EngineeringUK

Engineering UK 2009/10

Detailed Summary by Section

We gratefully acknoledge contributions from:

ADS

eef The manufacturers' organisation

Engineering Council

Equality and Human Rights Commission

energy&utilityskills

fdf innovating workforce development

Warwick Institute for Employment Research IER

The Nuclear Institute

semta The Sector Skills Council for Science, Engineering and

Summit SKILLS

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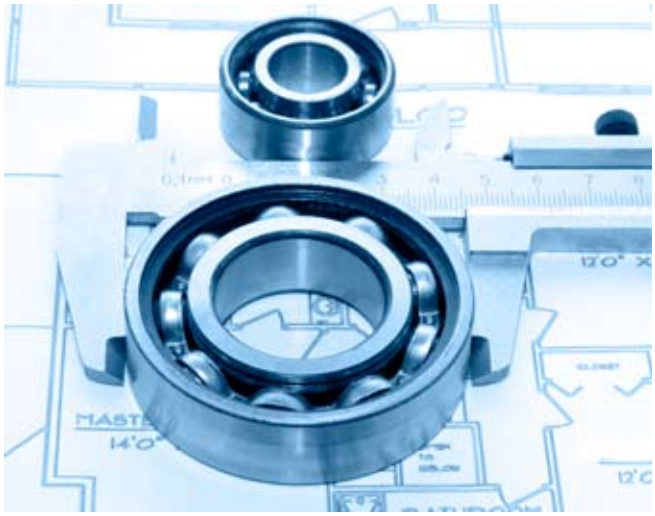

Engineering – a sector in the spotlight (Section 1)

Engineering is of strategic importance to the UK economy. It is the bedrock of the UK's manufacturing and construction industries and critical to the development of new manufacturing processes and technologies in the future.

Engineering is a very broad sector and an integral part of industries such as manufacturing and construction. An engineering footprint was defined by the ETB in 2008 using Standard Industrial Classification (SIC) 2003 codes. This was achieved by aggregating related industries to allow for year-on-year comparison of the sector. According to this definition, total turnover of VAT-registered engineering enterprises has increased from £716 billion in 2007 to £799 billion in 2008.

As a result of the current economic environment, engineering has received much more attention from central Government, which has recognised it as an important contributor to the economy and employment. Three of the reports published are précised below.

In March, the Innovations, Universities, Science and Skills (IUSS) committee released its report, Engineering: Turning Ideas into Reality. This report covered the key forms of engineering of strategic or economic importance to the UK. The major focus of the report though was on engineering in Government. The report advocated greater levels of involvement of engineers and at earlier stages in the policy formation process. It also called for the civil service to ensure that it is aware of the engineering skills at its disposal and to make more use of the engineering fast stream. Additionally, it called for a Government Chief Engineering Adviser and for an Engineering Adviser to be located in each Government Department sitting alongside Chief Scientific Advisers. In addition to this, the report called for increased use of Roadmaps to ensure that engineering projects are appropriately planned within Government.

In July, the Cabinet Office Panel on Fair Access to the Professions published the report Unleashing Aspiration. Although engineering has a continuing problem with gender balance, the report was very positive towards engineering with initiatives such as STEM ambassadors and The Big Bang being lauded, as well as the great range of routes into the profession.

Also in July there was a second IUSS Committee Report called Putting Science and Engineering at the Heart of Government Policy. This report revisited the committee's recommendations from the Engineering in Government case study and reiterated the call for a Chief Engineering Advisor as well as a Science, Engineering and Technology Committee with the remit to scrutinise the Government across departments on relevant policy.

Engineering talent in a globalising world (Section 2): Recruiting the engineering team from overseas and policy constraints

For large companies operating internationally, the recruitment 'talent pool' has been a global one for some time. As a member of the EU, there is no policy constraint to job-seeking in other Member States, and we can expect growing mobility to provide opportunities for younger people, both coming into and moving out of our country. However, the flow of migrants from other European countries has inevitably had a certain knock-on effect on flows of migrant labour from outside Europe - not least from Commonwealth countries. Work Permits are required for those applying for UK jobs from anywhere beyond the European Economic Area (EU plus Switzerland), and this

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poses a range of problems for a country with strong links to countries like Australia, Canada, India, etc. UK policy in this area has recently been significantly re-structured, in particular with a new Points Based System and with a new *Migration Advisory Committee*[1] tackling the difficult task of assessing skill shortages.

In addition to this, the Engineering Council continues to work on the relationship between professional engineering qualifications around Europe, in particular through active involvement in the FEANI Index of recognised degrees and the EurIng title, and the more recent ENAEE/Eurace work on engineering degree course accreditation.

The changing face of manufacturing (Section 3)

The UK is the 6th largest manufacturer in the world. Manufacturing generated £150 billion for the UK economy in 2008 and employs three million people. It also accounts for over half (55%) of all UK exports. There are considerable opportunities for the UK in the future. Green technologies are now worth £3 trillion a year and there are opportunities for the UK to develop global leadership in this sector. To achieve this success, industry will need to focus on the development, design and customisation of production, while the Government supports it in this process.

Complementary Government policy (Section 4)

During 2009 there have been several major Government policy changes. The biggest change was the merging of the Department of Innovation, Universities and Skills (DIUS) with the Department of Business, Enterprise and Regulatory Reform (BERR), to form the Department of Business, Innovation and Skills (DBIS).

In April 2009, BERR published *Building Britain's Future: New Industry, New Jobs*[2], in which it identified several examples of industries that should play a larger role in the economy in the future, such as advanced engineering, electronics, biosciences and low-carbon technologies.

Starting in January 2010 in England, every 16-25 year old who has been unemployed for a year will be required to take up a guaranteed job, work experience or training place. The Apprenticeships, Skills, Children and Learning Bill represents the culmination of the Government's educational policy changes, especially those relating to apprenticeships. Its three main strategies are to increase the supply of apprenticeship places, develop a standard blueprint for apprenticeships and to consolidate delivery of apprenticeships through the National Apprenticeship Service, which officially launched in April.

UK engineering research quality (Section 5)

In 2008, a new Research Assessment Exercise (RAE) assessed the quality of research at UK universities. For engineering and related subjects, 15-20% of all research was classed as world leading and over half of all engineering-related research was classed as internationally excellent. In addition, the UK's share of research citations for engineering is 7.8% - fourth globally, behind the USA, Germany and Japan.

1 *Engineering UK 2008*, page 77
2 http:www.berr.gov.uk/files/file51023/pdf#

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Size of the engineering sector (Section 6)

The engineering-related[3] industries all experienced substantial growth in turnover between 1999 and 2007.

Production industries[4] reported turnover of £632.5m in 2007, a 19% rise since 1999. Manufacturing accounted for £505m of this. Construction enterprises saw turnover increase a huge 76% over the eight year period; the housing boom fuelling it to a massive £196m in 2007. The turnover from technical testing and analysis and R&D on natural science and engineering companies more than doubled to £3.5m and £12.5m respectively, and 'architectural and engineering activities and related consultancy' businesses reported £42m turnover in 2007, also having risen by a huge 78% in this period of rapid economic growth.

Engineering in the nations in regions (Section 7)

In 2008, there were 470,305 engineering enterprises[5] in the UK employing 4,499,335 people; nine out of ten of them are micro businesses. The spread is fairly uniform across the nations, though Northern Ireland has a slightly bigger proportion of SMEs. Overall, micro businesses employ 21% of staff within the engineering business footprint.

Perceptions of engineers and engineering (Section 8)

New research from the EngineeringUK finds that the current UK social and economic climate has seen a marked improvement in the perceived desirability of the engineering profession amongst education professionals and the general public. However, it also finds that this positive shift in perceptions of engineering has failed to reach those aged under 24.

A promising 85% of respondents from the general public stated that they would recommend a career in engineering to their children, friends or family, compared with only 66% in the initial pilot survey in 2008.

Art and design was the most popular subject choice among 7-11 year-olds, with design and technology third. However, this group do not tend to associate being an engineer with the designing and creating that they enjoy so much in the classroom: a worrying 49% of 7-11 year olds think it would be 'boring' to be an engineer. Clearly the task now is to harness and retain this enthusiasm for design throughout this age group's academic careers and to make the link between design-led subjects and engineering.

UK population changes (Section 9)

According to the Government Actuary's Department, over the next ten years the population of 18 year-olds and 15-24 year-olds will fall considerably - by 16% and 8% respectively - before beginning to rise again. This will be a challenge for all employment sectors.

3 Production industries (SIC 2003 codes C to E), construction (SIC code section F), R&D on natural sciences and engineering (SIC code group 73.1), architectural and engienering activities and related technical consultancy (SIC code group 74.2) and technical testing and analysis (SIC code group 74.3)
4 Mining and quarrying, manufacturing and electricity, gas and water supply (SIC 2003 codes C to E)
5 The ETB's engineering footprint SIC (2003) analysis of the Inter Departmental Business Register (IDBR)

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Engineering inclusion (Section 10)

The engineering and technology sector has clearly recognised the under-representation of women, and has launched a number of initiatives to address this. It has recognised the growth in the number of 25-34 year-olds, and has identified these as potential career changers. Other professions are also noticing the potential this group offers, so engineering and technology should not expect to monopolise them as a source of potential recruits.

There is also scope for attracting growing numbers to engineering from other sectors of the population, including those where under-representation would possibly have profound consequences for social cohesion. Although the disabled population isn't growing, it still constitutes 19% of the working age population. In addition, the number of school-leavers is declining but, within this group, the proportion of ethnic minorities is increasing.

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GCSEs (Section 11)

The core subjects account for nearly half of all GCSE full course entries (JCQ 2009)[6]. In 2009, mathematics remained the most popular (by proportion of entries) GCSE subject (13.8% of total). Science and additional science took fourth and fifth places with 9.02% and 7.26% respectively.

There has been an encouraging rise in the entrant numbers for separate single sciences. Entrant numbers for biology rose by 18%, for chemistry by 20% and for physics by 21% in the last year. The rise in physics is particularly beneficial as Higher Education institutions frequently require students to have GCSE and A-level physics in order to study engineering.

As one might expect, the A*-C pass rate is lower for compulsory subjects, with 57% of mathematics entrants and 63% of entrants to the science double GCSE (previously double award, now additional science) entrants achieving A*-C. The pass rate for biology, chemistry and physics remains very high at 92%, 94% and 98.5% respectively.

BTEC first diplomas make a significant contribution in providing young people with engineering and construction skills. Latest figures show growth of 89% and 340% from 2006/07 entrants to engineering and construction skills respectively. In 2009/10 the entrant numbers are currently 5,879 in engineering and 4,986 in construction skills.

Scottish Standards (Section 12)

Standard Grades or Intermediates are taken by students aged 14-16 in Scotland and broadly align with GCSEs. There was an increase in the number of entrants to Standards in mathematics (10%) and physics (9%) at credit grade in the last year.

AS and A level (Section 13)

Most STEM AS level courses have seen their entrant numbers rise over the six-year period. The rise in AS-level mathematics is particularly stark, with numbers increasing by two thirds since 2004. There were over 103,000 students taking AS level mathematics in 2009.

There has also been a steady rise in demand for sciences at AS level with biology rising 13%, physics 14% and chemistry 21% since 2004. However, since 2004, the number of students taking computing and ICT courses has declined.

Amongst STEM subjects at AS level, only chemistry is close to having an equal number of male and female students. The gender imbalance is particularly noticeable in computing where only 1 in 10 (10%) of students is female.

Across the individual STEM disciplines, 57% to 89% of A-level entrants achieved a grade C or above in 2009. Since 2004, this proportion has increased in all subjects, though this year's levels were, for most subjects, consistent with 2008. Further mathematics and mathematics had the best pass rates while computing and ICT had the lowest percentages of students getting a grade C or above.

6 JCQ (2009b). News release 27 August 2009 (GCSE results): http://www.jcq.org.uk/national_results/news_releases/2009/

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Scottish Highers (Section 14)

There have been a few minor changes, both positive and negative, to entrant numbers and pass rates in Scottish Highers across STEM. The upward trend in the number of mathematics entrants in AS and A-levels wasn't evident in the Higher, though the number of entrants to the Advanced Higher in mathematics had risen a substantial 10%.

Non Progression (Section 15)

Despite the positive results for A-levels, it should be noted that over half of students with seven GCSEs do not continue their studies.

NEETs (Section 16)

The figures for short-term 16-24 year-old unemployment show that 927,000[7] young people are currently unemployed, with youth unemployment expected to exceed 1m in 2010. In 2007, 56% of young people not in education or training were in work. In 2008, this fell to 49% (SFR 12/2009).[8]

14-19 Diplomas (Section 17)

Three Diplomas, which fall within the STEM footprint, were introduced by the Government in September 2008, these were Engineering, Construction and the Built Environment and IT. They have been developed in partnership with employers and the appropriate Sector Skills Councils and are delivered by consortia including schools and colleges.

In 2008, 6,290 enrolled for these diplomas and numbers of enrolments are predicted to increase significantly for each diploma in September 2009.

Further Education Sector (Section 18)

During the academic year 2006/07 (UK) 3.6m learners were engaged in Further Education. This was one million more than were in Higher Education in the same academic year.[9]

Lifelong Learning UK (LLUK) (2009) reports total numbers and percentage of learners by subject and provider type. Not all learners reported as studying in particular areas (particularly ICT) will be engaged in engineering-related study. That aside, however, the LLUK data, which is based on Individualised Learner Record(ILR)[10], indicates that there were more than 1.5m Further Education learners in engineering-related fields (at all levels) in 2006/07.

7 http://www.centreforcities.org/index.php?id=908
8 DCSF and National Statistics (2009a). *Participation in Education, Trainnig and Employment by 16-18 Year Olds in England.* SFR 12/2009 16 June 2009 http://www.dcsf.gov.uk/rsgateway/DB/SFR/s000849/index.shtml
9 DCSF: Education and Training Statistics for the United Kingdom (2008a). 27th November 2008/updated February 2009 http://www.dcsf.gov.uk/rsgateway/DB/VOL/v000823/index.shtml
10 The ILR is collected from providers that are in receipt of any of the following types of funding: 16-18 Learner Responsive, Adult Learner Responsive, Employer Responsive or Adult Safeguarded Learning (ASL); and from providers funded by LSC cofinanced European Social Runds (ESF). http://www.theia.org.uk/downloads/ilrdocuments

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Apprenticeships (Section 19)

Analysis of DS/SFR2[11] indicates that engineering & technology starts accounted for around a quarter of all apprenticeship starts, with some 35,400 (provisional) starts in engineering & technology sectors, from 1 August 2008 to 31 January 2009. This is out of a total of 140,500 starts across all frameworks and at all levels.

Of a total of 128 frameworks featuring in the ILR, just 10 account for 69% of all apprenticeship delivery (LSC 2009d:v). Notably, construction, engineering, electrotechnical and vehicle maintenance and repair appear in the 'top ten' frameworks.

Wage returns to apprentices

Research by McIntosh in 2004 and 2007 showed that, particularly for men, there are substantial wage returns for those completing an apprenticeship. In 2004, he predicted that men who completed an apprenticeship can expect to earn on average 7% more than those who have not when personal characteristics and other qualifications are held constant.

The value of apprentices to engineering employers

Research by the IER, Net Costs of Training to Employers, indicates that the average cost of training a single engineering apprentice is around £29,000. This is higher than the cost of training apprentices in other careers. However, employers recouped their investment in 2-3 years provided the apprentice stayed with the organisation. Employers support career development and provide opportunities to continue training as a way of retaining their trained apprentices.

Building Services Engineering sector

It is predicted by Building Service Engineering (BSE) professionals that the sector will come out of recession towards the end of 2010 or the beginning of 2011[12]. At such time, demand for qualified and trained Building Services Engineers - particularly at craft level - will increase for both the new build and the repair and maintenance sectors. The economic upturn at the end of previous recessions has invariably led to skills shortages and skills gaps appearing within the BSE sector, and indeed the whole of the construction industry (Hammond, 2007).[13]

It is possible that this problem will begin to manifest itself again, prohibiting the ability of the sector to respond effectively to increased workloads and opportunities.

Potentially, this recession could result in a higher percentage of losses for apprentices than for full operatives. One of the possible reasons for this phenomenon, as indicated in Hammond (2007), is that currently apprentices are viewed as a cost to a company rather than as a productive asset.

Research by Hammond (2009b)[14] indicates that apprentices, working either as part of a major work gang or on minor works (one craftsman and one apprentice) can, in fact, provide a cost saving if the apprentice is well managed.

11 The Data Service (2009c). DS/SFR2 March 2009 statistical first release on post-16 education & skills: learner participation, outcomes and level of highest qualification helf. Table S11.1 Apprenticeship starts - (2007/08 to 2009/09) - Geographic, sector framework code and quality and diversity breakdowns.

12 This piece of research was undertaken in November 2008 with professional Building Services Engineering consultants seekign to identify the quality of the reducing workload for the BSE sector in 2009, and the potential impact on jobs within the sector and potential redundancies.

13 This piece of research was undertaken as part of the Sector Skills Agreement for the Buildling Services Engineering sector, and involved assessing the skills needs of the sector against Porter's theoretical model for business excellence.

14 This piece of research was commiussioned out of the Sector Skills Agreement for the BSE sector, and sought to quantify the actual cost benefits that accrue from the employment of apprentices, allowing for their training, both in relation to major works contracts, and minor works contracts. THe report concludes that significant cost savings can be accrues through the eddective management and maximum utilisation of apprentices, as labour costs are lower or apprentices than fully qualified operatives.

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Young Apprenticeships

The Young Apprenticeship (YA) scheme was launched in September 2004. The 2009-11 cohort has 9,000 places, although this includes 2,000 places for a new pilot YA using 14-19 Diploma qualifications. SEMTA told the Skills Commission Inquiry that, "Young Apprenticeship starts in engineering nearly doubled between 2003 and 2007. Some 50% of those who enrol go on to an Advanced Apprenticeship with the same employer and 42% eventually progress on to Higher Education". (Skills Commission, 2009:26). [15]

Despite its success, the Young Apprenticeship scheme has run into policy and funding problems and the Government is running pilot projects to incorporate the programme into the 14-19 Diploma model.

Apprenticeships and gender pay

Since the late 1990s, the Equal Opportunities Commission (EOC) and now the Equality and Human Rights Commission (EHRC) have been investigating education, training and occupational segregation - including apprenticeships - by gender (cf EOC 1998[16], EOC 2004[17], EOC archive[18]).

Ullman and Deakin (2005)[19] found that there was an average weekly pay gap between male and female apprentices of £40. However, for certain apprenticeships, this gap was more pronounced e.g. hairdressing (£90 per week) and the electrotechnical sector (£183 per week).

Fuller and colleagues (2005) emphasised that the male-dominated engineering and construction sectors are, "more likely [than female dominated sectors] to offer training in level 3 occupations ... leading to qualifications which are acceptable for entry to Higher education and to pathways leading to professional status," (Fuller et al. 2005: unpaged source)[20]. They also found that these sectors are more likely to offer much higher rates of pay.

In 2007, the EHRC and the Apprenticeship Ambassadors Network emphasised that (still), "only 2% of engineering apprentices are female, only 4% are from ethnic minority communities and 6% have a learning difficulty, disability or health problem," (EHRC 2007:3).[21]

15 Skills Commission (2009). Progression through Apprenticeships: the Final Report of the Skills Commission's Inquiry into Apprenticeships; London: The Skills Commission pp 25-26 http://www.policyconnect.org.uk/docs/content/pc_apprenticeship_report-0.pdf

16 Equal Opportunities Commission (1998). Gender and Differential Achievement in Education and Training: A Research Review. Manchester: Equal Opportunities Commissionhttp://83.137.212.42/sitearchive/eoc/PDF/gender_and_differential_achievement_findings.pdf?page=16069

17 Equal Opportunities Commission (2004). Plugging Britain's Skills Gap: Challenging Gender Segregation in Training and Work: Report of Phase One of the EOC's Investigation into Gender Segregation and Modern Apprenticeships. Manchester: Equal Opportunities Commission.http://83.137.212.42/sitearchive/eoc/PDF/phaseone.pdf?page=17444

18 EOC Archive: http://83.137.212.42/sitearchive/eoc/Defaultf1f1.html?page=15569

19 Ullman, A. & Deakin, G., (2005). Apprenticeship Pay: A Survey of Earnings by Sector Research Report RR674. BMRB Social Research. Department for Education and Skills. HMSO. http://www.dcsf.gov.uk/research/data/uploadfiles/RR674.pdf

20 Fuller, A., Beck, V. and Unwin, L. (2005). The gendered nature of apprenticeship. Education & Training 47(4/5). In Emerald. Available at: http://www.emeraldinsight.com/Insight/ViewContentServlet?contentType=Article&Filename=Published/EmeraldFullTextArticle/Articles/0040470405.html

21 Equality and Human Rights Commission and the Apprenticeship Ambassadors Network (2007). Daring to be Different: The Business Case for Diversity on Apprenticeships. London: Equality and Human Rights Commission.http://www.equalityhumanrights.com/en/publicationsandresources/Pages/Daringtobedifferent.aspx

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Other level 3 qualifications (Section 20)

N/SVQ

It remains a concern that relatively few women gain N/SVQ awards in engineering and manufacturing technologies (EMT) or construction, planning and the built environment (CP&BE). The gender split for information and communication technology (ICT) N/SVQ awards (UK, all levels) is more balanced. However, not all these awards will be for ICT practitioner skills (the area which falls under the engineering and technology footprint).[22] Many may be for ICT user skills.

Vocationally Related Qualifications

In 2007/08, 46% of all UK Vocationally Related Qualifications (VRQ) awarded at levels 1-3 were achieved through Further Education/Tertiary Colleges (around 778,400), 19% through schools and 17% through private training providers. A quarter of all full level 2 VRQ awards were in construction, planning and the built environment (CP&BE).[23] The relatively low numbers achieving level 3 VRQs in the engineering and technology sectors may be a progression concern: a level 3 VRQ is often necessary to complete an Advanced Apprenticeship.

As with N/SVQs, the gender split for all levels in EMT and CP&BE also remains an area of substantial concern.

Further Education teaching workforce (Section 21)

Research by LLUK indicates that there could be hard to fill vacancies in the FE sector for staff to teach construction and engineering, manufacturing and technology (EMT). EMT covers a wide range of specialist provision, so it is unlikely that there is a general shortage in this area, however it is likely that there are shortages in certain specialist areas. LLUK (2007)[24] has identified particular areas of shortage, not all of which are engineering-related, as follows:

- Engineering: electrical; mechanical; refrigeration
- Construction: advanced plumbing; joinery; carpentry
- ICT: specialised areas rather than basic/ general ICT

22 For example, see the ECUK ICT Technician Standard website: http://www.icttech.org.uk/about-icttechs/roles-and-levels.aspx

23 The Data Service (2009a): DS/SFR2 Supplementary Release to Statistical First Release: Vocational Qualifications in the UK: 2007/08 commentary, published on 26th March 2009 http://www.thedataservice.org.uk/statistics/sfrmar09/summary.htm

24 LLUK paper to ACER Engineering, Manufacturing and Technology Forum October 2007.

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Higher Education (Section 22)

Participation rates

In 2007/08, the provisional HE Initial Participation Rate (HEIPR) in England was 43% - up from the final 2006/07 figure of 42%. The provisional figures for females and males were both up one percentage point from the final 2006/07 figures, to 49% and 38% respectively. The devolved assemblies use different methods of calculating HEIPR which are not comparable to the figures for England.

Student and graduate numbers

Examination of the overall number of applicants to STEM subjects reveals a positive trend, both in the last year and over a six year period. Engineering and technology attract the greatest proportion of international students by a considerable margin, with around 24% coming from outside the EU in 2007/08. Overall, applications in engineering and technology were up 16% since 2007. Encouragingly, this included an 11% increase in UK-domiciled students.

Biological sciences and physical sciences have both have seen a steady 20% increase in applicant numbers since the 2001/02 year. Over 90% of applicants for both areas were UK-domiciled and this proportion remained fairly consistent over the period.

Mathematical and computer sciences is the only STEM area to see a drop in applicant numbers since 2002, though the drop is actually attributable to the fall in popularity of computer science post the dot com boom in 2001. The 6% rise since 2007 is the first positive change in applicant numbers since then. Applicants to mathematics courses, however, have been steadily rising across the period, more than doubling since 2001/02.

Applicant numbers are up for most engineering disciplines, with the exception of production and manufacturing engineering, where they continue to fall, by 17% this year.

The level of female participation varies between specialisms in engineering. With the exception of chemical, process and energy engineering, females account for around 10-15% of applicants. This proportion is fairly static across the six-year period. The exception is civil engineering, which grew to 16% female applicants - an increase of a third in one year, albeit from a low base.

The trend in the number of applicants to engineering HE courses appears positive amongst most ethnic groups. The sharpest rate of increase was by Asian applicants, and the rise in black students applying continues steadily across the period. Broadly speaking, engineering applicants do seem to reflect the ethnic mix of the UK.

Qualifications achieved

STEM degrees account for a quarter of all first degrees achieved. Although the number of students enrolling on STEM courses is rising, it is slower than the growth for all first degrees. Engineering and technology has shown a 5% growth in student numbers since 2002/3. However, this masks the wide variations achieved at sub-discipline level. In civil engineering, the number of first degrees attained has risen by 44% since 2003/04. Conversely, attainment in production and manufacturing engineering declined by 35%, electronic and electrical engineering fell by a quarter (25%) and general engineering also dropped 15%.

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The largest number of postgraduate qualifications is in civil engineering, with 752 qualifications achieved in 2008. This is interesting as it is only the third largest group in terms of first degree numbers. The number of engineering postgraduates may look low because MEng degrees are classed as undergraduate courses.

Despite the sharp decline at undergraduate level, electronic and electrical engineering was the most popular STEM doctoral degree in 2008 with 145 degrees awarded.

Foundation degrees

In 2004-05 there were just 77 Foundation degree courses in engineering and technology (E&T) running in England. By 2008-09, provision had more than doubled, with students enrolled on 187 courses.

E&T Foundation degrees can either be general programmes covering a broad subject base and probably offering a route into initial employment within the sector, or very specific programmes, developed to suit the needs of a particular industry or company. The latter are more likely to be aimed at improving the skills of the existing workforce. Amongst the Foundation degrees that were available in 2008-09, the subject profile of E&T foundation degrees was most likely to include applied technology, electrical engineering and automotive engineering.

The majority of engineering and technology Foundation degrees are delivered by Further Education colleges (78%). 19% of provision is delivered by universities and 3% is delivered by other organisations such as private training providers or employers.

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Graduate destinations (Section 23)

The Destination of Leavers of Higher Education (DLHE) data for 2007/08 shows that 59% of engineering and technology (E&T) graduates leaving education that year entered full-time paid employment. This was higher than the 55% for all subjects. E&T graduates have a below-average likelihood of pursuing further study, at 20% (full- and part-time study), compared with 23% for all subjects. The unemployment rate in 2007/08 for all subjects (7%) and for engineering and technology graduates (10%) was higher than in 2006/07, where it was 5% and 6% respectively.

Among those who responded to the DHLE survey, almost three quarters (74%) of those who got a postgraduate qualification went into employment. For those who completed other undergraduate studies, the most popular destination was further studies (37%).

The HESA destinations data also details the type of industry[25] that graduates entering employment went into. This showed that in 2007/08, the majority (74%) of E&T graduates went to work for employers where E&T is the primary activity or a primary activity associated with E&T. Contrary to popular opinion, only 3.1% went into financial occupations.

Skills Shortage Vacancies (Section 24)

The greatest area of skills shortages, accounting for just over two-fifths of Skills Shortage Vacancies (SSVs), is in the skilled trades occupations. These include metal working production and maintenance fitters, motor mechanics, auto engineers, electricians, electrical fitters and steel erectors. However the vast majority of E&T employers claim that they do not face skills shortages.

Professional occupations (eg chemical, civil, mechanical or electrical engineers, or ICT professionals) account for 55% of first-degree HE E&T leavers' employment account but for just 15% of SSVs.

Graduate recruitment and salaries (Section 25)

According to the Association of Graduate Recruiters' (AGR) Summer Review 2009, there has been a slump of 24% in graduate recruitment due to the current recession. Recruitment across the engineering industry appears to have been more severely affected than some sectors. There has been a 44.5% decline in vacancies in IT, while construction and the engineering and industrial sector have also experienced steep declines, at 40.6% and 40.5% respectively.

The number of applicants per place in the engineering and industrial sector went up to 52 from 32 in 2008, according to the AGR review.

Though the number of graduate vacancies in engineering and industrial sectors and IT has decreased since 2008, there has been a slight increase in salary levels, which are up 2.2% and 4% respectively. The CBI's Education and Skills Survey 2009[26] found engineering salaries to be favourable pay-wise to other graduate jobs, with a median salary of £22,500.

25 By Standard Industrial Classification (SOC) code. See Annex 33.3
26 http://www.cbi.org.uk/pdf/20090406-cbi-education-and-skills-survey-2009.pdf

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Earnings in engineering (Section 26)

In 2008, the Office for National Statistics' (ONS) Annual Survey of Hours and Earnings (ASHE)[27] found engineering salaries to be favourable when compared with other professions. Within engineering and technology, management positions yielded the highest earnings. The mean gross salary for electrical engineers was £42,732, for civil engineers £39,132, mechanical engineers £38,797, software professionals £37,763 and engineering technicians £31,474.

EngineeringUK's survey of registered engineers found mean salaries of chartered engineers, incorporated engineers and engineering technicians to be £54,181, £43,759 and £34,392 respectively.

Professional Registered Engineers (Section 27)

In common with most countries, there are no significant constraints in the UK on who may practise or be employed as an engineer or technician. However, many employers and clients require evidence that the engineers they employ or commission are competent to practise. The Engineering Council is the national registration body that sets standards and registers professional engineers and engineering technicians. Registration is in one of three categories: Chartered Engineer; Incorporated Engineer; and Engineering Technician. The number of professional engineers in the UK economy is estimated at between 369,000[28] and 568,000[29]. The Engineering Council estimates that approximately 180,000 are registered as either chartered or incorporated engineers.

In early 2009, the Engineering Council moved to create a new register of ICT Technicians. Potential ICT Technicians are widespread in the workforce, and the standards of their education and competence are readily comparable with those of Engineering Technicians. It is estimated that there may be as many as one million IT technicians working in the UK. The establishment of the register illustrates the close links between engineering and IT. The first licence to award registration was granted to the Institution for Engineering and Technology, and initial interest has been high.

Emotional Intelligence – the missing link to superior business performance (Section 28)

Wales and the West Utilities (WWU), via research, identified its high performers and what differentiates them from their colleagues, and then put in place a change programme to bring the balance of the workforce up to the same standard.
Data from WWU's performance management system showed that on average productivity was 44%. Within that measure they were able to demonstrate that 20% of employees performed better than average, 60% were in an acceptable range and 20% performed significantly below average.

Investigation into the technical abilities of the three groups using established time and motion techniques showed no significant performance differences between them and that the overall efficiency of undertaking technical tasks was 94%. This clearly demonstrated that improving the technical abilities of the employees could only give a limited improvement in their overall productivity score.

27 http://www.statistics.gov.uk/statBase/product.asp?vlnk=13101
28 Engineering Professionals: Parliamentary Answer 16 July 2008 (quoting LFS 2003 data)
29 Engineering L4+L5 in the economy: The Demand for STEM Graduates: some benchmark projections Rob Wilson January 2009: table 3.3

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By contrast, using a mix of performance measures and qualitative interviews, the research was able to identify clear differences in both the both the Personal (Self) Management Competencies and Emotional & Behavioural Competencies between the three groups.

Personal (Self) Management is broadly the skills and competencies needed to manage both self and others to achieve productive outputs such as planning, organising, monitoring, implementing and reviewing. While these skills are sometimes included under the heading of Intelligence Quotient (IQ) they are identified separately in this research from the technical skills needed for an individual to operate effectively in the industry.

The emotional and behavioural competencies are those behaviours which are needed to achieve productive outputs for self and others such as self confidence, achievement drive, conscientiousness, teamwork and collaboration etc. These are often grouped under the heading of Emotional Intelligence and are measured using the Emotional Quotient (EQ) scale.

While a high performer will generally be strong in each area this is not to say that individuals with a weakness in one of the areas cannot be a perfectly adequate performer. As the research shows that 60% of the WWU workforce are adequate in that they produce the same amount of work as their co-workers and that this amount was acceptable to the organisation.

WWU implemented a companywide Performance Management Framework (PMF) underpinned by a series of Learning and Development Programmes. Two points were regarded as critical by WWU: that the programme be Board Room to Shop Floor including all support functions, and that those affected by it should be involved in its creation and development.

WWU were able to identify bottom line savings of £5 million in the first year of the programme. While it is not possible to accurately distinguish the contributions to enhanced performance from innovation and investment there is a belief within WWU that skills development was a significant contributor and that the overall saving would not have been realised without it.

As an aside it was notable that the very best performers in WWU's business were those that had been involved in the development of the PMF – a good argument for involving the whole organisation in the process.

While the research was centred on WWU the general applicability of their programme was confirmed by a joint workshop between themselves and BT Openreach.

Working Futures III[30] - implications for the engineering & manufacturing sectors (Section 29)

The Working Futures III (WFIII) projections for 2007-2017 suggest an increase in the numbers employed of around 1.65m over the period. In terms of jobs, almost two million additional jobs are projected by 2017. The majority of the additional jobs will be part-time, while about a third will be full-time. The implications for industry employment are dependent on two main factors: the demand for the industry's output and projected productivity growth. Prospects for demand for each industry's output in turn depend upon a whole host of factors, including technological change, productivity growth, international competition, globalisation, specialisation and sub-contracting, economic growth and real incomes and shifts in patterns of consumption.

30 Working Futures III (2007-17) is a detailed and comprehensive employment projection, covering the UK. The main focus of WFIII is the changing structure of employment and the implications for the demand for skills as measured by occupations.

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Patterns of change at a broad sectoral level suggest a continuation of the long-established trend away from employment in primary and manufacturing industries and in favour of the knowledge economy and services more generally.

The manufacturing sector is projected to expand slightly over the period 2007-2017 in output terms, but strong productivity growth means that employment will continue to fall. It is predicted that, within manufacturing industries, there will be a decline of those working in technical and supervisory occupations. There will be continued strong declines in machine & transport operatives (-20%), skilled trades (-19%) and elementary occupations (-19%).

Overall, almost 47% of all employees in 2017 will be at associate professional level or higher, compared with just over 32% in 1987, while skilled trades/machine operatives/elementary groups will have declined from a share of 42% to less than 27%.

Female employment in engineering manufacture is expected to decline by 9%. However, the proportion of full-time female employees is expected to rise from 15% to 18% by 2017. The most dramatic decline in female employment is expected to be in textiles (97% by 2017), with fairly sharp falls in other manufacturing & recycling and machinery, electrical & optical equipment.

Despite the negative net change in employment across the board in the engineering and manufacturing sectors, the need to replace workers who are retiring (or need replacing for other reasons) easily outweighs this decline. This means that, at every key occupational level in each of these sectors, there is a requirement for recruitment of substantial numbers of people by 2017. Overall, by 2017, 587,000 new workers will need to be recruited into the manufacturing sector, to replace those who are retiring or leaving for other reasons.

Focus on aerospace (Section 30)

Like many other engineering industries, the aerospace sector is suffering from a shortage of graduates and school-leavers with the right qualifications. Over the next 20 years, the UK aerospace & defence industry is set to retire close to 60% of its workforce or, on average, 3% a year. At the same time, the number of STEM students is forecast to decline by 15%; in line with the decline in the number of 18 year-olds over the same period.
During the summer of 2008, A|D|S People Management Board held a series of focus groups from among its member companies to determine the broad areas where there were skills shortages. Roadmaps were then developed from this research. The groups identified four areas of need:

- Leadership and management skills
- Technical skills
- Supply chain management
- Manufacturing and procurement, and skills for the aftermarket, including Total Life Cycle Management (TLCM)

In addition, the focus groups realised that a recognisable pipeline was needed so that industry could support key initiatives to encourage young people into aerospace. To this end, a fifth roadmap for Careers in Aerospace and Defence was created.
The Skills Roadmap is a living tool which will develop as circumstances change. As the Roadmap develops, we will be able to understand which skills will be needed and when action should be taken to ensure that the skills needs are met.

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Focus on manufacturing (Section 31)

2009 has turned out to be one of the most difficult years for manufacturing in recent memory. The downturn across the world economy combined with credit constraints caused by the turmoil in global financial markets hit manufacturers hard. This has refocused attention on the importance of striking a better balance in our economy.

The question now is how the UK begins to build a better, more diverse economy: and for a diverse economy to thrive, it is vital that manufacturing makes a greater contribution to growth.

Manufacturers must, therefore, continue to evolve, adapt and grow. UK manufacturers have improved their competitiveness, productivity and global reach. They responded to the recession at the beginning of this decade, to an uncompetitive exchange rate and to the emergence of new low-cost producers with a significant shift in their business strategies.

There are a number of significant challenges facing the UK and the rest of the world in the coming decade and beyond. UK manufacturing is potentially able to contribute many of the solutions to these future challenges and, in doing so, can produce the goods and services exports needed to close the trade deficit and underpin future prosperity. If the UK does not develop its own domestic industrial capacity, it will continue to be reliant on buying solutions from elsewhere.

The focus, therefore, must shift to supporting a more diverse, agile and innovative manufacturing base. Put simply, the UK needs to focus its scarce resources and provide clear, long-term support for manufacturing in order to stimulate and encourage the production of goods and services that allow us to pay our way in the world. But this will not happen without a different approach by both manufacturers and politicians.

For policy makers, it will require a conscious change in strategy; a long-term plan that gives manufacturers the confidence they need to invest in a better-balanced economy. Government influences market outcomes on a daily basis, through taxation and regulation and as a customer and investor. A new framework for the economy will see Government recognising this influence and being clear about what kind of economy the UK needs and what Government will do to support that shift.

Focus on nuclear (Section 32)

In the Western developed world, for the first time in a generation, energy has become a critical factor for social and economic welfare. This is true in Europe and particularly in the UK.

Globally, there are over 440 Nuclear Power Plant (NPP) units with a collective output of 370GWe[31] providing 18% of world electricity. (In Europe, 32% of power comes from nuclear plants.)

The majority of reactors worldwide are so-called 2nd and 3rd generation Light Water Reactors (LWRs). Over 250 of the world's current units have been in operation for more than 20 years and over 80 have been in operation for more than 30 years. Internationally, the US has over 100 plants generating 20% of its electricity generation, while France has 58 plants yielding almost 80% of its electricity generation.

In the UK, around 15-17% of our electricity is currently provided from nuclear generating plants. At its peak in the early 1990s, before older systems were decommissioned and when demand was slightly lower, nuclear power provided 30% of UK electric power.

31 Gigawatt Electrical

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Without new nuclear build, the UK would need to have a greater dependency on fossil fuel plants for baseload, which would not assist in delivering the low carbon strategy or providing security of supply in the future.

Currently, the nuclear workforce in the electricity generation, decommissioning and fuel processing sectors is estimated at 44,000 - with around 45% of these being in the supply chain. In addition, there are approximately 12,000 personnel involved in defence programmes. Of these, the percentage of technical, engineering and scientific staff is in excess of 40%. Not surprisingly, the skill levels are high, with the main segments of the industry peaking at a skill level equating to technician and graduate/professional.

The overriding factor leading to a decline in skilled workers in the nuclear industry is retirement. The civil nuclear workforce is older than the general UK workforce and in part, significantly older. The industry also has a younger retirement profile. A long-term commitment to succession planning is therefore needed, along with robust training and attraction mechanisms to retain the required levels of suitably qualified and experienced personnel.

The UK could benefit enormously from a new build programme. Estimates have shown that a fleet of new reactors would be worth £30 billion to the UK economy. This is because, although the designs may have been developed overseas, there are massive opportunities for UK-based companies to become part of the growing global supply chain. Some companies are already active internationally in supplying engineering and components to new-build programmes in Finland, China and South Africa. Fleet build in the UK could regenerate heavy manufacturing industry and provide the springboard for significant exports in the future.

32 Cogent Nuclear Industry Labour Market Intelligence http://www.cogent-ssc.com/research/nuclearresearch.php