Statistics on Women in Engineering

"We must challenge the stereotyping and bias that can still pervade our culture, particularly within the male dominated engineering and technology sectors. Attracting and retaining a more diverse workforce will maximize innovation, creativity and competitiveness."

(Success through STEM, STEM Business Group November 2013)

"..some of the statistics highlighted in the IET's report have not changed significantly since 2005… For example, the number of women in engineering has remained under 10 per cent of the total engineering workforce in the UK; the gender balance in the profession remains one of the worst in Europe."

(Skills & Demands from Industry - 2015 Survey, IET)

"Retention of women in science, engineering and technology (SET) is an important issue, with economic and social justice implications.[…] The situation… is sometimes described as "the leaky pipeline"; as scientists and engineers flow along the science career pipeline … they 'leak out' and are lost to science."

(Diversity in Engineering, Women's Engineering Society, September 2014)

About this document

There is much data and information out there on gender, diversity, STEM and engineering in particular. The Women's Engineering Society does not try to replicate the good work carried out by others. Instead this document tries to pull together a few pieces of data and statistics with the intention to help WES members and others to understand what the issues might be.
In case of errors & omissions, suggestions for additions, or queries & requests for further information, please let me know (email office@wes.org.uk, please set the subject to **WES Statistics**, and mark it **FAO Sarah Peers**).

Dr Sarah Peers
March 2016

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Key Statistics and Messages

The following are some key pieces of data are extracted from the following sections and which are the most often requested.

- Only 9% of the engineering workforce is female.(1) And only 6% of registered engineers and technicians (i.e. CEng, IEng, EngTech) are women.(2)
- The UK has the lowest percentage of female engineering professionals in Europe, at less than 10%, while Latvia, Bulgaria and Cyprus lead with nearly 30%.(3)
- 15.8% of engineering and technology undergraduates in the UK are female.(4) Compare with India: where over 30% of engineering students are women on engineering courses account for over 30% of the students.(5)
- The proportion of young women studying engineering and physics has remained virtually static since 2012.(6)
- In 2013/14, women accounted for only 3.8% of Engineering apprenticeship starts and 1.7% of Construction Skills starts.(7)
- Only around 20% of A Level physics students are girls and this has not changed in 25 years.(8)
- There is now very little gender difference in take up of and achievement in core STEM GCSE subjects.(9)
- 64% of engineering employers say a shortage of engineers in the UK is a threat to their business.(10) 32% of companies across sectors currently have difficulties recruiting experienced STEM staff, and 20% find it difficult to recruit entrants to STEM.(11)
- The UK needs to significantly increase the number of people with engineering skills. In 2014, one report put the annual shortfall of STEM skills at 40,000.(12) As of 2015, the annual shortfall of the right engineering skills is 55000.(1) We need to double, at least, the number of UK based university engineering students.(10)
- Women and men engineering and technology students express similar levels of intent to work in engineering & technology, but 66.2% of the men and 47.4% of the women graduates in 2011 went on to work in engineering and technology.(13)
- Women Fellows of the Royal Academy of Engineering: 2% in 2006 and 4% in 2014.(14)
- BUT In a survey of 300 female engineers, 84% were either happy or extremely happy with their career choice.(15)
- AND Engineering students are second only to medics in securing full-time jobs and earning good salaries.(15)
- Enabling women to meet their full potential in work could add as much as $28 trillion to annual GDP in 2025.(16)
- In 2010 nearly 100,000 female STEM graduates were unemployed or economically inactive.(17)
- Diversity matters: companies are 15% more likely to perform better if they are gender diverse.(18)

- Diversity is crucial for innovation: in a global survey, 85% corporate diversity and talent leaders agreed that “A diverse and inclusive workforce is crucial to encouraging different perspectives and ideas that drive innovation”.(19)

Sources

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16. McKinsey Global Institute The power of parity, McKinsey & Co, Sept 2015 http://www.mckinsey.com/insights/growth/how_advancing_womens_equality_can_add_12_trillion_to_global_growth
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18. Why Diversity Matters article, McKinsey & Co, January 2015 http://www.mckinsey.com/insights/organization/why_diversity_matters
19. Global Diversity and Inclusion - Fostering innovation through a diverse workforce, Forbes Insights, 2011 http://images.forbes.com/forbesinsights/StudyPDFs/Innovation_Through_Diversity.pdf

NB All URLs above accessed January 2016

Schools & Girls

- According to a British Gas survey, almost half (48%) of young women do not even consider careers in STEM sectors, citing a lack of STEM knowledge (30%), a perception that the industries are sexist (13%), and a belief that STEM careers are better suited to the opposite sex (9%).

  (Research highlights STEM gender gap, The Engineer, 10 August 2015 https://www.theengineer.co.uk/research-highlights-stem-gender-gap/)

- According to research by Engineering UK in 2011, the main reason for the low number of women in engineering is girls’ subject choices in school.

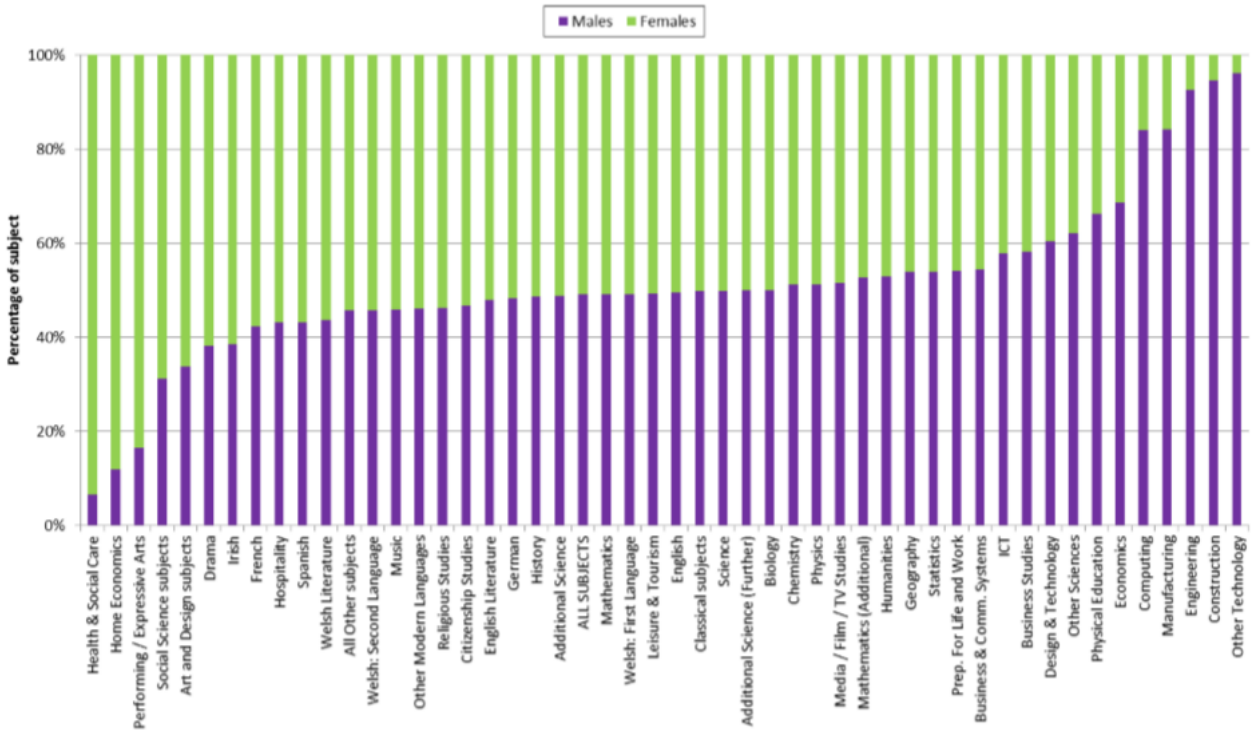
  (Engineering UK, An investigation into why the UK has the lowest proportion of female engineers in the EU, April 2011)

- In polling carried out for Tomorrow's Engineers Week, more boys (+9%) reported being encouraged to think about engineering as a career, particularly by parents.
  (Professor John Perkins' Review of Engineering Skills, RAEng November 2013 https://www.gov.uk/government/publications/engineering-skills-perkins-review)
- In 2015, 17% of STEM teachers think that a career in engineering is undesirable for their students. This rises to 19% for the 25-44-year-old STEM teacher group.
  (Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)
- Only 36% of STEM teachers felt confident in giving engineering careers advice.
  (Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)
- Almost half of all maintained co-ed schools in England (49%) sent no girls on to take A Level physics in 2011.
  (It's Different for Girls, Institute of Physics, 2012 http://www.iop.org/education/teacher/support/girls_physics/different/page_61620.html)
- The IoP's Closing Doors report identifies schools that do not tackling gender bias in choice of subjects, and "49% of schools actually making the gender imbalance … worse".
  (Closing Doors, Institute of Physics, 2013 http://www.iop.org/education/teacher/support/girls_physics/closing-doors/page_62076.html)
- There has, however, been some progress in recent years. For example, according to Tomorrow's Engineers, the percentage of secondary school age children who would consider a career in engineering increased from 29% to 47% between 2011 and 2014, BUT only 29% of those being girls. However, only 34% said they know what to do next in order to become an engineer.
  (Engineering UK 2013, 2012 Engineers and Engineering Brand Monitor; Three-quarters of parents would recommend engineering career, Engineering & Technology Magazine, 3 November 2014 http://eandt.theiet.org/news/2014/nov/tomorrows-engineers.cfm)
- On the other hand, men and women receive completely different careers advice at school, according to a 2014 survey of 2000 young professionals by City & Guilds. The top 3 career choices recommended to girls are nursing & care, teaching, medical. For boys they are IT, engineering and finance.
  (See details of City & Guild 2014 survey here: http://www.cityandguilds.com/news/March-2014/apprenticeships-not-just-for-boys#.VtMwsvKLTNM and infographic here: http://www.cityandguilds.com/news/March-2014/infographic-careers-advice-girls-v-boys#.VtMsi_KLTNM)
- Female and male A Level students in STEM subjects will be, based on current expected changes, equally represented in 2058. However, trends are not necessarily always on the up, as noted by Talent 2030.
  (Research Briefing No. 11; Tomorrow's Women, Tomorrow's World; UK Resource Centre for Women in Science, Engineering and Technology; March 2009; National Centre for Universities and Business, Talent 2030 Dashboard, 2015 http://www.ncub.co.uk/reports/talent-2030-dashboard-2015.html)

GCSEs and A Levels

Note: Where sources are not provided below, data is taken from Joint Council for Qualifications, which represents the seven largest awarding bodies in the UK, from their online sites http://www.jcq.org.uk/examination-results/gcses/2015 and http://www.jcq.org.uk/examination-results/a-levels/2015.

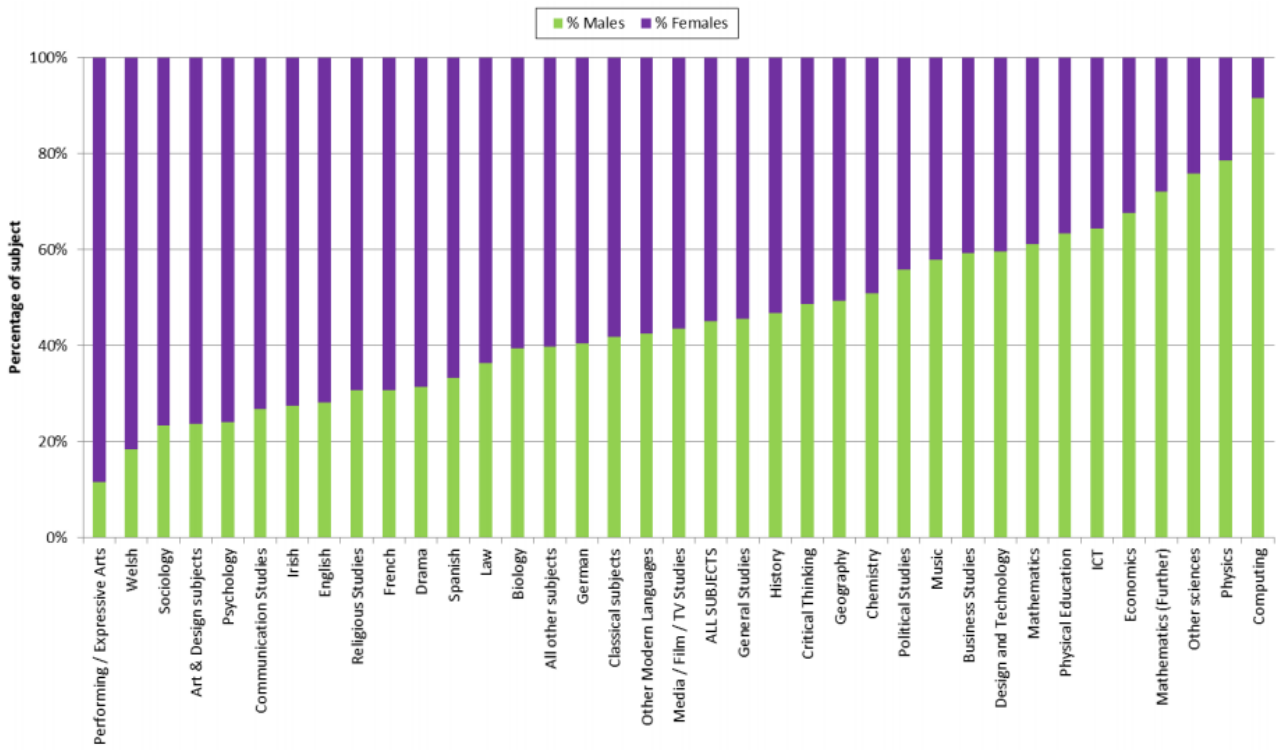
- At GCSE, there is some gender divide in subject choices as seen in the JCQ 'Differences between male and female GCSE subject choices' chart below. But for the core STEM GCSEs there are few gender differences, apart from Design & Technology (just under 40%) and Computing (16%). Engineering and Construction have very low number of girls taking these (7.4% and 5%).



- Girls are now more likely than boys to achieve high A*-B grades are across nearly all STEM GCSE subjects (sometimes spectacularly so, e.g. in D&T where 49.9% of female entrants achieve A*-B compared to 29.4% of male entrants, and in Engineering, where the respective figures are 36.8% girls and 17.3% boys achieving A*-B grades). In 2015, girls did slightly less well than boys in the core Mathematics GCSE, but did better in Maths (Additional) and Statistics.
- So the good news on D&T is that attainment gaps have clearly closed and reversed since Ofsted reported in 2011 "the attainment gap between high GCSE grades for girls and lower grades for boys is one of the widest and has grown since 2007". What is not known is whether stereotypes are now challenged: in 2011 Osfted reported negatively, reporting that schools did not encourage non-stereotypical choices so that "girls take up textiles and food technology instead of electronics".

  (Meeting technological challenges? Design and technology in schools 2007–10, Ofsted, March 2011)
- More good news from the DfE: there has been an increase in takeup in STEM GCSEs. It is to be noted however that the lauded Computing and Engineering GCSEs are at the bottom of the gender league.

  (Press release GCSE results show surge in pupils taking valuable STEM subjects, DfE 20 August 2015 https://www.gov.uk/government/news/gcse-results-show-surge-in-pupils-taking-valuable-stem-subjects)
- At A Level, there is gender divide in subject choices as seen in the JCQ 'Differences between male and female A Level subject choices' chart below. For STEM lower numbers of females enter STEM subjects, except biology and psychology.



- The gender gap in Physics, a key requirement for engineering programmes, remains striking: in 2012 it was the second most popular A Level subject for boys in England, but only 17th amongst girls.

  (Professor John Perkins' Review of Engineering Skills, November 2013)

- In 2015, only 21.5% of A Level physics students are girls (and a slight drop from 23.7% in 2014). The proportions have remained at around 20% over the past 25+ years.
- Of those who do take STEM A Levels, proportionally more females achieved A*-B combined grades compared to males in nearly all STEM subjects in 2015[1] (only in Chemistry do boys seem to do slightly better).
- Girls do very well in Physics with 33.9% of female entrants gaining an A or A*, compared to 29.5% of male entrants.
- Where girls do not fare so well is in Maths (boys beat them at grades A and A*) and in Further Mathematics (boys beat at A*, but in A grades girls do very slightly better) but girls do catch up by grade B, and well and truly overtake by grade C.
- Also to be noted are the even lower proportions of girls taking Computing A Level: a total of only 421, representing just over 8.5% of entrants in 2015. Although these low numbers do not bode well for digital skills, the good news is that this is a rise both in numbers and proportion from 2014 (314 and 7.5%) and girls do well in comparison to boys (42.3% achieving grades A* to B, cf. 35.9%).

[1] An aside: In fact in 2015 in nearly all subjects girls have done better cumulatively, aside from some modern foreign languages, namely Spanish, French, German, rather undermining the common gender-biased assumption that girls have better language skills.

- In 2015, 38.8% of mathematics A Level entries were female; this is a drop from in 2012 and 2007. The good news is that numbers of students taking maths are rising, albeit slowly.

Further Education, Vocational & Apprenticeships

Note: There have been considerable changes to the vocational qualifications landscape in the past 5 or so years, with the removal of the new Diplomas (last examined in 2013) and the introduction of the QCF framework in 2010 which led to a sharp reduction in NVQs. Gender diversity in vocational education/apprenticeships is also rarely commented on and many reports have not been updated. This makes it a little tricky to keep statistics updated and to look at historical trends. It is tempting just to summarise with "it was bad, and it is still bad."

- There is no mention of gender, or any other form of diversity, in the highly influential review of apprenticeships by Doug Richard. And there has been no update to the excellent Unionlearn and IES work on diversity carried out in 2011 and reported in 2013. Recent apprenticeship evaluations also do not refer to diversity.

  (The Richard Review of Apprenticeships, DBIS, 2012 https://www.gov.uk/government/publications/the-richard-review-of-apprenticeships; Under-representation by gender and race in apprenticeships, IES for Unionlearn and the National Apprenticeship Service, December 2013; Apprentice evaluation: employer survey 2014, DBIS, Dec 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387595/bis-14-1207-Apprenticeships-Evaluation-Employers-December-2014.pdf)

- In 2013/14, only 2.5% of those completing Engineering BTEC were female. On the other hand, for Construction BTEC, the percentage of females was higher than engineering at 7.8%.

  (Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)

- Also in 2013/14, only around 4-5% of entrants to HNCs and HNDs in engineering were female; 12.2% of full-time entrants to Foundation Degrees in engineering were female. However women do slightly better than men as 13.3% of completions were female.

  (Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)

- There is also high gender imbalance in take up of engineering and related NVQs/SVQs as shown by the following % achievements by women:
  - Engineering & manufacturing technologies - 5.2%
  - Construction, planning and the built environment - 1.3%
  - Information and communication technology - 25.0%
  - Across all engineering related Sector Subject Areas the figure is 4.6%.

  (Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)

- EMT courses in FE are heavily male dominated. In 2004/05 the proportion of males in EMT (86%) was more than twice the average across all other areas of learning combined (39%).

  (Engineering, Manufacturing and Technology Provision within Further Education; Engineering and Technology Board / York Consulting; November 2007)

- It is reported that gender stereotyping is dissuading young women from pursuing careers in traditionally male industries, resulting in women ending up in low-paid jobs. 3.4% of engineering & manufacture apprentices are female.

  (Under-representation by gender and race in apprenticeships, Unionlearn and the National Apprenticeship Service, December 2013 https://www.tuc.org.uk/sites/default/files/UnderRepresentationInApprenticeships.pdf)

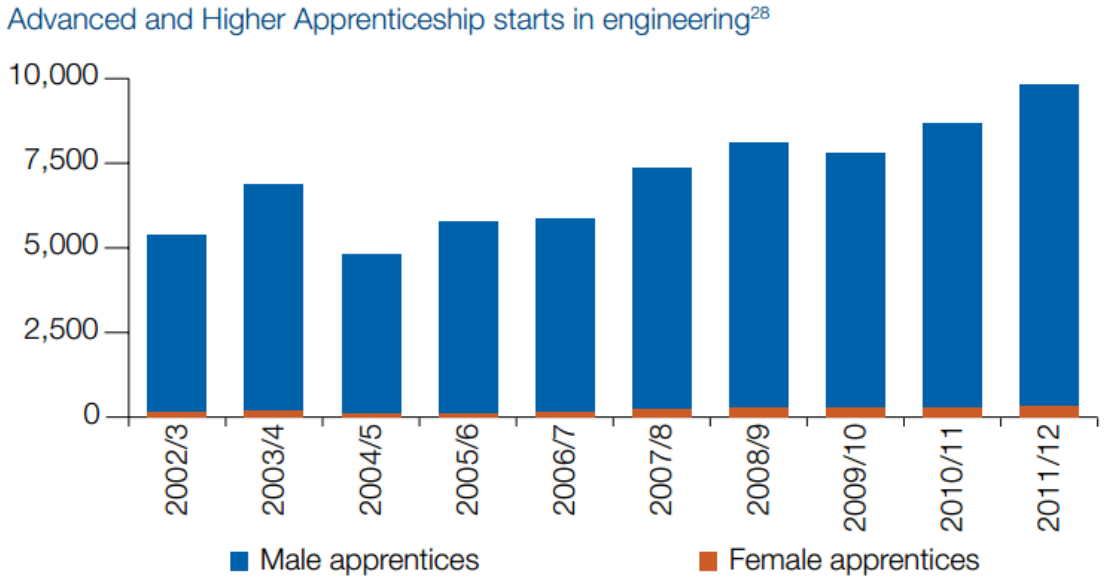
- A 2014 City and Guilds survey also indicated that only 17% of young women were encouraged to consider apprenticeships, as compared to a third of young men.

  (See details of City & Guild 2014 survey here: http://www.cityandguilds.com/news/March-2014/apprenticeships-not-just-for-boys#.VtMwsvKLTNM and infographic here: http://www.cityandguilds.com/news/March-2014/infographic-careers-advice-girls-v-boys#.VtMsi_KLTNM)

- In 2014/15, 53% of apprenticeships starts were by women and 47% by men. On the other hand[2], female apprenticeship 2013/14 starts in the following frameworks are: Engineering – 3.8%, Construction Skills – 1.7%, compared to Children's Care Learning and Development – 94.2%.[3]

  (FE Data Library, Updated Dec 2015 https://www.gov.uk/government/statistical-data-sets/fe-data-library-apprenticeships)

- Perkins also reported on the historical gender gap in engineering apprenticeships – indicative of the gender gap found in other types of vocational qualifications in engineering.



[28] ONS.

(Perkins' Review of Engineering Skills, RAEng, November 2013)

[2] There is no official breakdown of achievement data by gender and apprenticeship for 2014/15.
[3] See section Equal Pay for info on apprentices, gender and pay.

- There appears to be no recent official analysis and breakdowns of gender, BAME and other forms of diversity across each apprenticeship framework. There are around 200 frameworks listed, of which 12 include “engineering” in the title and many others are also for engineering or technology roles: this makes it difficult to visualise the data and understand the scale of the gender divide in apprenticeships. A House of Commons briefing paper in 2015 does not even hint at the diversity issue in apprenticeships.

  (FE Data Library, Updated Dec 2015 https://www.gov.uk/government/statistical-data-sets/fe-data-library-apprenticeships; Apprenticeship Statistics: England (1996-2015), BRIEFING PAPER Number 06113, 5 January 2015 House of Commons)

- However, the good news is that there does seem to be some slight increases in women taking up STEM apprenticeships. Historically, females have done well in apprenticeships: in 2010/11 females completed 4.3% (1,140) of engineering and manufacture apprenticeships, i.e. proportionally higher than the start %ages (just over 3%).

  (WISE statistics 2012 www.wisecampaign.org.uk)

- The top STEM apprenticeships started by women in 2013/14 by proportion are: IT User (41%), Supply Chain Management (33.3%), Aviation Ops on the Ground (30.6%), and Food Manufacture (29.1%). By numbers, the top apprenticeships for women are: Industrial Applications (2140, representing 14.4% of starts), IT User (1330), IT and Telecoms Professionals (1060, representing 10.8% of starts), Food Manufacture (880) and Engineering (590, representing 3.8%).

  (FE Data Library, Updated Dec 2015 https://www.gov.uk/government/statistical-data-sets/fe-data-library-apprenticeships)

Higher Education

Note: The 2014 WES report Diversity in Engineering is a good starting point to understand some of the issues for women engineering students: see http://www.wes.org.uk/diversityinengineering. Where sources are not provided below, data has been obtained from HESA Free Statistics Online https://www.hesa.ac.uk/free-statistics. Issues of citations and women academics are not covered here: see http://www.wes.org.uk/highlycited.

- Between 1980 and 2008 the proportion of women at university rose from 40% to 54%. It is now 56%.

  (Professor Alan Smithers, Director of the Centre for Education and Employment Research, University of Buckingham; article in The Independent, 5 March 2009; (www.independent.co.uk/news/education/education-news/alan-smithers-does-it-matter-that-mainly-boys-do-physics-406756.html accessed on 22 April 2009; and HESA student data)

- At degree level, there are marked differences in the STEM undergraduate subjects which attract males and females:
  - Males dominated undergraduate degrees starts in Engineering and Technology (83%), Computer science (83%) and Architecture, Building and Planning (64%).
  - Females dominated undergraduate degree starts in Subjects Allied to Medicine (79%), Veterinary science (76%) and Agriculture and Related Subjects (62%).

- In 2012/13 the number of applications into engineering was 32,026 (an increase of 5.5%, almost double the +3.1% for all subjects). 87.1% of the applicants were male and 12.9% were female. There is considerable variation, however:
  - Production and manufacturing engineering (23.4%)
  - Chemical, process and energy engineering (25.7%)

(Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)

- For more examples of variation in different engineering subjects: in 2010/11, 29% of chemical engineering graduates were female compared to 17% civil engineering, 14% electronic engineering, and 9% mechanical engineering.
  (Diversity in Engineering, Women's Engineering Society, September 2014)
- Once students have made the transition to higher education to study engineering and technology subjects, gender is a more significant factor than social class in determining occupation types.
  (Diversity in Engineering, Women's Engineering Society, September 2014)
- Women engineering and technology university students share similar career ambitions to men students: overall 60-70% of final year white and BME students stated in a survey that they were intent on pursuing a career in engineering/technology.
  (Diversity in Engineering, Women's Engineering Society, September 2014)
- Men were much more likely than women, however, to be in engineering and technology occupations six months after completion of their courses: for example of 2010/11 graduates of a bachelor engineering course, 66.2% of the men were working in engineering, and only 47.4% of the women were in engineering.
  (Diversity in Engineering, Women's Engineering Society, September 2014)
- The overall retention rate of female SET graduates is far lower than that of males, 25% compared with 40%.
  (Diversity in Engineering, Women's Engineering Society, September 2014)
- The proportion of young women studying engineering and physics has remained virtually static since 2012. Any increase in postgraduates is largely due to international students.
  (National Centre for Universities and Business, Talent 2030 Dashboard, 2015 http://www.ncub.co.uk/reports/talent-2030-dashboard-2015.html)
- The proportion of those qualifying in undergraduate Engineering and Technology courses has actually dropped from 14% to 13.7% in 2015. In fact proportions of women in engineering degree courses are in downward trend to 9% in 2030. Although numbers of engineering students are increasing, recruitment of men students is proportionally higher than women students.
  (National Centre for Universities and Business, Talent 2030 Dashboard, 2015 http://www.ncub.co.uk/reports/talent-2030-dashboard-2015.html)
- Engineering students are second only to medics in securing full-time jobs and earning good salaries (In 2012, 83% in full time jobs within 6 months, and earning £769 median weekly gross earnings).
  (Britain has got talented female engineers, RAEng and Atkins 2013, http://www.raeng.org.uk/publications/other/britains-got-talented-female-engineers)
- In university engineering departments around 80% of male and 20% of females worked as full time academic staff in 2011/12.
  (HESA staff data – not free!)

- A 2012 European Commission study found that around 42% of UK academic staff are women but at the most senior research grade it is around 17%, below the EU average.

  (Women in scientific careers, House of Commons Science and Technology Committee - Sixth Report, January 2014)

Employment & Industry

- Only 9% of the engineering workforce is female.

  (Skills & Demands from Industry - 2015 Survey, IET http://www.theiet.org/factfiles/education/skills2015-page.cfm)

- The numbers of women actually working in engineering are not really changing: see Figure 1 below:

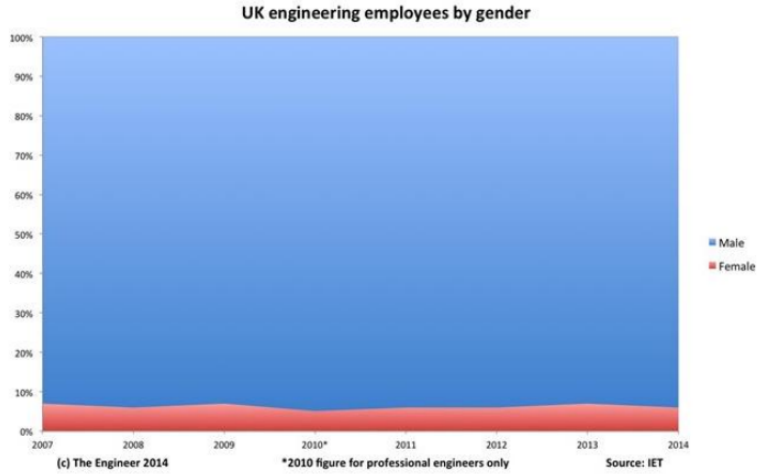
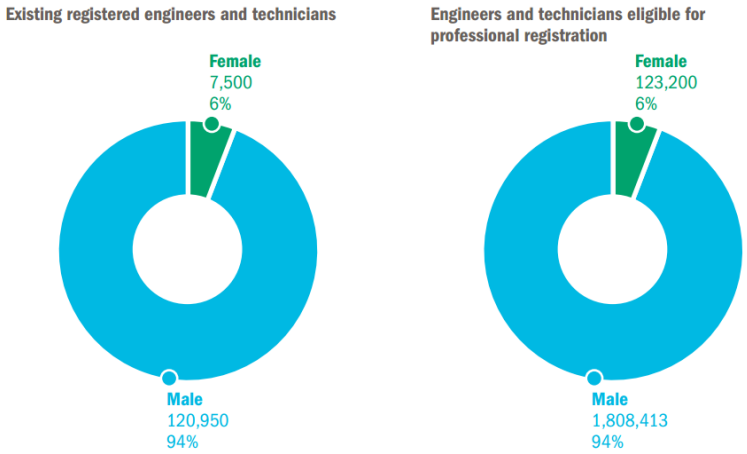


Figure 1 UK Engineering Employees by Gender

(Disruptive Diversity, A report for the ICE, Dawn Bonfield, October 2015 – available here: http://www.dawnbonfield.com/uploads/4/0/3/7/40379829/disruptive_diversity_v9.pdf)

- Women engineers and technicians eligible for professional registration (CEng, IEng, EngTech) and registered women engineers and technicians are both at 6% of the total numbers.



(see 'Fig. 15.4: Gender – existing registrants vs eligible for registration in UK' in Engineering UK 2015: The State of Engineering, http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)

- In the tech sector, the number of women working in information technology and computing in the UK represents only 15-17% of the total. The proportions of women vary according to role: in the lucrative development and coding roles it is 92% whilst most women in tech gravitate towards project management (NB The average London salary for a software engineer in 2015 was £73,000, compared to £50,000 for a project manager or business analyst.

  (Women in the tech sector now: latest data and trends for employment and career development, Rhona Hutchon, Harvey Nash, Women in the Tech Sector, Westminster e-Forum, 1 March 2016)

- In 2014, CaSE reported a need for upwards of 450,000 new STEM based technicians by 2020, and put the annual shortfall of STEM skills at 40,000.

  (Improving diversity in STEM, CaSE, 2014 http://sciencecampaign.org.uk/CaSEDiversityinSTEMreport2014.pdf)

- The UK needs to significantly increase the number of people with engineering skills. In the period 2012-2022, engineering companies will need to recruit 1.82 million people with engineering, i.e. 182,000 per year. As of 2015, it is known that there is a shortfall of 55,000 with the right skills (both Level 3, e.g. advanced apprentices, and Level 4+, i.e. higher education levels).

  (Skills & Demands from Industry - 2015 Survey, IET)

- The UK needs to double the number of recruits into engineering to meet demand; the number of engineering students has been almost static over the past eight years with 12,700 in 2004 and 13,700 in 2012, and we need to double this.

  (Engineering for a successful nation, RAEng and EPSRC, March 2015 http://www.raeng.org.uk/publications/reports/engineering-for-a-successful-nation)

- A 2013 report notes that even if we level up achievements (in the case of boys) and take up (in the case of girls) of science GCSEs and A Levels, and assuming a 59% take up of STEM beyond school, the UK would only see an extra 18,000 STEM graduates a year and not the extra 40,000 required. The report also highlights that 80% of new STEM demand is in engineering and IT. To satisfy demands in engineering, 1 in 5 of all 21 year olds in the UK would need to enter engineering.

  (In the balance: the STEM human capital crunch, The Social Market Foundation, 2013 http://www.smf.co.uk/economic-rebalancing-to-be-thwarted-by-40000-annual-science-graduate-shortfall-and-immigration-clampdown/)

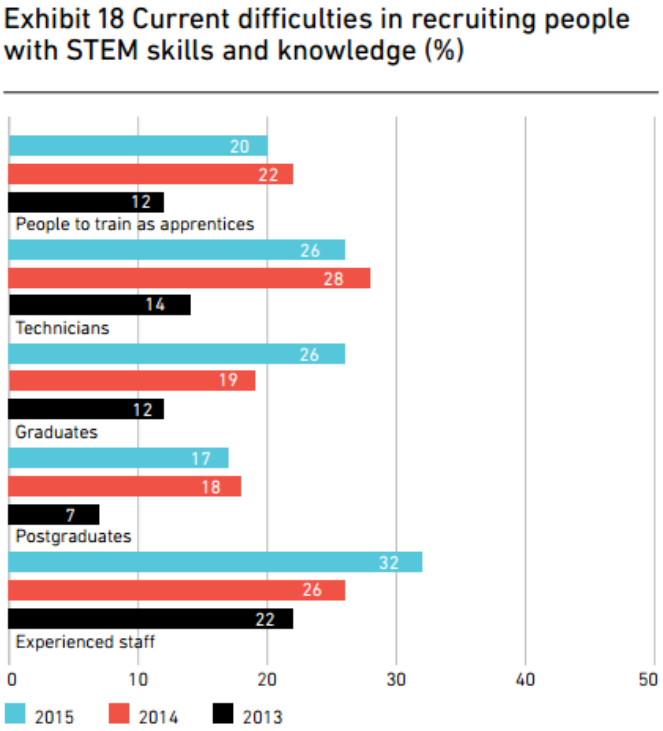
- Between 2012 and 2020, the UK economy will require 830,000 professional scientists, engineers and technologists, largely to replace those leaving engineering practice e.g. through retirement. This works out at over 100,000 new professionals each year.

  (Jobs and Growth: the importance of engineering skills to the economy, Royal Academy of Engineering, July 2012)

- Over the next 3-5 years, demand for more people with higher-level skills is expected to be particularly strong in construction (+73%), manufacturing (+69%) and engineering, science and hi-tech (+52%).

  (Inspiring Growth, CBI/Pearson 2015 Education and Skills Survey, http://news.cbi.org.uk/reports/education-and-skills-survey-2015/education-and-skills-survey-2015/)

- Nearly a third of companies (32%) surveyed by the CBI currently have difficulties recruiting experienced STEM staff, and 20% find it difficult to recruit entrants to STEM. 52% expect those difficulties to persist in the next three years.



(Inspiring Growth, CBI/Pearson 2015 Education and Skills Survey)

- 64% of engineering employers say a shortage of engineers in the UK is a threat to their business.

  (Skills & Demands from Industry - 2015 Survey, IET)

- In 2013, only 5% of engineering technicians were female; cf. more than 90% of registered pharmacy technicians.

  (Skills & Demands from Industry - 2013 Survey, IET; First analysis brings greater insight into pharmacy technician workforce, General Pharmaceutical Council, October 2012).

- Proportion of women in SET employment will not reach 50% in the 21st century.

  (Research Briefing No. 11; Tomorrow's Women, Tomorrow's World; UK Resource Centre for Women in Science, Engineering and Technology; March 2009)

- In 2012, only 39% of female engineering graduates entered roles in engineering and technology, compared to 50% of males. However three quarters of both male and female final year engineering students reported (a survey of over 4500) expecting to work in engineering roles.

  (SET to Lead survey reported in: Jobs for the Boys?, Peters and McWhinnie, July 2013)

- In 2010 nearly 100,000 female STEM graduates were unemployed or economically inactive.

  (Women and men in science, engineering and technology: the UK statistics guide 2010, UKRC https://www.wisecampaign.org.uk/uploads/wise/files/archive/final_sept_15th_15.42_ukrc_statistics_guide_2010.pdf)

- 13% of all those working in occupations classed as STEM (including health occupations) are women. 1 in 8 STEM jobs are taken up by women.

  (Labour Force Survey, March 2011-March 2012; IET Women In STEM Statistics and Facts, Reporting Period 2012-15)

- Fewer than one in ten (9.8%) of STEM managers are female.

  (Labour Force Survey, March 2011-March 2012; IET Women In STEM Statistics and Facts, Reporting Period 2012-15)

- Just over one in ten (11%) of STEM business owners are women, compared to one in three (33%) who are owners of non-STEM businesses.

  (Labour Force Survey, March 2011-March 2012)

- Part-time working at management levels remains rare in the UK: 27% of the UK workforce works part-time, of which 74% are women and just 6.5 % of part-time workers are employed in the occupational category of managers and senior officials.

  (Labour Force Survey 2012)

- Opportunities for flexible working in STEM sectors are sparse, and where they are offered, they are often in poorly paid jobs, with short-term contracts. 50% of available part-time work in Wales is low paid work.

  (WEN Wales cited research in Women in Workplace, Business, Innovation and Skills Committee - First Report, June 2013)

- Only 6% of engineering companies offer flexible working. 57% do not have gender diversity initiatives,

  (Skills & Demands from Industry - 2015 Survey, IET)

- In a survey carried out in 2014 a high 60% of women found that there were barriers which prevented them returning to careers in STEM after a career break.

  (Women in STEM: Are you in or Out?, WES, 2014 http://www.wes.org.uk/return)

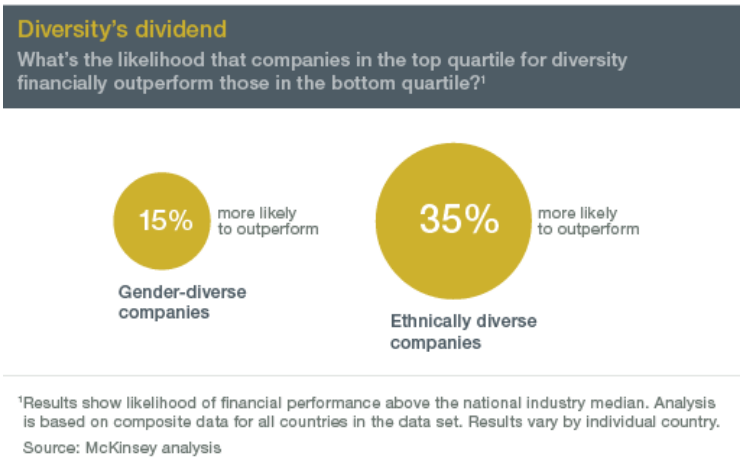
- BUT in a survey of 300 female engineers, 84% were either happy or extremely happy with their career choice and two thirds claimed advantages to being a woman in engineering.

  (Britain has got talented female engineers, RAEng and Atkins 2013, http://www.raeng.org.uk/publications/other/britains-got-talented-female-engineers)

- Engineering sectors contribute an estimated £455.6 billion to Gross Domestic Product (GDP) in 2014, 27.1% of the £1,683 billion total.

  (Engineering UK 2015: The State of Engineering,
  http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf)

- Diversity matters: companies are 15% more likely to perform better if they are gender diverse, and 35% more likely if ethnically diverse.

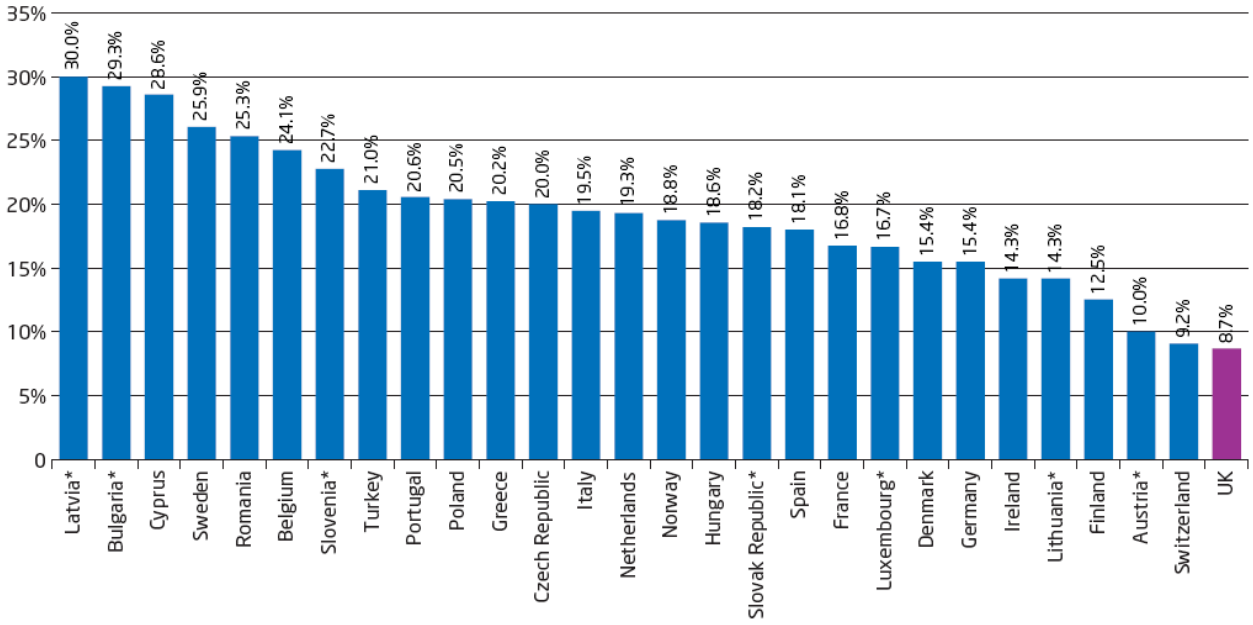


(Why Diversity Matters Article, McKinsey & Co, January 2015,
http://www.mckinsey.com/insights/organization/why_diversity_matters)

International & Immigration

- The UK has the lowest proportion of female engineers in the European Union, less than one in ten engineering professionals is a woman. It is less than 10% comparing to Latvia 30% and some following countries like Bulgaria, Cyprus, and Sweden who also stand significantly higher than UK.

Fig. 26.4: Proportion of female engineering professionals in EU countries



Source: UKRC's analysis of the European Labour Force Survey (2007)

(UKRC analysis of the European Labour Force Survey 2007; quoted again in Perkins' Review of Engineering Skills, RAEng, November 2013)

- Engineering and technology subjects in UK higher education institutions recruit 32% of their students from overseas.
  (HESA, Students in Higher Education Institutions 2013)
- In India, despite being ranked 19th in gender equity among the G20 countries, females on engineering courses account for over 30% compared to the UK's 13-16%.
  (Engineering Is a Man's Field: Changing a Stereotype with a Lesson from India, Scientific American, 2013 http://blogs.scientificamerican.com/guest-blog/engineering-is-a-mane28099s-field-changing-a-stereotype-with-a-lesson-from-india/)
- The UK currently relies on inward migration for engineering skills: immigrants (EEA and non-EEA) account for 20% of professionals in strategically important sectors such as oil and gas extraction, aerospace, and computer, electronic and optical engineering.
  (NIESR, Skilled immigration and strategically important skills in the UK economy 2012. Not all companies can or want to use migration to fill skills gaps: the use of non-UK nationals is limited in some sectors, for example by security restrictions or concern about retention)
- Enabling women to meet their full potential in work could add as much as $28 trillion to annual GDP in 2025, raising global economic output by 26 percent over a business-as-usual scenario.
  (McKinsey Global Institute The power of parity, McKinsey & Co, Sept 2015)

Equal Pay

- In 2013, the median basic income for male registered engineers and technicians (£55,000) was 19.7% higher than that of females (£45,941). This reflects exactly the 2013 national gender pay gap for the UK.

  (The Engineering Council 2013 survey of professionally registered engineers and technicians, 3 December 2013; Statistics, Equal Pay Portal, see text here http://www.equalpayportal.co.uk/statistics/ - accessed January 2016)

- But note: There is much bigger differential between all part-time workers of both genders and full-time workers. It particularly hits women because they are about three times more likely to be working part-time. The good news, however, is that the gender pay gap is decreasing AND part-time pay is increasing too.

  (Annual Survey of Hours and Earnings, Office of National Statistics, November 2015 http://www.ons.gov.uk/ons/dcp171778_424052.pdf)

- According to the Women's Business Council and National Careers Service,a large part of the gender pay gap could be explained by the roles and sectors that men and women work in. women are more likely to work in sectors that are low paid and regarded as female: 23.1% of women work in public administration, health or education, compared with 8.6% of men. While in STEM higher paid sectors: only 0.9% of women work in construction, (6.1% of men) and only 2.6% of women work in manufacturing (7.1% of men). https://nationalcareersservice.direct.gov.uk/youngpeople/Pages/YourDaughtersFuture.aspx

- Apprenticeships and pay: why does the gender divide in apprenticeships matter? Because there is a big differential in pay across frameworks and sectors. A 2011 report showed that a fully qualified apprentice in construction and engineering earnt on average over £22k; an equivalent fully qualified apprentice in education (e.g. child care) or retail (e.g. beauty) earnt around £16k. Technical engineers can expect to command high salaries afterwards as it is technical skills that are globally in high demand.

  (Apprentice Pay and Conditions, A research report for TUC/Unionlearn, February 2011, https://www.unionlearn.org.uk/sites/default/files/apprenticeship-research.pdf)

- Some more good news: there are some reports that gender pay gap in engineering is closing. In 2013, the gap in engineering was reported to be a mere 10% (cf. 19.7% for the UK population as a whole). Furthermore and according to a Reed 2014 engineering sector survey, men earned just 4% more with salaries of £33,583 compared to £32,096 for women.

  (Male-dominated engineering has an 87 per cent gender gap - but it pays pretty well, Daily Telegraph, 23 June 2015 http://www.telegraph.co.uk/women/womens-business/11692996/Women-In-Engineering-Day-Gender-gap-in-male-dominated-industry-falls.html)

Women in Leadership & Innovation

- In 1991 the number of female professors of physics in the UK doubled: it went from one to two! By 2009/10, it had risen to 36 out a total of 650 professors of physics.

  (Part quoted from Tapping all our Talents: Women in science, technology, engineering and mathematics: a strategy for Scotland, April 2012)

- Just 17% of all professors working in science, technology, engineering and mathematics are women.

  (Women in scientific careers, House of Commons Science and Technology Committee - Sixth Report, January 2014)

- Fellows of the Royal Academy of Engineering: 2% in 2006 and 4% in 2014.

  (Why engineering should be a woman's game, Dame Prof Ann Dowling, BBC News, 3 February 2015)

- Lord Davies' Report of 2011 provided the impetus for change: from 12.5% women on boards in 2011, there are now (Oct 2015) 26.1% women on boards. There are no FTSE 100 companies has an all-male board, and only 15 all-male boards in the FTSE 250.

  (Women on Boards Davies Review: Five Year Summary, October 2015
  https://www.gov.uk/government/publications/women-on-boards-5-year-summary-davies-review)

- "It is a sign of our evolution on Women on Boards that few British business leaders now ask why we need more women at the top, the business case is raised less and less …"

  (Women on Boards Davies Review: Five Year Summary, October 2015)

- In 2012, of FTSE100 companies in STEM sectors, 13% of Board Directors were female compared to 17% of Board Directors of companies in other sectors.

  (The Female FTSE board report 2012, Cranfield University School of Management)

- Of the 15 FTSE 250 companies in 2015 with no women on their board, 7 are in STEM sectors.

  (Women on Boards Davies Review: Five Year Summary, October 2015)

- Companies with more women on their boards were found to outperform their rivals with a 42% higher return in sales, 66% higher return on invested capital and 53% higher return on equity.

  (Quoted from Women on Boards, DBIS, February 2011)

- "Innovative engineering is the key to future growth in the UK and we will have to make increasing use of our intellectual abilities and our creative talent if we are to take advantage of this opportunity."

  (Engineering for a successful nation[4], RAEng and EPSRC, March 2015
  http://www.raeng.org.uk/publications/reports/engineering-for-a-successful-nation)

- "Diversity is a key driver of innovation and is a critical component of being successful on a global scale." … In a global survey, 85% corporate diversity and talent leaders agreed with statement "A diverse and inclusive workforce is crucial to encouraging different perspectives and ideas that drive innovation".

  (Global Diversity and Inclusion Fostering Innovation Through a Diverse Workforce, Forbes Insights, 2011,
  http://images.forbes.com/forbesinsights/StudyPDFs/Innovation_Through_Diversity.pdf)

Thank you to all organisations who carry out the research!

Minor additions 15 March 2016

[4] This report from the RAEng unfortunately does not make any reference to diversity as a source of innovation or an area to explore in the state of engineering in the UK.