# 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?

## 1. Introduction

The global financial crisis and the resulting recession saw the end of 15 years of continuous growth. In 2010 the UK was ranked 12th, down from 4th in 1998, in the World's Economic Forum's (2010) Global Competitiveness Index and its share of global exports has halved (HM Treasury, 2011). The UK economy is recovering slowly and the current Government has outlined its *" path to sustainable, long- term economic growth*" (HM Treasury, 2011, p. 5).

The UK is forecasted to become the most successful western economy after the US by 2028 (Centre for Economic and Business Research [CEBR], 2013). Current and successive Governments have recognised the importance of engineering and thus have focused on the industry as part of their strategy for economic wellbeing. This paper aims to ascertain the engineering industry's contribution to the UK economy, assess how the contribution can be increased and whether there is a role for Higher Education (HE) institutions in creating sustainable, long-term economic growth.

## 2. Engineering and the UK Economy

Engineering has long been viewed as a significant sector for the UK economy (Leitch, 2006; Sainsbury, 2007; CBI, 2010). At the end of the 2012 financial year, the industry turned over £1.1 trillion, accounting for 24.5% of the turnover by all UK enterprises (Engineering UK, 2014). To put this contribution to the UK's economy into perspective, the turnover is 3.2 times greater than the £342 billion retail sector (Engineering UK, 2014). The UK's Growth Review has identified 14 engineering sectors in the UK economy which have proven their strength with further capacity for growth (Engineering UK, 2014).

The author and Perkins (2013) support the view that there is a great need to increase the supply of engineers in the workforce. The UK is forecasted to become the largest Western European economy by 2028 (CEBR, 2013) and the supply of a workforce with engineering skills will be critical to reaching and maintaining this success. It is estimated that just increasing productivity or employment by 1% will generate an extra £10 billion of GDP each year (UKCES, 2012). Currently the engineering industry represents 19.5% of the working population (Engineering UK, 2014). Engineering skills are in high demand, not just by the engineering industry but also in other occupations. Currently the industry demand vastly outweighs the supply. There is an annual estimated demand by UK engineering enterprises of 87,000 people with degree level qualifications, only 58% of the demand is being met (Engineering UK, 2014). If the UK is to compete as a leading world economy, action must be taken to create a long term supply of quality engineers.

## 3. Barriers to the supply of engineering skills

The *Educating Engineers for the 21ST Century* Report concluded that the best of UK graduates are still world class and satisfy the needs of the industry, but there is simply not enough of the best (The Royal Academy of Engineering, 2010). Various authors have identified reasons why the demands of engineering skills are not being met. This author has identified key barriers that reflects own experiences and current literature.

Young people have a distorted perception of engineering, associating it with building, electricians and car mechanics (British Market Research Bureau [BMRB], 2007). This is largely accredited to media influences

(Canavan *et al.*, 2002) and the lack of encounters with engineers, unlike other professionals (Ekevall *et al.*, 2010). Compared with the medical and law professions, 16-19 year olds showed the least knowledge of engineering as a profession (BMRB, 2007). There is little general understanding about the engineering profession across the population (Engineering UK, 2012). Over 75% of people surveyed noted that there were so many different types of engineering it made it confusing for the average person to understand, leading to an overall conclusion that "*engineers fix things*" (BMRB, 2007, p. 4).

Children do not associate engineering with designing and creativity that they enjoy in the classroom, with 49% of 7-11 year olds thinking it would be 'boring' as a career (Engineering and Technology Board, 2009). Engineering education in schools is considered sporadic and often championed by a teacher hosting extra-curriculum activities (Clark and Andrews, 2010). Ekevall et *al.(2010)* found that teachers and pupils were seen to benefit from engineering activities inserted into the curriculum through practical learning and increased awareness of possible engineering careers. However, many teachers noted resourcing issues and lack of their engineering experience made teaching of the subject daunting (Ekevall *et al.*, 2010), raising concern that the interest in young children would not be sustained and built upon (Andrews and Clark, 2011). A study by IOE Research Centre suggests that young people are more likely to take STEM subjects if they have been taught well in schools and encouraged by a key adult to study the subject (Engineering UK, 2014). Currently only 50% of teachers in maths and physics have a relevant HE degree and only one in five engineering teachers have attained a post A Level qualification (Engineering UK, 2014).

Females represented 54.6% of all STEM applicants but only 13% of the total engineering applications. Tomorrow's Engineer Week found that 65% of girls would not consider a degree in engineering with just under 25% claiming it was not suitable or an attractive career for women (Women's Engineering Society, 2013). Archer *et al.* (2013) argues that this is merely an issue of changing student perception but it must be noted that engineering is not for everyone. With girls outperforming boys in STEM subjects, there is the potential to address the shortages of engineers in the UK by attracting young women to the industry

The engineering industry's contribution to the UK economy is underpinned by the technical foundations of the workforce. So, whilst meeting the supply of engineers is important, they must also be fit for purpose. Universities are still considered the gateway to the industry and want to ensure that their engineering programmes are relevant for the 21st century and have introduced more hands-on activities and problem based learning (Arlett *et al.*, 2010). These initiatives have decreased drop-out rates and improved graduates employability (Arlett *et al.*, 2010). Collins and Davies (2009) found there was strong consensus that industry led experience was highly valued by students. However, in recent years the number of academic staff with industry experience has been declining, particularly in research led universities (Arlett *et al.*, 2010).

Sainsbury (2007) called for a review of engineering education to develop *'experience-led degrees'* in leading engineering universities. An experience-led degree in this paper is a degree that develops industry related skills and includes industry interaction. Students, academic staff and the industry agree that industrial experience is beneficial for all parties (Soltani-Tafreshi *et al.*, 2010). The

majority of companies consider industry experience as an important discriminator in their graduate intake, yet most universities would include more industrial experience if it was easier to arrange with dedicated staff in the industry (The Royal Academy of Engineering, 2007).

## 4. Recommendations

Engineering skills take time to develop. It is important that there is a focus on long term strategies, while in the short term; the industry makes the best of the current supply of engineers. In agreement with Perkins (2013) , there are opportunities for the Government, industry, institutions and the education system to encourage and produce a long term supply of engineers to place the UK as a leading world economy.

Engineering should be a part of the UK National Curriculum as a separate subject to compliment science or embedded into other subjects, particularly at primary school. Whilst design and technology is part of the national curriculum, it does not focus on engineering context and engineering problem types. The engagement and exposure to engineering in the curriculum will encourage young children to see the links between design and engineering at a young age, influencing their academic careers, particularly in young women. There is a great role for STEM initiatives and University partnerships to play, in coordinating additional engineering enrichment activities alongside the school curriculum. These initiatives and partnerships should target those schools with a historically poor STEM engagement and a lack of resources.

Introducing engineering into the education curriculum requires teachers with the relevant knowledge to attract and inspire school children throughout their early academic career. Graduate engineers are in a good position with their background in physics and mathematics to deliver quality and inspiring education in schools. While this seems counterintuitive, in the long term there could be an exponential growth in the number of school children choosing to take engineering as a career as a result of inspiring and quality teachers. Additionally, encouraging teachers from an engineering background will result in greater knowledge and careers advice for both young men and women in the education system.

The industry suffers from strong misconceptions and the general population is unaware and confused with engineering disciplines. The Tomorrow's Engineer brand is a good example of an attempt to coordinate a collective message. While Tomorrow's Engineer is collaborating with professional institutions, they do not fully represent the 14 identified strengths in the UK engineering economy. It is also important that the message is updated and inspiring to enthuse young people, linking the industry to imagination, design and creativity for both boy and girls. Government, industry and more professional institutions should invest and support a mainstream collective message of engineering and provide a 'one-stop shop' for information on engineering in the education system.

*'Champions'* from the industry should be encouraged into University to teach or support teaching. This will enable the industry to directly input into teaching and the curriculum, benefiting the students. Additionally, creating formalised mechanisms that will allow academics to spend time in the industry, through secondments and collaborations, to gain experience or achieve chartership. This will ensure that the student education is directly relevant to the industry, creating graduates fit for the 21st century.

There is a need to improve equipment and quality of spaces in HE institutions, but it is unrealistic in the current economic climate to expect an increase in funding. The industry and HE should focus on collaboration and building and strengthening relationships in order to share facilities and develop experience-led engineering degrees. This will require commitment and time to sustain and build lasting partnerships, with small and medium enterprises not just large firms. As degrees provided by HE must meet the requirements for quality, the accreditation process should be used to encourage the experience-led components in HE degree courses. Whether that be with industry leading design modules or in partnership with the University. Through the partnerships, industrial placements should be incorporated into the agreements in order to make it easier to provide industrial experience to students. In order to encourage such collaborations, the Government should provide tax incentives to support engineering enterprises to offer placements to students.

## 5. Conclusion

The engineering industry is a keystone in the UK economy. It already has good foundations within 14 sectors, with the potential to further increase its competiveness and share of the global market. This potential could be realised if the demand for individuals with engineering skills is met. Currently the demand of engineering skills vastly outweighs the supply. The pipeline of skills is constrained by, and not limited to, misconceptions and misunderstanding of the industry, a lack of gender diversity and a lack of engagement engineering within the education system. While the supply of engineers in the workforce needs to be addressed, they must also be of quality and fit for the 21st century.

There is an opportunity for all parties with an interest in the engineering industry to inspire and influence the future supply of quality engineers for the industry. The supply of engineers could be increased by introducing engineering to young school children through the National Curriculum, University enrichment activities and encouraging engineers to enter the teaching profession. University is still the gateway to industry and should push for experience-led degrees with contributions from the industry directly involved in teaching and offering industry experience to students, in order to meet the needs of a globally competitive UK economy.

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