those facts leading to a shrinking in the size of younger age cohorts (NIS, 2008). Despite this evidence, the Romanian higher education system might suffer only a limited impact, as demographic changes do not necessarily lead to a decrease in student enrollments (OECD, 2009), other factors being of equal importance, namely the access to higher education, education at older ages, public policies and investments in education and science & technology (S&T), employability chances. Gross enrollment rate (GER) for tertiary students rose from 22% in 1997 to 51% in 2007 (Altbach at al., 2010), showing that in only one decade the Romanian higher education changed from "mass" to "universal" one (GER for Romania was calculated by dividing the total number of students by the total number of citizens in the group age 18-22). The classification of higher education systems in function of GER was articulated by Martin Trow in his well-known "massification theory" (Trow, 1974). According to Trow, there are three types of higher education systems depending on GER: elite - less than 15%, mass – 16-50% and universal – over 50%. However, the values for GER in Romania should be regarded with skepticism when it comes to the quality of the enrollments, as they also incorporate a large number of students at private universities with very lax educational requirements.

The engineering education in Romania has an old and prestigious tradition and was started in 1818 by Gheorghe Lazar who founded the first technical higher education school in Bucharest, with Romanian as a teaching language. Today, the number of institutions with official accreditation or provisional functioning authorization offering engineering degrees is quite large, scoring a number of 42 (34 state out of 56, and 8 private of 53) out of 109 (MO 465, 2009). An impressive 61% of state universities are offering at least one Bachelor's degree program in engineering.

The number of students in tertiary education rose during the last decade worldwide and in the EU and this demand is likely to increase in the next years, as the people with higher qualification tend to be more "employable" than others with inferior education (Momete, 2009). More than 85% of people with tertiary education under 40 years were employed in EU-27 (Eurydice, 2009), proving that they have good prospects for finding skilled jobs. At the same time, during the last decade, a larger interest in engineering education was recorded over the world, for instance in 2007 more than 4 million first university degrees were earned in science & engineering worldwide, EU-27 accounting for a 19% of them (760,000), China for 21% and USA for 11% (Burelli, 2010). In EU-27, the percentage of tertiary education graduates in the domain of S&T per 1000 inhabitants was 13%, while engineering graduates accounted for about 12% of all graduates. However, this does not imply that they were also employed in their profession, as they tend to accept jobs for which they are over-qualified. These trends are also followed by Romania, where the numbers even exceed the European mean (see table 1). At the end of 2007, the total enrollment in tertiary education in Romania was of 928,000 students, more than 50% being enrolled in social sciences, business & law, and 17.2% of them were enrolled in the engineering, manufacture & construction (EMC) fields of study (159,616). However, EMC records for Romania also incorporate IT&C and constructions, fields that have registered an increased demand over other traditional engineering specialties like chemical, materials or mechanical engineering.

Region / Key indicator	Romania	EU-27
Employment rate for tertiary graduates (25-39 years old) (%)	91.8	87.6
Tertiary education graduates in EMC (% of all graduates)	17.2	12.5
Graduates in S&T/1000 inhabitants, aged 20-29 (%)	10.5	13.0
Tertiary graduates employed as professionals & managers (%)	78.4	56.8

Tab.1. Key data for engineering education in Romania and EU-27, 2007. Source: data processed from: Eurydice, 2009 and Eurostat, 2010, Labour Force Survey, accessed on: 2010-03-01, http://epp.eurostat.ec.europa.eu.

The link between higher education and the labor market proves to be stronger in Romania than in EU-27, where about 57% of tertiary graduates were employed as professionals. An impressive number of 78.4 % (the largest in the EU-27) was recorded in Romania for the tertiary graduates employed as professionals, showing a good match between their job positions and level of qualification. However, this figure has to be taken carefully when it comes to engineers, as those educated in Romania tend to be very versatile and adapt easily to different positions, not necessarily in their specialty.

3. MEASURES TO ENCOURAGE ENGINEERING EDUCATION IN ROMANIA

Engineering education is one of the keys towards a smart growth based on knowledge and innovation (Momete, 2007), but a modernization of its agenda is needed regarding curricula, financing and policies that will provide better educational outcomes in the global and European context.

Universities in the EU embrace two systems of admission: a cvasi-automatic system of admission once a candidate has obtained the Baccalaureate diploma - the so called continental system applied for instance in France – and the British one based on high degree of selection. For engineering education the British system seems more appropriate, but unfortunately in Romania some specialties, like chemical engineering, are not based on rigorous selection process due to seemingly lack of competition, so less qualified students are attracted. Therefore, enthusiastic students studying for chemical engineering are less and less encountered and, at the end of their studies, most of them desire to work in other domains. Therefore, universities offering chemical engineering education must understand that they have to compete for students in the same manner they are competing for funds or research grants and act on it to attract talented and enthusiastic persons. Consequently, university-business partnerships must be fostered and made public and these will guarantee that more students will be aware of their opportunities. These actions will lead to an easier integration of students on work placements and internships, providing them with reliable specialty knowledge. Moreover, a system of study and research grants should be available especially to engineering students and should be properly advertised.

Engineering education is assumed to provide creative, flexible and innovative graduates with the capability to develop sustainable solutions that are both technically and economically viable. Engineering graduates are supposed to develop, provide and maintain products, processes, infrastructure and services for society (QAA, 2006), tackling their complete life cycles from conception, design, manufacture, operation to decommissioning and disposal, within existing constraints (legal, commercial, environmental, social, etc). Therefore, the relevant knowledge about the economic, environmental, social and legal factors should be incorporated in their curricula. Moreover, by providing them with appropriate entrepreneurship education, they could be easily self-employed.

Many of the Romanian chemical engineering students spend most of their student life struggling to pass their exams and survive, some of them having full or part-time jobs, without trying to self-develop. Therefore, they tend to complete their education without gaining the necessary skills that will make them employable in their field of study. Consequently, they should become full-time students in order not to compromise the quality of their higher education, and must be involved only in specialty internships and work placements during holidays.

4. CONCLUSION

The Romanian engineering higher education institutions must convert the challenges of "universalisation" into opportunities to attract more talented and enthusiastic young people to engineering. Despite the optimistic numbers presented by statistics, fewer persons are presently involved in traditional engineering programs and this should be addressed by measures taken directly by the universities. Therefore, the faculties should leave their ivory towers and try to focus on the promotion of the importance of engineering studies for a better society. Universities offering engineering education have to cope with the present crisis and develop quality programs especially designed to attract young and talented people and engage in direct partnerships with the industry.

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