EDUCATION

ENGINEERING SKILLS FOR THE UK INDUSTRIAL STRATEGY

Institution of MECHANICAL ENGINEERS

The UK Industrial Strategy[1] has set out 11 key industry sectors for growth. Without exception, these rely on Science, Technology, Engineering and Mathematics (STEM) skills to deliver world-class competitiveness. The UK Commission for Employment and Skills (UKCES)[2] has estimated that overall 1.35 million new recruits each year through to 2020 will be required to sustain even very modest economic growth. About one tenth of these will need to have skills. The current capacity of the UK to produce either student or mid-careers recruits for these roles is about only one half of this number. Decisive action therefore needs to be taken to intervene to double the level of interest in STEM careers within the UK population.

There is also a particular challenge in relation to technical skills for employers in engineering and IT.[3] With 56% of the entire workforce over the age of 40, the education and skills part of this sector has a remarkable 73% over 40. They are not alone; some 10% of employees in the Transport, Energy and Defence sectors are over 60 years old. There is therefore the potential for a 'Perfect Storm'. Just at the time when we have an Industrial Strategy calling for growth in key value-adding sectors of international competitiveness, the majority of our workforce will be looking to retire.

The Institution of Mechanical Engineers therefore recommends the following:

1. **Destination measures.** Schools and colleges should be measured and compared individually on the education, training and employment destinations of their leavers, in addition to their success with academic achievements. They should also provide information on the progression of former students.
2. **Stronger careers information, advice and guidance.** Based on successful practice demonstrated in Germany and other nations, face-to-face careers guidance should form part of a programme of careers support to be made available for all secondary school pupils – that is provided by professional careers advisers with specific expertise in STEM careers knowledge.
3. **Better work-related learning.** Employers should be encouraged to open their places of work to students (as a complementary alternative to employer 'outreach' in schools), since authentic and well-planned work experience placements convey reality of employment in their sector and are regarded as highly effective, especially for apprenticeships.

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SKILLS DEMAND

Economic growth relies on businesses having not only the right products but also the right people. The Royal Academy of Engineering[4], based on its analysis of the UKCES sectoral growth forecasts, estimates that we need 830,000 Science, Engineering and Technology (SET) professionals by 2020 and 450,000 SET technicians over the same period.

Engineering UK[5], through their own analysis, suggests a very similar figure of an average of 87,000 degree-qualified recruits per year to engineering companies between 2010 and 2020. It also estimates an average of 69,000 per year Level 3 qualified recruits in parallel. From its extensive research it concludes that there are only 46,000 appropriate degree-level and 27,000 appropriate apprentice-level students graduating in total in the UK.

In 2010, Sir James Dyson's report 'Ingenious Britain'[6] for the Conservative Party highlighted the need for our education system to be much more aware of employment opportunities. He recommended that mid-career transitions from employment into teaching should be encouraged and that teachers, especially those in STEM subjects, should be able to refresh their knowledge of the latest advances in industry through time away from the classroom.

The aim of the Dyson recommendations was to create a clear picture of the world of work and bring it closer to the students' experience. This turns out to be harder than it sounds, as the picture is far from clear. In a previous report[7], the Institution of Mechanical Engineers called upon Government departments together with large employers, through their supply chains, to co-ordinate activities and messages for the benefit of their sectors. It remains a particular challenge to provide a single and authoritative view of demand. In its most recent public assessment[8], even the Sector Skills Council for Science, Engineering and Manufacturing Technologies could comment only those businesses within its 'footprint'. This restricted view meant that its total demand (23,000 a year across degree and apprentice qualifications) seemed at odds with their sector title and the estimated 150,000 per year demand promoted by others.

Finally, the UK Industrial Strategy (issued after the majority of the work referenced above) calls for an infrastructure that stimulates growth in 11 chosen sectors (Aerospace, Automotive, Life Sciences, Agri-Tech, Education, Information Economy, Professional and Business Services, Nuclear, Oil & Gas, Offshore Wind and Construction). Strategies are being produced for each of these sectors. Each will no doubt result in increased demand for skilled engineers and scientists. Growth targets may well be speculative, but a 1% increase in GDP from the STEM size equates to about 300,000 new jobs. Previous estimates for low-carbon technologies, for example[9], predicted 170,000 new jobs across offshore wind and building retrofits alone.

SKILLS SUPPLY

Excellent data exists on the UK supply of STEM academic achievement at all levels. This is very easy to measure, although slow to modify. Engineering UK[5] has shown that the number of students graduating across all STEM subjects in the UK has risen by just 17.6% over the eight years since 2002/3 (2% per year). This has however been driven mostly by growth in biological science degrees. Extracting the biological science data gives a meagre 7% growth over the same period for the remainder of STEM subjects (less than 1% per year).

Performance at GCSE remains a concern. Education for Engineering analysis[10] of data for 2010 in England showed that 39% of students do not achieve grade C in mathematics at GCSE. In addition, a further 12% failed to attain grade C in two or more science qualifications. This combination means that 51% of the GCSE cohort in 2010 did not have the qualifications to be able to directly progress to further study in STEM. Of those that could progress, 49% were female. We know however that women make up only 7% of those finally working in engineering careers[3]. Effectively therefore the pool of talent to meet engineering employment demand is being drawn from just under 27% of the UK population.

The reasons for this are many. Significantly, awareness of engineering as a subject at school is very limited[7]. Teaching has also become predominantly 'transmissive' and risk-averse, while examination results and league tables are seen as the only indicators of success. Investigative teaching however, especially in STEM, has been shown to be more effective in inspiring students and encouraging a deeper level of engagement. More effort is also needed to embed careers-related learning in mainstream STEM learning.

A recent study by the Institution of Engineering Technology (IET)[3] has also shown that not enough is being done yet to create more high-level apprenticeships. Stronger incentives may need to be in place for employers (especially SMEs) to provide the places for training for Level 2 and Level 3 qualifications. A worrying 36% of respondents from the 400 companies surveyed also revealed that they were doing nothing at all to improve the diversity of their workforce. This was at the same time as 68% of those surveyed claimed they were having difficulties in filling vacancies.

KNOWN SHORTAGES

Previous work by the Institution of Mechanical Engineers has shown that shortages are surprisingly difficult to quantify[7]. UK engineering skills demands are initially hindered by the absence of cross-Government departmental planning. In some ways it is also an unanswerable question, as migration allows both employment and unemployment to move across borders.

The key issue seems to be that young people do not have a clear picture of what might be most likely as a job opportunity for them. Recent work by UKCES with the Education and Employers Taskforce and the b-live Foundation[11] has shown that especially at the early stages of secondary education, career aspirations "have

nothing in common with the projected demand for labour in the UK between 2010 and 2020". Even post-16 students favour 1: Health, 2: Culture, Media and Sport and 3: Business, Media and Public Service as career options, despite limited opportunities. The consequence of these perceptions is seen in curriculum choice (where there is therefore a strong demand for those subjects that allow students to pursue their career aspirations). As a result, just 14% of the population end up taking A-level Mathematics and even fewer (5%) A-level Physics[5]. (Of those, about three quarters then go on to achieve grade C and above.)

The clearest data remains the anecdotal information from individual employers. The recent IET survey[3] shows that 68% of employers of engineering staff are currently finding difficulty in filling vacancies for senior engineers with five to ten years' experience. Worryingly this has risen from just 48% of UK employers asked the same question in 2011. There has also been a doubling (43% from 21%) over the same period of those struggling to find the right engineering managers.

The direction being taken by these employers to address these issues seems to be to adopt a 'grow your own' policy. The top two positive actions in the survey were first, to focus on hiring apprentices and graduates and second, to train and develop existing staff. Both actions will need better engagement with the education sector and more work seems to be needed at this interface. It is therefore of concern that 31% of employers interviewed saw no benefit to the company in engaging with the education and skills system. In addition, 19% thought it would be too time-consuming and 15% too expensive.

CAREERS ADVICE

The logical approach to better STEM careers information, advice and guidance for young people might be to ensure that the very best labour market information was in the hands of specialists in careers in the sector.[12] For schools and colleges, these experts could then engage with STEM teachers who similarly had been given the opportunity to take time out to keep up to date with STEM employment.

While this doesn't yet happen, it has been suggested that employers need to take a lead[7]. By making use of their supply chains they can invest in work placements and business practices to attract more young people, including more women, into STEM. As the ultimate beneficiaries they surely have the most to gain. Young people (aged 12 to 16) look to their schools in the first instance to help them make contact with employers/ employees and also gain work experience to help them decide on careers.[11] In the absence of this contact, there is a risk that young people will gather their careers advice from parents, other relatives and friends. Since only 7% of the population are involved in engineering careers, there is then a low probability of them getting the encouragement and advice the engineering employers would like them to have.

The National Careers Council (NCC) has just released a report[13] calling for a culture change in careers advice provision. Its leading point is that while the UK operates with simultaneously shortages in certain professions and yet unemployment in others, we need a lifelong process to encourage not only high-quality initial choice but also mid-life retraining and transitions. The whole process should be employer-led with visits to schools and better online information (including labour market data) being key factors. This is no easy task. The current National Careers Service (NCS) website shows 29 major 'job families' and under the "Manufacturing and Engineering" job family, some 143 individual jobs with five or six pages of description on each. Overall there are over 750 job descriptions on the site and hence it lends itself currently to be more of a reference library than a useful advice tool.

The NCC report[13] also highlights that with face-to-face advice being restricted to those beyond school age, the NCS does not serve schools as well as it might. It offers only telephone support and web chat advice to the school cohort. Between April 2012 and May 2013, whilst it conducted 1.1 million face-to-face sessions with 650,000 adults, it managed to interact with only 33,500 youngsters. In other words, the vast majority of its work goes on non-school age support at a time when youth unemployment is a major concern. In countries with a thriving engineering skills sector such as Germany, the state invests significantly in planned long-term careers education, sitting alongside well-established vocational pathways, underpinned by local ties between industry and schools.

Within overall careers advice, STEM careers clearly have particular needs. STEM however is not prioritised as a subject in either teaching or advice. A report from the Gatsby Charitable Foundation[14] highlighted the need for careers professionals to have access to high-quality STEM careers training modules and that the quality of the advice then provided in schools should be monitored by Ofsted.

There is also a special issue for those potentially disposed to an apprenticeship for a STEM careers as summed up in a recent BIS Select Committee report[15]. Taking evidence during 2012 they concluded that there needed to be a strategy and a purpose to the current expansion of apprenticeship programmes. They felt that the current "National Apprenticeship Service's (NAS's) objectives are too heavily weighted on numbers". In delivering value for money it needs to be linked to "those areas where economic benefits are greatest". They specifically call for the NAS to be given statutory responsibility to raise awareness of apprenticeships in schools.

The Richard Review[16] highlighted the need for all apprenticeships to aim for high standards linked to clear, effective and trusted qualifications. For engineering, there is therefore a great opportunity to build on the existing accreditation schemes approved by the Engineering Council[17]. Not only would these add value to the specific qualification, but also the raised public awareness of their existence would help to address the broader issue of the status of engineering in society.

RECOMMENDATIONS

Delivering the UK Industrial Strategy needs a willing and able workforce to support the desired business growth. The context of a retiring baby-boomer generation more attuned to careers using STEM skills than the current school and college population, leads to a 'perfect storm' of increasing demand at a time of static or reducing supply. This is particularly the case for vocational routes to employment, which remain as 'second class' options for many of our best students.

The Institution of Mechanical Engineers therefore calls for the following actions to be taken to start to close the gap between the vision for a more balanced economy and the reality of more of the same.

1. **Destination measures.** Schools and colleges should be measured and compared individually on the education, training and employment destinations of their leavers, in addition to their success with academic achievements. They should also provide information on the progression of former students.
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REFERENCES

1 www.gov.uk/government/speeches/industrial-strategy-cable-outlines-vision-for-future-of-british-industry, September 2012

2 Working Futures 2010–2020, UKCES Report 41, December 2011

3 Skills and Demand in Industry, Annual Survey 2013, IET, June 2013

4 Jobs and Growth: The importance of engineering skills to the UK economy, Royal Academy of Engineering, September 2012

5 Engineering UK 2013, The state of engineering, Engineering UK, November 2012

6 Ingenious Britain, Making the UK the leading high tech exporter in Europe, Sir James Dyson, March 2010

7 Meeting the Challenge: Demand and Supply of Engineers in the UK, Institution of Mechanical Engineers, September 2011

8 Sector Skills Assessment for Science, Engineering and Manufacturing Technologies, SEMTA, December 2010

9 Meeting the Low Carbon Skills Challenge, Department of Energy & Climate Change, March 2010

10 Opportunity and Ability? Key Stage 4 science and mathematics participation and attainment in England in 2010, June 2012

11 Nothing in Common: The career aspirations of young Britons mapped against projected labour market demand (2010–2020), Education and Employers Taskforce, March 2013

12 Careers Information Advice and Guidance, Institution of Mechanical Engineers, April 2012

13 An Aspirational Nation: Creating a culture change in careers provision, National Careers Council, June 2013

14 STEM Careers Review, Gatsby Charitable Foundation, November 2010

15 Apprenticeships: Fifth Report of the Session 2012–13, Business, Innovation and Skills Committee, November 2012

16 The Richard Review of Apprenticeships, November 2012

17 UK Skills – Apprenticeships, Institution of Mechanical Engineers, February 2009

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