# ENGINEERING AND MANAGEMENT AT THE UNIVERSITY OF PETROSANI

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***ABSTRACT:*** *The engineering and management is a representative domain for the Romanian engineering field. In 2012 there were more than 20.000 students enrolled in this domain out of 138.000 engineering students in Romania. At the master level there were also 6.000 master students, the best represented master in engineering. At PhD level there are 29 Ph.D supervisors and almost 100 PhD's graduates between 2011 and 2014, the academic program being re-started only in the year 2008. The University of Petrosani has the bachelor program Economic Engineering in mechanical field since 1992, as part of the Engineering and Management domain. Since 2005, just as the University of Petrosani has joined the Bologna process, the University of Petrosani also has a Project Management (PM) – graduate (master) program. Bachelor degree and master degree programs are coordinated by the collective of management of the university, consisting of 10 teachers having a PhD in Industrial Engineering, having a strong orientation towards management, and other 4 having an engineering or management profile. We must emphasize that the 10 teaching staff started the PhD preparation in the domain of Management and Industrial Engineering, but graduated in Industrial Engineering, under the PhD supervision of Prof. PhD. Eng. Simionescu Aurelian.*

***KEYWORDS:*** *Engineering, Management, Economic Engineering, Project Management*

## 1. ENGINEERS, ENGINEERING AND MANAGEMENT AND INDUSTRIAL ENGINEERING

Romania is our country. We cannot all go outside the borders, as someone seems to urge us. A figure disputed by anyone yet, Ion IC Bratianu, said at the peace conference in 1919: *"The forces of salvation are within the borders, not with those powerful"*. And if we are good in training engineers, we should bring young people from around the world and "produce" quality engineers to everyone's satisfaction.

The President of the European Center for Security Studies George H. Marshall, Mr. Robert Kennedy, meant during the international conference "Romania's contribution to the security and stability of the Euro-Atlantic", held on 01/16/2002 that the major contribution Romania can bring to the Euro-Atlantic stability is "*human capital*". (Abrudan, 2012)

An Engineering and Management curricula integrates the technical education of the engineer with a business education for management. In each year of the program students are required to take a mix of engineering, business, economics, and integrative engineering and management courses.

### 1.1. Industrial Engineering

Industrial engineering is a branch of engineering which deals with the optimization of complex processes or systems. It is concerned with the development, improvement, implementation and evaluation of integrated systems of people, money, knowledge, information, equipment, energy, materials, analysis and synthesis, as well as the mathematical, physical and social sciences together with the principles and methods of engineering design to specify, predict, and evaluate the results to be obtained from such systems or processes. While industrial engineering is a traditional and longstanding engineering discipline subject to (and eligible for) professional engineering licensure in most jurisdictions, its underlying concepts overlap considerably with certain business-oriented disciplines such as operations management.

Depending on the subspecialties involved, industrial engineering may also be known as, or overlap with, operations management, management science, operations research, systems engineering, management engineering, manufacturing engineering, ergonomics or human factors engineering, safety engineering, or others, depending on the viewpoint or motives of the user. For example, in health care, the engineers known as health management engineers or health systems

engineers are, in essence, industrial engineers by another name.
(http://en.wikipedia.org/wiki/Industrial_engineering)

While the term originally applied to manufacturing, the use of "industrial" in "industrial engineering" can be somewhat misleading, since it has grown to encompass any methodical or quantitative approach to optimizing how a process, system, or organization operates. Some engineering universities and educational agencies around the world have changed the term "industrial" to broader terms such as "production" or "systems", leading to the typical extensions noted above.

The total number of engineers employed in the US in 2006 was roughly 1.5 million. Of these, 201,000 were industrial engineers (13.3%), the third most popular engineering specialty.

In December 1999, the Board of Trustees, Stanford University authorized the creation of the Department of Management Science and Engineering from the Department of Industrial Engineering and Engineering Management and the Department of Engineering-Economic Systems and Operations Research. The objective of the newly formed department was to become the leader among academic departments, at the interface of engineering, business, and public policy.

The Stanford department of IE-EM started as an Industrial Engineering department including an Operations Research group. It remained as an IE department following a split in the early sixties of this OR group. Subsequently, an Engineering Management focus was added to the IE department in response, in part, to a growing demand in the Silicon Valley for engineers with management skills. The result was a small (and original) department that covered a larger spectrum of topics and had a stronger emphasis on management than most IE departments in the United Stated. It offered an ABET - accredited undergraduate program and included three main areas of teaching and research (Stanford University, 1999).

### 1.2. Engineering Management MEM

The world is changing. With the challenges facing us on a global level (sustainability, health, environmental protection) there is a new need for companies and organizations to integrate technical and business skills to solve these difficult problems. In the complex, competitive world of technology driven industry, skilled engineers who understand the essential principles of business and law have a tremendous competitive advantage.

The engineering management degrees (often referred to as "MEM degrees") offered by universities combine professional engineering practice with core business and management subjects typically found in an M.B.A. program. These comprehensive graduate engineering degrees provide a core curriculum in marketing, finance, intellectual property, business law, and/or management. They represent a blend of engineering skill and business knowledge needed to develop innovative solutions to complex business problems. Depending on each Program's requirements, new or experienced engineering professionals are prepared for technical leadership roles and develop the skills to manage emerging technologies and the ability to assess economic needs.
(http://www.mempc.org/degree/)

### 1.3. Comparing an MEM to Other Degrees

The mix of management concepts and technical focus presented in MEM programs allows new graduates and working professionals to acquire the management skills necessary to advance in today's technical world. Unlike a graduate degree in a science or engineering specialty, an MEM degree offers the practical business perspective needed by technical managers. Unlike a traditional MBA program, MEM programs emphasize skills specifically required in technology-based organizations. For most programs, a student with an undergraduate engineering degree and a technical management career goal in mind may want to choose between an MEM and an MBA. Below is a chart comparing the skills acquired during an MEM degree with the skills acquired during an MBA.

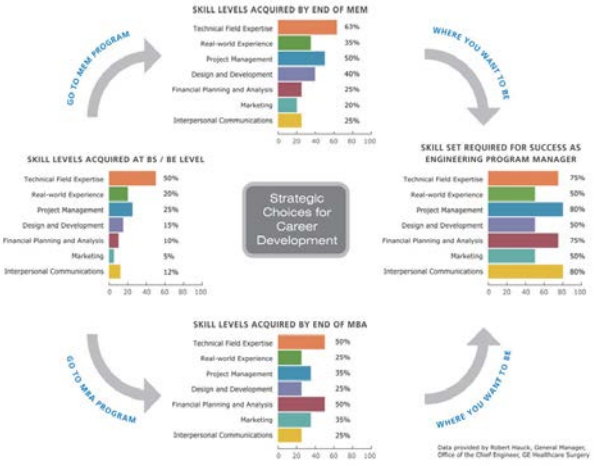


**Fig. 1.** Strategic choices for career development
Data provided by Robert Hauck, General Manager, Office of the Chief Engineer, GE Healthcare Surgery
(http://www.mempc.org/degree/comparison.htm)

## 2. ENGINEERING AND MANAGEMENT IN ROMANIA OF THE 2012 YEAR

In Romanian universities graduate out nearly 50,000 engineers annually, sufficient to meet the needs of the labor market, but employers who recruit young engineers say that, in terms of quality, they are not well enough prepared. Curriculum has not kept pace with the rapid development of engineering and companies were forced to develop master programs (on their own or in partnership with universities) to facilitate insertion of young engineers in the labor market.

Almost 140,000 young people currently are studying in Faculties of Engineering (over a quarter of the total number of Romanian students), according to data from the National Statistics Institute.

Although in the last four years the financial services sector lost 5,000 employees caused by the crisis, young people who enroll in college have chosen mainly for

undergraduate studies in economic engineering. Currently the number of the students who want to become economic engineers is about 20,000 young people (about 14% of all the students that are studying in the technical sector).

([http://www.zf.ro/profesii/romania-produce-50-000-de-ingineri-pe-an-dar-angajatorii-spun-ca-acestia-nu-stiu-meserie-cu-adevarat-10335028)](http://www.zf.ro/profesii/romania-produce-50-000-de-ingineri-pe-an-dar-angajatorii-spun-ca-acestia-nu-stiu-meserie-cu-adevarat-10335028)

"*Not always study develops where there is demand, either due to misinformation or because of poor documentation. Myth exists in the economy or the idea that young people want to kill two birds with one stone. Thus have knowledge of economics, but have technical training and that most use in marketing and sales. They can sell in the true sense, as I understand much better the product they sell.*" says Mirela Marinescu, recruitment manager at APT a human resources company. It also states that the salary that an engineer economist may draw salesperson, although it is similar to the one you gain a mechanical engineer (about 400 euros net per month) can be doubled thanks to sales commissions or bonuses.

## 3. ENGINEERING AND MANAGEMENT AT THE UNIVERSITY OF PETROSANI

In the 1992 the Management collective from the University of Petrosani created an academic program called "Engineering and Management for the Production Systems", that became with the 2002 class "Economic Engineering". During 16 classes from 1997 through 2012, 279 students have graduate in the Engineering and Management domain.

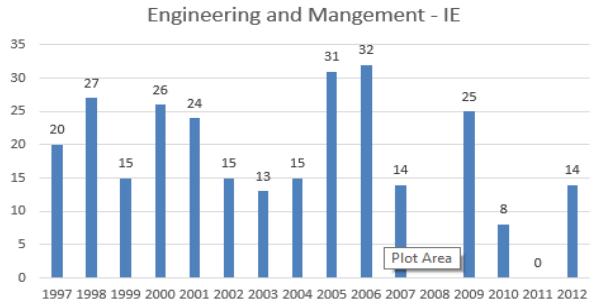


**Fig. 2.** Engineering and Management bachelor program graduates evolution during 1997 -2012 at the University of Petroşani
(The Monograph of the University of Petroşani)

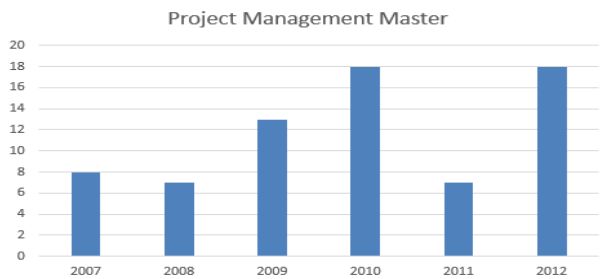


**Fig.3.** Project Management master program graduate evolution during 1997 -2012 at the University of Petroşani
(The Monograph of the University of Petroşani)

From the 2007 year we created in the field of engineering and management a master program called "Project Management" and in six classes during 2007 and 2012 have graduated 71 master students.

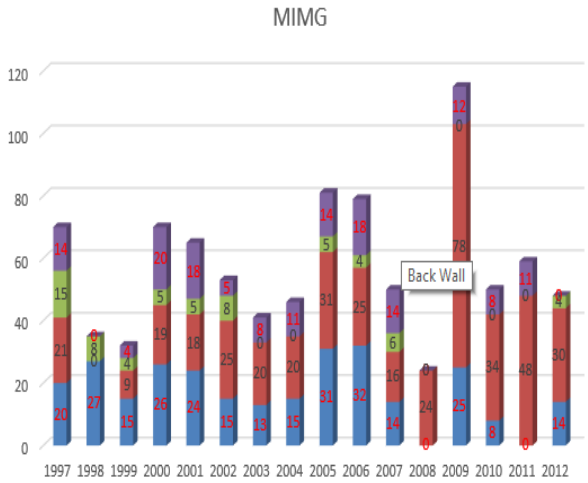


**Fig. 4.** Faculty of Mining, Management, Environmental Engineering and Geology Department programs - graduates evolution during 1997 -2012 at the University of Petroşani
(The Monograph of the University of Petroşani)

In the Faculty of Mining, in the areas of specializations coordinated by the actual Management, Environmental Engineering and Geology Department, during 1997 and 2012 have graduated 918 students, 418 of them in Environmental Engineering, 279 in Engineering and Management, 64 in Waste recovery engineering and Preparation and other 157 in Geology.

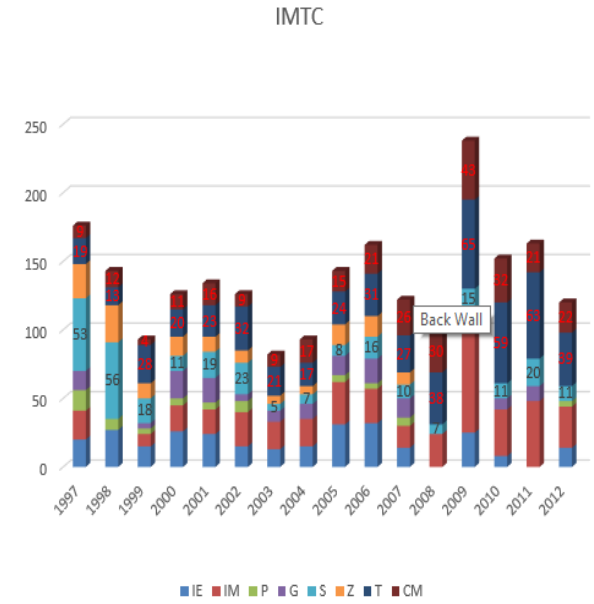


**Fig. 5.** Faculty of Mining, Mining, Survey and Construction Department programs - graduates evolution during 1997 -2012 at the University of Petroşani
(The Monograph of the University of Petroşani)

In the Faculty of Mining, in the areas of specializations coordinated by the actual Mining, Survey and Construction Department, during 1997 and 2012 have graduated 1254 students, 518 of them in Surveying Engineering, 297 in Construction Engineering and 438 in Mining Engineering.

## 4. THE TEACHING STAFF IN THE ENGINEERING AND MANAGEMENT FIELD

In 2002, high education which will become what we call today "Engineering and Management" was already quite stabilized after several changes of name. In 1996, the Economic Engineering Consortium was established in Romania (CIER/ EECR) and began to "govern", by consensus, the specializations included under the heading of "economic engineering" or "engineering and management". Since CIER was a "Friends organization" without legal personality, in 2002, they founded the Association of Managers and Economist Engineers in Romania (AMIER) from the nucleus constituted by CIER. This scientific and professional organization received a legal personality and therefore was able to financially support even the appearance of a specialized magazine. Thus was issued, in 2002, the Review of Management and Economic Engineering which has come in 2014, to 12 years of existence. In 2011, CIER and AMIER are mature organizations. CIER, as the essence of AMIER, consistently meets twice a year, until this year consuming more than 30 briefings and consultation of members' representatives of the academic assembly within the specializations of "engineering and management". (Abrudan, 2012)

Meanwhile, the profile (area) of "management and engineering" has become the most common among the profiles in the fundamental field of "Engineering Sciences" that is present in 90 Romanian universities. Thus, the "engineering and management" field is present in 32 universities, and other areas in the field of engineering have an average presence in about 16 universities. The present situation shows now, about 20 years after its creation, that this field is in line with university training interests of the Romanian society and that of all types of engineering, most of the Romanian universities which offer engineering training, turned by this profile. Among these, five are private universities. (Abrudan, 2012)

The Consortium of Engineering Economics from Romania (CIER), is a consultative association without legal personality, which brings together in one horizontal structure faculties, departments or groups of teachers associated to economic engineering education in Romania.


**Fig. 6.** The 2006 CIER convention centenary

In the Management, Environmental Engineering and Geology Department of the University of Petrosani, we have 10 teachers having a PhD in Industrial Engineering, with a concern in Engineering and Management. In the University of Petrosani almost 145 teachers have a PhD, most of them in the Mining Field, so this 9 professors from the Management Department could represent a core for the future development of the University in the EM domain. From 2007 they were involved in more than five EU projects, that's why they teach also in a Project Management master degree program.

## 5. CONCLUSIONS

In 1982, the American futurologist J. Naisbitt warned us in his well known book "Mega tendencies": "*For the first time in America's history, the generation that steps into life is less qualified than its parents*". Is this the future? If American can buy specialists, Romania cannot, it needs to produce them. Even America frightened and, in the message regarding the nation's state (2006), president Bush showed that, in 2003, 59% of the PhDs in engineering have been given to foreigners and the USA "produced " in 2004, 70.000 engineers compared to India with 200.000 and China with 500.000. Of course that to learn is difficult, and difficult things are being done by people who need to do them.

In the field of Engineering and Management the University of Petrosani must maintain the bachelor and master degree programs, and must create a PhD supervisor center in the field of Engineering and Management - Institution Organizing Doctoral Studies in Engineering and Management (IOSUD).

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