Defining an Engineer

It’s not completely out of the blue to trace the origins of engineering back to the origin of mankind. The first hominids possessed no physical attributes like claws or sharp teeth that allowed them to hunt for animals. As soon as evolution allowed, the first hominids started to develop and to use tools to compensate for the lack of physical advantages over other animals. The advantage they had was the ability to use and transform what nature gave them. Fast forward a couple of million years and you reach the technological age, the age where mankind bends the elements and nature to reach places that were unreachable, cure diseases that were incurable and build structures that were unbuildable. In the middle of this evolution and peak are the engineers. A fast search on the internet leads us to the definition of engineer as being “*professional practitioner of engineering, concerned with applying scientific knowledge mathematics and ingenuity to develop solutions for technical problems[[1]](#footnote-1)”*.

The purpose of this report is to shed some light on how attractive is engineering in Europe nowadays and in order to achieve that goal, it is necessary to understand what really engineering is and what being an engineer implies in terms of education, skills and professional life. What is indeed an engineer? Each of the partners involved in this project offered different points of view and focus on this matter but one can easily see how these converge and complete each other. For instance, in Portugal, it´s national order of engineers [[2]](#footnote-2) defines the practice of engineering as the use of the knowledge of laws of nature to design, to analyze, to promote, to manage or to control an achievement of something economically profitable, technically predictable and of social interest[[3]](#footnote-3). It clearly shows a focus on “What engineers do” and a wide area of intervention in different aspects of society and social life. This focus fits right in on how the present role of the engineer is defined by “Swedish partners[[4]](#footnote-4)”. Engineers can work in a variety of areas as engineers are needed in all industries and not just in traditional technology. Environmental, health, design, energy, information, medicine, manufacturing and food are other examples of engineering versatility.

Engineers can virtually be found everywhere in the community both in private and public sectors, large and small companies, both employed and self-employed. The possibility to choose guidance is large and many doors are opened with an engineer degree. In Finland, many engineers work in projects nowadays, often as managers or project managers while other engineers are providers and specialists, among several others domains that will be addressed in this report. In Finland according to a project entitled “Competence through Learning[[5]](#footnote-5)”, which was conducted as part of the National Strategy Project for Higher Engineering Education with the purpose of developing higher engineering education, the special strength of Finnish engineers is their excellent problem solving capacity, which is based on in-depth knowledge of technology, and on their mathematic-al and scientific competence.

If a very brief summary on what is an engineer, based on the different points of view from all the partners involved is allowed, one can say that engineers have the knowledge and ability to manipulate and to incorporate technological, scientific and mathematic elements while contributing to run properly a whole lot of society domains and to develop new means of improving performances. This link to a wide spectrum of society areas demands the engineer not only to possess the technical attributes mentioned before but also a set of skills to operate and interact within those areas, meaning that the engineer in the 21st century needs other skills aside from the core competencies which define him as an engineer. The activities of engineers changed, from developing new technical components, units, and equipment to advanced problem-solving requiring competence in project planning, implementation, and integration of complex systems of hardware and software. Engineers must complement their professional and technical expertise with non-technical competencies such as systematic problem solving, communications, management, and leadership skills. Mielityinen[[6]](#footnote-6) proposes the following diagram in order to understand how all the skills are combined:

*Competencies and skills of future engineers. Source: Mielityinen 2010.*

This kind of knowledge and skills are provided by higher education institutions such as university and polytechnic institutes. These institutions work both as knowledge transmission agents and also as legitimation agents by confering academic degrees which certify before society that a person is indeed an engineer and is able to perform his or her role as one. Both in Portugal and in Finland, engineers are defined as graduates at Master degree at a (For instance: Master of Science Degree in Technology in the Finnish case or a 2nd cycle or integrated master degree in Portuguese case) The engineer is then a combination of skills and knowledge gained during his training/ academic path and by a formal degree obtained in a higher education institution, meaning that one might even have the technical skills and competences but without the higher education degree he cannot be considered an engineer.

The Portuguese order of engineers presents a scheme which depicts the evolution from the training stages of an engineer up to his/her advanced professional career, concerning the more focused skills on each stage:



*Portuguese Order of Engineers, 2010*

 It can easily be seen that the core engineering competencies are more present at the training stage and with the practice development the more interaction and organization skills start to gain relevance. Both practice and education are constantly evolving to adapt to the turmoil and fast paced changes of the modern 21st century world. The engineering profession and education have changed and will continue to change in the future in order to adjust to the fast paced evolution of the demands of society and the planet itself.

This evolution path followed by engineering profession and education (and its needed joint evolution) can be verified in the current situation in Germany. The activities of engineers have also changed, from developing new technical components, units, and equipment to advanced problem-solving requiring competence in project planning, implementation, and integration of complex systems of hardware and software. Engineering teams follow the so-called product lifecycle: ideation, product conception, product planning, product development and design, production planning, manufacturing, marketing and distribution, maintenance, repair, and overhaul to recycling and demolition. Consequently, engineers must complement their professional and technical expertise with non-technical competencies such as systematic problem solving, communications, management, and leadership skills. A typical profile of engineers expected by industry covers four main areas:

•Technical and methodical competence (technical knowledge and know-how in natural sciences, engineering sciences, engineering expertise, and the ability to apply modern information and communication technologies);

•Personal competence (flexibility, profound general education background, willingness to perform, willingness to engage in lifelong learning, mobility, credibility, and readiness to take responsibility);

•Management competence (managerial qualification, ability to assert oneself, decision-making ability, ability to analyze and to evaluate, strategic thinking, and negotiating skills); and

•Social competence (persistence, intuition, intercultural competence, ability to communicate, ability to negotiate compromises and trade-offs, and ability to work in teams).

Interestingly, engineering education typically has not focused on areas such as decision making, strategic thinking, negotiating skills, and readiness to take responsibility. This deficit has been recognized, however, and steps are being taken to solve it. New interdisciplinary study programs like industrial engineering and business management improve the skills of engineers in these areas by combining engineering and management education. Students can also gain practical experience, foreign language skill, and cross-cultural competence through compulsory internships as well as by studying abroad. In 2005, roughly 19 percent of all engineering students enrolled in Germany spent at least one semester abroad at a foreign university or in foreign internships.

Perceptions on Engineering in the Society

It has already been mentioned that engineers dwell deep into different realms of society, which may or may not provide a certain amount of social visibility. It is important to shed some light on the way engineers and engineering are looked upon by a variety of social actors and areas. This light comes not from a common source but from different studies and analysis done by WP5 partners. Being the Attract Project a collaborative effort from multiple partners, and considering the lack of a global and unified view on the subject, it has been attempted a way to combine the work and information provided by each partner. This chapter provides a review of some of the most relevant results for the main goal of studying the attractiveness of engineering.

As would be engineering students, secondary school students are an important group to be dealt with, as measures taken to improve the recruitment of new students to engineering courses must contemplate this particular group. A study of Irish secondary school students published in 2004 assessed their attitudes towards engineering[[7]](#footnote-7). Overall, the students regarded engineering as a secure and well-paid profession, offering opportunities to travel and work abroad, deal with environmental issues, work in a creative environment, and obtain a job without too much difficulty. In order to gather more detail about these perceptions, it was also asked to these students to identify both personal characteristics and skills they associate with engineers. We can say that a positive image surfaced, engineers were mostly considered to be creative, clever and knowledgeable. It is true that to a lesser extent, they were considered to be “anti-social/shy” and “*geeky/nerdy”*. Still the main picture is quite positive. Concerning the skills, “Hard Working”, “organized” and “smart” are the ones that stand out the most. While some are more traits or behaviors (Hard working and smart) than skills, it’s clearly an indicator of a very positive image about performing an engineering profession. Other mentioned skills include analytical, eager to learn and team player among others.

*It would be interesting to have here some sort of evolution of engineering graduates and students between 2000 and 2010 in Ireland, in order to see if this perception students had in 2004, translates in actual students studying and graduating in engineering. Ask Claire or Kevin*

Other interesting aspects mentioned by the Irish secondary school students were the personal characteristics and skill associated with engineers. The majority considered engineers to be creative, clever, knowledgeable and doing something important for society. Overall we can say that a very positive image of engineers was present among these students.

*The data about evolution of engineering graduates and students should be mentioned here again in order to once again support or refute this positive image students had.*

As for the possibility to enroll in an engineering course, the primary reasons these students gave, for accepting a place on an engineering course at third-level if offered, come under three main headings: interesting field of study, good career prospects and interest in math and problem-solving.

Reasons given for not choosing to study engineering were primarily students not knowing enough about it, or perceiving it as difficult. Although there are strong motivations for the students to enroll, the perception of the engineering courses as being difficult, place significant barrier for students. A study [[8]](#footnote-8)assessing the future supply of engineers in Ireland found additional barriers in students’ perceptions of engineering. A perceived heavy and difficult workload and long contact hours were key factors that deterred students from choosing to study engineering. A further deterrent associated with these factors was that students would have little time remaining to take up part-time work, which is the norm among third-level students in other disciplines. Furthermore, the “considerable ignorance about what is involved in studying and practicing engineering, both among male and female students” was observed as a significant barrier.

Also on the subject of difficulty, the Engineering Perceptions Inquiry[[9]](#footnote-9)made in Portugal, also addressed to the engineering education difficulty issues, by comparing it with other major areas:



One can notice, aside from Health, all other areas are considered to be easier than engineering. It converges with the Irish results from 6 years before concerning the difficulty of the engineering courses. We can see in different countries and in different time periods (2004 vs. 2010) that the study of engineering is perceived as something difficult.. Looking through the different areas in the chart, one can point out that all the ones mainly considered easier do not deal within a very advanced technological or exact sciences context. This is a factor to point out when dealing with the “how difficult it is” subject since the key competences required both in education and profession deal with those contexts. One action point concerning the attractiveness of engineering should focus on analyzing the technological, mathematical and scientific skills of the potential engineering students. Are the courses hard? Are the students not prepared to deal with the course contents? Is it a confidence issue? These are questions, among several others, that the stakeholders need to answer in order to improve the attractiveness of engineering.

Although important, the difficulty issue is not a monster and the fact is that engineering has a positive image and aspects that are identified by, not only secondary school students, but by a other different social groups. In Sweden, for instance, it was concluded that those who want to become engineers believe it is a dream job because it allows them to do so much with their lives[[10]](#footnote-10). They can both earn quite a good amount of financial income while improving society. There is a strong correlation between choosing the engineering profession as a dream job and to justify its opportunities for high pay:

* 40% of those who dream of the engineering profession say that salary is one reason.
* 78% says it is an exciting job with personal development.
* 43% says that it provides high status and that there is a possibility to improve and transform society.

Throughout examples of positive views on engineering can be found. Turning over to Finland and on how engineering & technology are doing among the young Finnish people, the following table[[11]](#footnote-11) shows the appreciation young people have on various professions:

As for the reasons on why a particular profession was chosen as the most preferable and appreciable, salary, interesting and agreeable work were the main ones mentioned. The following chart, provides the results concerning young People’s views on the field of technology and engineering work[[12]](#footnote-12):



High income level is the main incentive among young people, followed closely by the opportunities of learning something new while performing their profession, by seeing technology as an interesting field of work and recognition of the competence of engineers and architects.

Another example of a positive view[[13]](#footnote-13) on engineering comes from Portugal, where engineers are considered either important or very important (25, 3 % and 74, 2 % respectively). This view gathers not only secondary school students or young people, but also people from different backgrounds and professions; it is a mixed general view. Also some of the most common traits and characteristics associated with engineers generate a quite positive image of engineers. Engineers are seen as dynamic, creative, affirmative, active and entrepreneur.

|  |  |  |
| --- | --- | --- |
| A different point of view comes from France where a study[[14]](#footnote-14) was made in order to capture views of engineers on themselves and how they feel about their career. One of the most relevant subjects is to know where these engineers draw their satisfaction from, the table below provides interesting results on this issue:**Personal sources of satisfactions in engineering careers** | **Engineering students (nearly graduated)** | **Young engineers (less than 30)** |
| **The exercise of responsibilities** | **93%** | **45%** |
| **Career opportunities** | **91%** | **64%** |
| Missions and job technical interest | 88% | 84% |
| Autonomy, ability to make proposals, initiative, etc. | 88% | 77% |
| Continuous training and increasing skills | 87% | 71% |
| **High income** | **85%** | **49%** |
| **Opportunity for international missions/careers** | **79%** | **38%** |
| **Stress/challenges** | **71%** | **34%** |
| Creativity | 64% | 48% |
| High quality interpersonal relations | 58% | 66% |
| Meaningful job, social assessment | 57% | 55% |
| Employment security | 54% | 54% |

As it may be noticed there are huge differences between the perception by young students and the experience of young engineers, particularly related to expected responsibilities, careers opportunities, income, international opportunities and challenges. It is also interesting to notice that young students have a better perception of technical satisfaction they could expect from their early engineering career. These perceptions and views from engineers themselves is also a theme to point out in the sense that current engineers, both old and new, should have a key role in projecting a positive and attractive image of engineering to potential and current engineering students in order to minimize potential differences between reality and students perceptions and to ease the transition between school and the labour market, and also to capture the interest of younger people to engineering and technology.

Labour Market

**NOTICE: Please read the deliverable 13.1 document concerning the labour market section**

Attractiveness is a concept that cannot be dissociated from a labour market analysis. The relation between both is as simple as one might guess: if a certain area of expertise really doesn’t pay off in terms of getting a job, why should people spend time and effort in learning how to do it? Isn’t that why the old ways of craftsmanship are fading and struggling to gather younger generations to carry on with the craft? It doesen’t pay off.

One important action point in attracting students to the engineering areas is to show them that it does pay off to be an engineer. Not only in terms of economical capital but also when it comes to social or cultural capital. Considering the current global economical, the labour market for engineers still looks good. The main purpose of this chapter is to confirm this statement and to seek means of capitalizing this advantage engineering has into a attractiveness enhancement tool. The premise behind the Attract Project is that today - contrary to what people think – there is a shortage of engineers in several fields. Projections[[15]](#footnote-15) show that the need for engineers will grow strongly in coming years. But just as for other professions labour market for engineers can vary. Demand can go up and down. Eventually, the engineering profession is a safe choice.

Each country has own characteristics and particular social, economic and political contexts, and therefore has different focus when analysing the labour market. Considering this, what is presented in this chapter is an overview of the most relevant variables related to labour market by country.

Portugal:

Higher Education Graduates Unemployment rate by professional area in 2009[[16]](#footnote-16):



Engineering and related techniques present one the lowest unemployment rates (3, 4%, being the total rate 4, 1%). The debate whether 3,4% is a high or low rate isn’t the main issue here, the focus is that considering the whole, we can say that engineering and related techniques has one of the lowest rates, making it safe to say that the working prospects for engineering are better than in the majority of areas. Considering the increase in the percentage of engineering graduates and enrolled students[[17]](#footnote-17) in the last years we can verify that this smaller unemployment rate (is there some sort of study on students motivations to enrol in a certain course? If so, it would fit nicely here-work in progress) echoes in the search for engineering courses. One action point concerning this matter will be to verify if this is intentional and if Portuguese engineering HEI are marketing the good job prospects in order to recruit students and, if so, to identify what good practices are at use.

From an employer perspective and demands, an analysis of Job offers was made[[18]](#footnote-18). The results are provided bellow:

|  |  |
| --- | --- |
| **Type of offer** | **%** |
| Only for Engineers | 20 |
| General request | 51 |
| Not for Engineers | 29 |

20% of the job offers asked specifically for an engineer. The general request job offers did not specify any sort of education area but an engineer could apply for it if needed. The rest of the offers, request specifically education areas like health, business or management.

In 66% of the engineering offers employers required the engineers to have some sort of professional experience and also core engineering skills. Aside from the engineering skills, some of the most mentioned were: planning and organization, leadership, good command of the English language and goal orientation.

As for the main activity areas where engineers perform their skills and expertise, we can turn over to the IST students[[19]](#footnote-19), who were inquired about their employment conditions in 2009. The main areas where these students are employed are the following:

* Consulting, Scientific & Technical activities (35%)
* Information & Communication (15%)
* Construction (11%)
* Education (11%)

*Missing here: Information about IST students Income.(this information will be included along with the rest of deliverable 13.1)*

France:

Figures for 2007 and 2008 are positive. The number of recruited engineers was 62 800 in 2007 and 71 700 in 2008. Obviously, young engineers (less than 30) accounts for more than a half of these recruitments. However the unemployment rate among these young engineers is greater than among older ones as it can be seen from figure X below. It should be stressed that the legal minimum age for retirement was 60 in France in 2008 (when statistics from figure 6 were collected). Many of older engineers retired then before 65 (the upper age limit for retirement). However the unemployment rate among 60/64 years old engineers remains very high.



Figure X: breakdown of unemployment rates among engineers (source: CNISF)

It should also be mentioned that preliminary results for the year 2009 are worse, especially for young engineers graduated in 2008. The most recent inquiry about this was conducted by the National Agency for Executives Employment (APEC) and states a 16% increase of the unemployment rate among these new engineers (graduated in 2008). The employment rate for these young engineers is 72%, compared with 73% in Business Schools and 61% in Universities. The 2009 recruitments distribution in the different fields of activities for engineers are represented on figure Y below. The three main domains for recruitments of engineers were SSII (computer engineering companies), engineering consulting firms (“Ingénierie”) and the industries related to energy production and transportation. They account for about 40% of the total recruitments of young engineers (less than 30).



Figure 7: Main fields of recruitments for young engineers (less than 30) for 2009 (source: CNISF)

Finland

Most university graduate engineers work either as specialists or in the middle/top management. According to the Labor Market Survey 2009 of the Finnish Association of Graduate Engineers TEK, the employment sectors of polytechnic graduate engineers are distributed as follows:

* Manufacturing (52 %)
* Services (27 %)
* State (15 %)
* Municipalities (6 %)

Main fields of responsibilities among the members of TEK include research and development, and planning and expertise. One third of the members have also worked abroad at some point. The five biggest employers among the members of TEK (2008) include Nokia, Nokia Siemens Networks, Metso, Aalto University School of Science and Technology (former Helsinki University of Technology), and Technical Research Centre of Finland. Also the polytechnic graduate engineers mostly work as specialists or in the middle management either in the private (87 %) or in the public (13 %) sector. According to the Labor Market Survey 2009 of the Union of Professional Engineers in Finland[[20]](#footnote-20), the responsibilities of most polytechnic graduate engineers include planning (24 %), other engineering tasks (22 %), IT tasks (13 %), and commercial tasks/ services (12 %).

According to the Employment Report I/2010 of the Finnish Association of Graduate Engineers TEK, the number of unemployed university graduate engineers and architects was 1850 in March 2010, which equals to an unemployment rate of 3,5 %. Between March 2009 and March 2010, the number of unemployed university graduate engineers and architects increased by 483 (0, 8 percentage points).

Figure Z represents the number of unemployed university graduate engineers and architects by different age groups, and figure 2 the number of unemployed university graduate engineers by field of study. Among the polytechnic graduate engineers, unemployment is the biggest problem among newly graduated students (over 25 %) and engineers of over 30 years (over 10 %). According to the Labor Market Survey 2009 of the Union of Professional Engineers in Finland, however, most polytechnic graduate engineers have a steady job (85 %) and work fulltime (89 %). Most polytechnic graduate engineers also find that their work corresponds really well to their education.



*Figure Z. The number of unemployed university graduate engineers and architects by age group between March 2008 and March 2010. Source: Employment Report I/2010.*

Germany:

Engineers enjoy considerable social standing in German society, respected for their creativity, innovation, and high degree of responsibility. A 2005 study by the Allensbach Institute ranked engineers eighth among professions in terms of respect and social prestige [ ]. Annual salaries for engineers are conspicuously higher than average compared with other professions that require a university degree, depending on the industry, position, type of degree, etc. Salaries have recently begun to rise slightly for practicing engineers [ ] as well as for new engineering graduates.

Germany is a leading global competitor in scientific research and in the production of innovative technological products. Engineers work in virtually every branch of German industry and services, pioneering developments in nearly all facets of electronic and information technology, energy technology, microelectronics, micro- and nanotechnology, and in interdisciplinary fields such as automation and medical technology.

The latest engineering study by the Association for Electrical, Electronic, and Information Technologies (VDE) shows that German businesses could fill only 80 percent of their job offers for engineers. As of 2004, Germany’s workforce included about 1 million engineers, 360,000 of whom were self-employed or working as civil servants and 640,000 who were employed by companies. The number of engineers working in public and private enterprises has decreased by about 20,000 since 2001. This is partly due to global competition and partly the result of the declining number of engineering graduates over the last decade. The cohort of 37,000 engineering graduates of 2004 is 25 percent less than the cohort in 1996. This trend is expected to reverse, however, as a result of the increased engineering enrollments during the past five years. In fact, a recent study by the German Kultusministerkonferenz4 forecasts rapid growth in engineering graduates through 2015, reaching 49,000 per year [ ]. At this level, engineering students would represent 18.6 percent of total graduates from all disciplines, up from 17.8 percent in 2004.

In response to the increasingly global characteristics of the marketplace, German engineers are expected to be more mobile and flexible, to move to different work sites both nationally and abroad, and to change job responsibilities as new needs arise. In the past, engineers may have worked within one company and perhaps even in one department for decades. Today’s engineers may change companies two or three time during their careers—and specific positions even more frequently. In Germany, 15,000 engineering jobs go unfilled each year although 65,000 German engineers are unemployed. This gap is due in part to the lack of mobility and flexibility by German engineers to adjust to changing work environments or expectations. Thus, Germany must fill the gap with engineers from foreign countries.

Media Coverage

Besides spurring efforts to define and identify the professional, social and cultural characteristics of an engineer, and assess the degree of attraction of his/her social role, an additional goal has been set: to determine the degree of visibility of engineers in the media, and the media’s perception of them. This section is therefore an attempt to assess the image of an engineer and engineering, conveyed by the media in a given period from each different partner. In other words what we want to know is: “What is the image of an engineer in the media?”

Starting with the basics and with the trendy, a Google search is an obvious choice for a starter. A Google search demonstrates that most engineer-related stories cover the following topics:

* Engineer employment and salary
* Female engineers; women who have chosen a career in the field of technology and engineering
* Engineering students; engineering student culture
* Student recruitment
* Engineer jokes
* More features on technology than on engineers

Moving away from the starter, a more in-depth analysis of media was made by some of the partners involved which are enough to project a reliable image of engineering in media throughout Europe.

In the context of the Attract Project, an analysis of media content was made in Portugal[[21]](#footnote-21) . An initial approach was made by focusing on the representations of engineers and engineering in the media discourse, both professionally and in terms of their collective, social, cultural, institutional, political and symbolic action, by recording the references made in the selected media to engineering and engineers, considering the circumstances under which those references occur, in order to find out the way those images are ranked and the type of existing major associations.

Such task was achieved by a collection and indexation of news items with references to engineering that was made from the common search engine to 3 of the top news agents in Portugal[[22]](#footnote-22). 92 pieces of news were validated, which were produced between 1 and 30 November 2010 and despite the fact that the data only covered one month, it can be said that engineers and engineering are positively involved in 47.8% of the news items. Negative references do not account for more than 14.1%.

The following table allows seeing the most mentioned news themes covered during the analysis period:

| **Theme** | **%** |
| --- | --- |
| Social and Political Action | 33,7 |
| Manufacturing/Industry/Trade/Distribution | 18,5 |
| S & IT + Engineering and expert areas | 15,2 |
| Safety | 9,8 |
| Culture, Arts, Sports and Shows | 8,7 |
| Biography | 6,5 |
| Renewable Energies & Environment | 5,4 |
| International | 2,2 |

Considering the breakdown of positive references to engineers and engineering by the news coverage, according to the these news themes it is worthwhile mentioning that the subject area associated with “S&TI and Expert Engineering Areas” ranks first, with 13% of all references (85.7% within “S&IT + Expert Engineering Areas”, and 27.3% of all positive references. A summary of this breakdown can be seen in the following table:

|  |  |
| --- | --- |
|  | % of total |
| **Theme** | **Positive** | **Neutral** | **Negative** |
| Biography | 3,3 | 3,3 | 0 |
| Social and Political action | 9,8 | 16,3 | 7,6 |
| Manufacturing/Industries; Trade/Distribution | 8,7 | 5,4 | 4,3 |
| S&IT + Expert Engineering Areas | 13 | 2,2 | 0 |
| Culture, Arts, and Shows | 4,3 | 3,3 | 1,1 |
| Safety | 2,2 | 6,5 | 1,1 |
| International | 2,2 | 0 | 0 |
| Renewable Energies & Environment | 4,3 | 1,1 | 0 |

 Secondly, most of the positive references cover the area that gathers together the themes associated with manufacturing, industry, trade and distribution, representing 8.7% of the total (47.1% within “Manufacturing/Industry/Trade/Distribution” and 18% of all positive valuations.

Thirdly, positive references are made to subjects within “Social and Political Action”, totaling 9.8% (29% of the news items considered within the same theme category and nearly 1/5 of all news items classified positively). It should however be pointed out that it is within this category that almost half (48.4%) of the references considered as “neutral” were made, which were mostly composed of news associated with the way Courts and Justice operate.

The positive image of engineers and engineering stands out for the period and the media analyzed. In fact, it is mainly polarized around subject areas associated with, on one hand, expert engineering areas, scientific research and the development of cutting-edge technologies, and, on the other hand, with the productive areas of society, industry and services.

1. Wikipedia [↑](#footnote-ref-1)
2. [www.ordemdosengenheiros.pt](http://www.ordemdosengenheiros.pt) [↑](#footnote-ref-2)
3. Formal definition by the Portuguese Order of Engineers; [www.ordemdosengenheiros.pt](http://www.ordemdosengenheiros.pt) [↑](#footnote-ref-3)
4. Inserir aqui referência dos suecos [↑](#footnote-ref-4)
5. Mielityinen 2009 [↑](#footnote-ref-5)
6. Reference needed [↑](#footnote-ref-6)
7. Drew, E. and Roughneen. C. (2004). *Danger! Men at Work: A Study of the Under-Representation of Women in Third-Level Engineering.* Dublin: Department of Education and Science. [↑](#footnote-ref-7)
8. McIver Consulting (2003). *The Demand and Supply of Engineers and Engineering Technicians*. Dublin: Expert Group on Future Skills Needs [↑](#footnote-ref-8)
9. *Engineering Perceptions Inquiry 2010, IST ; Websurvey: 233 Answers*  [↑](#footnote-ref-9)
10. http://www.iva.se/mi [↑](#footnote-ref-10)
11. Techbaro 2010 [↑](#footnote-ref-11)
12. Question presented: The following list sets out statements on working in the field of technology, plus typical features of engineering work. What is your opinion on each of the following statements? 5 = Agree entirely, 4 = Agree by and large, 3 = Difficult to say, 2 = Disagree by and large, 1 = Disagree entirely). Source: TECHBARO 2010 [↑](#footnote-ref-12)
13. *Engineering Perceptions Inquiry 2010, IST ; Websurvey: 233 Answers* [↑](#footnote-ref-13)
14. CNISF, CEFI [↑](#footnote-ref-14)
15. What projections ? [↑](#footnote-ref-15)
16. *GPEARI/MCTES 2009* [↑](#footnote-ref-16)
17. Reference to statistics chapter, where the enrolled and graduate students in PT will be [↑](#footnote-ref-17)
18. Job Offers poster between the 7th and 14th of September 2010 at a Portuguese journal [www.expressoemprego.pt](http://www.expressoemprego.pt) [↑](#footnote-ref-18)
19. *IST Graduates Survey 2009* [↑](#footnote-ref-19)
20. The Union of Professional Engineers in Finland UIL promotes the interests of engineers, engineering students and other experts in the technical field. Through its member organisations, UIL’s total membership is approximately 62,000. UIL comprises thirty regional branches and five national branches through which engineers and other experts in the technical field belong to the union. [↑](#footnote-ref-20)
21. PressCoverageAnalysis2010\_IST [↑](#footnote-ref-21)
22. Diário de Notícias ([www.dn.pt](http://www.dn.pt))

 Jornal de Notícias ([www.jn.pt](http://www.jn.pt))

 TSF ([www.tsf.pt](http://www.tsf.pt)) [↑](#footnote-ref-22)