

Attracting Student Vocations into Engineering Careers

EnginyCAT: Catalonia Promotional and Prospective Plan

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Abstract—In the developed countries vocational demand for scientific and technical studies is a serious concern for government, universities and companies and different analysis and programs are promoted to try to compensate the steady decrease of their demand. In this communication the phenomena for Spain, with an spatial emphasis in Catalonia, will be reviewed in the European context, and some clues for promoting new engineering vocations will be given.

Keywords—component; engineering vocations, engineering studies promotion

I. INTRODUCTION

The Catalan Government concerned by the decreasing number for engineering vocations in the context of a foreseeable mid term increase on engineering graduates demand to sustain the so called knowledge-based society new challenges decided to promote a plan to foster engineering vocations in Catalonia, through the EnginyCAT initiative. Progress and output figures for high school and university have been analyzed and compared at international level and more significant insights on youngsters' vocations and clues for attracting vocations have been studied.

UPC-Telefonica Chair on Future Trends on Information Society focuses its activity on the analysis of the Information Society evolution and in its impact on the different significant social fields and in particular on education, health, administration and competitiveness. Special attention is devoted to the national and international best practices and indicators at both national and international levels. The research approach for the different fields is based on the analysis on the general trends at global level and its projection at local level based on specific regional studies that allow extracting robust indicators. One of the main topic consists on studying the evolution and future trends of the scientific and technical education at the different educational levels and more particularly in high education at both national and international perspective

EnginyCAT and the UPC-Telefonica Chair have joined efforts to study the main professional fields and factors for engineering practice are to draft the main professional tendencies. Basic trends for job market will be analyzed at international level and projected into the national and regional Spanish levels. Specific and differential parameters for the job market corresponding to the different main disciplines: civil, industrial and ICT, is a central field of research.

II. ACADEMIC AND PROFESSIONAL CONTEXT

In order to have a consistent perspective about higher educational demand on engineering and technology it seems convenient to take a look at the preceding pre-university secondary education, Fig. 1, [1-2], data in science and technology areas.

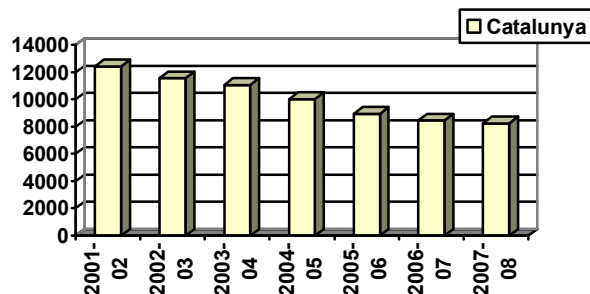


Fig.1 Number of technology junior-year high school students in Catalonia

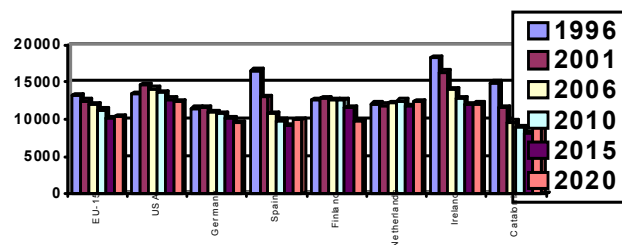


Fig. 2. 18-year old population evolution per million of country inhabitants.

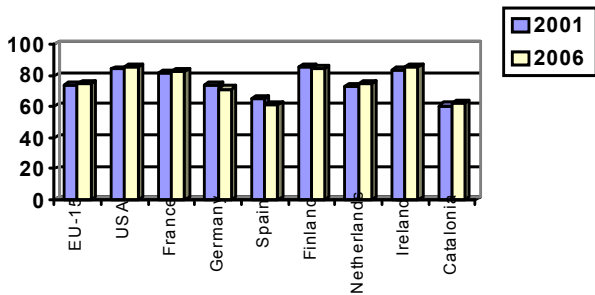


Fig. 3 Percentage of population successfully completing secondary school

At Catalonia (and similarly Spanish level) data show, [3], a steady yearly decrease of about the 5% (2% due to the demographic decrease and the 3% due to the percentage decrease with respect to its population of age). In absolute terms the population has passed from 12.400 youngsters in 2001-02 to 8.243 in 2007-08 academic year. When looking at the evolution into the international context, it may be seen, Fig. 2, that demographic decrease will still add pressure to the total demand decrease at least until 2015. An additional factor stressing the number of students entering at higher educational level is the percentage of youngsters completing secondary school. It may be seen in Fig. 3 how these percentages for the Spanish and Catalan cases are 15-20 percentage point below European averages.

Finally a last significant aspect contributing to the engineering studies vocation shortage is the percentage of women going into Science and Engineering studies. It may be seen, Fig.4, how the percentage of women is around 25-30% far below the “natural” 50%. If some studies as Biology and Architecture are extracted, the percentage fall below 20%.

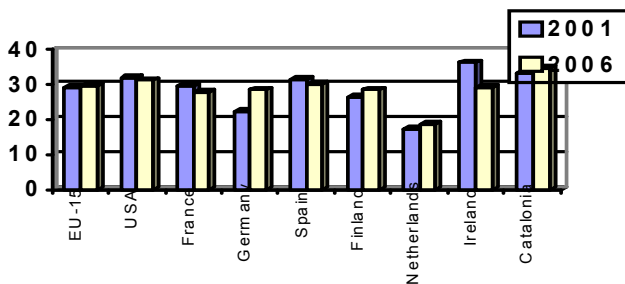


Fig.4 Population percentage Science and Engineering higher education women presence

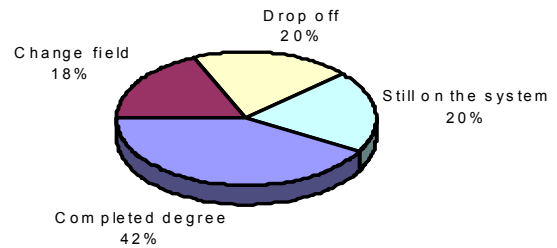


Fig. 5. 2000-07 follow-up of 8.700 university engineering students in the Catalonia University system

Once entering into the higher education, [4-7], engineering studies tend to be relatively difficult studies and the graduation rate is in some cases really low. Fig. 5, shows the academic evolution of a cohort of students entering into engineering studies in Catalonia and their evolution after 7 years (largely enough to have completed their studies). Results show, that eve entering with good marks in general, in average 60% of the students will probably complete their degree (20% probably with a quite longer time than necessary), 20% will switch to different university systems and 20% will drop off from the university system. In Fig. 6, comparative international results show that the situation in quite similar in mostly of the countries except in very well organized systems as the Ireland (Anglo-Saxon) and France systems.

When looking at the occupational job market, Fig. 8, it may be seen that in general the number of necessary professional engineers and technicians to attend the so called knowledge based society is normally above academic output and this shortage will foreseeably increase in the coming years. As an example, for the Catalan case, Fig. 8, the actual number of existing professionals (98.000) is slightly below companies demand (110.000) this makes a shortage of 12.000 graduates (10%. approximately). With the actual number of yearly graduates 7.600 out of 13.000 students entering the university this shortage will increase up to 25.000 when compared to the average EU-25 or up to 55.000 when compared to the number of professional engineers and technicians of the top European countries.

It is then clear the urgent need for reducing the gap.

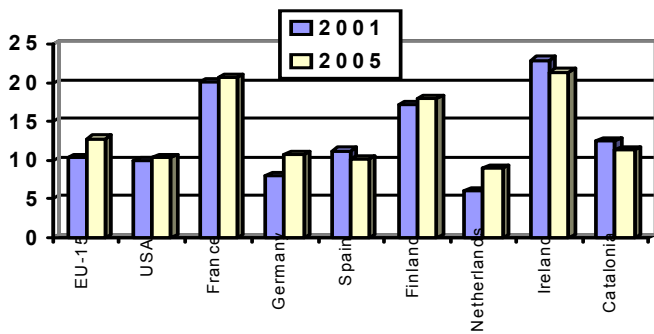


Fig. 6. Science & Engineering university graduates per 1,000 20-29 year old inhabitants

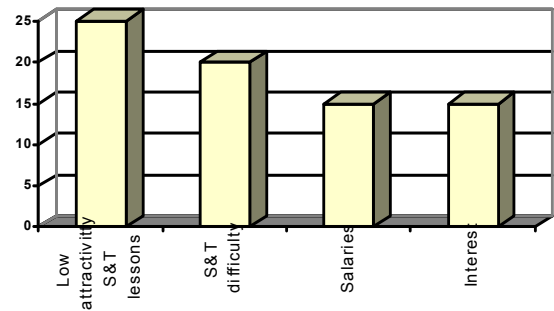


Fig. 8 Percentage of European youngsters marking the different reasons to express their lack of interest towards Science & Technology studies.

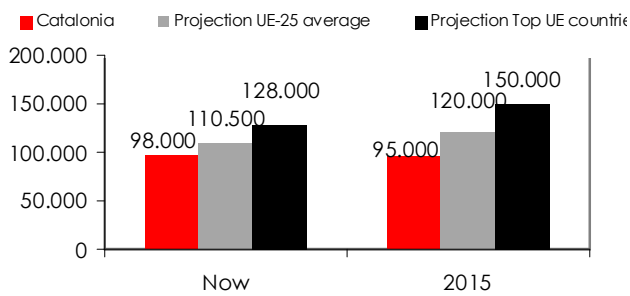


Fig. 7. Number of professionals now and 2015 projection for the engineering professional occupational market in Catalonia. Source CEDEFOP and EnginyCAT processing [8]

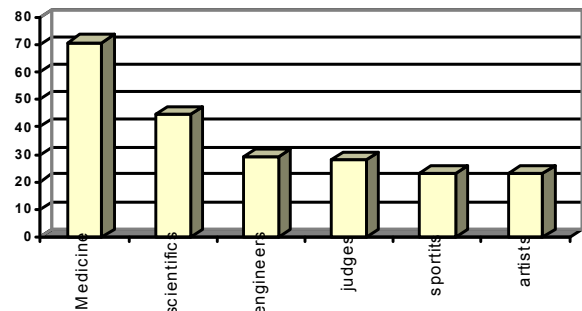


Fig. 9. Percentage of European youngsters positive perception of different professions.

III. ENGINEERING YOUTH PERCEPTION

In order to act over the system it is necessary to understand the factors behind the vocational shortage phenomena. Mostly of the factors are qualitative perceptual elements [9], Fig. 9, shows the more significant reasons expressed by the European youngsters to explain their lack of interest towards the Science and Technology studies.

Among the different aspects: attractiveness, difficulty, salaries and interest express their perception of a low return for a significant effort. In short they do not feel the social return (not just or especially in terms of salary) is consistent with their personal investment.

In order to contextualize this question, Fig. 9, shows the perception comparison for different professions.

It may be seen for example as Medicine studies even when having many common threats in terms of effort with engineering studies are perceived much more positively than the engineering studies.

IV. ENGINYCAT A PLAN TO PROMOTE THE ENGINEERING STUDIES IN CATALONIA

To balance this situation different aspects will need to be addressed. Three points will be critical: to attract more youngsters to the S&T studies, to improve the graduation rate at both secondary and university levels, and specially to improve the matching between the graduate expectations and the social return. Starting late 2008 the Catalan Government, through the University and Research Department created a plan, EnginyCAT, to promote engineering studies among Catalan youth. The goals of the program, Fig. 9, where addressed towards three main focus:

- To improve the scientific education among secondary education.
- To increase the number of youth vocations to pursuit science and technology studies, addressing a special attention to the women presence.
- To contribute to the improvement of the graduation rate at university level, with a special effort towards the engineering and technology curricula modernization.
- To improve the matching at both quantitative and especially qualitative levels between the engineering and technology graduates and the professional demand.

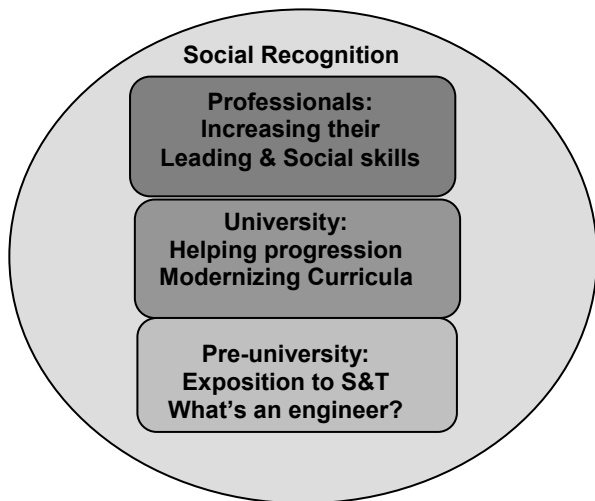


Fig. 9. The main goals of Promotional Plan EnginyCAT

The different actions need to be strongly coordinated with the different agents already operating in the system as universities and higher education institutions, professional charters, companies, etc, to create synergies and avoid duplicities.

The program consists on a broad scope limited number of actions to cover the three main areas of interest, pre-university youngsters, higher education (engineering and technicians) and professional insertion as described in Table I.

LÍNE 1: What engineers do?	
	ACTION 1: VÍDEO Engineering Presentation (Youtube format)
	ACTION 2: Engineering Studies Thematic Guide
LÍNE 2: Explore!	
	ACTION 3: High School S&T Workshops (Robotics)
	ACTION 4: S&T Summer Camp
LÍNE 3: S&T Talent recognition	
	ACTION 5: Pre-university S&T Prize Log
LÍNE 4: Prepare yourself!	
	ACTION 6: Teaching Assistant Mentoring Program
	ACTION 7: Designing future projects
LÍNE 5: Get involved!	
	ACTION 8: Engineering 2020. Curricula modernizing
LÍNE 6: Your future: Innovation!	
	ACTION 9: Leading and Communication skills

Table I. EnginyCAT Program basic lines and actions

V. ENGINEERING CHALLENGES AND PROSPECTIVE JOB OPPORTUNITIES

On of the main actual social concerns is job market in general, and youngster's job market in particular. One of the ways to give a clear vision about engineering is through their

professional and job new opportunities. The basic point is to translate to the society a fresh idea of the engineer role, not just from its parts but mostly from the point of view of the problems that may solve, Table II, and the job opportunities it may create.

The reasons to become an engineer
Leading a sustainable economic development to solve the emerging social XXI century new challenges
Increasing number of job opportunities and professional outputs
Innovative designs to promote new projects, ideas and companies

Table II. The engineer vision

VI. CONCLUSION

From an attentive analysis of the different academic and professional parameters it comes clearly the need to increase engineering attractiveness among youngsters. Science and technology proficiency will become of the leading economic development factors.

The key element is to generate a clear, positive and realist vision of the future engineering professional role. It is then necessary to interact with the k-18 pre-university kids and youngsters to let them know the new engineering challenges, (energy, water, health, environment, education, mobility, entertainment, aging people, etc), to increase the design and problem-solving component in our higher level studies, and to promote the innovation and entrepreneurship culture among our graduates to contribute too create a new generation of high-added-value companies able to hire very talented and motivated people.

ACKNOWLEDGMENT

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