Dear Secretary of State

Everyone recognises that our rapidly changing economy is placing ever-greater demands on the skills of the workforce. If we are to compete in the global race, we need to equip our people with the skills to adapt, innovate and ourish. Given the rapid technological change we are facing, science, technology, engineering and maths (STEM) skills are especially vital, so I was delighted to accept your request to review the provision of engineering skills in our economy.

Of course, concern about the provision of engineers is nothing new. Over the past 150 years, public and business concerns prompted periodic investigations into the nature, scale and effectiveness of the system of science teaching and technical instruction. As a result, the systems of further, higher and vocational education and continuous professional development have grown up to support the formation of engineering competence.

As our economy recovers and rebalances, it is right to ask again whether the current arrangements for the provision of engineering skills are t-for-purpose. In conducting this Review, I have spoken to many industrialists, professional bodies, and educators. I am grateful for all of their contributions. I am especially grateful for the support and detailed policy input received from the Royal Academy of Engineering.

This Review endorses the widely accepted view that it would bene t the economy to substantially increase the supply of engineers entering the labour market. It would add exibility and resilience to our economy, and enable more people to take advantage of the new opportunities that technological change presents.

Over the longer term, if we accept that there will be a growth in demand for engineering skills as a result of growth and rebalancing of the economy, then we need to act. My report exposes a series of structural and behavioural barriers that must be tackled in order to improve the longer-term talent pipeline; this is especially the case in inspiring young people throughout their education. In addition, we should be concerned over the quality of parts of the supply system and pinch points that inhibit the development of the types of engineer which current and future industries require. There is also evidence of current shortage in speci c areas: my report includes recommendations that could help the short-term position.

Finally, I am strongly of the view that this is not an agenda that Government alone can solve. Employers and professional bodies need to step up. Of my 22 recommendations, 15 require full and active engagement of industry, the profession and the education sector. I hope this report will be a call to action that will bring engineering employers, the profession and educators together, to own and collectively shape a future in which our supply of engineers grows in quality as well as quantity

Yours
Professor John Perkins CBE FREng

Acknowledgements

In conducting this Review, and preparing my report, I have been assisted by a large number of individuals and organisations. I am especially indebted to the Royal Academy of Engineering, and in particular to Professor Matthew Harrison and Philip Greenish, both of whom have responded tirelessly to what must have seemed like endless urgent requests for data and advice on the engineering profession. The Institution of Engineering and Technology (IET) has provided help through seconding one of its very able staff, Stephanie Fernandes, to the project, and by convening several industry round-tables for us. Overall, the profession, through its major institutions, has been tremendously helpful.

I have been in BIS for nearly two years now, and I remain highly impressed by the quality and commitment of the staff of the Department. The number of colleagues who have helped during the course of the Review are too numerous to mention, but you know who you are – many thanks to you all for your help and support. However, one individual does merit a special mention. My deputy, Amanda Dickins, brought fresh energy to the project when she joined the Of ce of the Chief Scientist earlier this year. Her efforts have played a crucial role in bringing this project to its current state.

Contents

Summary of recommendations and responsibilities

Short term	

Higher Education (HE)		
17.	Government should review funding arrangements for engineering degree courses to ensure that it is nancially sustainable for HE institutions to deliver high quality engineering programmes.	Government
18.	Government should ensure that the £200 million teaching capital fund encourages diversity by seeking evidence of commitment (e.g. through Athena SWAN registration) as a prerequisite for receiving funding.	Government, HE institutions
19.	HE institutions should work with Government and commercial banks to ensure their students are aware of Professional Career Development Loans.	HE institutions
20.	The engineering community should develop concerted engagement with university students, including work placements to raise the pro le of engineering careers and ensure that students on every campus are aware of the full range of diverse opportunities with engineering employers, large and small.	Engineering community via the RAEng
21.	Engineering employers should explore the potential for developing cooperative cross-sector schemes to support postgraduate students.	Employers, professional engineering institutions
22.	Government, through EPSRC, should seek further evidence of unsatis ed demand for engineers trained to doctoral level, and review arrangements for the support of PhD students in the light of their ndings.	Government, EPSRC

1 Introduction

Engineering businesses depend for their viability on their skills and on the abilities and ambitions of each new generation that joins the labour market. Many employers have been forced to look overseas for workers with the expertise and experience needed to sustain their businesses and it is clear that migration will continue to be an important source of engineering skills for some time to come. But it is up to us, together, to ensure that the right skills become readily available to employers at home, and that they are no longer obliged to look further a eld for the highly-skilled professionals they need.

That task is made all the more pressing by the fact that, although unemployment overall has begun to fall, nearly a million 16-24 year-olds are still without a job. We owe it to our young people to equip them with the skills, including engineering skills, that British industry and the British economy needs now and will need in the future, and which can offer as many of them as possible rewarding and satisfying long-term careers. This Review highlights programmes that successfully attract new recruits to engineering. I have also looked at what more could be done, taking account of the continuing nancial restraints on the public sector, to promote and support engineering skills.

Ensuring the supply of engineering skills is a long-term problem that we need to solve collectively. The solutions that I propose are long-term, working across Government and in partnership with employers and the engineering community. We also welcome the attention given to these issues by the devolved administrations.

Action on engineering skills in the Devolved Administrations

The Scottish Government is supporting the Scottish Resource Centre for Women in Science, Engineering and Technology (SET) to create sustainable change for women in SET sectors throughout Scotland, and the CareerWISE Scotland campaign to support girls and women to take up and retain jobs in STEM occupations. It has also encouraged Scottish universities to sign up to diversity schemes such as Athena SWAN.

The Welsh Government's National Science Academy (NSA) and sector work fund activities to engage young people in STEM, e.g. supporting Airbus to run an all girls cohort of Industrial Cadets. The Welsh Government is reviewing the curriculum including science and technology aspects and provides nancial incentives for high quality STEM graduates to enter teaching. It is also investing in STEM apprenticeships and actively supporting the engineering sector to pilot and test new ideas.

In Northern Ireland, the Minister for Employment and Learning has formed an Advanced Manufacturing Working Group, bringing together Government, business and education to tackle skills shortages. The availability of engineering skills is a key issue for the Group: investigation is under way and they will be producing an action plan in early 2014. There is also a cross-departmental STEM skills strategy, ‘Success through STEM’, which has received strong support from business in promoting STEM and STEM careers.

Education and skills are devolved matters and the recommendations contained in this Review apply to England, although the improvement to engineering skills should bene t employers across all four nations and may have implications for organisations

2 The opportunity

There is clearly a substantial demand for engineers in the UK economy. Based on my examination of the evidence in the course of this Review, I endorse the widely accepted view that it would bene t the economy to substantially increase the supply of engineers, adding exibility and resilience to our economy, and enabling more people to take advantage of the opportunities created by technological change. I agree with Sir James Dyson that we need more engineers.

I believe this because the structural changes in our economy have, and will continue to, drive demand for engineering skills. Over the last thirty years we have seen a widening gap between the wages and job prospects for skilled workers, compared to the unskilled. Under any plausible scenario for our future growth, new technology is likely to drive greater demand for higher, technical skills. Based on recent experience, it is likely to be those with a solid level of English, maths and problem-solving skills who will have the most chances to ourish. Engineering skills, with their strong maths and problem-solving component based on the application of science will clearly be very important.

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Estimating demand and supply

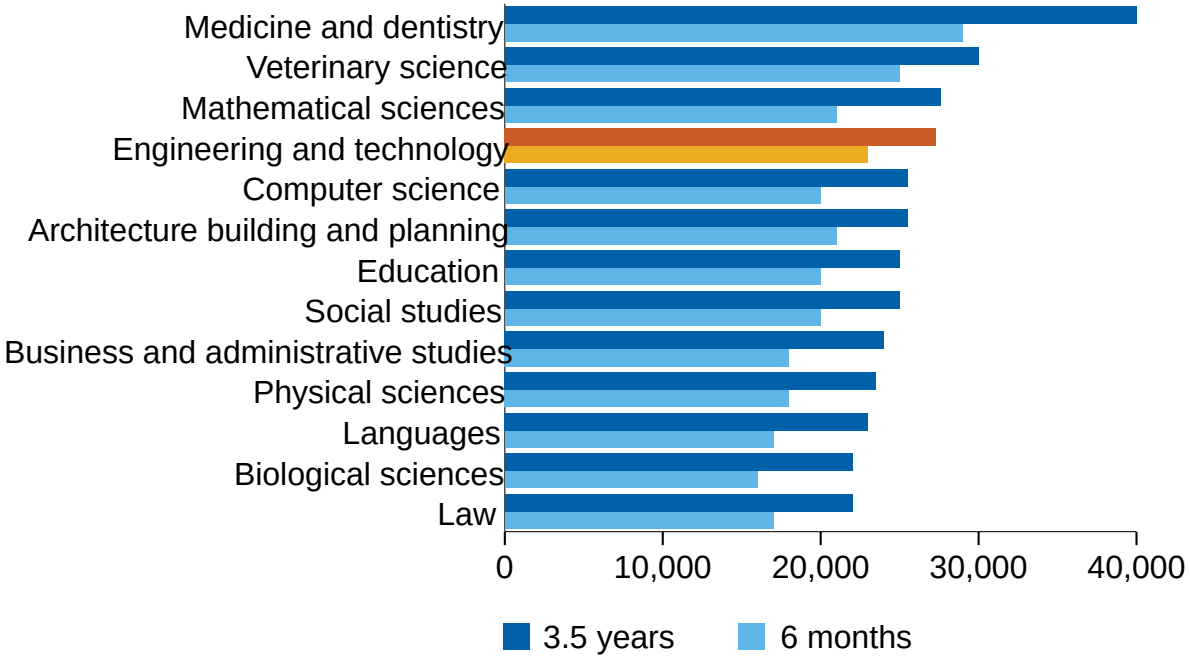
Estimating the future workforce demand and supply is tricky. For example, the authors of a 2013 UKCES report on the supply and demand for high level STEM skills acknowledge that their model is sensitive to assumptions about vacancy rates, minor adjustments to which can cause the model to predict skills gaps – or their absence.[1] One of the most widely-cited estimates is the Royal Academy of Engineering's report on "Jobs and Growth", which forecasts that, 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.[2] However, we should not assume that the supply relies solely on the provision of fresh STEM graduates. As the Royal Academy of Engineering points out in the same report, only 60% of current engineering professionals are educated to degree level. There are multiple pathways into engineering, including training within the workforce and conversions from those with quali cations in related subjects. The ranks of the UK's professional engineers are also boosted by people returning after a career break or working abroad – and further reinforced by inward migration, including from outside the EU.

Short-term pressures

In the short-term we must ensure that recovery is not constrained by a lack of speci c skills: employers are likely to experience increased dif culty recruiting when the economy picks up. We know that engineering graduates command a wage premium that is bigger than the average for graduates as a whole, and indeed for science graduates, and has continued to increase even as the average graduate wage premium has fallen in the UK.[3] Graduates with a rst degree in engineering and technology earn a median salary of £28,500 three years after graduation, compared to a median salary across all science areas of £25,500. Only 8% of engineering and technology graduates earn less than £20,000, compared to 13.7% of all science subject graduates, and 17.8% of all graduates.[4] Some employers are lling gaps by working their current staff harder, putting senior staff on lower level jobs, turning down work and employing contractors. Unfortunately these problems may self-reinforce if senior staff are too busy to mentor or train recruits and staff leave due to poor work-life balance.[5]

1 UKCES Supply and demand for High Level STEM Skills, 2013.
2 Royal Academy of Engineering, Jobs and Growth: the imporance of engineering skills to the economy.
3 Greenwood et al, The labour market value of STEM quali cations and occupations, Institute of Education and Royal Academy of Engineering 2011.
4 HESA Longitudinal Survey.
5 Interviews conducted for UKCES Supply and demand for High Level STEM Skills, 2013.

Median annual salary by degree subject, 6 months and 3.5 years after graduation[6]

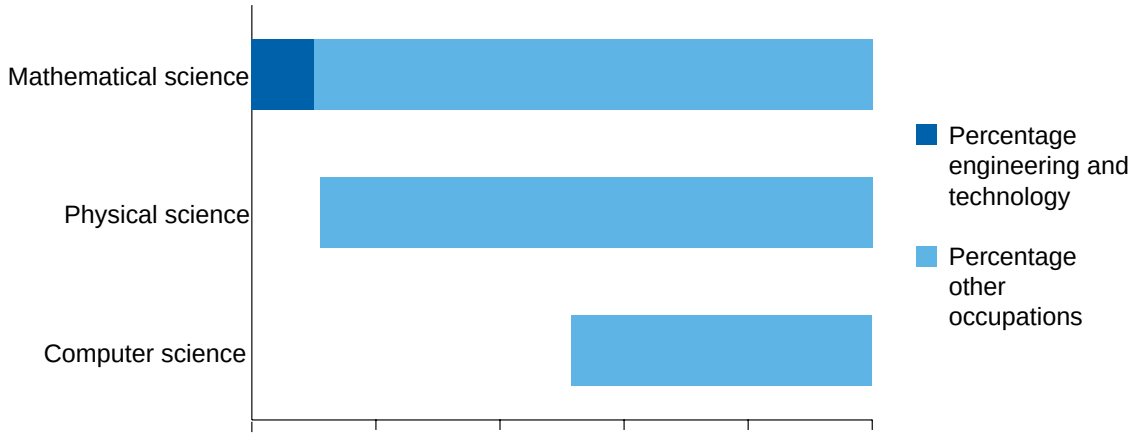


We also have evidence of shortages in some speci c areas of engineering. As our economy rebalances, it will create increased demand for engineering and other types of skills. Industrial Strategy sectors are already identifying future growth opportunities, and note the need, for example, for systems engineers in the automotive sector and composite technicians in aerospace. It is no accident that there are skills pressures in sectors that have received substantial support: where we seek to facilitate growth, there we can expect an increased demand for skills. This is why each Industrial Strategy sector is undertaking speci c skills planning. It is right that, instead of Government planning the skills needs of sectors, employers should collectively take ownership of the opportunities and, working with Government and the profession, shape the provision that is needed. This is why I recommend that, to tackle short-term pressures, we should invite employers to come forward with innovative proposals for developing skills in areas of shortage, for example by creating rapid conversion courses for those who have studied subjects other than engineering that nonetheless provide good foundations for engineering.

Moreover, 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[7]. The extent to which we rely on immigration for engineering skills is re ected in the Tier 2 shortage occupation list, which lists those occupations where

[6] HESA Longitudinal Destinations of Leavers from Higher Education Survey.

[7] NIESR, Skilled immigration and strategically important skills in the UK economy 2012. Not all companies can or want to use migration to ll skills gaps: the use of non-UK nationals is limited in some sectors, for example by security restrictions or concern about retention.


Mathematical science
Physical science
Computer science
Percentage engineering and technology
Percentage other occupations

Investigations into the causes of the UK's poor performance have highlighted girls' subject choices at 16 and perceptions of engineering as a career, which is sometimes reinforced by gender stereotypes in the careers advice received by students.[12] Rather than treat diversity as a separate issue, we have chosen to "mainstream" the issue and consider what can be done about it throughout the Review.

Conclusion

Engineering is a British success story. We have an enviable track record of producing world-class engineers and technicians. The way the global economy is changing should be good for engineers and good for Britain. However, we are at risk of not making the most of the opportunities that will come our way. As an engineer, I have looked at the whole pipeline and identi ed the areas where, in the short and long term, Government, employers, the profession and educational institutions must act if we are to secure our engineering future.

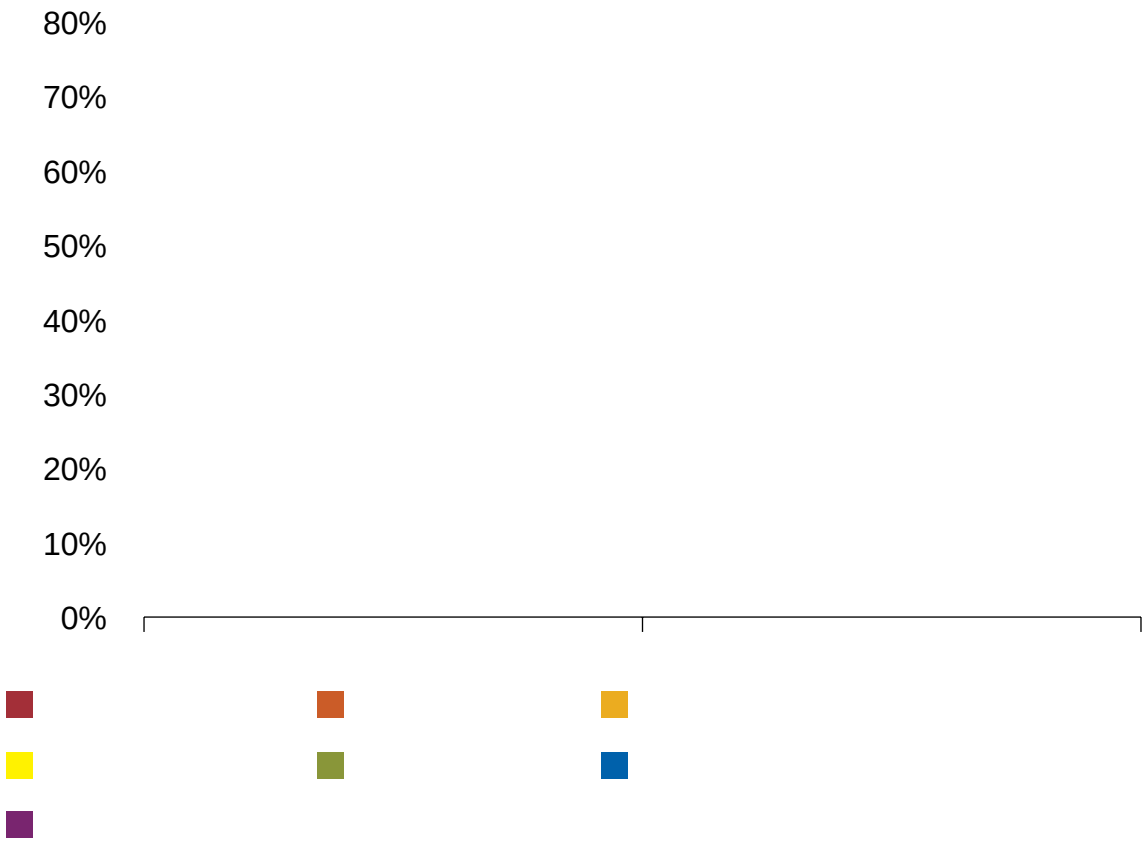
[12] EngineeringUK, An investigation into why the UK has the lowest proportion of female engineers in the EU, 2011. See also Institute of Physics, It's Different for Girls: The In uence of Schools, 2012.

3 Inspiration and academic foundations

Introduction

If we are going to secure the ow of talent into engineering, we need to start at the very beginning. We need young people who are technically and academically competent, but who are also inspired by the possibilities of engineering. Starting to inspire people at 16 years old is too late; choices are made, and options are closed off well before then. So we need purposeful and effective early intervention to enthuse tomorrow's engineers.

Inspiring young people and helping them to understand where different choices could take them in the future is crucial if engineering is to be able to draw on the full talent pool. There has been some progress in recent years: for example, the percentage of secondary school age children who would consider a career in engineering increased from 29% to 46% between 2011 and 2013.[13]


80%
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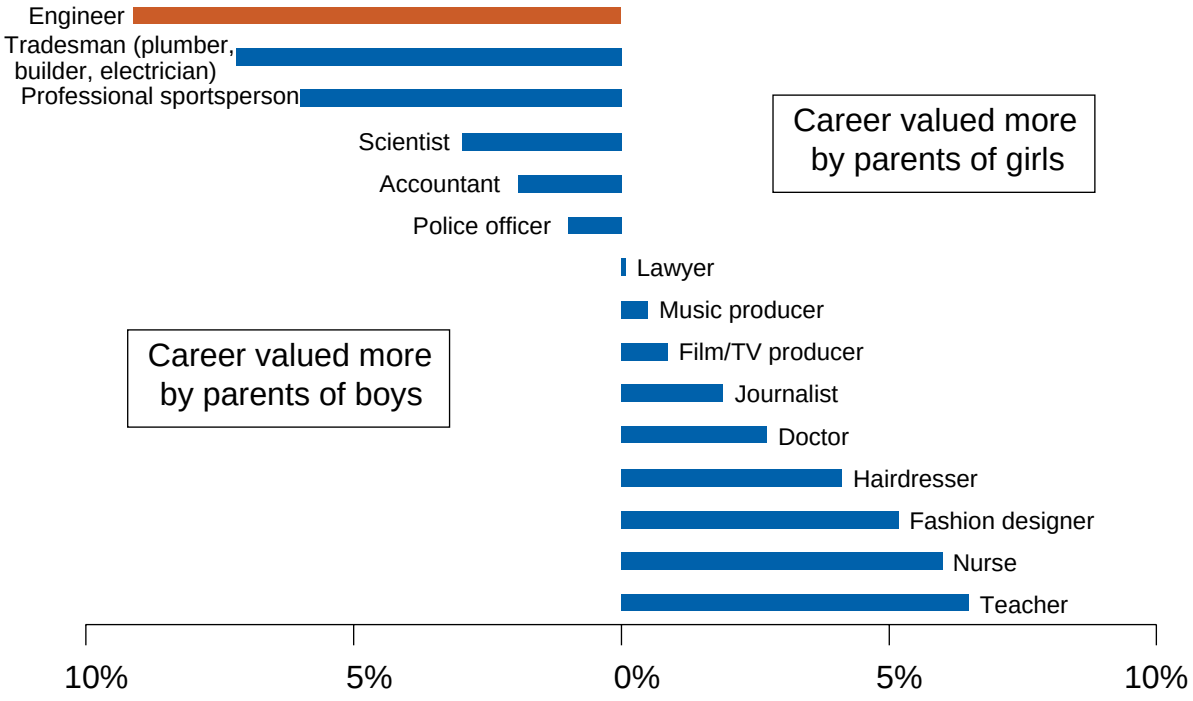
Which career would parents most like that child to pursue?



Difference between % parents of sons vs % parents of girls valuing career

As well as being inspired to consider engineering, our young people need the solid academic foundations to engage in the subject. Maths and science are the key gateway subjects for engineering.[15] As a result, we need to make sure that as many young people as possible are studying rigorous curricula in maths and science (especially physics) and/or high-quality vocational quali cations. They will need to be supported by excellent teaching, with strong subject knowledge. We also need to make sure that young people are inspired by engineering careers and the wider opportunities opened up by their study of science, technology, engineering and maths (STEM).

All engineers need a strong foundation in maths, whether they follow an academic or vocational route to becoming an engineer. However the UK lags behind its competitors in post-16 maths participation, creating a 'maths gap' between 16 and 18 for many students. Only about 20% of students in England study maths after GCSE, signi cantly lower than comparable countries: 48% of Scottish students study maths post-16, in the US the gure is over 65% and it is over 90% in Germany.[16] The OECD's recent survey of adult skills estimated that 8.5 million, roughly a quarter of England's adult population, have the maths skills of a 10-year-old, able to tackle

[15] The precise requirements will vary depending on which pathway a young person takes. For those choosing an academic route, Royal Academy of Engineering data shows that, for the years 2007-2010, 90% of applicants accepted onto Mechanical Engineering degrees at Russell Group universities held A-level maths and 78% held A-level physics. The numbers are lower for other engineering disciplines and other universities.

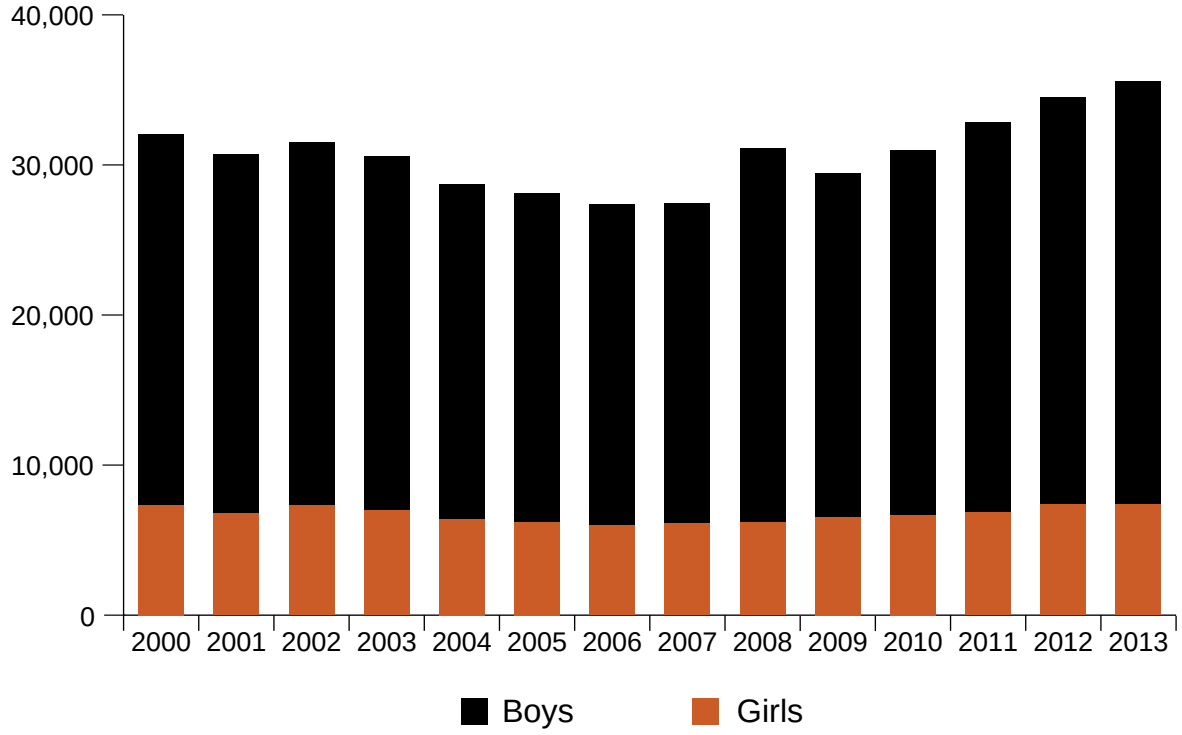
[16] Nuf eld Foundation report Towards universal participation in post-16 mathematics 2013.

only one-step tasks in arithmetic, sorting numbers or reading graphs. The same survey showed that our young people are falling behind: 16 to 24 year olds in England score lower on basic skills than their grandparents' generation[17]. This poor performance limits the pool of people able to work in engineering both at technician level and at professional level[18].

One of the main reasons for the low number of women in engineering in the UK is girls' subject choices in school[19]. In recent years there has been a signi cant increase in the number of students studying three individual sciences at GCSE and, at GCSE, there is now no gender gap. Girls are now equally or more likely than boys to attempt and achieve an A*-C grade in mathematics, core or additional science, and in each of the three individual sciences[20]. Entry for all three sciences rose in the summer 2013 GCSE results. This rise was largely driven by an increase in the number of girls: physics GCSE entries by girls are up 6.5% in 2013 to 78,000[21]. Mathematics GCSE entry has increased 12.5% to 760,000 in 2013, although, the percentage of entries achieving A*-C has dropped slightly.

However, a signi cant gap starts to widen at A-level: only 40% of those taking A-level

A-level physics candidates by gender[25]



What are we doing?

Inspiration

Widespread recognition of the need to inspire young people and increase their

1300 teachers to spend a day at a local engineering rm, seeing for themselves industry in action.

The best motivation and advice come from people in jobs. Employers have a role in giving young people more real-life contact with the world of work[26]. In the Review, . Sme f]TJ -T*12 b

In the same spirit, I very much welcome the revisions that have been made to the Design and Technology National Curriculum in full consultation with the engineering profession and others, to make it more consistent with 21st century needs. Design and Technology is not compulsory but remains a highly popular GCSE, and gives young people the chance to learn about engineering principles before the age of 16.

The Government has allocated £5 million to support the Stimulating Physics Network (SPN) to reach more schools and widen participation in physics by groups that are currently under-represented, including girls and those living in disadvantaged areas. The programme has been successful in raising progression rates: these have risen faster in the schools it has been working with relative to the national average, particularly in relation to girls.

Last but not least, Government is reforming A-levels, by giving more control to universities, to ensure that A-levels provide the right foundation for progression into HE in relevant subjects. It is important, however, that this process take account of the fact that more A-level students go on to study engineering at university than progress to physics. According to analysis of UCAS data by the Institute of Physics, 9.7% of higher education accepted applicants with physics A-level entered a physics course, compared to 25.4% who entered engineering degrees.[27] A consultation on the subject content of A-levels, including science, was launched on 25 October 2013. The aim is that the subjects included in the consultation will be ready for rst teaching in September 2015. elation to gi715.

employers in mentoring teachers, including via the informal links established by involving employers in interviewing prospective trainee teachers.

What do we need to do?

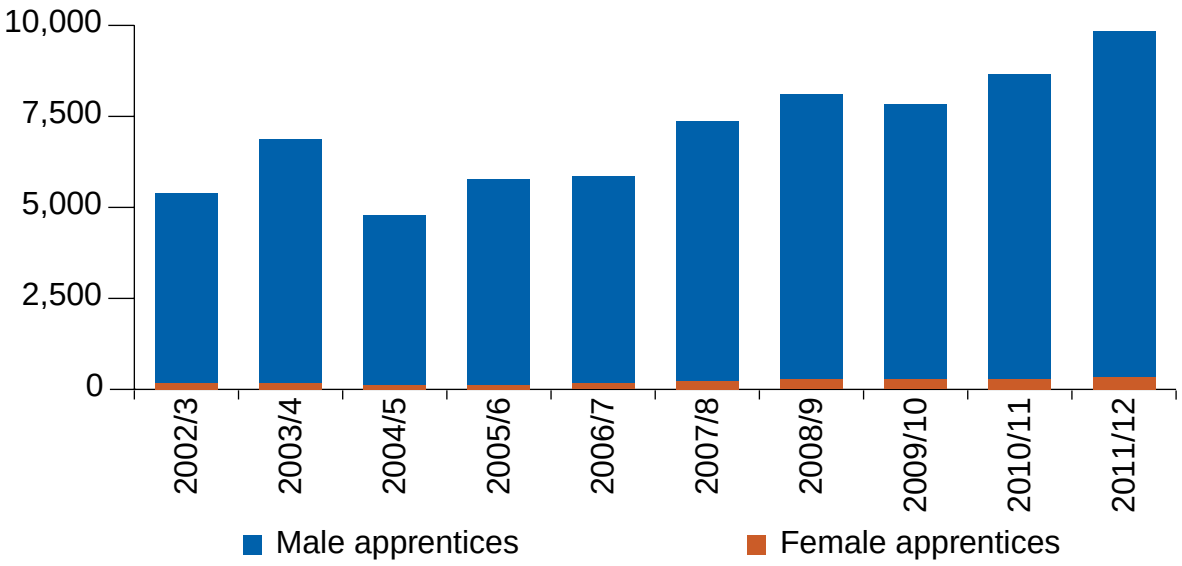
Inspiration

Engineering has a powerful and inspiring story to tell. But a better coordinated and more purposeful approach is needed. So I recommend:

4 Vocational Education

Introduction

There are two principal pathways into engineering: the academic route through higher



However the chart also shows how few women are taking engineering apprenticeships. In the 2011/12 academic year in England, only 400 women started the engineering framework apprenticeship, compared to 12,880 men. And the gender gap found in apprenticeships is also found in other types of vocational quali cations in engineering.

Government is reforming vocational education to ensure that it provides high-quality, rigorous quali cations that respond to employer needs. I believe that these reforms – by improving responsiveness and by structuring better, higher-skill pathways – can deliver important improvements in the scale, esteem and quality of vocational engineering skills.

What are we doing?

Ensuring a responsive system

Govemment has freed up the Further Education (FE) system. It has allowed colleges and private sector providers to respond more effectively to local demand conditions. However, in the course of my work on this Review I have heard evidence of mismatches between what local business needs, and what local FE provides. I have also heard examples of where FE colleges have been unable to put on provision to support local job opportunities because the funding rules have been in exible; even where the employer is willing to foot most of the bill.

Given the opportunities that can be created through retraining people who already have basic science and maths skills, the lack of responsiveness in the system could hold us back. So innovative approaches that would permit greater exibility could be especially valuable. As a result, I have been encouraged by Government's recent experiment with the Employer Ownership Pilot (EOP). The EOP is a £340 million competitive bidding fund that invited employers, over two rounds, to tell Government how they would better use public investment, alongside their own, to invest in the skills of their current and future workforce in order to grow our economy. Already the rst round of EOP projects have started to deliver training to over 470 individuals in engineering and manufacturing projects. This approach has the merits of being exible, targeted, and employer-driven.

I have also been struck by employer views that, given the rapid changes in technologational be

ensuring that students develop the key practical and technical skills that employers need. UTC students also study a core academic curriculum that prepares them to undertake a higher level apprenticeship and/or university degree. Engineering is a key focus for the UTCs: of the 44 UTCs that are open or near completion, 33 have engineering as a specialism.[29]

Examples of UTCs with an engineering focus

The very first UTC to open, the JCB Academy, focuses on delivering high-quality engineering and business education in partnership with engineering employers such as Rolls-Royce, Bombardier, Network Rail, Toyota, Bentley and National Grid in addition to JCB.

The Aston University Engineering Academy embeds an employer-led engineering curriculum into 14+ education. Six engineering learning themes include: communications, energy futures (E.ON, National Grid); Transport (JaguarLandRover); Metrology; Design (PTC); and Environmental. Each theme will be supported by an innovation centre which will help students follow a project through all the steps from creation to sale.

Visions Learning Trust (Burnley) specialises in engineering and construction, supporting advanced manufacturing employers within the aerospace supply chain, the nuclear industry and green utilities and technologies. Learners will solve real problems from particular industries via termly employer-led projects.

Between UTCs and the development of higher apprenticeship frameworks, there is the beginning of a new vocational pathway for young engineers. It will be possible for a young person to start at a UTC, take a strong set of GCSEs, move on to A or Tech levels, and then move on to a higher apprenticeship and/or a university degree. This is an exciting development and one that could make a real difference to fostering engineering skills in this country. Adult vocational education should capitalise on these developments: I recommend the development of elite vocational provision for adults to sit at the pinnacle of this promising engineering pathway.

Apprenticeships: professional registration and Trailblazers

Engineering-related industries have long depended on apprenticeships for the supply of skilled staff. Despite the pressures that the recession has placed on public finances, the last three years have seen an unprecedented level of investment in apprenticeships. Higher Apprenticeships are being expanded, with investment in new frameworks to degree level and beyond. To support this, the Prime Minister launched a £25 million Higher Apprenticeship Fund in 2011, and it is funding around 30 projects with the aim

[29] This includes five UTCs that have both computing/ digital technologies and engineering as a specialism and a further four that have either computer science/digital technology/media as a specialism.

of delivering 22,000 Higher Apprenticeship starts by 2015. New Higher Apprenticeships

Diversity

Some talented women have already followed the apprenticeship route into engineering, yet the latest gures available show that, in 2013, less than 1 in 30 of those starting an engineering apprenticeship were female. The Skills Funding Agency has responsibility for delivery of the apprenticeships programme, and increasing the diversity of apprenticeship applicants is a priority. Last year the Agency funded pilots across the country to test new delivery methods to engage more individuals from under-represented groups in apprenticeships. Following evaluation of these pilots, the Agency has commissioned additional research on gender and apprenticeships. The research will be published later this year and Government should use this to develop future plans to increase the diversity of apprenticeships.

Reforming vocational quali cations

Reform of apprenticeships is leading the way for wider reform of vocational education, emphasising quality and making skills providers accountable to those whom they serve.

Engagement from employers and the professional engineering institutions is critically important to making this responsiveness work as intended, ensuring that vocational education is preparing students for successful engineering careers. Our main concern is that employers themselves should take responsibility for the content of the training that prospective new entrants receive and the currency of the quali cations that they gain. Engineering's long history validates this approach, notably through its championing of apprenticeships and other forms of work-based training.

Government is implementing reforms to improve vocational education for young people. These include the introduction of Tech Levels (Level 3 vocational quali cations backed by industry) as a high-quality alternative to A-levels. Excellence will be recognised through a new performance measure, the Technical Baccalaureate (TechBacc), which will report students completing advanced (Level 3) programmes that include an approved Tech Level quali cation, the new post-16 core maths quali cation and an extended project. The TechBacc measure will incentivise the development of high-value vocational education and encourage the most able students to study demanding technical programmes.

Government's wider reforms to performance tables aim to incentivise schools and colleges to focus on high-quality, rigorous quali cations that enable progression to further study and employment opportunities. Government is encouraging awarding organisations to submit quali cations in sectors that are under-represented in performance tables, including manufacturing, construction and engineering. For example, the Royal Academy of Engineering has already led work to develop a suite of successors to the Level 1 and 2 Diploma Principal Learning quali cations in engineering. Two new Level 1 and 2 quali cations in engineering have been accredited by Ofqual and submitted for approval for the 2016 Key Stage 4

performance tables. Further quali cations for 14-16 year olds are expected to follow and the Royal Academy of Engineering has initiated discussions on the development of a new Level 3 quali cation in engineering. Government will seek to continue this work with the engineering sector to promote development of high-value vocational quali cations at both Level 2 and 3 for post-16 students.

Strengthening teaching in the wider FE system

Not everyone will be able to secure an apprenticeship or attend an elite vocational institution. Many students will continue to pursue college-based courses in the wider FE system. Stronger collaboration between industry and local FE colleges would help teaching staff understand and embrace up-to-date workplace skills needs. Provision of mentoring and work experience to students can increase the aspirations of learners to progress.

Employers can have a very direct impact on the quality of vocational training by releasing their employees to participate in the Education and Training Foundation's "Teach Too" programme. Teach Too enables colleges to secure up-to-date occupational expertise by encouraging working people to teach for a few hours a week. By becoming directly involved in teaching in their local FE colleges, employers can help to ensure that learners are being trained in the latest industry standard skills.

Alongside more rigorous vocational quali cations, Government is working to ensure that young people are offered high-quality and meaningful work experience. From September 2013, work experience forms an essential part of 16-19 study programmes undertaken by students. A recent survey of FE colleges indicates that the number of work experience placements offered in the engineering sector is lower than some others, suggesting further development is needed in this area.

What do we need to do?

The vocational route into engineering is an under-exploited asset for the profession. In this area there is real opportunity for the sector to take advantage of the new FE freedoms and exibilities and take ownership of future skills needs. Based on the Review, I have identi ed the following actions that could make a real difference:

> The engineering community should work with Government to develop and ry and locale qualityvh6(T* (quali cations ents wke a r)nd 8(ed high-quaalue vocational)]T T
>
> The engineering communi T

Government should develop plans to boost diversity of engineering apprentices, building on the pilots and research commissioned by the Skills Funding Agency.

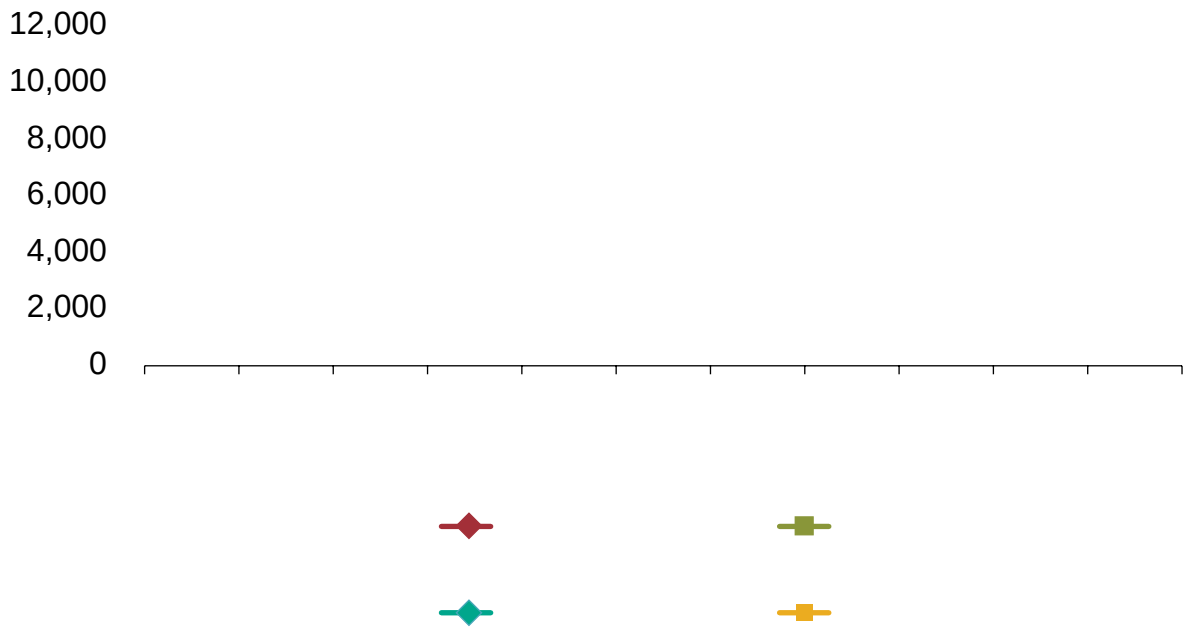
Government should build on the UTC experience and seek to develop elite vocational provision for adults so that our people have the opportunity to learn the very latest techniques and approaches in a vocational setting.

Engineering employers should encourage their staff to share their skills and knowledge, for example, by participating in the Education and Teaching Foundation's Teach Too scheme.

Government and the FE sector should encourage the application of learning technologies to extract maximum value from expert lecturers and the materials they produce, for example through Teach Too.

Conclusion

High-quality vocational education has the potential to support engineering skills development in both the short and long term. In the short term, the FE system can help deal with speci c skills gaps, especially if exible methods of funding can be found. Over the longer term, there is the potential through UTCs, apprenticeship reform, and the development of elite provision to create a high quality, aspirational pathway that can secure a robust pipeline of future engineers.


12,000
10,000
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Education

Medicine, dentistry and health

Agriculture, forestry and veterinary science

Humanities and language based studies and archaeology

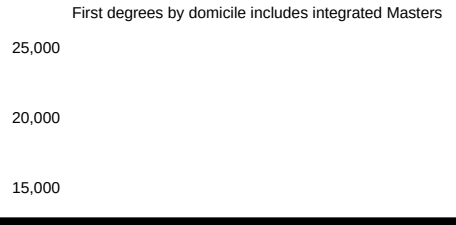
Design, creative and performing arts

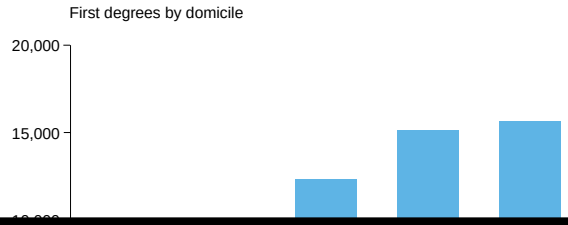
Administrative, business and social studies

Biological, mathematical and physical sciences

Architecture and planning

Engineering and technology

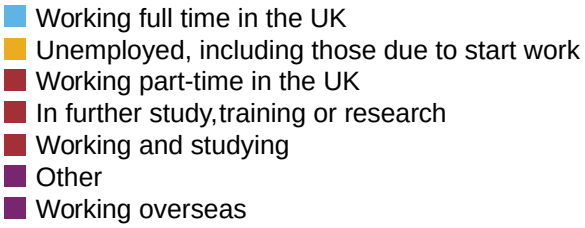

First degrees by domicile includes integrated Masters
25,000
20,000
15,000


First degrees by domicile
20,000
15,000

UK-domiciled first degree graduates, 6 months after graduation[38]

Electrical and Electronic Engineering
12% unemployed, 10% part time

Mechanical Engineering
8% unemployed, 6% part time



List of consultees

Engineering Employers

Airbus
ARM Holdings
Arup
BAE Systems
Babcock International
BP
Dow
Dyson
EDF
Group Rhode
GSK
IBM
JaguarLandRover
JCB
JJ Churchill plc
Mott McDonald
National Grid
Rolls-Royce plc
Schlumberger plc
Siemens
Syngenta
WS Atkins

And members of the Royal Academy of Engineering Diversity Leadership Group

Professional Institutions and other Bodies

Career Academies UK
Confederation of British Industry
Chemical Industries Association
Cogent
Daphne Jackson Trust
e-skills UK (National Skills Academy for IT)

Energy and Utility Skills
Engineering Employers' Federation
Education for Engineering (E4E)
Engineering Council
Engineering Development Trust
Engineering Professors' Council
EngineeringUK
The Gatsby Charitable Foundation
Institution of Engineering and Technology
Institution of Mechanical Engineers
Institution of Civil Engineers
Institution of Chemical Engineers
Institute of Physics
National Centre for Business and Universities
National Skills Academy for Nuclear
Royal Academy of Engineering
Science Council
SEMTA
STEMNET
UK Commission for Education and Skills
Women's Engineering Society
Women in Science and Engineering

Universities

Universities UK
University of Birmingham
Oxford Brookes University
University of Shef eld
University of Southampton
University of Surrey

Picture credits: Young engineers featured on the front cover

1. Roma Agrawal – Roma is a structural engineer at engineering consultancy firm WSP Atkins. The picture depicts Roma overseeing the construction of the Shard, one of the world's most recognisable and iconic buildings which she helped to design using computer modelling. A large part of Roma's work is to present to and meet with clients, which often involves overseas travel.
   Credit: IET

2. Colleen Campbell, Gold medal winner in the WorldSkills UK National Aeronautical Engineering competition in 2010. The UK competed at WorldSkills,

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