

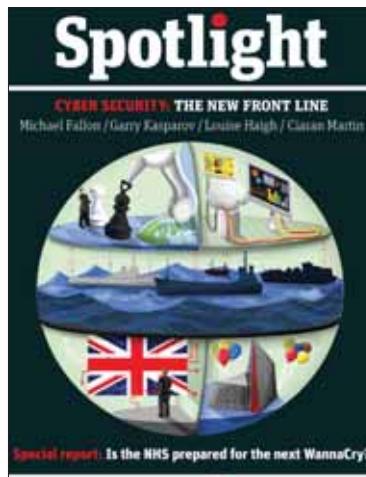
Spotlight

MANUFACTURING: A FUTURE MADE IN BRITAIN

Karan Bilimoria / Nick Grey / John Stevenson MP



Spotlight



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The making or unmaking of UK industry



Anyone who doesn't read the Office for National Statistics' regular production index – to be fair, it's no *Wolf Hall* – may have missed the news, at the end of last week, that manufacturing output grew by 0.1 per cent between December and January. This is in itself not explosive news, but in context it represents something significant: it is the only time since records began, 50 years ago, that the UK's manufacturing output has grown for nine months in a row.

The manufacturers' organisation, EEF, has forecast that the manufacturing sector is likely to grow by two per cent this year, at a faster rate than the country's GDP.

Brexiters will doubtless celebrate these figures as early evidence that the 26.5 per cent of the UK population that voted to leave the EU has steered the nation wisely. But it is also true that one of the reasons manufacturing has grown is that British goods were made cheaper by the huge fall in the pound that the referendum result created, which stimulated demand; the property market experienced a similar surge. Another revealing statistic, the Purchasing Managers' Index, shows that while manufacturing growth in the UK is more sustained than at any point since at least 1968, the *amount* of growth is slowing; January's 0.1 per cent growth actually represents an eight-month low in the rate of activity.

This means that the UK's manufacturing sector stands at a turning point. If it can grasp the opportunity during what Bank of England deputy governor Ben Broadbent called the "sweet spot" of increased demand before tariffs arrive, it may yet reap the benefits of a new position in a global economy that the IMF expects to grow by 3.9 per cent in the next year. The question now is whether enough manufacturers are reinvesting the short-term gains of the post-referendum Sterling dip to deliver a long-term acceleration in the growth of skills, technology, production and exports.

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NewStatesman

71-73 Carter Lane
London EC4V 5EQ
Subscription inquiries:
sbrasher@
newstatesman.co.uk
Account Directors
Justin Payne
Dominic Russell
Stephen Hayter

Commercial Director
Peter Coombs
+44 (0)20 3096 2268

Special Projects Editor
Will Dunn

Special Projects Writers
Rohan Banerjee
Augusta Riddy

Design and Production
Leon Parks

Cover illustration
Sam Falconer



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Cobra Beer co-founder and cross-party peer Karan Bilimoria wants the government to support more domestic manufacturing. He talks to Rohan Banerjee

What British manufacturing can learn from India



A grand copy of the *Bhagavad Gita* rests open on a lectern in the corner of Karan Bilimoria's Barbican office. Overlooking central London the room, though small, is filled with items from around the world, showcasing the Cobra Beer co-founder and cross-party peer's well-travelled career, as well as the artwork of his children. He arrives, in true Indian style, half an hour late but the apology he offers is quintessentially British. "I'm so terribly sorry, just been one thing after another you know, very sorry. Can I get you anything?"

Bilimoria was born in Hyderabad to a Zoroastrian Parsi family with a background in the armed forces. His father, Faridoon Noshir Bilimoria, was the General Officer Commanding-in-Chief of the Central Command of the Indian Army, and also served as *aide-de-camp* to the first Indian president, Rajendra Prasad. His grandfather,

Nasservanji Bilimoria, was one of the first Indians to be commissioned as an officer at Sandhurst. Both his mother and grandfather studied at the University of Birmingham, of which he is now chancellor. "I feel as at home in Britain as I do in India," he says, stirring a third spoonful of sugar into his coffee.

Bilimoria, whose other roles include being the founding chairman of the UK India Business Council and president of the UK Council for International Student Affairs (UKCISA), believes that Britain, within the context of its manufacturing industry, "needs to be doing better on the international stage". Leaning back, he begins: "as a child, I was fascinated by Great Britain. My grandfather would come back from his trips and bring me toys... that 'made in Great Britain' trademark was on them. For me it was a sign of manufacturing excellence. We seem to have lost that sense."

"Britain's manufacturing industry



“Our economy has become over-reliant on services”

SHUTTERSTOCK/KITTY

accounted for around 30 per cent of our total GDP 40 years ago. The main catalyst for the drop is that we opened up as an economy and became over-reliant on services.” Bilimoria points to the “Make in India” initiative launched by Indian Prime Minister Narendra Modi – a long-term policy that aims to increase the proportion of products sold in India and made in India from 16 per cent of GDP to 25 per cent. “We have no such target in Britain.”

How can Britain, an island nation that has Bilimoria acknowledges, “very few natural resources” compete with the vast Indian sub-continent? “It’s proportionate, of course. But the idea remains the same.” Manufacturing currently accounts for 10 per cent of the total British GDP. Bilimoria suggests an increase to 15 per cent is a “realistic target” for the government. “If the government wants to have an impact on industry, then it must consider using the

tax system effectively. The government must focus on how to exploit the world-class features that this country already has. The University of Cambridge has won almost 100 Nobel Prizes. We punch way above our weight, although we underinvest, compared to America or other countries when it comes to our R&D. We also have a great location.”

Britain’s position in Europe, “both physically and within the European Union”, Bilimoria says, “signposts it as a great gateway for industry”. According to Bilimoria, Britain represents “the ideal launchpad for companies looking to ship their products out to Europe”, but “Brexit casts that into jeopardy”. While Bilimoria is critical of some aspects of the EU – “I think the single currency was a terrible mistake” – ultimately, he was “very disappointed” with the result of Britain’s 2016 referendum. “I’ve never said that the EU was perfect, but I think it will be devastating if the government persists with a hard Brexit.”

He adds: “I think as people take in the effects of what leaving the single market or customs union would entail, neither the public nor parliament will accept. Speaking as a businessman who manufactures in Britain, this relationship we have is fantastic. The idea that leaving the single market and customs union is going to make us more global is nonsense”

Issues of immigration and economic migration, Bilimoria says, have been “chronically misunderstood”, and “a failure to design the right policies” would be “catastrophic for British manufacturing when you consider the skills gap”. In the Lords, Bilimoria spearheaded legislation for a two-year graduate VISA for international students. “I had cross-party support in 2008. If they’re paying tax over here, that’s good for our economy and our industrial workforce.” He calls the coalition government’s decision to introduce caveats to the policy such as a minimum salary “politically illiterate”, and insists that “immigrants are an asset to the manufacturing industry”.

Bilimoria’s stance on Brexit, however

“Automation isn’t something to be afraid of”

forthright, seems unlikely to persuade the incumbent. If the government does pursue a hard Brexit, then, what must the manufacturing industry do? “I still don’t think it will happen, but OK. If we go after a hard Brexit, then the manufacturing industry must brace itself. We will have to revise our VISA system. Ironically, then, we might even need to be more open with our immigration and who we let in, from outside of the EU.”

Is it disingenuous to suggest that a country with world-class universities will necessarily require more international students? “I think people are underestimating exactly how much of the manufacturing industry currently benefits from the EU. You can’t just replace those workers overnight.”

Bilimoria would also recommend revisiting the rate of corporation tax to encourage more companies to manufacture in Britain. “In a hard Brexit, we would have to consider lowering it. The main thing that we need to do is encourage more investment and that’s when things like capital allowances become more serious. Look at Molson Coors [Cobra Beer’s American partner] and the state of the art bottling plant that we’ve got – that cost £80m. You’ve got to incentivise this with tax breaks.”

Bilimoria has been chancellor of the University of Birmingham since 2014. “Industrial strategy for any government must revolve round more collaboration with academia. At Birmingham, we have been very proud to win a Queen’s Award for engineering. We specialise in railway engineering and have been named a centre of excellence. We now head up a network of universities that offer similar courses. We’ve forged industrial partnerships with companies such as Crossrail and Siemens, so we are able to tailor our courses to what industry needs. That is what manufacturing needs more of.”

While transport infrastructure is important to Bilimoria, it is in food and drink manufacturing where his most personal interests lie. The first shipment of Cobra was imported to Britain from

the Bangalore-based Mysore Brewery in 1990, but large consumer demand – “mainly from Indian restaurants” – and issues with supply from India prompted Bilimoria to move production to Britain by the middle of the decade.

Cobra’s rise wasn’t straightforward. In 2008, and in need of fresh investment, the company agreed to multinational drinks firm Diageo buying a minority stake, but the deal was called off. A bank loan, secured just days before Lehmann Brothers went bust, presented a “lucky escape” for the company. But the loan didn’t see Cobra entirely out of the woods. On 29 May 2009 Cobra went into administration, but achieved salvation on the same day when it was rescued through the formation of a partnership between Bilimoria and Molson Coors, which has a brewery in Burton-on-Trent.

Automation, Bilimoria says, “played a big role” in Cobra’s renaissance. “Automation isn’t something to be afraid of. It’s something to be aware of. Of course it has got to our factory floor. It’s not about getting rid of people – we use robots because they are faster and more efficient, so you can move people elsewhere in the business. That’s the reality of technology.” Since the formation of the joint venture with Molson Coors, growth has averaged between seven and ten per year-on-year, and in 2013 the company turned over just shy of £60m with a pre-tax profit of £7.7m.

Cobra’s journey back to Britain pleases Bilimoria. He says: “It’s an Indo-British product. Britain has allowed Cobra to thrive.” Brexit, he reiterates, would make “stories like ours less likely”. Bilimoria adds: “Being based in Britain, we have had efficient access to the continent in terms of importing and exporting, and a far-reaching skills base. The brewer I founded Cobra with [Dr Cariappa] has a PhD in biochemistry from Prague University. Whether it is car manufacturing or making beer, it doesn’t matter. Ensuring overlap between universities and industry, and between countries, is vital.”

Industry 4.0 is an evolution rather than a revolution

The UK has failed to embrace Industry 4.0 to the same extent as its international counterparts, according to **Andrew Minturn**, business development and strategic product manager at Bosch Rexroth

Governments around the world are creating policies to encourage the adoption of digitalised manufacturing, from the United States' Advanced Manufacturing Partnership, to Germany's High-Tech Strategy 2020 Action Plan. The real indicator of Industry 4.0 success, however, is the rate at which individual companies embrace a digital, software-based framework as part of their own strategy.

One of the major issues with discussion around Industry 4.0 is that it is often referred to in isolation. All manufacturing companies are under constant pressure from their customers for their products to be better quality, lower cost and available more quickly. Industry 4.0 should be seen as an umbrella term for a toolkit of available technology that can enable them to deliver these customer requirements.

Scalability

A concern for many will be the feasibility of scaling digital technologies. A complete digital overhaul, is an enormous task that would prove difficult for even the most resourced businesses to undertake. It is vital that businesses understand such an approach is unnecessary, and may actually be hampering any possibility of moving forwards with an Industry 4.0 strategy.

Many manufacturers remain unaware that a range of technologies exist to support the digitalisation of their infrastructure, without the need to replace existing equipment. One such example is Bosch Rexroth's IoT Gateway Technology, which enables

businesses to digitalise their production machinery, without requiring extensive re-wiring or replacement of existing assets. In effect, it allows manufacturers to network new and existing machines in order to optimise production processes and improve product quality, without interfering with any existing automation logic.

Readiness

It is important to remember that Industry 4.0 does not just refer to technologies within automation, cloud or edge computing and data sharing. It also encapsulates organisational restructuring – moving from a physical to a digital infrastructure within a more collaborative, data-reliant environment.

This, therefore, requires each employee at an individual level to change their mindset and adopt one that is not only open to change, but open to the concepts that Industry 4.0 embodies.

Gradual implementation

The best way to implement Industry 4.0 is through a gradual process. This means prioritising the areas in which digitalisation would offer the most benefit, whether it be improving productivity, or quality and consistency.

A step-by-step approach is arguably the best way to implement and adopt digital manufacturing, enabling businesses to expand Industry 4.0 capabilities by building on its initial digitalised capabilities. The advantage is that the solid foundations of technology, infrastructure and skills can be laid, facilitating the final move into the so-called "Factory of the Future".

As a useful guide to gradual adoption, the following three-step approach for Industry 4.0 integration can be used:

1. The implementation of sensors and controls.
2. Enhancing the capabilities of these sensors.
3. Full implementation, in which Industry 4.0 capabilities are rolled out at plant level.

For more information, please visit:
<http://bit.ly/Industry4OWP>

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The UK's biggest manufacturing sector is also its most vital

Chair of the Food and Drink Manufacturing APPG, John Stevenson MP, explains why the UK must protect a resource worth £110bn a year



After the end of the Second World War, it was said by Winston Churchill that the only threat that truly scared him throughout the six-year conflict was that posed by German U-Boats to British merchant shipping. The reason Churchill, the public face of stoic British defiance, was shaken by the struggle that played out on and under the Atlantic Ocean was the prospect that were the Battle of the Atlantic to have been lost, Britain may well have starved. Throughout human history, the fastest way to beat a nation into submission has been to take away its ability to feed itself.

This historical comparison helps draw attention to a truth perhaps overlooked by arguing for the sector's importance primarily by referring to the fact that it adds £110bn a year to our economy. A thriving and prosperous food and drinks manufacturing sector is deeply important to our national security. Just as we look to our armed forces to keep us safe from any threat that may come our way, we must not forget that the farms and factories keeping us fed could one day be relied upon to keep us going in a time of great peril. Which is why it is of such paramount importance that the government continues to put our food and drinks manufacturing sector at the very centre of any post-Brexit industrial

strategy. The government has so far made strides towards ensuring the industry is sheltered and nurtured through the inevitable turbulence of the transitional Brexit phase. Just this month, a draft withdrawal agreement between the European Commission and the UK was released, outlining assurances that UK manufacturers will be allowed to continue trading freely across all 27 EU borders beyond the UK's EU withdrawal date, right up until 2021. This is significant, as a guarantee of continued access to the EU beyond the Brexit deadline will allow for time to secure post-Brexit trade agreements, both with the EU and with countries further afield. Because Brexit is truly an opportunity, one that could be seized upon by a sector perhaps less flashy than our aviation and automotive industries but worth more than both put together. Our food and drinks manufacturing industry is an example of why Brexit is a cause for excitement, as long as the government continues its commitment to keeping it protected and supported.

Norwich Research Park is home to 70 R&D businesses, and this year will be opening the Quadram Institute, specialising in genetic research. It is already attracting attention from food manufacturing companies across the globe. As a nation we have long been



Brexit is an opportunity to export expertise



Europe's largest sugar refinery in Silvertown, London

guilty of fatalism and complaints of decline. We could be accused of possessing a self-deprecating national character. Now is not the time to be humble. Now is the time to celebrate the globally recognised assets we do have, and to take advantage of the opportunity Brexit will create.

I do not say this as someone who campaigned for Brexit. I voted to remain in the EU, but I believe in the democratic process and I believe in a pragmatic approach to seizing the moment. It is not time to be timid, it is time to be confident and to successfully complete our “global pivot.” The world will need 60 per cent more food by 2050 in order to feed a population of 9bn. The vast majority of this population growth will occur outside of the EU. Brexit is an opportunity for us to export the expertise, skills and produce we have to offer directly to this growing market. At present, only one in five UK food manufacturers export. The UK’s global food and drink export market share was less than half of France and Germany’s share. As the world outside the EU becomes larger and wealthier, it will become hungrier, for more and for better quality food. The UK’s food and drinks manufacturing industry has a rich array of advantages when it comes to exporting globally to an increasingly

discerning market. Our advanced R&D assets continually push forth our technological and scientific capabilities. This will be of ever more importance as the automation revolution gathers pace, transforming the manufacturing workplace. And our regulatory and compliance frameworks ensure our safety and quality standards are amongst the highest in the world, reassuring global customers that buying British means buying quality.

This is an argument perhaps best made by a dedicated specialist export organisation, whose purpose would be to foster links between UK food and drinks manufacturers and the global marketplace. Such an organization would demonstrate that we have confidence in our national manufacturing capabilities to be able to sell in any market, and its creation is supported by the Food and Drinks Federation, the representative body of the nation’s food and drinks manufacturers.

Our food and drinks manufacturing industry is too important to gamble with. I am pleased to see that the government is taking its vital role in our economy and our national security seriously. It is paramount that food and drink manufacturing can thrive beyond Brexit. And this should be a driving force as the government negotiates its deal.

An exhibition of UK manufacturing excellence

James Selka,
CEO of the
Manufacturing
Technologies
Association,
previews MACH
2018 – the
upcoming
showcase for
advanced
engineering and
manufacturing

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The Manufacturing Technologies
 Association

MACH 2018 is the UK's premier trade show for engineering-based manufacturing technologies. Held at the NEC in Birmingham from 9-13 April 2018, it will welcome manufacturers, engineers, students and new technology enthusiasts to experience the best of what UK manufacturing has to offer. Sir Ben Ainslie, the most successful sailor in Olympic history, is set to open the festivities.

Since its inception in 1912, MACH has inscribed itself in the great tradition of UK engineering, which culminates in this age of rapid automation in manufacturing technologies, or Industry 4.0. Britain stands at the forefront of this new industrial revolution, with major actors like Nissan and McLaren investing far and wide in new manufacturing plants to exploit British skills, as well as a series of government measures designed to promote industry. With nearly 600 exhibitors, including big names such as Hewlett Packard and Jaguar Land Rover, MACH 2018 will bring all that talent and innovation together under one roof, putting paid to the manufacturing sector's reputation for being uninspiring and outdated in one fell swoop.

The Manufacturing Technologies Association (MTA), which organises MACH, has teamed up with Factory 2050 at the University of Sheffield Advanced Manufacturing Research Centre (AMRC) to bring one of its most exciting new features to the 2018 exhibition: a joint showcase of cost-effective automated solutions for SMEs. This initiative stems from the knowledge

that faster innovation and adoption of industrial digitalisation technologies could result in £455bn extra profit for UK manufacturing over the next decade, based on the recent, government-supported Industrial Digitalisation Review, also known as "Made Smarter."

Beyond Industry 4.0 technologies, MACH 2018 exhibitors span a wide range of technologies, including milling, metrology, additive manufacturing and tooling, all of which are evolving at unprecedented rates. Visitors to MACH will experience the future of engineering first-hand, from Renishaw's industrial 3D printers to AP&T's press-hardening production solutions.

In addition to the wealth of technology on display and the many peer-to-peer networking opportunities MACH 2018 provides, the exhibition prides itself on its Education and Development zone, dedicated to arming the next generation of engineers with the tools they need to utilise their full potential and generate new ideas as they enter the industry. This fantastic platform to show off the industry will be manned by apprentices and graduates from exhibiting companies, who will lead students on guided tours through the NEC halls. Young visitors will also have many opportunities to engage in interactive activities and attend a full roster of educational seminars throughout the week, learning about careers in various sectors within advanced engineering in the process. Aimed at 11 to 19-year-olds, the Education and Development zone at MACH also places extra emphasis on encouraging young women to pursue careers in engineering, which continues to be a male-dominated industry.

A biennial fixture, MACH punctuates the British manufacturing sector's business calendar and has earned its place as the largest and most important engineering trade show in the UK. In 2018, the five-day exhibition is expecting 25,000 visitors, all keen to create valuable connections and explore the exciting future of engineering.

For more information, please visit:
www.machexhibition.com

The CEO of appliance manufacturer Gtech, Nick Grey, tells Will Dunn why his next vacuum cleaner will be manufactured in Worcester

“People want to use British products”



“I didn’t really get on well at school,” recalls Nick Grey. “I didn’t like it, and it didn’t like me very much”. Work, however, was a different matter. In his first job in the design lab at vacuum cleaner company Vax, Grey found that “design was something I found really easy. It came quite naturally.” From a lab technician Grey became a design engineer and eventually, in his early 30s, the company’s head of engineering and design. He left Vax in 2001 with enough savings to last him a year or so, a home office in a village outside Worcester, and an idea for a new company. Less than 15 years later he had sold tens of millions of products in countries around the world, and last year the company, which remains 90 per cent owned by Grey and his family, turned over £91m.

For those with an eye on British manufacturing, then, it was encouraging

to hear that this burgeoning company (Gtech was named the fastest-growing company in the Midlands in 2016, and the 11th fastest-growing in the UK) plans to make its next vacuum cleaner in Britain.

“It’ll create 100 jobs,” says Grey. “About half of them will relate directly to manufacturing and half will be related positions, such as admin and customer service.”

Why manufacture in the UK? “People want to use British products. They are always very complementary about Gtech and what we do, but the one thing people say is, ‘why don’t you manufacture here?’ So we designed a product specifically for British manufacture.”

Grey says this is not simply a case of moving a product line from China back to Britain; the economics of manufacturing in the two countries are different, and this changes how products



are designed. “You can’t build things that are hugely labour-intensive in the UK – it just isn’t competitive. But if you make it relatively straightforward to put together, and find some savings elsewhere, it should work.”

“I think there’s a lot of pride that we can manufacture our own stuff, still. When you manufacture a product anywhere, it’s usually made from raw materials or parts that are brought in. But being able to manufacture here, being able to say we can compete, you can build a product in Worcester and it can compete with products built anywhere – I think there’s a lot of pride in that.”

The environmental benefits, too, are a selling point. Shipping already releases a billion tonnes of CO₂ into the atmosphere each year – more than three times the UK’s total emissions – and this could rise to 17 per cent of total world

emissions by 2050. Many consumers already avoid food from the other side of the world; product manufacturers may soon need to consider this as a force in buying decisions.

For Grey these efficiencies are what bring UK manufacturing “within touching distance of the price of manufacturing offshore.” “We’ll save a lot of shipping costs, we’ll save storage costs, and we’ll save picking and packing costs.” When the new vacuum gets to the end of the production line in Worcester, he says it will go “straight onto the courier’s van to go out to consumers. That helps make up for the higher cost of manufacturing here.”

The sum that has to be balanced for a company to be able to manufacture in the UK rather than China is weighted heavily towards the east. While Chinese workers’ wages have risen dramatically in recent years, the average wage in

manufacturing remains around £2.60 to the UK’s £8.20. In factories in Sri Lanka and Bangladesh, where many of the clothes worn in the UK are made, workers are typically paid £2-£4 a day. Factory space is also much cheaper and more readily available abroad. In the UK, says Grey, “there’s a shortage of space. Manufacturing needs a lot of space, and the rent and the rates are very expensive here. It can actually be difficult to find factory space even if you’ve got the money.” When Gtech left its old office – a collection of buildings on a farm – in 2016, Grey says that “on the local property pages, there were two properties of the right size within the limits of Worcester. The whole choice was two properties. One of them was very old and run down, and the other was the one we moved into.”

Grey says that factories in China also benefit from a government that actively promotes manufacturing. “The investment in China is readily available. For any factory that wants to export goods, they can borrow money, open premises, buy machinery, and the government is very, very supportive. Here, you basically have to have a lot of money.”

This situation is not new. Grey describes manufacturing in the Far East as “very mature” in terms of the quality of manufacturing, and the availability of skilled workers is “like for like”. “We’re able to attract a very strong workforce here too,” he adds, but the higher value placed on a UK citizen’s time means products must be designed accordingly. “You need something that’s fairly streamlined in its design and assembly.”

That said, Grey acknowledges that the UK government does offer some “very good” incentives for businesses. He highlights research and development tax relief – a considerable deduction from corporation tax that can be claimed whether R&D is successful or not – as a policy that strongly incentivises innovative companies such as Gtech.

This is good for the UK because “most of the value of a new, innovative product is in the intellectual property,” he says,

“Brexit doesn’t make any difference to us”



pointing out that manufacturing in the UK doesn’t actually bring in as much value as designing in the UK. “That’s the really important bit. Britain has this incredible resource of design talent, from Spitfires to radar to F1 cars – the very top of design is usually British influenced. So to make the most of that is the main thing for government. Research, development and design, that’s what we’re good at.”

In the US, Donald Trump’s promise during his election campaign to “get Apple to start making their computers and their iPhones on our land, not in China,” shows a failure to understand the realities of globalised business and manufacturing. According to Grey, “anything that’s compact, labour-intensive and easy to ship, you’re better off making in the Far East. If it’s quite bulky and big, or if it’s not labour-intensive, you’ve got a chance, you can manufacture that locally.”

“I would encourage British manufacturing,” he says, “just not

of everything.”

The decision to manufacture in the UK could also represent a Brexit insurance policy for Gtech. Following the referendum, the cost of materials – which are for Gtech negotiated in US dollars – rose steeply as the pound lost value. “It certainly wiped some off our bottom line,” says Grey, agreeing that reshoring “does underpin that a little bit.” That said, Grey points out that EU law has made “selling goods within the EU more complicated than selling them outside, “so Brexit “doesn’t make any difference to us, to be honest.”

The new Gtech model, when it begins production later this year, will not be the only vacuum cleaner made in the UK (Numatic has made its well-known Henry vacuum in Somerset for more than 35 years) but it will be an important test of British manufacturing’s appeal to consumers in the modern economy. If it is successful, other companies may find both efficiency and security following Gtech’s lead.

How big data is changing manufacturing

Predictive data and the use of analytics are changing the UK's manufacturing landscape, writes Dr David Bott, principal fellow at WMG, University of Warwick

It is very common these days to talk about the digital revolution – being applied to most human activities – but although it is having profound impacts, it is currently more an evolution of things people have already done. However, the availability of more powerful computers, bigger data storage and faster communications mean that going forward this evolution is going to start going a lot faster than we are used to.

In manufacturing, data can support the selection of materials and processes, optimise the process-material combination, and accelerate products to market. It can bring flexibility by making sure that the right components and sub-assemblies are there when needed. It can understand how customers use products, providing, for example, valuable feedback on service support.

The desire to control individual machines (or reactors in the process side of manufacturing) has been around for a long time. Initially measurements were simple and infrequent, but as the measurement and computing capability grew, so did the type and amount of data we can collect and use to control machines. This led, in turn, to the ability to virtually model existing, or even new, machines and optimise them “offline”.

Very few factories comprise one machine, and it is important to manage the flow of materials from one machine to another. The enhanced computing and communication capability enables the monitoring, control and modelling of assembly lines for optimal productivity.

The next step in this evolution was to apply this newfound insight back up the

supply chain. Factories often buy in components and sub-assemblies made in other factories. Given that it was possible to use data to optimise a factory, it was simply just a bigger task to optimise a supply chain. There are challenges in that the suppliers are separate companies with their own drivers and restrictions, and care needs to be taken sharing commercially sensitive data.

More recent (although the driver was always there) is the need to find out what your customers do with your products, and how you can turn that insight into the information necessary to produce better products in the future. This is behind the rise of the “smart” product. Used properly, this approach enables managed service and maintenance in use – with the consequent minimum disruption of use – which makes the customer happy, and an understanding of what your customers actually want.

All this data gives insight into what everyone along the supply chain wants and can ask questions of the way products and services are delivered. It has enabled the restructuring of many types of transactions, where it is simply the need, or ability to supply, that is traded and the physical side of the business is carried out at a lower level. This ability has caused the disintermediation of the music and book industries, is changing the way we find taxis and hotel rooms, and even enabling people to make money from the parking space in front of their house.

However, there are risks. Understanding the security requirements of personal, manufacturing and usage data will be critical to the design of future digital systems. Those risks can be caused by the failure of humans to be aware of the importance of security, or by those who recognise that disrupting these data flows can be a source of income. This in itself appears to be a burgeoning industry.

Ultimately, there are profound changes happening in the manufacturing industry. Not to recognise their potential feels like a willingly missed opportunity.

For more information, please visit:
www.wmg.warwick.ac.uk

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Michael Gasiorek, Ilona Serwicka and Alasdair Smith of Sussex University's Trade Policy Observatory discuss the research they've done on the impact of the government's Brexit plans on the manufacturing sector

Theresa May's EU plans may fail the jobs test

Theresa May's Mansion House speech on March 2nd expressed her wish that the UK's post-Brexit arrangements should "protect people's jobs and security". At the UK Trade Policy Observatory we have modelled the impact of Brexit on manufacturing output and jobs, so we can assess the likely effects of the Prime Minister's decision that the UK should not remain in a customs union with the EU or in the single market, and instead have a bespoke trade deal with the EU to "deliver the ambition we need".

Manufacturing accounts for about ten per cent of the UK's GDP, and 44 per cent of the UK's exports. The availability of disaggregated data on trade flows and trade barriers in manufacturing makes it possible to look at the effects of Brexit on UK manufacturing in a quite detailed way: our work is based on data for

122 manufacturing sectors. In our research, we've considered the possible effects of Brexit on UK manufacturing in three steps to a progressively "harder" Brexit.

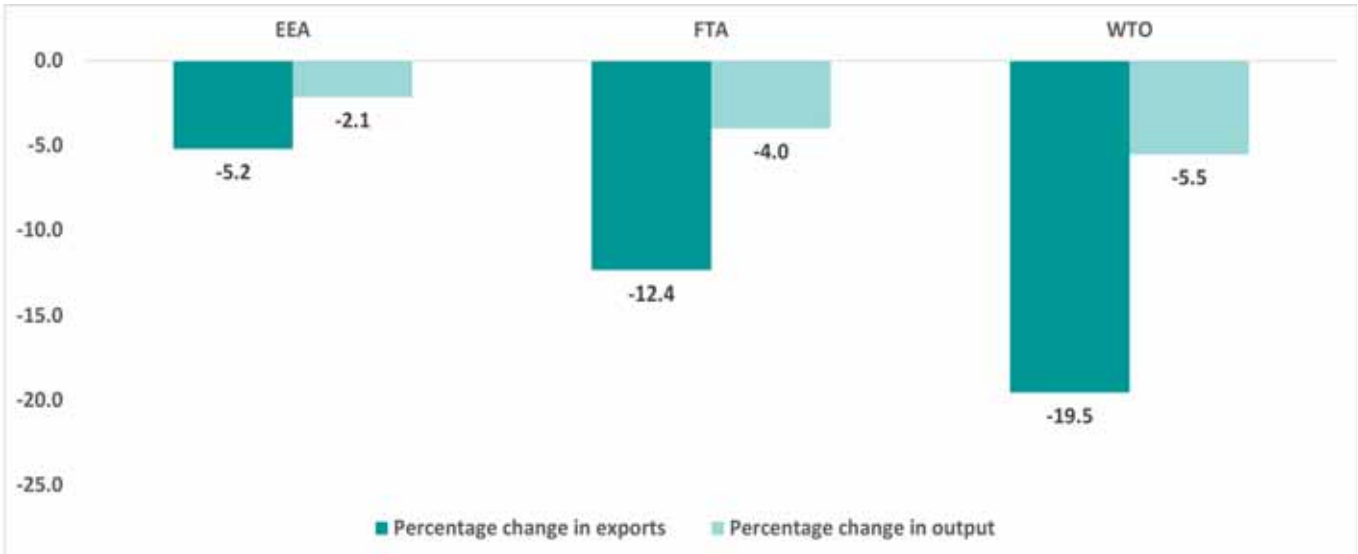
First, we suppose that the UK leaves the EU customs union and is therefore able to make its own trade agreements with non-EU countries. Even with no tariffs on trade between the EU and the UK, border inspections will be needed to ensure that other countries do not import goods into the EU via the UK to evade EU tariffs and trade restrictions. Such border inspections impose costs upon UK-EU trade. This is the "EEA" scenario, in which the UK would be like Norway, outside the customs union, but in the single market and in a free-trade area with the EU.

The second step is for the UK to leave the EU single market as well as the customs union and apply its

own regulatory rules. This too will give rise to additional border costs as the EU will need to have mechanisms to ensure that imports from the UK satisfy EU rules, and vice versa. The UK remains in a free trade area with the EU in this "FTA" scenario.

Thirdly, we suppose that the UK fails to maintain free trade with the EU and with all the 67 countries with which the EU (including the UK) currently has free trade agreements. Now the UK trades on World Trade Organisation terms with all countries. This is the "WTO" scenario.

We have estimated the possible effect on UK manufacturing of these three scenarios, and in each case we found that Brexit leads to a decline in trade and a decline in output, with these effects being greatest in the WTO scenario in which, considering all 122 sectors together, exports fall



UKTPO research points to reductions in exports and industrial output for every Brexit scenario, with the reductions in each case becoming more pronounced the “harder” the Brexit agreement

by almost 20 per cent and output falls by almost 5.5 per cent. We estimate that in this scenario, up to 70,000 jobs could be directly at risk in manufacturing alone. In making such estimates, we have looked at the direct impact of changes in trade flows, sector by sector. In practice, there might be labour market adjustments, changes in supply chains, and exits by some firms, so the actual number of jobs lost might be somewhat less or substantially more than predicted

The hardest Brexit could put 70,000 manufacturing jobs at risk

from the direct effects of changing trade flows. A good way of thinking about these results, therefore, is that they indicate how many jobs, and in which sectors, may be vulnerable following Brexit. Taking account of manufacturing and service jobs in manufacturing supply chains adds many more jobs to the total number that are at risk.

The impact across sectors varies widely but, perhaps unsurprisingly, the sectors in which a high proportion of output is sold in the EU market are the most vulnerable as they face increased barriers to a major market. It turns out also that when we look at industries classified according to their “technological intensity”, it is the higher-technology sectors which are especially dependent on the EU market. Some 60 per cent of high-tech industries’ sales go to the EU. As a result, higher-tech industries are more vulnerable to Brexit. The government’s industrial strategy seeks to promote high-tech sectors, but Brexit will pull in the other direction.

If the UK manufacturing industry does less business with the EU, some have suggested that Brexit will open up opportunities to do more with the rest of the world, and this can compensate for the relative loss of the

EU market. To explore this we have analysed the scenario in which the UK makes free trade agreements with every single non-EU country in the world, or that the UK unilaterally opens up its markets completely to the world. In the first case, manufacturing output falls by almost four per cent; while in the second the decline is 12 per cent. The reason for this is straightforward. Our trading arrangements with China and the USA are not going to reach as deep as the EU customs union and single market. Tariffs on most non-agricultural products are already quite low. Some further reduction in the external tariffs that apply to the half of our trade we do with non-EU countries will therefore not compensate the UK for the loss of the deep trading relationship with the EU which accounts for the other half of our trade.

Do Mrs May’s decisions on the customs union and the single market meet her objectives for employment, as stated at Mansion House? We fear not. *Michael Gasiorek, Ilona Serwicka, and Alasdair Smith work at the UK Trade Policy Observatory at the University of Sussex and are the authors of the recent UKTPO briefing paper: “Which manufacturing sectors are most vulnerable to Brexit?”*

Plantweb digital ecosystem puts ROI into IIoT

Peter Zornio, chief technology officer at Emerson Automation Solutions, takes questions on the IIoT and how Emerson's expanded Plantweb™ digital ecosystem is helping customers reap its benefits

Emerson's Operational Certainty programme aims to help industrial companies achieve top quartile performance. What role does the Industrial Internet of Things (IIoT) play in Operational Certainty?

Perhaps the biggest industry technology buzz we hear today is about digital transformation and one of the largest new developments is the Industrial Internet of Things. Distributing data and information seamlessly via the internet makes IIoT the new frontier of manufacturing – it has even been referred to as a manufacturing phenomenon. IIoT is pivotal to Operational Certainty because Emerson can leverage the benefits of IIoT.

How will investing in IIoT applications improve operational performance?

IIoT makes it possible to either empower your company's experts with the additional information they need for decisions and action that can facilitate operational performance improvements, or for the first time to completely outsource that analysis and decision-making to third party domain experts.

There are four critical aspects to achieving this: the provision of rich, real-time operating data from intelligent sensing and automation technologies across the business; secure transport of that data to where it's needed anywhere in the world; robust, scalable software to convert the data into actionable insights, and domain expertise to make the decisions and drive the outcomes that will lead to improved performance. A new model called Connected Services has emerged where those last two pieces are performed by a remote third party.

How is Emerson helping companies successfully implement IIoT?

In 1997, Emerson revolutionised the automation landscape by launching Plantweb, the first field-based digital plant architecture. If you are using DeltaV™ or Ovation™ control systems, AMS asset management tools, Rosemount™ measurement devices and Fisher™ valves, you already have the foundation of Plantweb. Now we have introduced the expanded Plantweb digital ecosystem, a scalable portfolio of standards-based hardware, software, intelligent devices and services for securely implementing IIoT with measurable business performance.

What does the new, expanded Plantweb provide for customers?

In addition to highly secure process control, safety and asset management systems from the original Plantweb, the Plantweb digital ecosystem now provides robust, real-time visibility from an expanded range of Pervasive Sensing™ field instruments; protection via the Secure First Mile™ family of software, gateways, security devices and services; applications including Plantweb Insight™, Plantweb Advisor™ and Plantweb Optics that provide embedded domain expertise and connectivity across the enterprise; Microsoft-enabled Emerson Connected Services, offering secure, cloud-based access to analytics for real-time asset monitoring.

Can customers expand their use of Plantweb over time?

The scalability of these new applications allows you to start small, yet still have an immediate impact. Then, over time, you can keep expanding and get even greater results by introducing more integrated solutions across your whole operation.

Emerson is now delivering on IIoT's promise with a clear business case in Operational Certainty and with the most robust, scalable technology and service platform with the Plantweb digital ecosystem. Emerson is now putting the Return on Investment (ROI) into IIoT.

For more information, please visit: www.emerson.com/plantweb

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British software for a bright future in manufacturing

UK-based manufacturers must adapt to and overcome the challenges presented by Brexit, writes Rue Dilhe, managing director of Exel Computer Systems plc

At the end of 2017, British manufacturing output was at its highest since 2008, following seven months of successive growth. We have seen that trend reflected at Exel, with sales in the last quarter making 2017 a record-breaking year for the company. This is a statistic that we are very proud of, and it paints a positive outlook for the future.

Exel Computer Systems plc is a British software author; we have been developing EFACS E/8, an integrated ERP business solution, for manufacturers since 1985. It covers all aspects of their operations and equips them with the ability to easily manage every stage of the manufacturing process, from product development to delivery, through to servicing if needs be.

We serve an increasingly diverse customer base, covering companies of all sizes, and we understand well that needs vary from company to company.

Despite early hesitance in the wake of the vote to leave the European Union, and all the market flux that accompanied that reaction, companies are making the bold and committed decision to invest in the UK, as shown by the exciting manufacturing output numbers coming out of the last quarter of 2017.

Similarly, companies are choosing to upgrade and re-invest in new business systems that will enable them to grow their businesses and take their products and customer service to the next level. Despite the uncertainty, manufacturers are committed to creating growth, and building on the fantastic progress made

last year.

One important way that companies operating in the UK can aid their own development is by investing in a UK-authored business system. This is for the practical reason that a UK author will make sure all their products are compliant with upcoming changes that will inevitably effect how manufacturers do business.

Whether those are UK regulatory changes, or new trading rules set by countries that businesses are exporting to, it is Exel's priority to make sure that our software is compliant with whatever Brexit throws at us, and the UK manufacturing community.

As politicians love to remind us, Brexit may bring a lot of unknowns, but it will also bring a huge amount of business and trading opportunities. However, no one can deny that a tsunami of regulatory and rule changes are heading towards the UK's shores.

To capitalise on business opportunities, and not drown in bureaucratic overhaul, a manufacturer will need a modern, integrated and adaptable business solution that will guide them through these choppy waters. It makes sense to choose an author that is preparing for the next chapter in the UK's manufacturing story, just like their clients.

As the UK author of an ERP system tailor-made for manufacturers, Exel will always endeavour to keep pace with not just political changes, but the continuous advancements brought about by technological developments in the industry.

Exel is proud of the part it has played in British manufacturing over the last 33 years, and we are committed to doing our bit to make sure that the future of British manufacturing is a bright and prosperous one.

British manufacturing finished 2017 in a position of strength; let's make sure it finishes 2018 the same way, and builds on the high regard with which it is held throughout the rest of world.

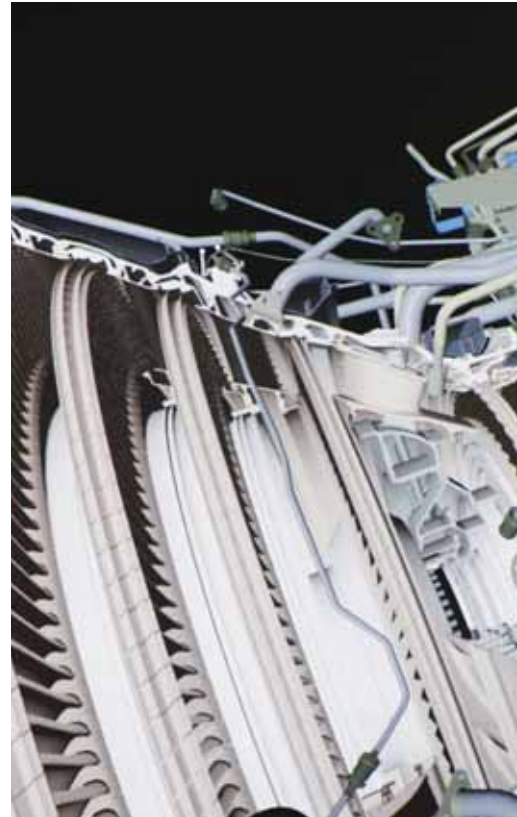
For more information, please visit: www.exel.co.uk

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Ben Morgan, of the University of Sheffield's Advanced Manufacturing Research Centre, urges the government to support collaboration between academia and industry in the North of England

A world-class asset in waiting



As the former chief executive of the Centre for Cities, Alexandra Jones has significant understanding of the ways in which devolution and place-based policies could stimulate innovation, growth and social regeneration. For advanced manufacturing in the North of England, then, it is highly encouraging that Jones has been appointed director of Industrial Strategy at the Department of Business, Energy and Industrial Strategy. It's a move that signals and strengthens the government's commitment to extending the place-based approach to economic and social renewal.

For the Northern Powerhouse and the city regions that are affiliated with it, this approach means they will have to learn to collaborate and innovate; they will need to stop behaving like political fiefdoms, and start to operate as a network of closely connected hubs,

driving change and innovation across the economic base.

The model for this is to be found not in politics but in the work of the High Value Manufacturing Catapults, the most successful of all the government's Catapults. The seven centres, including the Advanced Manufacturing Research Centre and the Nuclear AMRC in the Sheffield City Region are a connected network that provides innovation capability and technical expertise to manufacturing brands with global reach and reputation.

The HVM Catapult has already attracted £739m of external commercial and R&D funds leveraged from a total core funding of £330m. The combined effect has delivered over £1bn of new R&D in the UK – vital at a time when the industrial strategy has set the stretching target of increasing this investment to 2.4 per cent of



Collaborative research can prevent offshoring

UNIVERSITY OF SHEFFIELD

GDP by 2027.

But this is not just about investment. It is about the impact this investment is having on productivity. And this is where catapult centres like the AMRC are making perhaps the biggest impact. Our collaboration with the likes of Boeing and Rolls-Royce – and almost the entire aerospace supply chain – has led to game-changing improvements in productivity.

In the case of Rolls-Royce, our work supporting the efficient manufacture of fan discs for their jet engines not only prevented the work being offshored, but gave the company the confidence to invest more than £100m in a purpose-built facility in Washington in the North East, protecting thousands of skilled jobs.

The groundbreaking manufacturing techniques we developed included the introduction of automation as well as the latest advanced platforms for machining,

grinding, broaching and inspection processes which “reduced the time it takes to manufacture a disc by 50 per cent while producing a step-change in component performance.”

The state of the art facility, Rolls-Royce added: “makes use of manufacturing methods developed at the Advanced Manufacturing Research Centre (AMRC). The AMRC is part of a network of research centres which aim to work with businesses to apply university research to accelerate the commercialisation of new and emerging manufacturing technologies.”

That was four years ago. And that was largely machining. What Rolls-Royce and other high performing manufacturers realise, however, is that the application of digital technologies – from robotics and automation to augmented and virtual reality – are changing the face of manufacturing at such a speed that they need to stay connected with research and innovation partners such as the AMRC and the other HVMCs if they are to prevail.

For us, being close to our partners is key to understanding the dynamics of the marketplace and aligning this to technological innovation. That is why, with government support, we invested £43m in our Factory 2050, the place where digital meets manufacturing.

The beauty of a centre like Factory 2050 is that the problems we have been addressing in aerospace are similar, if not identical, to the ones we now see facing the construction and automotive industries, and the energy and water sectors. This means that the applications we are developing for high performing global companies such as Rolls-Royce, Boeing and Airbus, are equally applicable to the long tail of underperforming small and medium-sized firms (SMEs) who comprise the majority of the UK manufacturing base.

Factory 2050 has a talented team of 60 engineers with an average age of under 30. Some of these young men and women, many drawn from gaming degrees with little understanding of traditional manufacturing, don't know

Politics must catch up with the pace of technology



the half of how effective they are.

Robot programmes, concocted over the course of an afternoon are changing the game for SMEs; iPad apps written over the course of a couple of days are revolutionising major aerospace OEMs. If productivity and impact is the name of the game, automation and digital manufacturing is the strategy.

Recently, engineers in our integration team developed a vision system algorithm for aero engines that is now being used in furniture manufacture for a small Yorkshire business that employs just 20 people. This firm had ambitions to grow. They had a feeling that robotics could help them, but weren't sure how best to deploy. Our intervention has enabled them to understand the technology and exploit it to its full potential.

The impact on firms like this is hard to overstate. It changes the business for good; gains access to new markets; enables the development of new products; opens the door to new jobs and skills. When we measure the impact of these interventions we often find two- or three-fold gains on installing a piece of kit or capability. That's what attracts industry partners to the AMRC.

The hurdle to rolling this out further is not technological, but political. If the

Northern Powerhouse wants to live up to its name, and move out from under its parents' shadow, it must stop looking to the South for solutions: we already have them, we just need to apply them.

What we need is political innovation: new ways of connecting people and places; new ways of working across political boundaries and ideologies. The AMRC is a model here. We are opening hubs and spokes in the North West and North Wales, in the Midlands Engine and the Liverpool City Region, and internationally in Asia and America.

We already have an emerging research and innovation network in place. Northern political leaders should draw up a roadmap for exploiting this network to enable digital to meet more and more SMEs. The impact of this across the region – from Liverpool to Hull, Lancaster to Derby – would be transformative. Couple this with a roadmap for creating the skills base to meet the demand these newly digitalised firms will need as they accelerate their growth, and we would have the making of new industrial revolution.

We have the engineering, innovation and research leadership. What we need now is the political leadership to turn the Northern Powerhouse from a slogan into a reality.

Inspiring the workforce of tomorrow

The manufacturing sector must promote the exciting opportunities it has on offer if it is to plug the skills gap, writes Nunzia Florio, communications director at the UK Petroleum Industry Association

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The downstream oil sector is a significant contributor to the UK economy and growth, and provides the vital products that we rely on every day. From lubricants, petrochemicals and heating fuels, to road and construction, paints and solvents, and carbon electrodes for the aluminium sector, the downstream oil industry is responsible for providing the building blocks for the many products that are fundamental to the way we live today and for future innovations.

Today, the sector provides for more than one-third of the UK's primary energy needs, powers 96 per cent of the country's transportation energy demand and supplies close to 70 per cent of the raw material for the chemical industry. Domestic oil refining and marketing assets also make a substantial contribution to the UK economy, not only supporting the employment of over 88,000 people, many with highly specialist skills and technological expertise, but also many more jobs in related industries such as chemicals. Their annual contribution to the UK economy is £2.3bn per annum, with each large refinery estimated to inject approximately £60m locally, in addition to the value of its production's output.

In the context of innovation and skills, the oil refining industry is also among the top three most innovative sectors in the EU and employs one of the largest percentages of highly skilled labour amongst manufacturing sectors. Relative to other sectors, for example, the UK's downstream workforce is more highly qualified than the polymers, chemicals

and medical technologies workforce.

The downstream oil sector is also important for chemical and engineering graduates, related vocational skills and training and apprenticeships. And great opportunities exist across the whole sector to attract and retain lifelong careers and talent, from engineers, analysts and traders, to lawyers, technicians, drivers and accountants, to name but a few.

Looking ahead, the sector will continue powering the UK's energy needs and mobility for many years to come and will require the ingenuity, expertise and interest of the next generation of talent. For this reason, now more than ever we need to address the fact that increasing demand for replacement staff will be needed in the next decade as the industry's employee base retires. But also today, the wider process sector has some specific skills shortages – including engineering, safety and risk related skills, IT skills and skills in the area of process operations.

Over the course of 2018, our sector will add its voice to government's "Year of Engineering" initiative, a year-long campaign launched in response to an estimated shortfall of some 20,000 engineering graduates a year and a lack of diversity (the workforce is 91 per cent male and 94 per cent white). This year, UKPIA will also participate in the International Women in Engineering Day (INWED), which takes place on 23 June 2018, under the patronage of The United Nations Educational, Scientific and Cultural Organization.

In order to tip the scales, we'll need everyone's voice to prepare and inspire the next generation, to increase awareness of the exciting opportunities that this sector affords; to encourage more young women to choose science, technology, engineering and maths (STEM) subjects and equip our young talent with the right skills for the future. This will be not only be crucial to improve productivity and social mobility – and in maintaining international competitiveness – but also in meeting current and future challenges.



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Our new *BOMBARDIER AVENTRA* trains for the Elizabeth line, London Overground and the East Anglia, South Western, West Midlands and Essex Thameside rail franchises are designed and built here in Britain.

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