Rosemary Wainwright, Loughborough University

# 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?

## To paraphrase Mark Twain, reports of the death of the engineering industry in Britain have been greatly exaggerated.

The demise of British engineering and manufacturing has been widely reported, with articles contrasting the dominance of Britain as an industrial giant in the early 1950s, with today's industrial climate (Butterworth, J., 2010). However, there is evidence to suggest that the UK is not yet beyond its manufacturing heyday. In fact Figure 1 shows the increasing trend in the value the UK gets from the manufactured output from engineering companies. However, the UK cannot be complacent, and proactive measures are needed to ensure this growth does not stagnate or even decline.

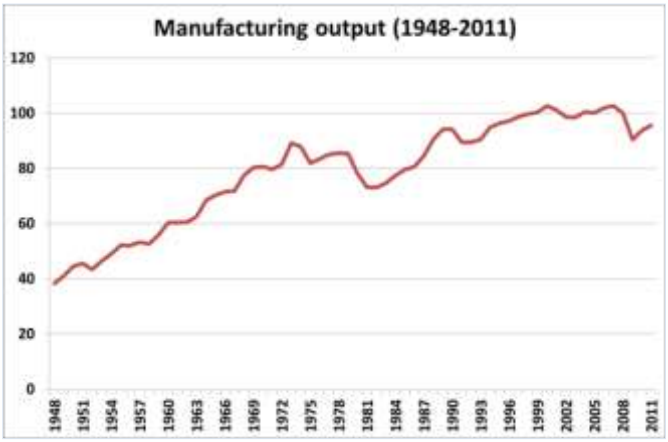


**Figure 1: Manufacturing Output from the Index of Production since 1948 – shown as Percentage Change, where 2008=100%**

**Source: (Centre for Policy Studies, 18 May 2012)**

Whilst it is correct to say that engineering has been identified as an important area of further opportunity for boosting the UK economy, we should not lose sight of the strength of its current contribution. As shown in Figure 1, a rise of 148% in output from 1948 to 2011 demonstrates the strong growth the UK has experienced (Engineering UK, 2013). In terms of the overall UK economy, engineering enterprises provide a substantial proportion - £1.06 trillion in the year ending March 2011, which is 23.9% of the turnover (Engineering UK, 2013).

## So what can we do to maintain, or even improve this trajectory?

*The long term health of the UK economy is likely to depend in large measure on our ability to compete successfully with other technologically advanced (and advancing) nations.* (The Royal Academy of Engineering, 2010)

Three of the main issues which need to be addressed in order to maintain and increase the contribution of engineering to the UK economy are: the development of a sustainable pipeline of capable engineers (Perkins, J., 2013), the realisation of the commercial potential of current research (Witty, A., 2013), and the sustained innovation and cutting-edge research within the UK.

Though on the face of it these seem separate issues, the initial steps to tackle all of them are interlinked – and can all be boosted by strengthening the networks between the academic and industrial/commercial sides of engineering.

## We need to take action to ensure continuous injections of new engineering talent into industry

Currently the age profile in industry is skewed towards older engineers, as can be seen in the Engineering Council's survey of registered engineers (Figure 2).

To meet the future demand for engineers, and develop engineering's contribution to the UK economy, there is clearly a need to build a pipeline of talent.

It is essential to start development at an early age. However, around 91% of girls have potentially ruled themselves out of engineering by the age of 14 (Engineering UK, 2013) by not studying triple science at GCSE - a pre-requisite to studying A-level physics which is a typical engineering degree requirement (Department for Education, 2011).

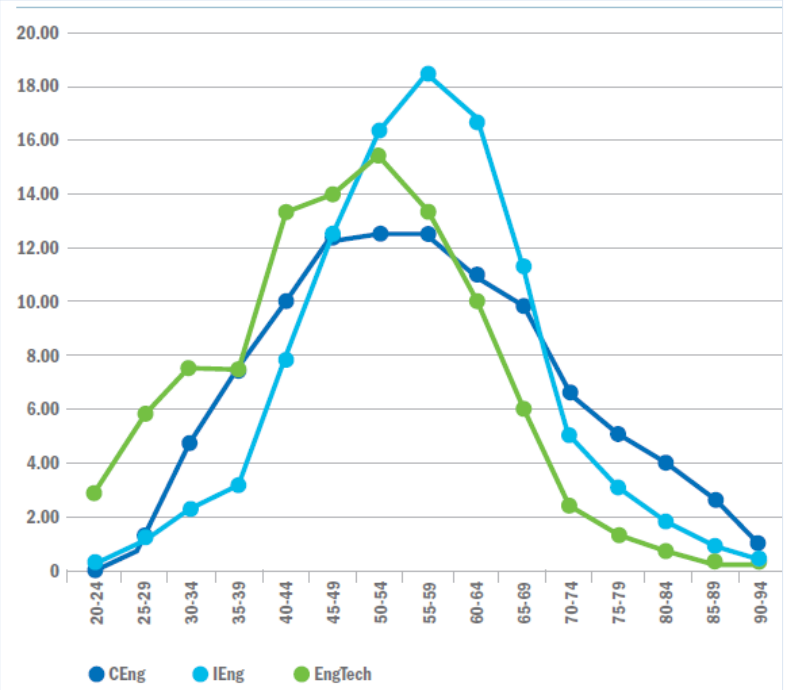


**Figure 2: Age Distribution of Engineering Technicians, Incorporated Engineers and Chartered Engineers**

**Source: Engineering Council 2012 (Engineering UK, 2013)**

Engineering also has an image problem. The ECITB's research shows that 21% of young people think the industry is not creative (Edwards, D., 2011), only 2% of students aged 14 and 16 said they wanted to be an engineer (Engineering UK, 2011), and a fifth of their career advisors think that a career in engineering is undesirable (Engineering UK, 2013).

Interaction of universities and industry with schools and sixth-form colleges is an essential component in combating these opinions. Schemes such as Tomorrow's Engineers - led by Engineering UK and the Royal Academy of Engineering, or the Engineering Education Scheme - from the Engineering Development Trust (EDT), are useful ways to provide relevant careers information or experience to younger students. Students can then make more informed decisions about the wide range of engineering career opportunities, and have greater understanding of the skills or subjects required.

Other action is needed in universities to stem the flow of engineering graduates into other industries. Though ensuring school students have the appropriate background in mathematics and science to progress to higher education is very important, research (Engineering UK, 2013) shows that a reasonable proportion of engineering and technology graduates do not go into occupations relating to their degree (Figure 3). These are students with the relevant school-age qualifications, who have dedicated at least 3 years to achieving degrees – and yet do not apply their knowledge into the workplace.

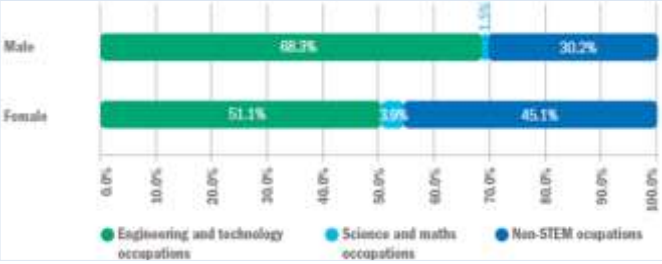


**Figure 3: Occupation of engineering and technology graduates who obtained first degrees, by gender (2009/10) – UK domiciled**

**Source: HESA/Destinations of Leavers from Higher Education Institutions (Engineering UK, 2013)**

Creating opportunities for deep, meaningful interaction between students and employers is key to building the interest and engagement of engineering undergraduates, and increasing the likelihood of them taking up an engineering career. Industry sponsored research projects, competitions or materials to aid studies helps to build relationships which can be of mutual benefit. Encouraging experienced, practicing engineers to spend time in universities talking with students and sharing their experiences will help bring to life what a career in engineering can give.

Sandwich courses, offering a year/ 6 month industrial placement, provide students with the opportunity to join theory with practical knowledge. This greater level of interaction benefits all of the three main stakeholders: students, universities and industry.

Students gain valuable industrial experience, allowing the amalgamation of practical business constraints of real world situations with the academic side of engineering principals (Education for Engineering, 2011). Work experience on CV's or potentially securing a graduate role before completion of studies are great bonuses, and the MPDS (Monitored Professional Development Scheme) can be started during placement – which can count for experience towards IEng or CEng.

Universities gain more knowledgeable students on their return, who are more likely to produce higher quality work, demonstrate better personal management, and bring commercially viable projects set by their placement company (Education for Engineering, 2011). Through collaboration with engineering firms, universities can find research opportunities and leverage additional funding (Perkins, J., 2013).

Industry has the opportunity to shape future graduates, having the chance to see the students in action before committing to employing them full time. By engaging with universities through placements, or setting real-world projects for final year dissertations, industry has influence in the students' experience. This interaction with upcoming engineering graduates is very important – in a survey of engineering employers by the IET (IET, 2003) the reasons provided for the largest skills gap amongst new recruits was due to a lack of practical experience, particularly for graduates.

## Though the UK is recognised as a world leader in several cutting-edge technologies, it is essential to ensure the commercial potential of current research is reached.

Though the UK leads the way in many technologies, too often we fail to convert these ideas into profit making companies (Witty, A., 2013). To counteract this, the government is taking steps to commercialise work that is done in universities, through initiatives such as the eight great technologies (Department for Business, Innovation & Skills , 2013). Working with researchers and industry, they have highlighted areas of potential with the aim of utilising the UK's research strength

and technical capability to foster, commercialise and capitalise on world class technology capabilities developed in the UK (Department for Business, Innovation & Skills , 2013).

It is essential that engineering graduates are aware of the opportunities in industry – as stated by Nicola Dandridge, chief executive of Universities UK, "The future of the UK economy depends on making the most of the knowledge, innovation and energy to be found at universities." (Witty, A., 2013) If this knowledge is not utilised in industry, there is wasted potential in filling the UK engineering skills gap.

Interaction between universities and industry is essential to reduce the skills gap, to ensure the next generation of engineers is able to cope with the business aspects of engineering companies. Currently 42% of engineering employers who responded to a recent survey, claim recent engineering, IT and technical recruits did not meet their expectations for level of skill (IET, 2013).

Through working together with industry and researchers within higher education, UK engineering would be better positioned to use these developing technologies for commercial applications and therefore increase the economic output from this research. Links created between industry and higher education, through initiatives such as company-set projects, sandwich courses or other industrial placements, could be used to maximise the opportunities for commercialisation of current research.

Though there is much to do to take full advantage of the commercial potential of research, universities are increasingly catering to students who are commercially savvy as well as technically literate, with modules such as Business, Structure and Strategy on offer to engineering students, or degree courses in Engineering Management becoming more popular. Initiatives such as Loughborough University's Student and Graduate Enterprise offer students entrepreneurial advice, extracurricular to degree studies. These types of additional support to students can enable ideas to be developed into commercially competitive products.

## Whilst maximising the commercial potential of current research is important, ensuring the continuous flow of new ideas and innovation is critical.

One way to ensure original ideas are generated is to ensure we have a stream of new minds coming up with innovative ideas – this links back strongly to the importance of encouraging and nurturing the next generation of engineers. By connecting with more students who may not have considered engineering as a career path, a larger talent pool will be able to rise through the engineering sector, bringing a fresh outlook on problem solving.

To encourage this stream of future engineers, and in order to keep the momentum of engineering in the UK economy, more must be done to highlight the variety, stimulation and enjoyment that an engineering career can offer. Industrial influence and context throughout academic life, through projects or work experience, provides the clarity and education about engineering as a profession, and should go some way to reducing many of the barriers and misconceptions currently present for young people considering a career in engineering.

Engineering is as much about creativity as it is about mechanics. Breaking down this stereotype, and encouraging more "right brained" creative thinkers, will ensure that we breed a generation of engineers who are capable of innovating, as well as translating these ideas into viable projects. By developing project based modules, where academic work can be applied in more creative ways, universities can train people to be more innovative. By bringing entrepreneurs and industrial experts together with engineers, be this through extracurricular initiatives or as part of assessed project-based modules, universities can act as incubators for the development of creative problem solving through improved experimentation and idea generation, to maintain a stream of new ideas and innovations.

In addition to increasing the number of engineers, more should be done to maximise the potential of those already in higher education, research or industry. By networking between industry and higher education, research could be targeted to solve specific needs for companies as they arise, and used to develop new solutions, materials or processes. By staying at the cutting edge of technology, ensuring means to continue, and realising the economic value of doing so, the UK economy will benefit.

**Though declarations of the demise of UK manufacturing and engineering are premature, universities and industry must join forces to strengthen the pipeline of talent, capitalise on the potential of the innovations we already have, and find ways to continue to generate new technologies, products and solutions.**

In conclusion, in order for engineering to continue or increase its positive contribution to the UK economy there is a need for proactive measures to be taken to improve communication between the academic and commercial sides of engineering. The UK is recognised as a world leader in many cutting edge technologies and inventions (Witty, A., 2013), however the commercialisation of this research – through collaboration between academic research institutions and engineering companies – is essential in making the most of these advantages and benefiting the UK economy (Perkins, J., 2013). This communication and clarity of expectations from industry is vital in ensuring the encouragement of the next generation of engineers to stem the skills gap. As discussed, this must be applied early on in education and maintained throughout to ensure students have a positive and informed view of the engineering profession from an early age, and can make subject choices which will allow them to reach their potential. The integration of higher education with engineering companies will be key to developing the role of engineering in the UK economy.

Rosemary Wainwright

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