

International Conference on the Paradigm Reform of Engineering Education, China

'Inspiring Futures' by Nigel Fine, Chief Executive, IET

Friday 13 October 2017

Length: 25 minutes

Introduction

- Thank you to our hosts for the very warm welcome, and especially to the Chinese Society for Engineering Education who we were delighted to sign a memorandum of understanding with yesterday.
- I'm Nigel Fine, Chief Executive of the IET.
- The IET is one of the world's biggest and most multidisciplinary engineering institutions, covering a broad spectrum of engineering disciplines across 5 main sectors;
 1. The Built Environment
 2. Design and Production
 3. Energy
 4. Information and Communications Technology (ICT)
 5. Transport
- We are a professional membership organization, formed in 1871 and have over 168,000 individual members in 150 countries.
- The IET is also a trusted source of Essential Engineering Intelligence, providing a range of world renowned publications and information services that are available in both printed and online formats.
- Our mission is to inspire the next generation of engineers; inform our members and the wider engineering community of the increasingly diverse nature of engineering in the 21st century, and

to use our position as an independent and impartial organisation to influence Government, media and other stakeholders to support the vital role that engineering plays in today's world.

- For generations engineers have been solving some of the world's biggest challenges, inventing new ways to do things and finding solutions that will make this world a better place.
- In the UK, we're now at a crossroads for our profession, with some pressing and important challenges, which also bring many opportunities.
- Engineering is no longer a set of different disciplines to be taught in isolation. Instead it's becoming more of a spectrum, with blurring boundaries between hard and soft skills, and types of education – and an ever closer relationship with technology.
- There is growing consensus that we need to promote a broader and more inclusive view of engineering – seeing it as a profession rather than a sector of the economy.
- I am going to share with you some initiatives we are taking to do with these challenges. You might call them “Paradigm Reforms” or “Inspiring Futures”.

Skills shortage and gap

- For many years we have faced an engineering skills shortage in the UK – which means we're not seeing enough people training to become engineers and, to compound the situation, those who do qualify as engineers do not always have the right skills for the modern engineering workplace.
- Engineering contributed £486 billion to the UK GDP in 2015 and engineering jobs account for 19% of the total UK employment.

- Despite this, research shows that 186,000 people with engineering skills will be needed annually through to 2024 in order to meet demand.
- The IET's latest annual skills survey found that 62% of employers believe that engineering graduates don't have the right skills for the modern workplace and 68% said they thought the education system would struggle to keep pace with technological change.
- As our negotiations on leaving Europe (Brexit) continue, it's difficult to predict what impact the UK's exit will have on the skills shortage – certainly as a profession we're making it very clear to the UK Government that maintaining access to skills from the EU – and to research funding – will be vital.
- The IET, through a range of campaigns and activities, is leading the way to encourage more young people into the profession, as well as supporting those in their early career.

Work experience

- One way the IET is helping to tackle the skills shortage in the UK is by promoting the importance of work experience for engineering students in higher education.
- Last year we launched our 'Engineering Work Experience for All' campaign to champion the need for more employers and universities to collaborate to offer quality and practical work experience to engineering students.
- The campaign is designed to rally employers, universities, Government and students to make a range of work experience opportunities more widespread.
- We need to make sure graduates and young professionals have the right skills for the workplace, more practice perhaps less theory.

- We want to seek a step-change in offering quality work experience opportunities so we are gathering case studies to showcase best practice in engineering work experience from employers, university and the student perspectives.
- There are all kinds of examples of industry and higher education institutions collaborating to provide quality work experience and this month we'll be launching a digital platform in the UK to share this best practice more widely.
- The message we're getting from UK industry is that they want 'work-ready' students who can apply their learning in the workplace – and they acknowledge that they have a crucial role to play by creating more of these quality work experience opportunities.

Gender diversity

- It's also important that we inspire more women into engineering. In our country – currently only 9% of the UK engineering workforce are female – I know that here in China, that figure is far higher at approximately 37%, which is much closer to the optimum ratio of 50% male engineers and 50% female engineers.
- Improving our gender diversity – and indeed our diversity more generally in engineering – has a strong economic motivation.
- Other professions such as medicine are seeing the benefits of a more gender diverse workforce in terms of a wider talent pool, improved creativity and better customer insight.
- We need to harness these benefits for engineering by getting better at attracting more girls and women into UK engineering courses.

- Promoting women and engineering is close to our hearts at the IET...
- Our IET Women's Network continues to go from strength to strength – providing an invaluable networking tool for female engineers – as well as a forum to share new ideas
- Past President of the IET Naomi Climer, was the first female president of the IET in its 145-year history - and spent her presidential year championing the urgent need to attract more girls and women into engineering.
- Our IET Young Woman Engineer of the Year Awards, which celebrate their 40th anniversary this year, recognise and showcase outstanding young women working in modern engineering – and aim to help change the perception that engineering is predominantly a career for men by stopping outdated engineering stereotypes of hard hats and greasy pipes.
- And the IET's #9percentisnotenough social media campaign, which has had huge success in the UK, has been highlighting this issue, and calling for more UK women to join us.

Automation and digitisation

- Another factor contributing to the skills requirements that we need from future engineers in the UK, is Industry 4.0 – otherwise known as the 'new industrial revolution', which is expected to have a similar impact on society as the previous industrial revolution when railways and factories arrived in abundance.
- For years now, manufacturing has produced products that have become increasingly identical but this is about to change.

- Soon we will be able to produce mobile phones, cars and even foods that are customised to the needs or preferences of individuals.
- In effect we'll be fusing craft and creativity with the modern production line.
- Technologies like virtualisation, robotics and 3D printing mean we'll be able to develop, prototype and make products quickly and at very low cost – which will redefine the economics of manufacturing.
- Advanced manufacturing technologies, big data analytics, robotics, greater consumer research and new financial models such as crowdfunding, mean risk will be managed and investment will become more predictable – so the factory of the future will not be a large and uncertain outlay that can be shouldered only by large companies.
- The implications of all of this for the higher education sector are enormous.
- We need to equip people with skills that are emerging alongside the technologies that require them.
- For example, you cannot have a factory in which people use robots to greatly increase their productivity without training those people in 'co-botics' – working with and understanding robots.
- People cannot use data to make machinery more reliable and effective if they are not trained to interpret that data. The manufacturing of the future will require a more highly skilled workforce than ever before.
- The emphasis on creativity and digital capability will be far greater, and we'll need engineers who have the intellectual, creative and

practical prowess to keep up with an ever increasing speed of product development and technological change.

- But above all, we need to inspire a new generation of engineers giving them skills that are genuinely relevant to the new industrial values of flexibility, technical advancement and ongoing innovation.

Industrial strategy

- Another aspect, the Industrial Strategy from UK Government – which aims to deliver a high-skilled, competitive economy that benefits people throughout the UK – provides significant opportunities for UK engineering, but so is the challenge in term of skills.
- Single discipline specialism and theory will no longer work in the modern world.
- Engineering needs to break down barriers, nurture creativity and work across disciplines to solve some of the world’s biggest challenges and embrace the opportunities that the Industrial Strategy and Industry 4.0 present.
- The future will rely on an ‘interdisciplinary’ engineering approach, which embraces other skills both engineering and non engineering, like economics, human resource management.

Higher education

- These changes call on a very different approach to engineering education – and the IET plays a key role in the UK and internationally to try and achieve this.
- Earlier in the year, the IET and the UK’s Engineering Professors’ Council brought together engineering experts and higher education leaders from across the globe to see how the UK higher education

sector can learn from others who have adopted pioneering approaches within their degree courses – and who have seen impressive results.

- These approaches include:
 - changing entry criteria to remove the roadblock for those who have studied humanities or arts subjects instead of maths and physics to an advanced level at school
 - refocusing the higher education curriculum away from ‘theory’ to creating solutions to make a better world
 - offering internships, placements and work-related learning opportunities during the degree course
 - making courses more appealing and accessible to women and mature students, creating a diverse profession
- The IET believes adopting these approaches will help to address skills shortages – and we’re calling for fundamental changes to the entry criteria that most UK universities currently require before students can start engineering undergraduate degree programmes.
- Apprenticeships and vocational education are also becoming an important part of the routes to engineering and particularly degree apprenticeships where you can earn money and learn at the same time.
- This work is ongoing and in early 2018, we’ll be bringing together senior academic and industry leaders to explore some of the themes from our recent conference and discuss how we can effect change.

Inspire

- To ensure we get engineering students and graduates, we need to influence parents and children to understand the potential that an engineering career offers.
- We also need to encourage teachers to move away from traditional methods of teaching STEM and move towards using more exciting, innovative, and inspirational ways of delivering STEM education to young people.
- And the IET works hard to do this – from outreach work into schools, such as our Faraday challenge competition to our ‘Engineer a Better World’ campaign to inspire more parents to encourage their children, especially girls, to become engineers
- Research behind the campaign showed that fewer than half of parents of girls would encourage their children to consider a career in engineering, compared to two thirds of parents of boys
- Most parents, particularly those with daughters are unaware of how many different types of engineering jobs there are – and that these jobs could be so creative, interesting and varied.
- But, encouragingly, after being shown information on engineering careers highlighting these aspects, three quarters of parents would encourage their children to become engineers, including two thirds of parents with girls.
- So there’s a clear message for us all. If we can improve our messages about engineering, we can start to shift perceptions and make engineering more appealing.
- It’s also about providing real-world opportunities to young people.
- Opening young people’s eyes to the many exciting and challenging real world scenarios in which they can use the skill they learn at school is vital to solving the engineering skills gaps and shortages there are in many parts of the world.

- Our Faraday Challenge Days which are based on solving real life engineering problems continue to grow – taking place internationally in Hong Kong, Brunei, Singapore and Australia.
- We also run other initiatives to help and inspire students.
- For example, IET on Campus is an international initiative that supports university students to run events in their engineering faculties – we create links with employers and other universities.
- Our Young Professionals Global Challenge, which launched for the first time in association with a humanitarian Charity RedR in 2014, encourages young professionals across the globe to address a real world engineering challenge, faced by engineers working in natural disasters.
- And the IET's Present Around the World competition tasks students with presenting a technical topic of their choice, encouraging young engineers to gain the 'soft skills' of good communications they need to become successful in this profession

IET work in China

- The IET has an office and staff based in China; in China we run our Academic Affiliates programme – where the IET has developed strong relationships with some of the best universities in China.
- We work closely with engineering students as well as senior faculty staff to support professional development and engineering knowledge.
- For example, we organise workshops on how to publish research papers, organise technical lectures from international experts.
- This helps to make students – in particular – “work ready”.

- The IET also accredits engineering degree courses around the world, including some in China such Beijing University of Posts & Telecommunications and University of Nottingham Ningbo.
- IET accreditation of university programmes is internationally recognised and provides quality assurance to students and employers.
- Accreditation supports graduate employability by ensuring that programmes are responsive to industry needs.
- The IET is also currently working in partnership with the State Administration for Foreign Experts Affairs (SAFEA) and the China Association for International Exchange of Personnel (CAIEP) to deliver a professional registration programme for Chinese engineers.
- The objective of the programme is to offer professional qualifications that meet international standards and, thus, gain international recognition for engineering competency against a recognised international standard.
- Achieving registration status is an important milestone for any engineer or technician. It establishes your proven knowledge, understanding and competence.
- In particular, professional registration shows your peers and employers that you have demonstrated a commitment to professional standards, and to developing and enhancing personal competence.

Closing Remarks

- Engineers play a key role in shaping the world around us and anyone considering their engineering career right now has incredible choices about which field to work in.

- We need more engineers on this planet because there are so many things to do – from renewable energy, space exploration, biomedicine, designing and building smart cities and sustainable transport, securing our food and water supplies for a growing population, creating new types of healthcare for an ageing population, delivering the many innovations enabled by the internet of things
- The IET is keen to explore how we can further work across the Chinese Education System and learn from one another to ensure that engineering students are work ready and able to meet the challenge of the digital age and fourth industrial revolution.
- Thank you.