

Spotlight

MANUFACTURING: A NEW INDUSTRIAL REVOLUTION

Richard Harrington MP / Lee Hopley / Jack Dromey MP



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Cakes, cars and competition



Search the internet for images of “manufacturing” and you’ll see heavy machinery, steel and sparks. But actually, a more realistic image would show a man wearing a hairnet instead of a welding mask, working on frozen lasagna rather than molten metal; the largest manufacturing sector in the UK is the food and drink industry.

Manufacturing employs 2.8m people in this country, covers five big sub-industries and accounts for 44 per cent of Britain’s exports. But when politicians talk about manufacturing as an individual sector, there is often the sense that they are picturing sparks and steel (which makes up 0.7 per cent of manufacturing output).

This failure to differentiate leads to false conclusions. A long list of politicians and economists has held forth on Britain’s productivity puzzle, but again, a more representative picture includes the fact that in some areas, such as the chemicals industry or transport equipment, productivity growth since 2008 has outpaced other EU nations, including Germany. As the EEF’s chief economist, Lee Hopley (interviewed on p8) told *Spotlight*: manufacturing “covers everything from food to aircraft wings, and their journeys post-financial crisis have looked quite different.”

Sectors also move at different speeds. While productivity growth in food and drink lags behind the UK industry average, individual businesses within it have quickly and successfully outgrown their international competitors. The automotive industry, on the other hand – and perhaps because it makes much larger and more expensive products – is much less nimble.

At the same time, however, there are common factors. Supply chains, consumer confidence, free trade and the need for engineers are crucial to any manufacturer, whether they are making a Jaffa Cake or a Nissan Juke. This supplement, then, aims to offer both a detailed picture of what is really happening in the wide world of manufacturing, and a view of the grand challenges, from Brexit to technological change, that lie ahead.

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FORD

Ford deploys exosuits worldwide

Will Dunn

Following a successful trial in Michigan, the US car giant is rolling out mechanical exosuits to 15 factories on five continents. The EksoVest is worn on the upper body and aids manufacturing workers in performing physically demanding tasks, such as holding up power tools or lifting components, using springs that can add more than 6kg of lifting power per arm.

While the EksoVest is unpowered, Ekso and other companies including Activelink, Sarcos Robotics and

Panasonic are developing powered exoskeletons that could offer more strength and speed to workers in many sectors, from construction and manufacturing to nursing.

In the UK, the most recent Labour Force Survey found that 60,000 workers in the manufacturing sector suffer a work-related illness each year, with lifting or handling injuries being the most common type of accident. Injuries in the manufacturing sector are estimated to cost £521m per year.

UK-Israel deal insured for \$125m

Augusta Riddy

The British firm Rolls Royce is supplying engines for 16 Boeing 787 Dreamliner aircraft for EL AL Israel Airlines. The sale represents the largest single export deal the UK has ever made with Israel.

UK Export Finance (UKEF) – a ministerial department and the UK’s export credit agency – provided \$125m worth of credit “support” to this deal, by insuring a loan from Citi to El Al Israel Airlines to finance their purchase. UKEF were not able to disclose the total cost of the deal due to “commercial sensitivity”.

Citi’s managing director Munawar Noorani said of the proceedings: “Citi has a long-standing relationship with EL AL and we are delighted to have been selected by them for their first ever financing through UK Export Finance.”

A few days before the announcement, the government launched its Export Strategy, as part of which Trade Secretary Liam Fox plans to raise exports as a percentage of GDP from 30 to 35 per cent. “I am delighted that as we launch the government’s Export Strategy, UK Export Finance is backing this significant contract, which will support the continued international success of Rolls-Royce,” he said.

Fund launched to grow UK medicine

Sam Forsdick

Up to £8m has been made available for UK businesses as part of a government challenge fund for drug manufacturing.

The Innovate UK fund, provided by UK Research and Innovation, is looking for digital solutions to improve the UK’s production and manufacturing of medicines, and opportunities to reduce

waste and costs. However, any projects that focus on reducing waste or cost must be able to show an improvement of more than 25 per cent.

The challenge fund forms part of a series of loan competitions available to SMEs as the government looks to bring down “barriers to productivity and growth”.

Research and development funds have also been opened in the area of construction with £12.5m being made available for projects that use manufacturing techniques to construct “quality buildings”.



British exports buoyed by gin

Will Dunn

UK food and drink exports hit a record high of £10.7bn in the first half of 2018, and gin was among the fastest-growing products; exports rose by over 19 per cent. Britain has rediscovered its taste for gin more than once since the “Gin Craze” of the early 18th century, when the nation averaged more than ten litres of spirit per person per year. Domestic sales have tripled in the past decade, but British gin is growing in popularity globally with a desire for high-end drinks and cocktails; whisky exports also rose by 10.5 per cent.

More than 62 per cent of food and

drink exports were to the EU, and EU exports grew much more quickly than exports to any other market, leading to concerns for the sector after Brexit. The Food and Drink Foundation has identified China, USA, India, Japan and the UAE as priority markets for the UK, and recommended the use of “in-market specialists”, funded by the government, to grow exports in these areas.

US manufacturing hits 14-year high

Augusta Riddy

In the midst of Donald Trump’s ongoing trade war, US manufacturing has hit a 14-year high, according to a reading by the Institute for Supply Management (ISM). Additionally, figures released at the start of August showed that jobs in the sector had risen by 327,000 over the previous 12 months.

Trump has been engaged in a tit-for-tat trade war with China, imposing heavy tariffs on billions of dollars’ worth of Chinese imports. China has responded in kind. Since June 2018, Trump has also been enacting tariffs on imports of steel and aluminium from the EU, Canada and Mexico.

Timothy Fiore, chair of the ISM manufacturing business survey committee, whose reading showed growth in 16 of the 18 manufacturing industries it monitors, welcomed the results but highlighted employment resources and supply chains as continuing problems. Industry analysts expressed unease at the potential effect of tariff instability on manufacturing in the future. “Respondents are again overwhelmingly concerned about tariff-related activity,” Fiore said.

Of the effect of his measures on steel manufacturing, Trump tweeted: “Tariffs have had a tremendous positive impact on our Steel Industry. Plants are opening all over the US, steelworkers are working again, and big dollars are flowing into our Treasury.”



Lego starts to build a no-plastic future

Sam Forsdick

Lego has committed to using only sustainable materials in all its products by 2030 and is already using plant-based material for some of its elements.

In 2015, the toy manufacturer invested over £100m into its Sustainable Materials Centre. The centre has now achieved its first major breakthrough with the production of bricks made from plant-based polyethylene using ethanol produced by sugarcane. Lego is now using the sustainably sourced materials for all botanical bricks in its sets, such as leaves and trees.

These new green bricks represent one to two per cent of the total amount of plastic elements produced by the Lego group. Tim Brooks, vice-president of environmental responsibility at Lego said: “This is a great first step in our ambitious commitment of making all Lego bricks using sustainable materials.”

Currently the majority of the 75bn Lego bricks sold a year consist of ABS plastics – a product derived from petroleum. The Danish company recorded revenue of DKK35bn (£4.2bn) in 2017 – an eight per cent drop on the previous year, and manufactures in Denmark, Holland and Mexico.

British manufacturing is on the cusp of a renaissance, according to **Richard Harrington**, Minister of State for Business and Industry

Giving meaning to “Made in Britain”



Most articles on British manufacturing reminisce about the industrial revolution and how we were the world’s leading commercial nation by the 19th century, dominating the mass production of textiles, steel, machine tools and so forth. Then there is often a consideration of how this developed into assembly lines and into computer-driven automation.

All the above is correct as far as it goes – and it is reasonable to say the cliché-driven mantra about the UK not being a manufacturing economy today is hugely overstated and part of a media-driven myth. Look at Toyota in Deeside, where a workforce of more than 500 people manufactures a new car engine every 57 seconds. Siemens in Hull is building wind turbine blades for Horsea Project Two, which will generate power for more

than a million homes.

British manufacturing is alive and well. The UK ranks in the top ten manufacturing nations in the world, with the sector employing 2.7m people and representing 69 per cent of business research and development. We want to continue to build on our manufacturing heritage and strengths. However, what I have seen in my travels throughout the UK in my capacity as the Minister of State for Business and Industry is that UK manufacturing can succeed under foreign ownership with foreign capital and management techniques imported from home countries such as Japan and Germany. Our test is to see if a new generation of startups can morph into large companies with UK capital and a modern management system aided by



AI and a hugely upskilled workforce.

In November 2017, this government launched its modern Industrial Strategy. Its mission is simple: to boost productivity by backing businesses, creating good jobs and increasing the earning power of people throughout the UK. Our Industrial Strategy will play a huge role in preparing the UK manufacturing sector for the Fourth Industrial Revolution.

Digitisation is creating new markets

SHUTTERSTOCK/AUGUSTPHUNTHIPHAT

In July 2018, the prestigious Farnborough International Air Show presented us with an opportunity to showcase our support for the future of UK aerospace. As part of our modern Industrial Strategy, government and industry committed to invest almost £4bn in UK aerospace from 2013 to 2026. More than £340m of this investment will support 18 revolutionary projects, including the development of hybrid electric engines, so that we can increase opportunities for smaller businesses, boost the productivity of the sector and develop cutting-edge technologies to help the UK lead the world in aerospace manufacturing.

When we look at our manufacturing industry today, it has been transformed in both scale and sophistication to an extent that our ancestors could never have imagined. Now with the digitisation of manufacturing transforming our industries, the future is already upon us.

Take Ocado, a British online-only supermarket leading the charge in digital manufacturing and artificial intelligence. On the outskirts of a small town in Hampshire sits “The Grid”, an automated distribution centre spanning 240,000 feet. Digital technology presents our manufacturing sector with huge opportunities to further increase productivity, and to create new markets, but we must be active to seize them.

To help businesses grasp these opportunities, we are backing the Made Smarter Review, an independent, industry-led review chaired by Juergen Maier, CEO of Siemens UK, with input from over 200 businesses, setting out how UK manufacturing can be transformed through the adoption of industrial digital technology (IDT), supported by a strong government industry partnership. The review identifies a wealth of opportunities, boosting UK manufacturing by £455bn, creating 175,000 jobs and reducing harmful CO₂ emissions by 4.5 per cent over the next decade.

In February, we announced a Made Smarter Commission, and asked Sir Mark

Walport, chief executive of UK Research and Innovation, to work with Juergen Maier on the development of a funding proposal. In May, we announced £20m of new funding for a pilot scheme in the North West to provide support for up to 3,000 manufacturing SMEs to adopt digital technology.

Those organisations that have already embraced digital technology have already made transformational improvements to UK manufacturing. But the technology alone is not enough. We have to ensure we have the right people in the right roles. To do that we need to address skills shortages. This is why we have made new investments in excess of £400m in maths, digital and technical education, helping to boost science, technology, engineering and maths (STEM) skills.

We’ve also developed a National Retraining Scheme targeting sectors with skills shortages. They will initially focus on digital and construction skills and establishing Skills Advisory Panels to identify current and future local skills needs, shaping the provision and funding of 16+ education, training and careers guidance. This includes expanding construction training programmes across the UK, and increasing apprenticeships starts to 25,000 per year and offering 1,000 T-level placements by 2020.

In February, we announced a £184m investment in the next generation of scientists and engineers. This will help to create more successes like YASA Motors, an Oxford University spin-off which has created a new electric motor production facility to supply the worldwide growing demand for high-quality UK products.

The new site will help deliver the next generation of environmentally-friendly hybrid and pure electric vehicles, 80 per cent of which are destined for export around the world. With these investments, we are putting the UK in the driving seat to lead the Fourth Industrial Revolution. A revolution where workers will be properly supported with the skills and expertise needed for the future, one where these skills will inspire future generations and help build a Britain fit for the future.

Chief economist at the EEF
Lee Hopley talks to Augusta Riddy
about the next era of global trade,
and how UK manufacturing can
navigate it

“Other countries aren’t in the mood for trade liberalisation”



On Tuesday 24th July, Jeremy Corbyn gave a speech to the EEF manufacturers’ organisation. He told the audience that a Labour government would “stand up for the real economy” and would “take decisive action to make finance the servant of industry not the masters of all”. By the “real economy”, Corbyn meant industry, and he promised to use new freedoms post-Brexit to “allow government to intervene to protect our industrial base” and start “reprogramming the economy”.

Lee Hopley, chief economist at the EEF, responded to the speech in her blog. “Manufacturers might challenge the idea of an industry in demise,” she wrote. “A smaller share of the economy in output terms – yes. But one that has been growing.” Anyway, she observes over coffee at the EEF offices in Westminster, no other sector is judged on its output.

“It seems to be a particular obsession we have with manufacturing.”

So, how would Hopley describe it? “It’s an industry which is resilient and adaptable. It has shifted with globalisation and technological advances, in spite or because of government policy.” This, she says, is how the 2.8m people that work in UK manufacturing would prefer the sector to be thought of.

Corbyn is not the first politician to appeal to a sentiment that idolises Britain’s “lost” industrial past. Why don’t we make things anymore? Why are we importing goods that Britain invented? Former chancellor George Osborne’s 2015 “March of the makers” speech played on the same emotion, when he too promised to re-balance the economy away from finance and increase manufacturing output. Is this vision possible? “What is their vision?” Hopley asks bluntly. “Because their vision of



re-industrialisation is not tangible. How do you measure it? How do we know we've delivered that?" Instead of getting all misty-eyed, she argues, politicians should be focused on driving improvements that will ready the industry that contributes ten per cent of UK gross value added (GVA) for the hurdles ahead. "We're the 9th biggest manufacturing economy in the world, which I think is alright ... There's no point having a big conceptual idea of a future that doesn't stack up with where business is going."

What Hopley is appealing for is a strong, lasting industrial strategy. "An industrial strategy doesn't lead to a brave new world of re-industrialisation but it can deliver industries that are capable of meeting society's future challenges." Four governments have now had a "crack" at an industrial strategy, she points out, and although "elements of them all are still hanging around", none

has stood the test of time. The fact that an industrial strategy is accepted as necessary across the political spectrum is progress, she says, and there is broad consensus around the "high-level" goals: "productivity, good jobs, improving living standards. There's some common ground there." Hopley is keen to see the promised (but delayed) Industrial Strategy Council installed "to make a judgement on whether progress is being made ... [and to] start giving indications of where progress is lacking."

The "challenges" that UK manufacturing needs support to face are significant and wide-ranging, but the most obvious is Brexit. A drop in the value of sterling – its performance between April and June 2018 was its worse quarter since the referendum and its second-worse quarter since the 2008 crash – led to optimistic speculation that UK manufacturing exports would rise as

they became cheaper. Not so fast, says Hopley. "The [idea] that sterling depreciation was going to suddenly lead to a boom in export demand sheds light on the lack of understanding we have of modern manufacturing in the UK." When demand goes up, gaps in the supply chain have to be filled by "sucking in more imports," she explains, and the "sharp movement in sterling does immediately impact on the cost of those imports." Overall a drop in value is a good thing for manufacturing, she accepts, but the real enemy is volatility. "Volatility is a nightmare. I think a lot of our members would accept a higher rate of sterling for more stability."

Hopley will not be drawn into a discussion on the impact of a "no-deal" Brexit on manufacturing: "I don't think we're close to that being the scenario ... I'm not sure as an economist I fully appreciate the practical ramifications." However, there are plenty of things that need to be addressed "whether or not we're leaving the European Union".

Greater even than Brexit is a fundamental shift that will rock global production and trade to its core, which is the fourth industrial revolution, or 4IR. The EEF defines 4IR in a fact sheet as "the coming together of cyber networks with physical networks, to create new autonomous systems". The UK needs to be ready, warns Hopley. "It's something that lots of other governments around the world have plans for. You don't choose to opt in or out of technological change. It's happening."

As intelligent machines continue to automate roles there are expected to be widespread job losses. When envisioning the workforce in 2025, "the vast majority of those people are in the workforce today," points out Hopley. Therefore it's not just a question of getting education right, "it's also about the stock of human capital that we've got at the moment and the adaptability of that." New technologies, however, – "if adopted and deployed in the right way" – could improve UK productivity, she argues, which has been stagnant since the financial crisis. "In broad terms,

“It’s not all about cost, it’s about value”



productivity has been flatlining.”

Hopley now has her sights on the Autumn Budget, and she hopes investment will be a key focus. “I think we need to look seriously at the gap between what we could have won, and where we need to be to make sure we aren’t losing pace with competitors.” Following the 2011 Eurozone crisis and a fall in commodity prices in 2014, European markets made a recovery that was “hugely important” for manufacturing in 2016/17. However, in the UK this “has not been accompanied by a corresponding improvement in investment”. That is important, she says, as investment “tells us about confidence; how do [investors] feel about the UK, the demand outlook, and the competitiveness of the business environment.”

But with goods being produced in low-cost markets such as China and India, can the UK really expect to compete in the future? “It’s not all about cost, it’s about value, and we definitely can [compete] in the UK.” When it comes to domestic procurement, which politicians like Corbyn are arguing for more of, there needs to be more communication between government and industry, and plenty of forward

planning, Hopley says. “It is about having that relationship on the procurement side which gives some kind of forward visibility about the pipeline and allows innovative solutions.” It’s no good, she argues, issuing one-off government contracts to UK suppliers without a more sustainable pipeline of orders. “You can’t have famine and feast. You can’t say we want 15 power stations and then we don’t want any for another ten years.”

The world is changing, Hopley acknowledges, and global trade structures that were taken for granted can no longer be relied on. Trump’s recent steel tariffs are a stark example of this new order. “We had the decade where it was all about multilateral agreements, opening up, freeing trading goods. The assumption was this is the new norm.” Now, she says, the UK government needs to think seriously about how the country can influence this “important global agenda”, especially as trade will have to shift its focus away from the EU when Britain exits. “Trade liberalisation is a game we want to play, but other countries aren’t in the mood. [As we] progress through the Brexit negotiations that is something we will need UK politicians to have an answer for.”

Why the UK must stand on its own two feet

Andrew Loake, managing director at Loake Shoemakers, explains why British craftsmanship is poised to make a comeback on the world stage

In Victorian times, Britain was a factory for the world and there seemed to be no limit to what we could make and export, but after decades of manufacturing, we began to export our nation's knowledge and skills to competitors in the East. Now, interest in British manufacturing is growing again. Globalisation has its pros and cons, but it can't be a healthy state of affairs when most of what we need has to be shipped half way round the world. After we leave the European Union, we will have to have a slightly more self-sufficient outlook but, in any case, sustainable local economies are a good thing.

But we all know that manufacturing in Britain is not without its problems. Because labour is relatively expensive here, much of what we make will, by necessity, be rather expensive and this is particularly true of craft industries where the work content is high. If we cannot compete with the rest of the world on price, the only viable alternative is to make things that are either unique or intrinsically better than what can be made elsewhere. In other words, we have to be able to justify a higher price on the grounds that the product is better. Branding and advertising can help, but these can only emphasise the authenticity of a product – not enhance the product itself.

Here in Northamptonshire, there is a cluster of extremely good shoemaking companies who make some of the finest men's shoes available anywhere in the world. Most are long-established businesses using traditional manufacturing techniques and their biggest challenge is the extraordinary

level of skill required by its workforce and the need to pass this on from generation to generation. The training can only be carried out "in-house" by those who are able to pass on their skills and knowledge but, as production gradually moved away from the UK, it became harder to find suitable recruits to train. As manufacturing declined in the 1970s and 80s, schoolchildren were encouraged to work hard and pass their exams with the threat that, if they didn't, they'd end up working in the factories. As a result, everyone wanted an office job and the chance to keep their hands clean.

The good news is that, at last, things are changing. Universities, after a period of rapid expansion, are now fighting each other to get the next intake of students. People are realising that not everyone wants to pursue higher education and there is once again growing interest in craft industries. The language has changed a little: we tend to talk about "craftsmanship" rather than "manufacturing" and "workshops" instead of "factories", but that's not important. What matters is that is that we're making things – and the things that we make in Britain tend to be really good.

In this industry, we have the satisfaction of knowing that we're making something that is not only useful but, in its own way, beautiful and as good as anything available anywhere in the world. We have the joy and frustration of working with a natural material and the knowledge that we're doing it in a reasonably environmentally friendly way and without inconvenience to anyone else. It's a very congenial way to make a living.

Our history and heritage can be valuable marketing tools, but should be used with care and respect, remembering that they can only point backwards. There's a fine line between building on the past and becoming enslaved to it and it's much more important to have a view to where you want to be tomorrow. We have a saying in our company: "Learn from the past but look to the future".

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

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How Manchester is making miracles happen in its labs

Professor Sarah Cartmell, leader of materials in medicine activity at The University of Manchester, explains how the university is ahead of the curve in advanced materials research

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The University of Manchester

The University of Manchester has developed a strong reputation in advanced materials research. So, what makes Manchester so special?

We have a critical mass of expert researchers and facilities that is second to none. This includes the research-focused National Graphene Institute, the soon to open business-facing Graphene Engineering Innovation Centre and the BP International Centre for Advanced Materials. Under construction is our £400m state-of-the-art engineering campus and the nearby £105m hub building for the Henry Royce Institute, the UK body supporting industry and academia to deliver innovation in advanced materials.

What is the secret to building advanced materials research on this scale?

Our ability to lead partnerships and having the capability to build and manage integrated research ecosystems is what sets us apart. This gives government, national agencies and industrial partners the confidence to work and invest in Manchester.

What role does Manchester's research play in supporting business and manufacturing?

Without significant breakthroughs in advanced materials the innovation to create new products will not progress. So Manchester takes a "lab-to-market" approach; starting with a design phase and working with relevant stakeholders so we have consensus of the challenge. Then we work through the "science supply chain", that is the various research communities which contribute

their specialist expertise to deliver a solution to the challenge. Then we look to support scale-up and deliver the final product to market, such as a biodegradable medical implant.

What are the latest trends to be aware of in advanced materials?

Biomedical materials is an exciting and transformational research area, because it is set to create a paradigm shift in healthcare treatments. For example, recent advances in additive manufacturing – that is, the type of materials, resolution and speed of 3D printing – can offer new therapeutic solutions for unmet clinical needs. Much of our research is looking at manufacturing novel materials and cells in combination to create living composites that can be used to replace damaged tissue.

What are the emerging and growing areas in the UK biomedical materials sector?

A rapidly growing area in the UK is one of bioelectronics. This multidisciplinary field is already strong but is growing quickly. In particular, novel conductive polymer manufacture and their applications, as well as wearable e-textiles that have sensors incorporated to detect salt levels or cardiac rhythm.

What are the blockages in the biomedical materials pipeline?

We have a plethora of innovative new materials being developed for biomedical applications. Being able to assess their efficacy rapidly and accurately is vital if we are to remain competitive. So we are developing scale-up capability at the Henry Royce Institute to increase the rate of materials production – for example, provision in the UK of rapid nanofiber production and characterisation. We are also developing a new ex-vivo testing platform that will allow fit-for-purpose information regarding biomaterials performance, and potentially reduce the need for animal testing. Lastly, we are improving regulatory, industrial and clinical input early into the biomedical materials design process.

To learn more, visit: www.manchester.ac.uk/advanced-materials-beacon

Bridging the gap between academia and industry

Manchester can lead the Fourth Industrial Revolution as it did the first, writes Paulo Bartolo, professor of advanced manufacturing at The University of Manchester

Manufacturing contributes ten per cent of the UK's GDP, 45 per cent of its exports, and employs approximately 2.7 m people. However, between 2005 and 2016 the UK has dropped from the fifth-largest manufacturing nation in the world to the seventh, and continues to lag behind Germany and the USA in productivity.

Driven by digital tools and technologies, industry is on the verge of its fourth revolution – Industry 4.0. By enabling the physical and digital worlds to be merged, industrial digitisation has the potential to boost productivity and efficiency, reduce costs, strengthen supply chains and make industry more resilient. Despite myriad UK research and innovation funding schemes aimed at keeping UK universities at the forefront of industrially applicable scientific advancements, UK manufacturers are finding it difficult to recruit people with relevant advanced technical and engineering skills.

The need for more investment in industrial digital technologies and the skills gap in its workforce have been recognised by the government. The Made Smarter Review – led by Juergen Maier, CEO of Siemens UK and an honorary professor at The University of Manchester – concluded that the benefit to the economy of adopting Industrial Digital Technologies over the next decade could reach £455bn, linked with growth in manufacturing of up to three per cent PA, the creation of 175,000 jobs and a 4.5 per cent reduction in CO₂ emissions. Crucially, the review highlighted the need for digital hubs, including one in the North-West.

With its world-class academic excellence, and geographic and cultural pull of its home city, The University of Manchester is uniquely positioned to be an exemplar of the leadership required from the UK's higher education sector. Taking the example of advanced materials, we are home to around £420m's worth of internationally renowned research and business innovation centres such as the Henry Royce Institute for advanced materials, BP International Centre for Advanced Materials, National Graphene Centre, and Graphene Engineering Innovation Centre. These are the ingredients of an ecosystem built around a talent supply chain – in this particular example, a Graphene City.

In other words, we have a track record in delivering on areas that are vital for Industry 4.0. This was made possible because of our success at grassroots level, with a critical mass of researchers at the forefront of Industry 4.0's technologies and societal and economic impact. Examples include the Industry 4.0 Centre, National Centre for Text Mining, Health E-research Centre, Manchester Institute of Innovation Research, Manchester Urban Institute, Robotics and Artificial Intelligence in Nuclear hub, Manchester Environmental Research Institute, as well as the Advanced Interfaces, Information Management, Electronics in Agriculture, and Control Systems research groups.

We are taking steps to cement our place as a world-leading hub for Industry 4.0 solutions in engineering, health and social sciences. Our Digital Futures initiative will be a network for ground-breaking digital research centred on around 800 of our researchers. Furthermore, our Manchester Industry 4.0 Strategy Paper, due in 2019, will set out a roadmap for a comprehensive framework spanning industrial research priorities and the teaching and learning approach required to produce future-ready industrialists. We invite industry leaders and government to join us in delivering our vision of the greater integration of resources.

To find out more about advanced materials and Industry 4.0 at Manchester, visit: www.informatics.manchester.ac.uk

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No deal would be a disaster for the car industry



Jack Dromey, the MP for Birmingham Erdington and former deputy general secretary of the T&G and Unite the Union, reflects on the impact leaving the European Union could have on car manufacturing in the UK

Britain's car industry has gone from strength to strength, having been on its knees four decades ago.

However, the future of the industry is at a crossroads where it needs continuation of the strong strategy established by the last Labour government and tariff-free access to its biggest market: Europe.

A generation ago, Britain's automotive industry was in turmoil. It had become a byword for poor management, low productivity and tumultuous industrial relations. While the car industry in Germany and France was forging ahead, it was in crisis in Britain.

The second half of the 20th century was a turbulent time for the British car industry, characterised by poor industrial relations, low productivity and the eventual bankruptcy of British Leyland, leading to its nationalisation. A key trade union player was Derek "Red Robbo" Robinson. Derek, who I knew well, famously said: "Pay, our problem. Productivity, their problem."

Derek was eventually sacked unfairly by British Leyland and the trade union movement was hammered. To the enormous credit of the unions, they

rebuilt, with a style I have often called the "car industry model of trade unionism". Strong, no-nonsense, hard-nosed, standing up for its members but acting as an agent of change, combining higher productivity and higher pay.

The industry needed long-term security and sustained investment. Under the last Labour government, a remarkable rebuilding process took place which sought to make the British automotive sector a world-class success story. Overseas investment flowed into the industry. This included foreign manufacturers investing in operations based in the UK, not least because of frictionless integration of products and people across the European Union, and no tariffs or regulatory barriers.

Then the 2008 global economic crash threatened catastrophe and wholesale closure of car plants. I remember what happened next well, not least because I, as deputy general secretary of Unite the Union, supported my good friend and colleague Tony Woodley, then general secretary, in the discussions to save the industry from collapse. Two things were key: the Scrappage Scheme and the



establishment of the Automotive Council.

The Vehicle Scrappage Scheme was a stroke of genius. Trade your old banger in and get a brand new car at a £2,000 discount. The scheme not only benefitted the environment, taking many of the most polluting cars off the road, but it also led to a boom in new car sales. It was enacted in the 2009 budget and by February 2010, new car sales were up 26 per cent on the previous year. The manufacture of 400,000 new cars saved the industry from collapse.

Next, the creation of the Automotive Council in 2009 led to a more co-ordinated, strategic approach to industrial strategy for the automotive sector. This meant that leading figures from the industry were able to develop a better dialogue with government, shaping a strategy for growth in the sector and leading to more inward investment. With this pioneering industrial strategy, the Automotive Council helped create a state of stability in an industry which had been the complete opposite for a long time.

The automotive sector accounts for more than £77.5bn in turnover and £21.5bn in value added to the UK economy. The sector employs over 169,000 people directly in manufacturing and over 814,000 across the wider economy. We now make more cars in Britain than we did in the 1970s.

However, the industry is now facing serious uncertainty. The triple threat of a no-deal Brexit, which could lead to job losses and factory closures, a botched transition away from diesel, which has left the public confused as to which cars to buy, and the most significant technological change in the industry in 100 years as electric and autonomous vehicles become the norm.

A no-deal Brexit would harm exports to the EU and mean that the “just in time” manufacturing system would become impossible. In “just in time” supply chains, components and parts are delivered at very high frequencies from suppliers located in nearby regions or countries. But for “just in time” to work, the whole delivery system has to be seamless or frictionless, which is why

the Society of Motor Manufacturers and Traders has consistently called for customs union membership to continue post-Brexit.

While it is vital that we move to an automotive industry which consists of primarily ultra low-emission vehicles, the government’s rhetoric around the transition from diesel has left the car industry in limbo. The public has become convinced that all diesel cars are polluting the planet and will be taxed higher, leading to lower sales. However, the sales of electric cars have yet to pick up the slack; this has led to falling sales overall.

The automotive industry is facing a fundamental technological shift, the likes of which we haven’t seen for over a century. It is vital that the growth of electric and autonomous vehicles is welcomed and embraced. If managed and invested in, this growth can lead to a further boost for British manufacturing. As Unite the Union stated in its impressive document – *Electric Vehicles, Autonomous Technology and Future Mobility: A Manufacturing Strategy from the Unite Automotive Sector* – investment in sustainable technology can lead to growth in high-skilled jobs for workers, that will help to create the high-pay, high-quality, high-productivity economy which is vital for Britain to succeed. However, if not managed well, our country could pay a heavy price.

For me, it is about the Jaguar Land Rover workers in the Erdington Jaguar plant. We worked hard to save the factory from closure in 2010. It doubled in size, transforming the lives of thousands of workers in one of the poorest parts of Birmingham. It is unthinkable that those workers’ future now be put at risk.

During this period of uncertainty, the government must put measures in place to ensure the stability and continued growth of one of Britain’s working class and world-class success stories. A detailed, long-term industrial strategy is vital for future investment and protecting almost a million jobs; something the Tories’ chaotic approach to Brexit simply cannot deliver, leaving one of the jewels in the crown of British manufacturing at risk.



The industry is facing a triple threat

Will Dunn looks at how factory design changed the world, and how new types of factories are preparing to do so once more

The buildings that make the future

Politicians may find it hard to imagine any building that has been more influential to our history than the Palace of Westminster, but there are factories that can give Parliament a run for its money. Lombe's Mill, built in 1721, was the first of a series of textile mills on the river Derwent that grew to employ almost everyone in the surrounding area, manufacturing products in huge volume and creating vast wealth for their owners, in a model that was eventually copied across the country and the globe. Parliament created Britain's legal and political framework, but the factories of the Derwent Valley helped transform everything that was made and sold, laying the economic and social foundations of the modern world.

Nor did the influence of factories on the modern world end there. Jane Pavitt, head of School of Critical Studies and Creative Industries at Kingston University, recently curated *SUPERSTRUCTURES: The New Architecture 1960–1990*, an exhibition at the Sainsbury Centre for Visual Arts that

looked at the way in which technology transformed architecture. The path to the “high-tech” buildings that define modern cities, says Pavitt, “started with a factory”.

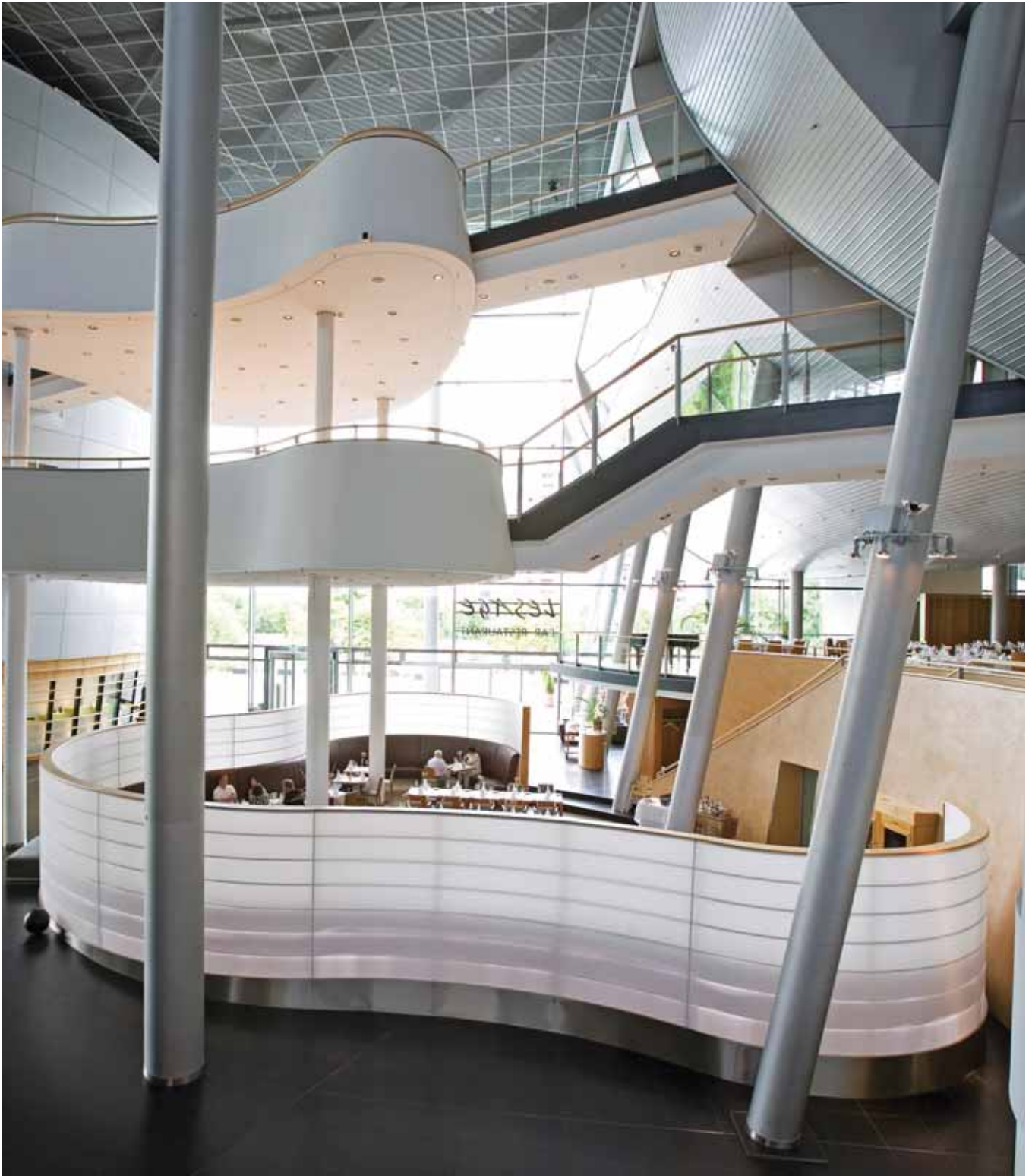
“The definition of a factory changed in the 1960s and 70s,” says Pavitt, “and in Britain, that was part of an industrial change. Many industrial buildings were not necessarily factories of production, as in the turning of raw materials into goods, but of assembly or distribution. That may seem like a fine line, but it was important in that industrial Britain moved away from being a place of dirty, heavy industry – the smokestack, the production line, where everyone was divided by class. What interests me about high-tech buildings is the way in which they embraced the factory with a progressive model of architecture, something cleaner and organised on different lines.”

In the UK, the first of these cleaner, more progressive factories was designed in the 1960s by Richard Rogers and Norman Foster, who had met at Yale University in the US. In the States, says

Pavitt, Foster and Rogers had become “interested in production techniques that allowed for quick assembly and ‘dry’ construction – buildings that could be assembled from high-tech, prefabricated components.” These were buildings that were more likely to be assembled by an engineering company than a traditional builder.

The Reliance Controls factory in Swindon was the culmination of Rogers and Foster's early partnership. Pavitt says it represents not only a new kind of building, but a new kind of client. “It was commissioned by a new type of company – an electronics company. This industry needed clean techniques, new processes, different sorts of production spaces. Microprocessor factories are more like a laboratory and factory combined. They needed to incorporate a lot of new systems, such as cooling and cabling. That's what interested [Rogers and Foster] – the idea of “plug-in” buildings with services routed under the floor, like the central aisle of an aeroplane.”

At a time when other factories were



Volkswagen's "Transparent Factory" in Dresden is not just a production facility but a visitor attraction – and a powerful marketing tool

assembled by “construction companies, putting up sheds”, the Reliance Controls factory aimed for “the democratisation of the workforce,” says Pavitt. In its flexible interior, “workers would be in closer interaction, there would be a different interaction between worker and manager.” Whether or not the workforce inside really achieved this, she argues, “you could say that they anticipated the changes in industry that were to come. A lot of their buildings were distribution and assembly, and as industry was moving out of Britain and Europe, those were the things that were retained.”

Today, says Pavitt, the “industrial buildings, factories, training centres, labs and research centres” of a large technology company all comprise “the industrial image – they all have a slot-together aesthetic.”

As the factories of the Industrial Revolution and the Space Age shaped both the production and the appearance of the world they inhabited, the influence of another set of technologies – the emerging fields of advanced materials, AI, automation and on-demand production – present the opportunity for a new breed of factories to reshape the world once more. Nina Rappaport, publications director at the Yale School of Architecture and author of *Vertical Urban Factory*, a book on the future of manufacturing, says factory architecture is diverging. While on the one hand, “you’re always going to need a giant shed to build an aeroplane”, Rappaport points out that “parts of aeroplanes can be built in smaller spaces. There’s one great example of that in New York. There’s an aeroplane parts manufacturer in an urban, multi-storey – what I call a ‘vertical urban factory’ – space, in Queens. People don’t even know it’s there.” As technologies such as 3D printing mean “it’s possible to make things anywhere”, Rappaport says a “neo-cottage industry” of smaller, distributed manufacturers is arising, “especially in cities”.

Rappaport says these manufacturers are also beginning to pool space, services



and machinery in larger buildings, “in what we could call an industrial common”. In co-working manufacturing facilities such as New Lab, in New York, or Building Bloqs in London, startup companies pay by the hour to use the facilities to develop and manufacture new products. “Often they’re sustainable companies, or they’re looking at new technologies.” Rappaport says these new kinds of factory are “not just replacing someone’s garage,” but about launching new businesses. “It’s become an entrepreneurial model, a testing ground for later production. They work best when they’re not just tinkering, they’re getting a product online.”

Manufacturing has long benefited from being situated in or near cities, and

Rappaport says that in many cases this is likely to continue. “Manufacturers have always wanted to be near power sources, labour sources, and entrepreneurs. I still think that’s the same.” In the future, it’s likely that manufacturing done by people will happen where people are available, and the UN forecasts that 68 per cent of the world’s population will live in cities by 2050.

Distributed urban manufacturing is also a result of wider economic change, says Rappaport. “The other thing we keep seeing is that in cities now, there are more companies, but with fewer employees. In the days of Big Industry there were company towns, and one company like Ford or GM employed everyone. Now it’s shifted to many companies.” Rappaport says this trend



has increased sharply over the past decade, and that it is driven by technology. “I think there are more opportunities, with advanced manufacturing, for these small-scale companies to start up.”

A well-designed factory that works in full view can also be one of a company’s most effective marketing tools. “The factory itself becomes a spectacle,” says Rappaport. “We’re seeing combinations of retail and manufacturing as well. People love seeing stuff in process, it’s like magic.”

Another view on what the factory of the future will look like can be found in Leamington Spa, where the furniture brand Vitsoe recently opened its new factory. The factory is a huge space, 135m long, but on completion it was the most

airtight commercial building in England. The whole building is made almost entirely from wood.

Mark Adams, Vitsoe UK’s managing director, says the new factory was built to reflect the company’s furniture – “a kit of parts that you can adapt, change and repair.” Built from cross-laminated timber, a building material that is increasingly popular for its efficiency and sustainability, the factory took just 23 days to put up. What Adams says is most important about it, however, is that “it is first and foremost a space for the human beings in it,” designed to give those people the positive things a building can offer – “views, natural light, fresh air... common-sense things. Wood is warm, and as humans we can feel that.”

The technology for a more human

factory has existed for a long time, says Adams. The “north-lit” factories of the Victorian era, and indeed the naturally lit naves of medieval cathedrals, show how large spaces were lit in the centuries before electric lighting. “There’s no rocket science here.”

But Adams avoided using a traditional architect for the design, consulting instead with furniture designers, a yacht designer and an environmental engineer, among others. As Foster and Rogers did in designing the Reliance Controls building, “we asked how we could break away from all those divisions, which are in every crinkly-tin industrial shed you walk into,” and create “enough separation for quiet and concentration, but where, on a regular basis, problems can be solved by bumping into each other, rather than needing constantly to arrange meetings.”

This is achieved also through food; Vitsoe employees have freshly made breakfasts and lunches at long tables in front of a huge window. One visitor told Adams: “Where I come from, people go out and sit in their cars at lunch time.” In Adams’ view, collaboration is not something that can be forced through structural design, but encouraged by pleasant surroundings, natural light, good food and a strong sense of equality among colleagues. While Adams admits that a tin shed is cheaper, he speaks passionately about the need to respect the natural world, to make products as sustainably and fairly as possible.

This, too, is a trend that will shape factories in the future. Scarcity of materials, increasing legislation for sustainability and a growing demand for ethical and sustainable products all point to a future in which production is different not just technologically but socially. The market for ethical products and services is already worth over £80bn a year in the UK, and the growth of this market comes mainly from younger consumers. For anyone who works in a factory – and who envies Vitsoe’s warm, wooden HQ – this can only be good news.

Humans are a key cog in the factory of the future

Despite advancements in technology, designing factories which are people-focussed remains key to unlocking true progress in manufacturing, according to **Jon Rigby**, associate at **Bond Bryan Architects**

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Manufacturing technology is changing fast. With it, both the physical world we inhabit and our working methods and behaviours are being forced to constantly adapt to suit. The days of factory buildings being huge, dirty, cold sheds filled with noisy processes and a low-skilled workforce have become a thing of distant memory. Instead, many 21st-century industrial workplaces are becoming engineered, polished structures more akin to a pharmaceutical research laboratory, with teams of engineers collaborating seamlessly via cloud-based technologies to solve complex problems in real-time, all across the world.

Despite these shifting technological goalposts, at Bond Bryan we recognise that our buildings are fundamentally concerned with something much simpler; our designs are about maximising and enhancing the experience of the people who use them. As architects, it is imperative that our buildings are timeless and adaptable. The only guaranteed way to achieve this and to safeguard the investment of our clients is to ensure that design is approached with users, rather than technology, in mind.

Our recently completed Factory 2050 building for the University of Sheffield's Advanced Manufacturing Research Centre embodies many of these ideas, the most important of which is how the architectural solution can act as a catalyst for innovation. We wanted the human interaction to take centre stage within the building and the technology, robots and service infrastructure to exist purely as a support network around which this

interaction could occur.

Conceived as an engineered, cylindrical glass drum, with Factory 2050 we sought to challenge the conventions of what an industrial building should look like in this day and age. The ground-breaking circular plan is subdivided across its 70m diameter into an outer ring of flexible production space which encompasses a 25m-diameter, three-storey office core at its heart. This central hub is where the majority of collaborative problem solving occurs, with engineers grouped around workstations to tackle problems on screen before radiating out into the factory space to test their theories in practice. This deliberate architectural strategic decision places the high-value human "thinking" space as both the physical and symbolic nucleus of the facility, around which the technological functions can orbit.

Another tradition-breaking intervention was to remove the physical barriers between the office and workshop space which all too often inhibit the flow of ideas between departments but moreover unnecessarily pigeon-hole the workforce into perceived roles and hierarchies of importance. By eliminating these walls, the engineers at Factory 2050 are able to seamlessly transition between "thinking" and "doing" in a bright, spacious environment with the resulting collaboration between colleagues enhanced immeasurably.

Bond Bryan has been fortunate enough to be at the forefront of advanced manufacturing projects for over 15 years, and, in that time, have designed more than 2.5m square feet of space for companies and institutions at the cutting edge of the next industrial revolution. The practice has created the university research buildings in which the manufacturing processes of the future are being developed; noticeably, at every level, we've seen that success comes from a human-led approach to architectural design and buildings that empower people to participate, to collaborate and to innovate together.

For more information, please visit:
www.amrc.co.uk/facilities/factory-2050

MANUFACTURING

The latest contracts, jobs and training

THESE CONTRACTS ARE NOW OPEN FOR TENDERS

1. University of Leeds

Design, supply, installation, commissioning and maintenance of railway testing systems

Bid deadline: 14th September

Tender value: £7m

The high speed rail Infrastructure Testing Facility (ITF) at the University of Leeds is inviting bids to design and build its railway track testing rig.

Contact: m.a.whitworth@adm.leeds.ac.uk

2. University of Sheffield

High resolution field emission electron probe micro-analyser (FE-EPMA)

Bid deadline: 14th September

Tender value: £1m

The University of Sheffield's Department of Materials Science and Engineering is looking to purchase a Field Emission Electron Probe Microanalyser.

Contact: james.noble@sheffield.ac.uk

Total value: £8m

THE LARGEST PUBLIC SECTOR CONTRACTS OPEN FOR BIDS SOON

"Pre-Information Notices" give advance warning of contracts that will soon be open for tenders.

1. Coventry City Council

A Coventry City Council-led consortium will invite tenders to construct the new

Tender and framework data supplied by

tussell

UK Battery Industrialisation Centre (UKBIC) in Warwickshire.
PIN Value: £50m

2. University of Leeds

The University of Leeds will invite tenders to develop a technology part within the Leeds City Region, with the facility to specialise in research into high-speed rail.

PIN Value: £8m

3. UK Atomic Energy Authority

The UKAEA will begin the market engagement process to reach out to potential prime contractors and sub-assembly manufacturers of a new hydrogen-based research facility.

PIN Value: Undisclosed

4. Porton Biopharma Limited

Porton Biopharma Limited will invite bids from contract manufacturers that can fill vials and freeze-dry drug substances at large scales for distribution around the world.

PIN Value: Undisclosed

Total value: £58m

MANUFACTURING JOBS NOW OPEN FOR APPLICATIONS

DE&S Chief Engineer – Air Commodities, Ministry of Defence

Salary: £56,000-£75,000 p.a.

Location: Abbey Wood, Filton, Bristol

Closing date: 28th September

The Ministry of Defence is on the lookout for an experienced chartered engineer to oversee the construction and compliance checks of avionic equipment. This will include airfield vehicles, through their journey from the assembly line to application, and surface finishing equipment.

Senior Robotics Developer, Automata

Salary: Competitive

Location: London

Closing date: Ongoing

Automata, which manufactures robots and cobots for use on assembly lines, is looking for a developer, with a background in kinematics and closed-loop control systems. The post-holder should have considerable programming skills and experience with CC/C++ and Python programmes, and motion sensors.

Senior Lecturer in Manufacturing, Brunel University

Salary: £55,341 - £60,255 p.a.

Location: London

Closing date: 4th October

Brunel University's Department of Engineering is looking for an exceptional PhD-holding candidate to lead teaching on undergraduate and postgraduate courses in mechanical engineering.

Manufacturing Manager, Norton Motorcycles

Salary: DOE

Location: Derby

Closing date: Ongoing

The ideal applicant should come from a medium-volume manufacturing volume with experience of all types of aluminium and steel-welded structures. He or she will be responsible for overseeing production of frames, swing arms, foot controls and fuel tanks.

Research Group Leader – Additive Manufacturing, Johnson Matthey

Salary: Competitive

Location: Royston

Closing date: Ongoing

Johnson Matthey seeks a postgraduate degree-holding scientist, to lead its research on identification, development, testing and pre-production of potential new products and technologies through the use of advanced materials.

Research Fellow – Autonomous Vehicles, Warwick Manufacturing Group

Salary: £30,395 - £39,609 p.a.

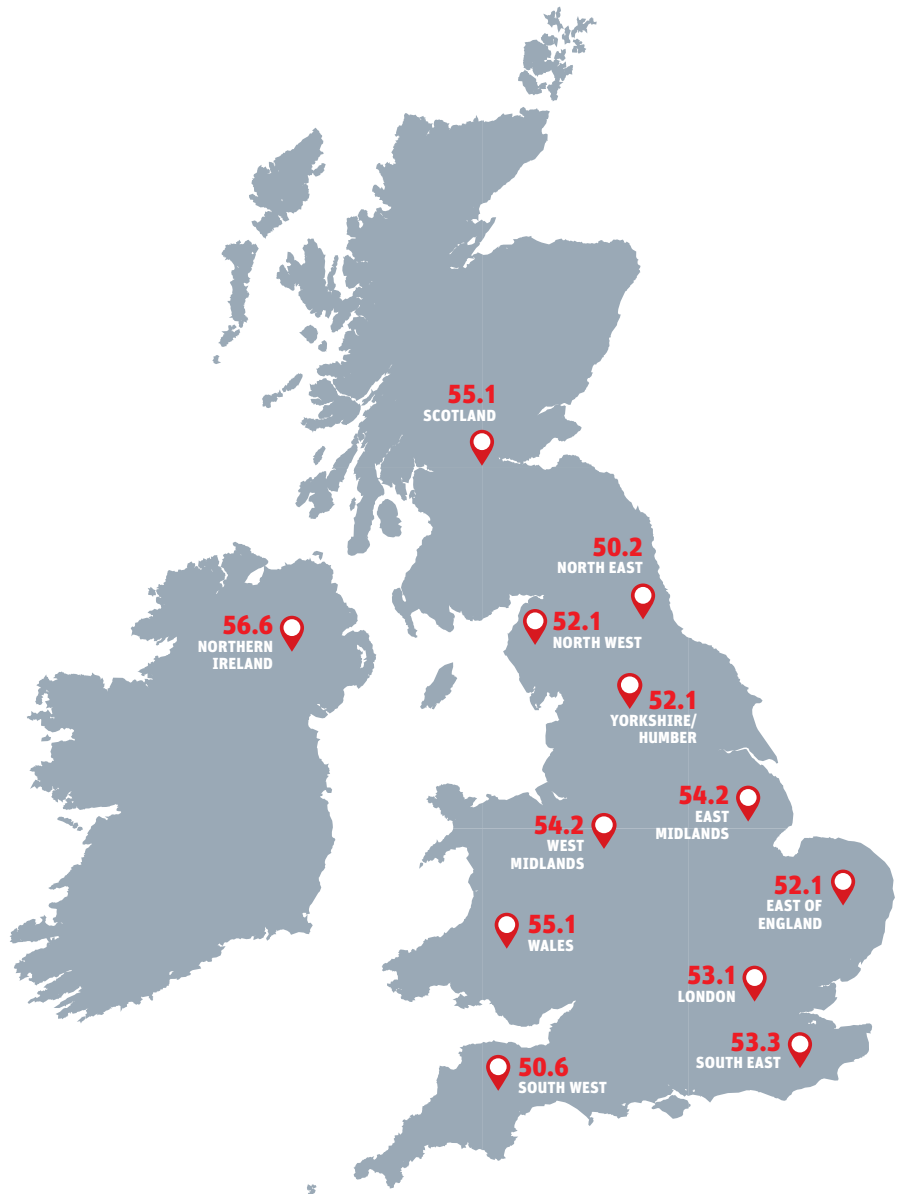
Location: Warwick

Closing date: 16th September

The University of Warwick’s Warwick Manufacturing Group is looking to recruit a researcher on a one-year fixed-term contract to August 2019. The successful candidate will work on the development of the WMG’s forthcoming series of low-speed driverless cars, called “Pods”.

NATIONAL PMI INDEX

The Purchasing Managers’ Index (PMI) is an indicator of economic health for manufacturing and service sectors. Banks carry out regional surveys to provide an advance indication of what is really happening in the private sector economy by tracking variables such as output, new orders, employment and prices. Any score above 50.0 signifies growth from the previous month. The higher above the neutral 50.0 threshold, the faster the rate of expansion is signalled. The map illustrates the regional scores recorded by NatWest for August 2018.



TRAINING OPPORTUNITIES

MSc Automation and Control, Newcastle University

This one-year course allows students to explore the integration of mechanical devices, sensors and “intelligent” cloud-based systems. The MSc focuses on automating various aspects of the manufacturing supply chain.

PhD Studentship in Machine Learning for Automated Software Engineering, Queen Mary, University of London

The successful candidate will spend three to four years on a course of research, developing data-driven software for machines used in the manufacturing industry.

MSc Manufacturing Technology and Management, Cranfield University

This one-year course has been developed for mid-career engineers, who want to further their understanding of advanced materials and their business-side applications in the Fourth Industrial Revolution.

Diploma in Advanced Manufacturing, University of West England

This five-day short course, accredited by the Institute of Mechanical Engineers (IMechE) provides students with an oversight of manufacturing trends part of Industry 4.0.

Why manufacturing really matters

Paul O'Donnell, head of external affairs at The Manufacturing Technologies Association, assesses the value of the manufacturing sector to the wider UK economy

If it is true that “we don't make anything anymore” – one of the most readily repeated saws about Britain's economy – then how does manufacturing account for almost half of our exports? How is it 70 per cent of the UK's business R&D in the sector?

Because manufacturing is less obviously present in our communities; factories are seldom located in town centres anymore and because fewer people work in them, there is a tendency to believe it is a sector that has declined to the point of irrelevance. But nothing could be further from the truth. In fact, manufacturing's impact extends to about a quarter of the UK's economy. That means that the sector is essential to delivering any sort of industrial strategy that could work for the benefit of the country's prosperity. The positive effects of investing in manufacturing are felt right across the country.

Frankly, the oft-repeated “fact” that manufacturing accounts for only a small proportion of UK GDP tells you more about how GDP is calculated than it does about the true impact of manufacturing within the UK economy.

Recent research by the MTA and Oxford Economics tells that richer story. Manufacturing critically impacts the economy in three ways:

- The direct impact: the output of businesses that are traditionally considered manufacturers for the purposes of the GDP calculation.
- The indirect impact: the economic effect supported in the supply chains of those businesses.
- The induced impact: the effect

of the spending by people employed directly and indirectly in manufacturing.

The first gives us the relatively familiar numbers; nine per cent of GDP and 2.6m jobs (still bigger than the UK's financial services sector). However, the second and third elements give us real food for thought. Including the indirect impact, manufacturing accounts for 15 per cent of the UK economy and over 5m jobs. When we incorporate the induced impact, the figures rise still further to 23 per cent and 7m jobs.

Those last two sets of numbers give a truer picture of the importance of manufacturing to the UK economy than the first. The reasons are clear: over the last 40 years, the economy has become increasingly diverse, and activities that used to be done within vertically integrated companies – in areas as different as logistics and catering – are now done by partners. There are also companies, from design houses to accountancy practices, whose activity, or at least a large part of it, is predicated on serving manufacturing businesses. That output and those jobs are not normally considered as manufacturing, but they would not exist if there was no manufacturing. Not to see them as such is to miss half the picture.

The induced impacts are also vital to understanding the full picture of the sector. If manufacturing disappeared overnight, it would leave a huge hole in the economy as the wages of manufacturers disappeared. Over time, other industries might substitute for manufacturing, but simply buying everything from abroad would not replace the lost wealth that manufacturing creates. It is clear, therefore, that manufacturing remains an essential component of the British economy, and government policy should reflect that. Boosting investment in manufacturing is a great way to turbo-charge the rest of the economy. It has to be at the heart of a serious industrial strategy.

You can read the whole paper at www.mta.org.uk/policy/recommendations

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The Manufacturing Technologies Association

Creating the manufacturing centres of the future

As an island nation, ports have a major role to play in shaping the UK's manufacturing landscape, writes **David Leighton**, group head of corporate affairs at Associated British Ports



As an island nation, ports remain the key link connecting UK manufacturing to global markets. Even today, ports handle some 95 per cent of the nation's trade in goods. That's why the future success of British manufacturing depends on our ports. And it's not just because ports facilitate trade, it's because ports can become the manufacturing centres of the future.

Every year ABP's network of 21 ports around Britain handles £150bn of trade, contributing £7.5bn to the economy and supporting 119,000 jobs. Our ports include the Port of Southampton, the UK's number one export port, exporting goods worth £40bn. Some £36bn of those exports is destined for countries outside the EU. The port is the UK's number one automotive port and last year handled around 876,000 vehicles on behalf of leading manufacturers such as Jaguar

Land Rover, Bentley, Honda and BMW Mini, as well as facilitating the import of components to support automotive production. 23,200 jobs in automotive manufacturing depend on the Port of Southampton, including 11,700 in the West Midlands.

Our four ports on the Humber, including the UK's largest port at Immingham, serve a wide range of sectors, ranging from refining to pharmaceuticals to food and beverages. The £75bn of trade handled by our Humber ports is more than the Mersey, Tyne and Tees combined, making the Humber the Northern Powerhouse's premier gateway to trade. Together with other ports on the east coast, the Humber also provides one solution for manufacturers wishing to reduce their exposure to the risk of potential disruption at Dover when the UK leaves the European Union.

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That's why ABP is investing £50m in new equipment and facilities, more than doubling our container handling capacity in Immingham and Hull. The Humber also offers many manufacturers the opportunity to import and export using ports closer to their locations, saving carbon by reducing lorry miles on UK roads and avoiding congestion in the south east.

Immingham is also critical to the operation of British Steel's plant in

ABP's ports handle £150bn of trade a year

Scunthorpe, handling iron ore and coal, and ABP's Port Talbot is the backbone of Tata's steel manufacturing in South Wales. Our other ports in South Wales, including Cardiff and Newport, and a constellation of smaller ports around Britain also serve manufacturers across Britain.

Recognising the key role that ports have in supporting manufacturing, it is clear that making sure ports can develop and grow, and prioritising investment in road and rail links to ports are an important part of achieving the government's desire to boost exports. The current appraisal methodology used by government to determine public investment in infrastructure does not adequately capture this policy objective or the vital economic contribution of trade and exports. Fortunately, this is a problem which can be easily remedied.

The potential of our ports to boost manufacturing is not limited to facilitating trade. Ports themselves can become the manufacturing centres of the future. A number of ports offer large areas of development land adjacent to deep water. Examples include the Humber International Enterprise Park, one of the largest development sites in the UK, and Port Talbot. These are ideal locations for the efficient import of raw materials or components and export of finished products. ABP's joint £310m investment with Siemens in an offshore wind manufacturing facility at Green Port Hull underlines these benefits, but using sites close to deep water can offer significant advantages for any type of manufacturing. That's why ports offer a major opportunity to attract investment in new manufacturing. And the creation of a Free Ports policy can make a vital contribution to realising that potential.

Free Ports (or Free Trade Zones) are designated areas where goods can be imported, products manufactured and re-exported without incurring domestic customs duties or taxes. Consequently, a Free Ports policy can super-charge the ability of ports and the UK to attract global investment in new manufacturing, especially when combined with other existing incentive regimes to create "Super Enterprise Zones". It is estimated that a Free Ports policy in the UK has the potential to create up to 86,000 new jobs. The importance of realising this opportunity is reinforced by the fact that many ports are located in parts of the country with severe socio-economic challenges; 17 of the UK's 30 largest ports are currently located in the bottom quartile of local authorities when ranked by the Office of National Statistics' Index of Multiple Deprivation.

Boosting manufacturing and increasing exports is key to the UK's future prosperity. But achieving that ambition depends on backing the nation's ports.

Man and machine: collaborative manufacturing



“Cobots” are filling factory floors. Should their human colleagues view them as a threat or an asset? Rohan Banerjee investigates

A collaborative robot, or “cobot”, is the umbrella term used to describe a machine designed to work alongside humans. Most commonly, cobots are used in the manufacturing sector as programmable arm tools to help complete the more mundane and repetitive tasks on an assembly line. More mobile than traditional robotic units, which are often static, bolted to the floor or protected by cage guards, cobots are usually smaller and can be moved around a factory. They can be mounted onto different surfaces, including the ceiling, and can be programmed to lift, push, pull, cut, open, seal and draw on different materials or objects.

“While cobots ultimately still require a human to tell them what to do,” explains Adam Kushner, chief executive of robotics distributor Robots of London, “once they have been programmed to

complete a task, they are able to repeat that task over and over again, at the same pace and with very little supervision or margin for error.”

Presently, cobots are used most widely in car manufacturing. At Ford’s Fiesta factory in Cologne in Germany, cobots work side by side with 4,000 human factory workers, assisting them with fitting heavy shock absorbers to wheel arches, attaching doors and applying paint. Cobots are also being used to boost productivity in the food and drink industry, offering manufacturers a means of automating much of the preparation and packaging processes. Atria, a manufacturer of vegetarian and meat substitute food products in Finland, started using cobots made by Danish company Universal Robots (UR) last year, to speed up their production line. As the cobots could be reprogrammed, they could pack different



“A cobot doesn’t need to take a lunch break”

SHUTTERSTOCK/ALEXANDERTOLSTYKH

types or different shapes of food, far more quickly than a human. Minimising production downtime is a key factor for food manufacturers and the use of cobots, according to a report from UR, meant that “packaging for different products, which usually took Atria six hours, was reduced to 20 minutes.”

Kushner’s company, Robots of London, distributes various cobot models on behalf of international robot manufacturers, and also programmes these to specification for different clients. One model, Panda by Franka Emika, is a robotic arm with nimble fingers that can be “trained by demonstration” to assemble or package small and intricate items. Kushner says: “The arm and hand can be guided to carry out a task and it ‘records’ what it’s been shown on its own hard drive, so it can do it again. The arm can work in close proximity to or in direct contact with humans,

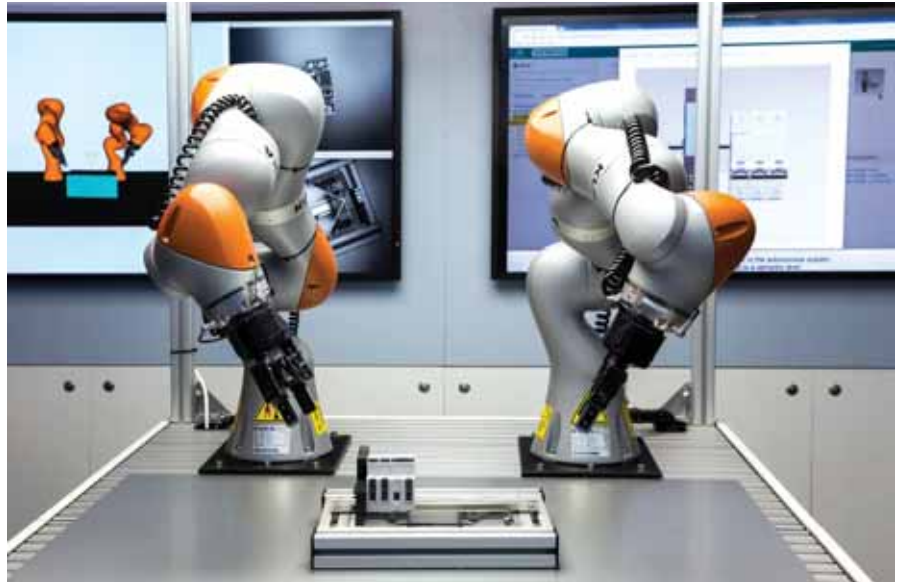
without requiring any safety measures. All of the motors and wiring are internal and unexposed. That means you don’t need caging around cobots and you save money and floor space from the start. Cobots are easy to programme and can be factory trained by existing staff, as they do not require written code, allowing full focus to remain solely on production.”

For Kushner, cobots are a “sort of phased automation”. While he acknowledges that some tasks, “at least for now”, remain beyond the capabilities of robots, he views cobots as a way of “automating what can be automated”. He adds: “Obviously a robot or cobot doesn’t have a sense of touch. So when you have an instance where something doesn’t quite slot into place perfectly, and you have to fiddle around a bit or mould something into place, then you’re going to need a human for that. But what the cobot can do is automate certain aspects of the production line, which means that you’ll need fewer humans along it, and the ones you do have will not need to do as much, because the cobot will have taken some of the preparation or heavy lifting out of the equation. It could be that the cobot does most of the work and then the human just finishes it off at the end.”

Enthusiastic about the uptake of cobots, Kushner speculates that one cobot arm on the production line could equate to “having three human staff”. He says that cobots, which typically retail at a price between £17,000 and £24,000 per unit, have a “clear advantage in that they won’t slow down over time and can work continuously”. If one human works a shift lasting eight hours, Kushner continues, “then by the fifth or sixth hour, he or she is going to get tired. The cobot, in contrast, could work solidly for three shifts in a row and wouldn’t need to take a lunch break.” The “one-off” cost of a cobot, Kushner points out, is around the same as paying one human factory floor worker’s annual salary, with the “added advantage you don’t have to worry about the cobot taking a holiday or arguing with co-workers.”

But while cobots may offset some

“Jobs on the factory floor are likely to be replaced”



workplace politics, the wider politics around automation persists. Are people a price that companies are prepared to pay for productivity? If a cobot can effectively substitute three people on the production line, the extent to which these machines actually collaborate with humans, appears limited. Kushner admits that the “reality of cobots will mean that a number of jobs on the factory floor are likely to be replaced”, but counters with the idea that “those people can be redistributed towards other aspects of the company”. If cost cutting is the main motivation behind cobot uptake, though, a reasonable response to that argument might be to ask why they would.

Compared to other European countries, the United Kingdom has not embraced robotics en masse. According to a report by the International Federation of Robotics, in 2017 Germany could count 309 robots per 10,000 workers. In the UK, this figure stood at 71, below the global average. Kushner, however, believes that “the tide is turning” and that UK manufacturers will soon “realise what cobots have to offer”.

And there is some evidence to suggest that his idea of redistributing workers is not a total fantasy. The Danish company Trelleborg Sealing Solutions, another client of UR, which makes adhesives

for vehicles, installed 42 cobots over a period of 18 months. In that time, the company logged a reduction in costs while productivity increased. Trelleborg also reported an improvement in quality, with a far greater uniformity of product. And with increased productivity and quality, order numbers surged – to the point that 50 new jobs were created, in the company’s logistics, marketing and finance departments.

The UK’s decision to leave the European Union, meanwhile, could catalyse the use of cobots in the country’s manufacturing sector. As the terms of any potential Brexit deal are expected to reduce the access to migrant workers from the EU, Kushner says: “I can imagine that cobots will be brought in to pick up the slack.”

Automation, ultimately, is theming the future of manufacturing in the UK and elsewhere. Kushner, a champion for this change, believes that cobots can “open up the market” and “help smaller businesses upscale without having to pay lots of people”. While they will replace jobs on the factory floor, he argues, “it’s possible that cobots’ own production, engineering and maintenance will create jobs as well.” After all, he asks, “isn’t that what happened with the computer revolution anyway?”

Offering a helping hand to UK manufacturing

Tim Warrington,
CEO of
Bots.co.uk,
discusses the
advantages of
cobots and the
politics of
automation

What are the advantages of using “cobots” for manufacturers?

Collaborative robots are a sure-fire way to boost manufacturers' speed and productivity. Where humans tire and slow down over time, a cobot can work continuously and with minimal supervision. As an example, if you've got an assembly line in which a human is taking 40 minutes to fit a car bumper, with a cobot you're looking at reducing that time to about ten minutes. That frees the human up to do other tasks, all the while increasing the total number of bumpers fitted.

Cobots can be programmed with software to monitor their performance. So in addition to performing a task to spec, by recording its output, the cobot can actually provide its own logistics report. That sort of data is hugely valuable to any manufacturer. A cobot can also be a great guarantor of quality control – how well it performs doesn't suffer from fatigue and maintaining a uniformity of product is great for setting a company's standard.

Can automation help to plug the labour gap that could be left by Brexit?

Automation represents one of the key themes of Industry 4.0. Strangely, for a country with such a long history of manufacturing, the UK has fallen behind its European competitors in the uptake of robotics. However, I think Brexit, which is likely to limit the UK's access to workers, could signify a step change. Cobots represent not only a capable substitute – one cobot unit could replace

three people on the factory floor – but they are a good opportunity for smaller businesses to continue to upscale during trying times.

What role can Bots.co.uk play in making sure that the UK is better prepared for Industry 4.0?

One of the biggest barriers to the uptake of automation is a lack of understanding. People are scared of automation without realising how much it could help their business. But the idea that robots are a force for dystopia is both lazy and inaccurate. At Bots.co.uk we offer a proof of concept to any potential client before any money has changed hands. We help companies to understand what aspects of their business can be automated and we'll present it to them on a trial basis and talk them through it. We aim to minimise risks and, in turn, improve perceptions of robots.

By allowing customers to rent our models on a trial basis, we are helping them to make more informed decisions about the future of their manufacturing process. Bots.co.uk has a highly qualified team that can adapt units to complete a variety of complex tasks. We are an accessible company, dedicated to an end-to-end service, and we will not charge a penny until we are confident that our robot can complete the task the client wants it to.

What puts Bots.co.uk ahead of the curve in robotics?

The flexible hiring service – we offer some cobot models to be rented for as little as £2.70 per hour – means that we can help to improve accessibility to automation. By helping smaller manufacturers to grow, we are in turn growing the market through competition.

We also offer training to humans working with cobots so that we can help them make the most of their new colleagues, and will complete our programmes not only to spec, but on-site. Bots.co.uk offers a personalised, bespoke service that is unwaveringly low-risk yet high-quality.

IN ASSOCIATION WITH



Digitisation and the power of data

Companies that fail to adapt to the new data-driven industry trends risk being left behind by their competitors, warns **Asim Majid**, CCO of Smartia

IN ASSOCIATION WITH



A plethora of buzzwords have clouded the topic of industrial digital transformation for a number of years. Acronyms such as 4IR (Fourth Industrial Revolution), IOT (Internet of Things) AR and VR (Augmented & Virtual Reality) and phrases like Industry 4.0, Big Data, Digital Twin, Smart Factory and Connected Assets only manage to complicate matters. But these digital developments should not be overlooked.

By embracing the digital transformation of industry your company can gain a huge advantage over its competitors. These digital developments are fuelled by data which, once processed, can provide insight and give you the ability to understand the performance of each aspect of your business in precise detail. Data has the power to tell you how an asset is performing, how efficient the production process is or how many customers are reporting failures in your products. This type of information allows you to make informed decisions that are critical to the health of your business.

Digitisation is seen as the Fourth Industrial Revolution. In order to gain a deeper understanding of your business and avoid being left behind, technologies that generate data (sensors, connected assets), collect data (Big Data, IOT platforms) and store and manage data (Databases, Data Lakes) should be implemented. Decision-making tools, Artificial Intelligence and digital representations (through Augmented Reality or Virtual Reality) can apply the data to practical situations. This in turn will bring several benefits such as cost savings, increased productivity, new

revenue streams, reduction in waste and an increase in product quality.

Despite the many incentives, companies have been reluctant to take the plunge into digital. There are a number of reasons for this. The most common ones are a lack of understanding of the subject, not having digital skills or experience in-house, being unable to collect and store data or being put off by the levels of initial investment.

These are but a few examples and there are many publicly available testimonials that show both the successes and failures of adopting digital transformation technologies. However, each example is specific to that company, their circumstances and how it was implemented. Transforming your company for these digital developments requires a culture change within the organisation and a different way of working.

So how can we avoid some of these pitfalls and learn from some of the mistakes that have occurred in the past? The answer to this is to work with a team that has the knowhow and experience of these technologies combined with years of working in the manufacturing and engineering industries. Smartia was set up to help support companies explore and adopt digital transformation technologies

Technology is key to cost savings

by starting with well-defined proof of concept projects.

By seeing the returns on investment for each project, we can then start to scale up at a pace that minimises disruption and risk to the organisation. Through our customised services and Insight™ (our AI data platform technology) Smartia can help companies implement these data driven improvements which deliver tangible benefits to the industrial process.

For more information, please visit:
www.smartia.tech

“The robot revolution will create jobs, not destroy them”

The manufacturing sector is not, as some might suggest, on the verge of becoming a post-human operation. The machine age of automated assembly lines is still very much human-shaped and designed with people in mind. As an increasing number of routine, repetitive tasks are taken over by machines, the opportunity for manufacturers to redistribute their workforces should not be understated.

According to a report by the *Harvard Business Review*, in Germany, where manufacturers deploy three times more robots than in the United States, there are still twice as many people employed by the country’s manufacturing sector as a whole. Robots themselves present job opportunities in programming, construction, maintenance and sales, while scaled-up productivity – the core aim of automation – can lead to expansion of manufacturers’ logistics and finance departments in order to cover increased supply and demand, not to mention greater revenue streams.

The Fourth Industrial Revolution does not necessitate an either-or choice between robots and humans. Rather, the objective is to combine artificial intelligence with human intelligence to bring about manufacturing processes that are fast, efficient and well integrated. While machines have the ability to work faster than any human ever could, and do not suffer from fatigue or boredom, humans are still unbeatable at seeing patterns, understanding data, and making judgment calls on product quality.

Automation in the UK has not caught on as quickly as it has on the continent.



The Fourth Industrial Revolution is something to be embraced, not feared, according to Rohan Banerjee

A study by the International Federation of Robotics found that while in Germany there are 309 robots on average per 10,000 workers, in the UK this figure is just 71, below the global average. If the UK is to reap the full benefits that automation can bring – higher salaries and living standards tend to stem from a boost in productivity – then it must review its hesitance towards robots. We should reflect, as well, on the UK’s problems with poor management practices, unsafe working conditions and low wages, from which automation could also provide some respite.

Still, the need to invest in humans is at least as pressing as the need to invest in new technologies to boost productivity. The reformation of the factory floor must be mirrored by large-scale retraining programmes, and the role of government is crucial in making this happen. There is a social responsibility to ensure that the Fourth Industrial Revolution is accessible to anyone willing to learn. Delivered effectively, it could open up even more new jobs through emerging markets. Consider that for smaller manufacturers, automation may actually offer the means to be more competitive. Where overheads can be slashed, there is the opportunity to upscale at a lower cost.

Ultimately, automation represents countless new opportunities for the manufacturing industry, and will in all likelihood create more jobs than it replaces. The computer revolution led to job losses, but it also led to the creation of a £170bn industry that employs more than 1.6m people. And what would you rather be, a print-setter or a game designer?



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