How does engineering contribute to the UK economy and how can that contribution be increased? Is there a role for UK engineering in higher education in making this happen?

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1. Introduction

Engineers are creative problem solvers, who, driven by a desire of innovation, drive the innovation. Today, the UK appears as a world leader in several modern engineering sectors, from engineering design and project management, to satellite design and manufacture, passing by the energy industry (especially renewable energies) which is certainly one of the greatest prospect in terms of economic growth for the country. Engineers today differ from engineers 10 years ago. Indeed, as the society evolves, so do the skills required in industry. One of the Government priorities is related to the contribution of engineering to the UK's industrial Strategy and future economic well-being.

2. Engineering and UK economy: State-of-art

"*All we know about the new economic world tells us that nations which train engineers will prevail over those which train lawyers. No nation has ever sued its way to greatness*. "

— Richard Lamm

2.1 Overall contribution of engineering in our economy

In the UK, an overall picture shows that the Engineering sector has not escaped the fallout of recession, as the global number of enterprises in the UK remains 0.6% beneath the number in March 2009. However, the number of engineering enterprises, although most of them (97.9%) are small or micro companies, has significantly grown in every region of England, Scotland and Wales [1] with the exception of Northern Ireland, where a decrease of 1.1% was recorded.

Engineering accounts today for 24.5% of the turnover of all UK enterprises, that is 0.6% more than in 2011. In March 2012, 562,320 engineering enterprises were listed, showing a yearly growth of 4.2%. The repartition of engineering related enterprises into different sectors is as follows: 27.4% of enterprises belong to the constructor sector, 27.2% are found in information and telecommunication, and 21.7% belong to manufacturing [1]. Still, in March 2012, 5.4 million people were working in engineering enterprises, which translates into 19.5% of the total UK working population, a decrease of 20.1% compared to the previous year. The largest concentration of engineering workers is found in the South East, and London, whilst the smallest concentration is located in Northern Ireland [1].

2.2 Engineering sectors highlights

Oil and gas constitute one of the largest sectors, with 1100 companies spread across the UK, £27 billion revenue in 2011, and 4 million employees nationwide (45% in Scotland, 55% in England, Northern Ireland and Wales). England is the largest investor of all regions, with £14 billion invested in 2013. Gas, as we know, plays an important role in UK electricity. Indeed, due to factors such as fossil fuel and carbon prices, but also demand, the UK Government has envisaged the necessity to invest in up to 26GW of new gas capacity by 2030[1].

Alongside, the UK automotive industry has become the fourth-biggest automotive producer in the whole of Europe, producing 1.58 million vehicles in 2012, with 80% of the fabrication exported to over 100 countries, making it of one of the UK's leading export sectors (6.3% of all UK exports) with £30.7 billion revenue in 2012. In over 2,700 businesses, this sector provides 129,000 jobs and workers produce a car, van, bus or truck every 20 seconds [1].

As regards the construction sector, this accounts for 280,000 businesses and three million jobs to our economy, representing 10% of the total UK employment. It also contributes £90

billion gross value added to the economy, for around £124 billion of intermediate consumption, almost all from within the country itself [1].

The next great contribution comes from the UK aerospace industry, which holds 17% of the global market, making the UK the European leader. Indeed, 75% of the UK production is exported for annual revenues, greater than £24 billion, and while it currently supports 3000 companies UK wide, this industry is predicted to grow at a rate of 6.8% in the next few years and expected to the double the increase in air traffic over the next 15 years [1].

Another precious input into the economy can be called the life science sector, which regroups all pharmaceutical companies, as well as medical and biomedical technology. These two, combined, display an annual turnover of approximately £20 billion with 96,000 people currently employed. In 2011, the manufacturing business research and development expenses were the highest compared with all other sectors, with about 380 pharmaceutical companies and £30 billion annual turnover [1].

2. More, More and more contribution: Prospects

At the time when European countries are finding a way out of recession, engineering, although harshly described by some opinions as a domain in crisis, can certainly, according to others, preciously contribute to the re-building of the United Kingdom economy. According to Lord John Browne, former BP CEO, engineers will decide the future economic standing of our nation. Indeed, the past president of the Royal Academy believes that engineering is the sole route to achieving growth in any economy, [2] arguing, in a report, that Britain needs 1.25m science, engineering and technology professionals and technicians by 2020.[2]

But these professionals, where will they come from and how will they be integrated into the system? Engineering, similarly to medicine, constitutes one of the hardest subjects to study. The UK education is undeniably a highly recognized system which produces 90,000 people a year in engineering related disciplines [2]. UK campuses are filled with careers fairs throughout the academic year, as well as workshops and talks, where companies meet their potential “future” employees. In fact, a recent survey showed that more than 80% of students are happy with their engineering course, while over 90% of the recent graduates see themselves staying in the profession long term [3]. This, you would certainly agree with me sounds great.

Yet, the post-graduate picture of numerous engineering students is often different. At the same time as one third of engineering graduates not securing a job in areas related to their degrees, many companies still struggle to fill their positions. The question you and I ask is certainly “why”? We have seen the different engineering sectors that contribute to the economy, but we have not asked ourselves how the economy can also help engineering in general and engineering graduates in particular. If this was the case, would the post-graduation of engineering students and hence, the UK economy, be different? The argument suggested here is that, for engineering to better contribute to the economy, the economy must first, better contribute to engineering. Almost all agree that a boost for the economy would be a higher supply of high quality engineers, but fail to understand that a high quality product often requires a high quality investment.

2.1 It all starts there

The review proposed by Professor John Perkins has shown interesting results. Despite a global and appreciable amelioration, engineering struggles with an “image problem”, enhanced by a continuing gender gap. Although the number of secondary school children considering engineering as a profession increased by 17% in 2013, mathematics and sciences, especially physics, still suffered a decrease post-GCSE as well as a lack of female participation. Indeed, 17% (362) of all government funded schools and colleges had no A-level physics participants in 2012. In Perkin’s opinion, two things are needed: inspiration and academic foundations [4].

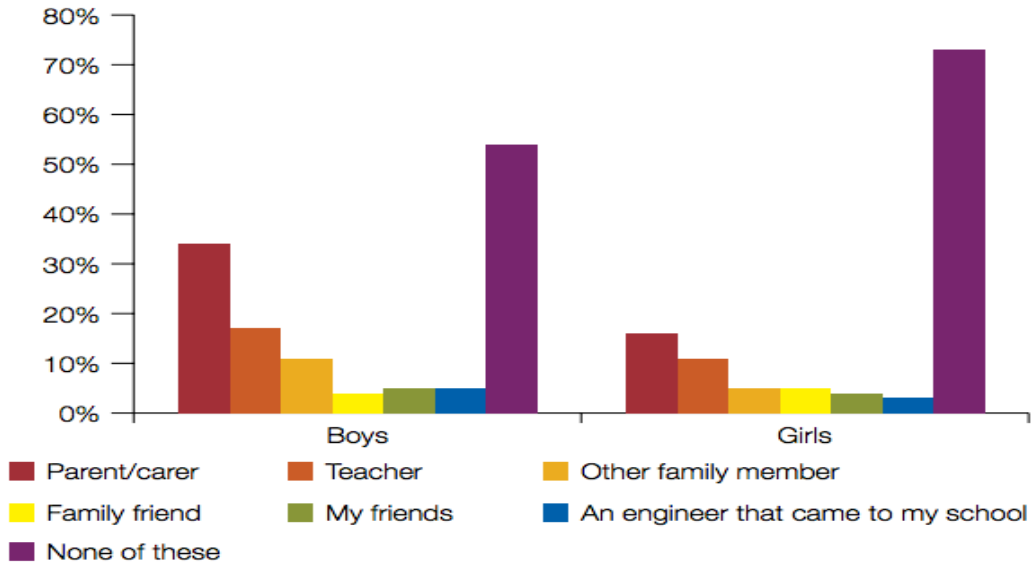

Figure 1 Who has encouraged boys and girls to think of an engineering career?[4]

As the figure above shows, boys are more encouraged by their parents than girls are, and “an engineer that came to my school” provides the least encouragement of all. This graph is very good in the sense that it shows us which direction to take, to inspire children and which areas are still lacking. Teachers come second after parents and their importance is not negligible, hence more efforts should be put into helping teachers better advise children in their career choice. The Government has allocated £5 million to support the Stimulating Physics Network, aiming to increase participation by groups that are in a minority, namely girls, and those living in disadvantaged areas. So far, the program is said to have been successful and an amelioration has been seen [4].

Engineering bodies and companies are to be praised for their presence in schools and their willingness to inspire children through workshops and others. The “image problem” suffered by engineering can be only be fought against by more and more presence of professionals in our school corridors.

As regards the academic foundations, the review also showed that 15-24 year olds have lower basic skills compared to their grandparents at the same age [4]. We need to ask ourselves the question “why”? Is it the way in which they are taught? Bearing in mind that society has evolved, so, the way in which skills are taught should. In other words, the teaching workforce must be looked at. We know that A-levels are currently being reformed for effectiveness in 2015.

2.2 The higher, (not) the lower

Yet, this willingness to inspire, seems to stop as we reach higher education. In four years of MEng in Chemical engineering, which includes modules such as thermodynamics, reaction engineering and plant design project, students are given the chance to become excellent at theory but have no, or little, real life experience. Yet, job vacancies are stating, “Some experience would be preferred”. Internships and work experiences are probably the best way to get experience, but are not accessible to all students. Should we make them a compulsory part of a degree, as very few universities do, instead of leaving students to find by themselves? This could certainly be a matter of discussion and ideas. Beyond developing intelligent minds, higher education should develop individuals who are confident and satisfied in the career path they have chosen. This is supported by a recent survey, which found that salaries only come second after the potential to do more interesting or fulfilling work (55%) [3]. This is to say that what matters most to engineering graduates is not the

money (although it indubitably counts), but the job satisfaction. Bearing in mind the definition of an engineer given earlier, which implies creativity and problem solving, education needs to see more than brains, but to look at individuals, human beings whose potential can only be developed through practical experiences, not only examination results. The truth is that, by reading job requirements, it appears that more and more is asked from recent graduates, but how much is given to them before they graduate?

2.3 Other routes, other possibilities

A vocation is a strong feeling of suitability for a profession. This vocation, supported by apprenticeship, further education, and other training, constitutes what is known as a vocational education. Indeed, many leaders of top companies have followed this path. This very “hands on” kind of system certainly allows required skills to be shaped from the start and produces high quality technicians ready for employment. An appreciable start is the Government’s creation of University Technical Colleges (UTCs) to provide high-grade education for 14-19 year olds centred on employment and most of these colleges have engineering as a specialism [4].

Yet, Perkins claims that this vocational route is still under-exploited and many opportunities have not yet been considered in different areas. Concretely, he suggests the following ideas: [4]:

- Together, the engineering community and Government need to develop and promote new level 2 and 3 qualifications in order to create high-grade vocational paths for young people as they enter engineering careers.
- Together, the engineering community and employers should aim to inspire and provide work experience for post-16 students currently in colleges and schools.
- Employers and Government should aim to develop more apprenticeships, promote diversity, and share skills and knowledge.

3. Conclusions

To ensure the progression of the UK economy, a larger supply of engineers is needed. The place of education in the scheme in incontestable and its role clear, whether referring to formal or vocational education. Education, supported by Government and employers constitutes the solution to the supply. Skilled engineers, but also inspired engineers are what our economy needs and a reform of the educational system, which has started, can only be encouraged, as it is the answer to the question “how can engineering better contribute to the economy”.

4. References

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4. Perkins J., Review of engineering skills. TheEngineer.co.uk. (2013)