

# FUTURE OF MANUFACTURING

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# FUTURE OF MANUFACTURING

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**RACONTEUR**

PUBLISHING MANAGER  
**Richard Hadler**

PRODUCTION EDITOR  
**Benjamin Chiou**

MANAGING EDITOR  
**Peter Archer**

HEAD OF PRODUCTION  
**Natalia Rosek**

DIGITAL CONTENT MANAGER  
**Jessica McGreal**

DESIGN  
**Samuele Motta**  
**Grant Chapman**  
**Kellie Jerrard**

**CONTRIBUTORS**

**RICHARD AUCOCK**  
Award-winning journalist and former chairman of the Guild of Motoring Writers, he is managing director of Motoring Research.

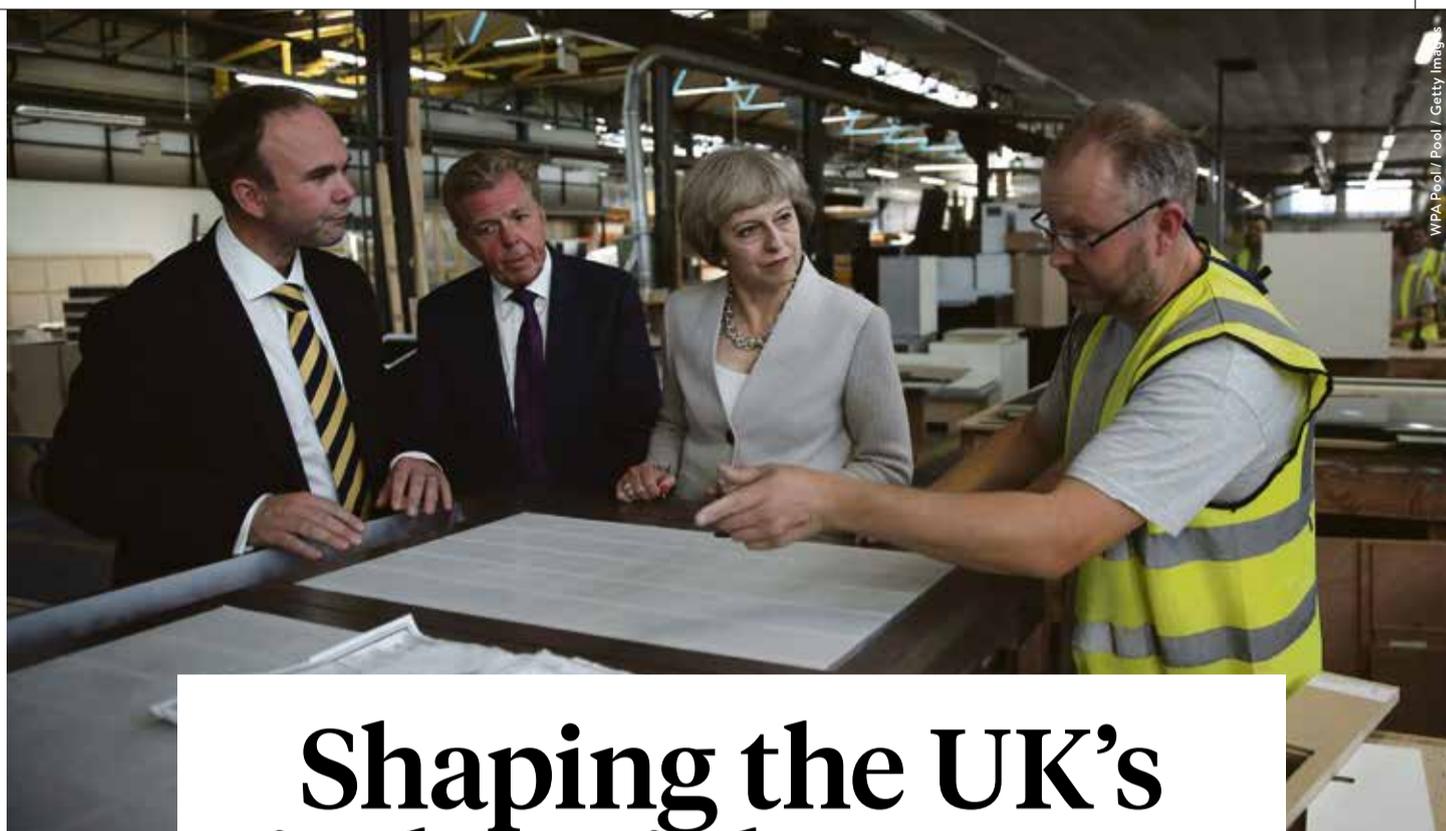
**ALISON COLEMAN**  
Writer and editor, she is a contributor to *Forbes*, *The Guardian*, *Director*, *Economia* and *Employee Benefits*.

**JAMES HURLEY**  
Enterprise editor at *The Times* and award-winning journalist, he was formerly enterprise editor with the Telegraph Media Group.

**PETER MARSH**  
Author of *The New Industrial Revolution: Consumers, Globalization and the End of Mass Production*, he was formerly manufacturing editor at the *Financial Times*.

**CHARLES ORTON-JONES**  
Award-winning journalist, he was editor-at-large of *LondonLovesBusiness.com* and editor of *EuroBusiness*.

**WILL STIRLING**  
Managing editor of *The Manufacturer* and *Lean Management Journal*, he has also worked for Euromoney and IPC Media.



# Shaping the UK's industrial strategy

Fresh efforts to stimulate manufacturing post-Brexit could help narrow the trade gap and relocate overseas production facilities in the UK

**OVERVIEW**  
PETER MARSH

While UK political life will be dominated for the foreseeable future by Brexit, not far behind in terms of attention will be industrial strategy. Theresa May set the wheels in motion with the announcement that the UK is to have a "proper industrial strategy to get the whole economy firing".

Civil servants in the newly created Department for Business, Energy and Industrial Strategy are expected to spend the next six months adding detail to the prime minister's vision.

The new policy thrust could set the stage for a fresh effort to stimulate manufacturing, which even though it accounts for only about 10 per cent of total UK output plays a disproportionate role in spreading wealth, skills and technological ideas throughout the economy. Accordingly the strategy is expected to include a package of measures to boost manufacturing covering areas such as skills, finance, general manufacturing awareness and import substitution.

Mrs May's push for an industrial strategy is likely to take the government further than the moves in this direction during 2010-15. The then-business secretary, Vince (now Sir Vince) Cable, was responsible for several key initiatives, but with muted support from the rest of the government.

In 2013 he set out his thinking on why stronger connections between government and industry were important. "A stronger economy won't be built overnight. It won't simply emerge of its own volition. It will come from long-term thinking and the gov-

ernment working in partnership with business," he said. "Our industrial strategy is... strengthening manufacturing supply chains, supporting new designs and developing skills."

But the Liberal Democrat's efforts failed to win support throughout the Conservative-led coalition. Following the Liberal Democrats' removal from government after the 2015 general election, the idea of an industrial strategy faded away, only to return unexpectedly following Mrs May's elevation.

Part of the new policy discussions is likely to concern import substitution. Manufactured goods are the biggest component of world trade. The production sector therefore has a big impact on the UK's position in world trade. If the UK is to narrow its enormous trade deficit, which in 2015 stood at £38.6 billion or 2.1 per cent of gross domestic product, it will almost certainly need to increase its manufacturing exports.

The new strategy could include measures to trigger a large increase in "reshoring" of production facilities, in part capitalising on the lower value of sterling and the potential for new technology to make UK-based manufacturing internationally competitive. This would involve selective assistance to businesses that had a strong competitive position in certain areas of manufacturing, for instance in car components or specialised electron-

ics, and where a boost to UK production would lead to lower imports.

Assuming Brexit happens, the UK will have more freedom to aid companies following such a course of action as the government will no longer have to comply with European Union rules limiting state aid.

Other measures that the new strategy could set in train are policies to boost skills useful to manufacturing, including engineering and design, and fiscal initiatives to increase the incentives for investors supporting new ventures.

Also important could be promotional efforts to raise awareness about new forms of manufacturing, some way from the traditional forms factories of the sort that most people in the UK know about, that Britain could benefit from.

One example could be production of new sorts of medicines and diagnostic kits created from a combination of genetic engineering, automated machinery and the engineering of specialised reactor vessels.

A key part of the new strategy would be an assessment of where the UK excels in manufacturing and where it lags behind. The former are the areas where government action could have the biggest impact. There would be no need to spend large sums on government handouts. A lot could be achieved through general promotion, a modest tweaking of

policies in fields such as training and research and development support, and targeted tax incentives.

Areas in which the UK already has a competitive advantage include industrial biotechnology, low-carbon car engines, high-value food processing, niche areas of clothing, scientific instruments, specialised medical devices and customised electronics.

There is an obvious link between industrial growth sectors and innovation and technology. Support for innovation would be likely to be a solid part of the industrial strategy. Room could be found in the industrial strategy for at least one big technology demonstration project. It could be financed jointly by the government and private interests.

A good candidate could be based on the concept of "massively digitised manufacturing". This is sometimes referred to as being part of Industry 4.0 or the industrial internet, the so-called internet of things.

In a town or city, engineers could create networks of thousands if not millions of sensors monitoring everything from air pollution to pedestrian accidents. Such machine-to-machine linkages could also supervise and control energy use. The sensors in these networks could be placed in public infrastructure – roadside lights or park benches – and also inside private buildings. Companies working on such a project would include businesses making a variety of connected pieces of hardware as well as those creating new sensors and software. It would be a convincing way of showing UK industrial strategy has practical purpose.

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## BREXIT

JAMES HURLEY

Any manufacturers who feared an economic meltdown in the immediate aftermath of Britain's vote to leave the European Union must have taken comfort from recent economic data.

September's *Purchasing Managers' Index* (PMI) figures saw factory activity grow at its fastest pace in more than two years, as the weakness of post-Brexit sterling helped industry towards its best quarter of growth of 2016.

Mec Com, a mid-sized business which provides services including sheet metal fabrication and electro-mechanical assembly, is among the manufacturing businesses enjoying a surprise post-Brexit upswing.

Richard Bunce, managing director of the Stafford-based company, estimates sales are about 12 per cent up since June's referendum, mostly driven by new export deals.

"We have secured about £2 million of new business," says Mr Bunce. "I'm not sure what we all expected the morning after the night before [in June]. So far, I can only report growth across all areas of the business, and we hope and plan for this [to continue]."

Those who argue the forecasts that Brexit would spell economic doom were overstated have seized upon the PMI data, which also showed manufacturers taking on additional staff to cope with higher demand.

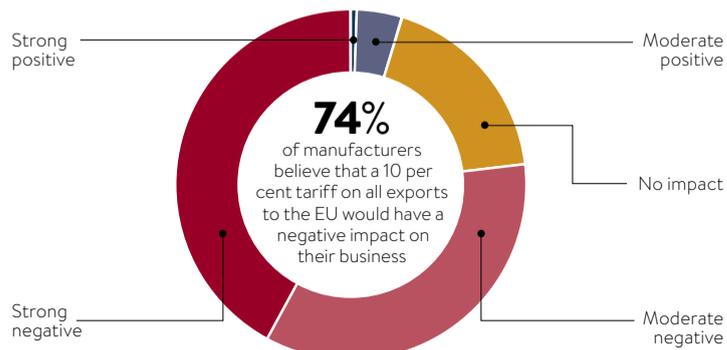
It is evidence, they say, that the marked decline in sterling is an overdue devaluation that could help rebalance the British economy away from a reliance on imports and consumption towards production and international trade.

"After an expected few weeks of decision-making stasis, caused by the reaction of the markets to Brexit, the real economy has largely returned to business as usual," says John Longworth, former boss of the British Chambers of Commerce, who left the role to campaign for Brexit.

"The rebasing of the value of sterling... is a massive opportunity for UK manufacturing and this part of the economy should make hay while the sun shines."

## CONCERNS OVER EU TARIFFS

What effect would a 10 per cent tariff on all exports to the EU have on UK manufacturers?



Source: EEF 2016



Nissan's decision to build its new Qashqai and X-Trail models in Sunderland safeguards more than 7,000 jobs

Bloomberg/Getty Images

# UK makers march on despite Brexit...

The real test for manufacturers is not the change that Brexit brings, but how they respond to the change

Mr Longworth argues that previous falls in sterling had not been capitalised on because they were short term in nature.

"This time it will last, so it should have a positive impact domestically through import substitution and through reshoring, which is happening anyway because of quality and lead-time issues, and by boosting exports.

"Most countries are secretly trying to devalue [through] competitive devaluation and the UK has been given a golden, free gift."

Yet even for factories enjoying something of a mini post-Brexit boom, the mood is one of uncertainty. Fears over access to international workers, Europe's single market and external investment are among the looming dark clouds.

Recent talk of a "hard Brexit" may have helped some exporting manufacturers in the form of a further slump in the value of the pound, but it was additional cause for concern for the EEF, the manufacturing employers' organisation.

A recent EEF report warns against rushing through a "clumsy" Brexit plan that could do lasting damage to manufacturers. The EEF says it is "critical" that the Brexit negotiations deliver unrestricted access to the single market. It points out that more than eight in ten manufacturers (84 per cent) export to the EU.

The hard line coming from the May government is renewing fears that access to vital European customers and skills will be compromised.

In the event no trade deal with the EU can be agreed, the EEF says that the fallback option of using World Trade Organization (WTO) rules to govern exports could prove costly.

While the EU would not be able to impose discriminatory or punitive tariffs after a UK exit due to WTO rules, the EEF says new tariffs would still be imposed on around 90 per cent by value of the UK's goods exports to the EU, which could make UK exports less price competitive.

The group warned that three quarters of the 500 companies it surveyed in August said a 10 per cent tariff on exports to the EU would have a negative impact on their business.

Anxiety grew when Nissan suggested Brexit had given it pause for thought on whether or not to produce the next model in its all-conquering Qashqai range in Sunderland.

The Wearside Nissan factory is one of the region's biggest employers and of critical importance to the manufacturing supply chain. The car manufacturer's decision to stay in Sunderland, announced



**73%**  
of UK manufacturers see the advantage of having one set of trading rules and regulations in Europe

Source: EEF 2015



The hard line coming from the May government is renewing fears that access to vital European customers and skills will be compromised

at the end of October, represents a major corporate endorsement for post-Brexit Britain.

With 80 per cent of the cars produced in Sunderland sold overseas, uncertainty over possible trade tariffs was of particular importance to Nissan.

Following a pledge of a package of support from the government, the car maker has decided to stay put, but bosses of smaller manufacturers across the UK are weighing up similar concerns.

Brandauer is a 154-year-old pressing and stamping business. It is one of the largest of its kind in Europe, making precision metal components for international customers involved in the automotive, construction, green technologies and medical sectors.

It might appear to be a prime candidate to benefit from the collapse in sterling, but things are not quite that straightforward for the Birmingham-based business.

"We have requoted all recent euro and dollar opportunities, and these [lower] prices have started to raise eyebrows, but [we have had] no firm decisions in our favour as of yet," says Rowan Crozier, chief executive.

Instead, despite being a proud exporter sending 70 per cent of its produce abroad, the company is in fact concerned about any further decline in the weakened pound.

"There is genuine concern around the long-term increase of raw material costs and there are already the first murmurings of threats from eurozone suppliers of future price increases," he says.

There are also fears about the ability to hire skilled staff from Europe. "The single market and movement of skilled labour are absolutely vital for UK business. Will they be delivered to the satisfaction of all interested parties? No, I can't see it I'm afraid," says Mr Crozier.

"We employ... people from countries such as France, Estonia and Romania. Of course, we try and employ locally where we can, but sometimes there just isn't the skill base available, and these guys and girls come over and bring real passion, commitment and skill to our business.

"When I talk to them they are feeling a little concerned, driven by the lack of certainty around a government plan. I can't help but feel the plan is too vague currently."



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## COMMERCIAL FEATURE

## KEEPING CUSTOMERS WITH ADDED SERVICE

**Antony Bourne**, global manufacturing industry director at leading enterprise software solution provider IFS, says UK manufacturers' best option for boosting business lies with servitisation

Much is riding on the UK's manufacturing sector, the ninth largest in the world, and a pillar of the nation's economic prosperity. But manufacturers are facing pressures on an unprecedented scale, not least from the relentless threat of overseas competition.

In a fiercely competitive global market, UK manufacturers are seeing their product margins being constantly squeezed. With many products becoming commoditised, they are looking for opportunities to differentiate themselves.

Servitisation, the transformation journey through which they can develop the capabilities they need to provide the services and solutions that supplement their traditional product offerings, is one way they can do this.

We have already seen the likes of Rolls-Royce, Xerox and JCB facing this situation, reaching the end of the current line in terms of what they can offer and embarking on a servitisation journey. A survey carried out at an IFS worldwide customer conference last year revealed that two-thirds of the companies in attendance were offering services as part of their offering. And they are seeing the light at the end of the tunnel.

However, transitioning from making a product to selling the capability of that product is not easy. At a basic level, servitisation goes beyond simply producing spare parts and consumables, with manufacturers offering scheduled maintenance tasks every quarter, or product repair or upgrade services.

At the highest and most effective level of servitisation, manufacturers are entering into formal contracts



with their customers, forging much closer relationships, and sharing the risk and the revenue with them. At this level, manufacturers need to understand what their customers want to achieve and sell them the capability which enables them to do that. By providing their customers with this level of service, they are ensuring customers do not look at the competition. They are effectively trying to lock them in.

For many manufacturers their servitisation journey will require

**ABOVE RIGHT**  
Antony Bourne  
Global  
manufacturing  
industry director  
IFS

significant organisational change. For example, they may not have the best service organisation set up already. There may also be new regulations, new compliances, a need to invest in new equipment and technology in order to go out and service existing equipment. Some will need to create new departments and recruit new people, one of the biggest challenges for manufacturing today.

It has become increasingly difficult to recruit the right people into the right jobs and one of the underlying reasons for this is branding. Manufacturing needs to be rebranded to reflect the modern industry. Automation is helping companies to improve the efficiency of their manufacturing operations, but they need to attract talented people with analytical minds who can work with and interpret data – people who can innovate.

Manufacturers also need to recognise that in making the transition to servitisation it will take them longer to win new customers. They are no longer selling a piece of product they are selling the fact it can improve their customer's efficiency by x per cent. It is a different type of selling, more a solution sell than a product sell, which requires a different approach and many will find it a challenge.

However, it is one they will have to overcome if they are to survive in an increasingly competitive global market, as one manufacturing customer of IFS, an electronics hardware producer, has discovered. Forecasts have shown that within six years their hardware sales will start to decrease and will never increase again. From a business point of view, how do they ensure they'll still be around in five or ten years' time? They have gone down the route of adding software which helps their customers control and manage the hardware, and that's where they see their future revenue growth and new business opportunities.

Manufacturers cannot make this change overnight. Before they can embark on their servitisation journey they need to know what options are available to help them achieve it and where to start. The relevant processes must be in place to deliver on the

“  
Because UK manufacturers won't be able to compete on price, they have to compete on service or capability rather than on actual commodity



servitisation model, for example they need an enterprise solution that can handle what they are delivering to customers, the ability to record and control the type of service they are offering, and to schedule people, including sub-contractors, to perform jobs in the field.

This is where IFS is playing a pivotal role. As a provider of enterprise software, IFS works with manufacturers to help them design, make and sell. With fully integrated asset management field service contract capabilities, their customers know what equipment they've sold, how and when they are going to maintain it, and how to optimise the capability of the service they are offering to their customers.

IFS enables more effective through-life asset management, showing customers what and where something is happening within the production, supply and service life cycle – helping manufactures guarantee the end-goal for their customers who, in turn, have the reassurance they are effectively in it together.

If we are going to ensure the longevity of the UK's manufacturing industry, we need to add uniqueness or increase competitiveness and this is where servitisation really comes into play. And it is something that manufacturers will have to do. Because they won't be able to continue to compete on price, they have to compete on service or capability rather than on actual commodity. Their rewards will be more predictable revenue streams and greater stability, knowing there are no surprises around the corner.

Servitisation allows them to see what will happen next month, next quarter, next year – and it has to be the way forward for UK manufacturing.

For more information please visit [www.ifsworld.com/times](http://www.ifsworld.com/times)



## COMMERCIAL FEATURE

# THE BEST OF BOTH WORLDS: MASS CUSTOMISATION WITH LEAN INVENTORY

*The growing demand for customisation and the increasing need to reduce inventory are pulling manufacturers in two very different directions. But, by using big data analytics correctly, smart companies can ride both trends*



“Any customer can have a car painted any colour that he wants so long as it is black,” Henry Ford famously said. The great industrialist would be shocked by today’s demand from consumers for personalised products and services.

A survey conducted last year for Deloitte revealed that around two-thirds of those asked were aware of the possibility of customising products such as clothing (64 per cent), furniture (63 per cent) and fashion accessories (61 per cent) while the figure for footwear was 56 per cent.

Mass customisation is putting huge pressure on supply chains as companies work to ensure they can offer customers sufficient permutations of a particular product and a variety of delivery options. Meanwhile, firms in all sectors are also looking to reduce inventory to avoid tying up capital in stock.

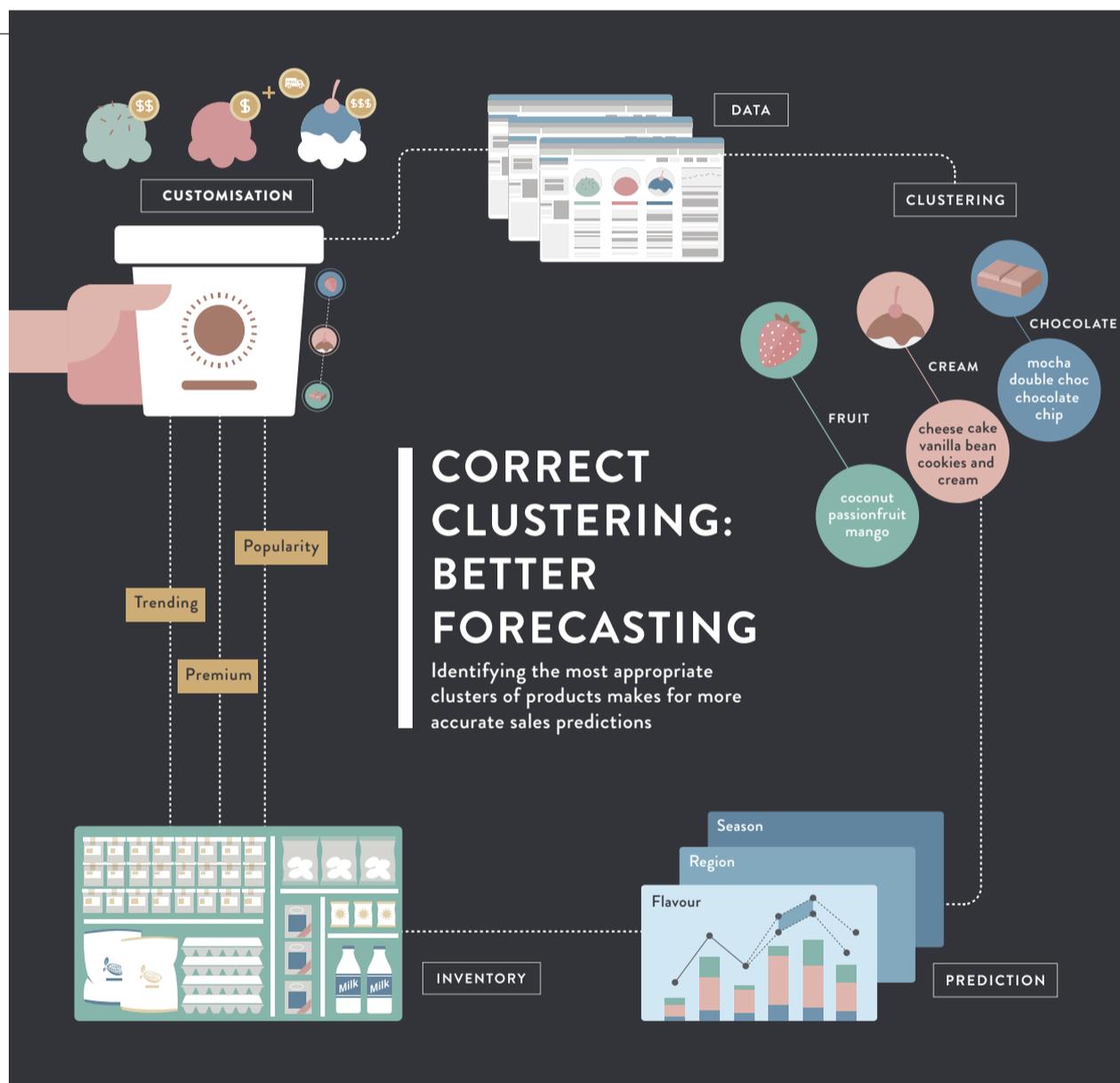
It’s a dichotomy that Sara Gifford, chief solutions officer at Quintiq, a leading provider of supply chain planning and optimisation software, sees first hand.

“Food and beverage manufacturers are particularly affected at the moment,” she says. “Take brewing. Some of the big household names in beer have acquired new microbreweries. The microbrewery market is exploding right now and it’s highly profitable, but acquiring a niche brand requires a complete change in the way in which these large companies approach production.

“They aren’t going to give up on their well-established money makers, so they have to work out how to add into their production suites much smaller rounds of a specialist product.”

For a growing number of manufacturers mass customisation introduces similar complexities as they have to consider how to schedule the different resources that are needed at various points in the production process of a wider range of products.

Option one is to ensure they have what they need by simply increasing the inventory, but this is costly and reduces their ability to respond quickly to changes in the market. The second option involves having minimal parts and accessories ready and waiting for use. This cuts inventory costs, but it reduces the opportunities for customisation as



the product nears completion in its journey along the production line. Stocks are more likely to run out, too, threatening lead times.

Meanwhile, customers are also increasingly demanding and impatient with delivery times.

“The ability to optimise data in real time to change your plans as you react to customer demand is critical as it allows you to drive down inventory, even when offering increased possibilities for customisation,” says Ms Gifford. She points out that following the excitement a few years ago over the emergence of big data, attention is now turning to what can be done with this data.

“Analytics is the key,” she says. “You’ve got those ones and zeros sitting on a machine, but now what do you do with them? Companies

have all of this data drawn from the production process. This might include the way in which various intermediate inventory points flow through their supply chain. With effective analytics you can interrogate your big data and get usable information.”

Quintiq technology can now use big data to identify the precise points during the production cycle at which the manufacturer should be holding inventory ready for use. As a result manufacturers can respond cost effectively to customer demands. And these increasingly accurate forecasts make for an even leaner inventory.

Trying to make predictions from every single product line would be too confusing with too many outcomes and so products should

be grouped. How, though, do you identify the right groups?

“A paint company, for instance, with an industrial and a domestic division might be tempted to create product groups for forecasting purposes along these lines,” says Ms Gifford. “But this allocation might not create the most accurate forecasts. Instead it might be better to divide



The ability to optimise data in real time to change your plans as you react to customer demand is critical as it allows you to drive down inventory, even when offering increased possibilities for customisation

groups into vinyl, matt and metallic or to create clusters of colours such as blues and reds.”

Quintiq technology can identify how best to cluster products and at what level of granularity in order to produce the most accurate forecasts. More accurate forecasting means more efficient inventory management.

Big data analytics can also be used for influencing customers. “Airlines have been doing this for years, but it’s now creeping into manufacturing,” says Ms Gifford. “When I go online to book a flight, the airline will influence my decision about when I fly by the price of the ticket. Factories are starting to do the same thing. You can lead customers into or away from a decision through price or other factors.

“Customers feel that they have personalisation during this process, but subconsciously they’re choosing something because they can get it faster and perhaps cheaper. For instance, I might only really want the silver version of an iPad if I can get it in a few days. If it’ll take three weeks, then I’ll be happy with another colour instead.”

Companies can influence customer behaviour to improve costs in their supply chain. “But you need to be able to respond quickly and that’s where real-time optimisation and just-in-time scheduling come into effect. It can only work if you use this with proper analytics of your big data,” she says.

However, there is considerably less data available from the growing number of these new products driven by increasing customisation than there is with long-standing, best-selling items. The good news is that big data analytics allows manufacturers to start learning from much less data because the software can identify trends earlier than humans can.

“We’re going to see more product customisation based on agile responses to the changing market,” Ms Gifford concludes. “Companies that are able to predict quickly and accurately where the market is going can react equally quickly and accurately to make changes to their supply chain. And that will determine the real winners in this exciting, but challenging, new world of mass customisation married with leaner inventories.”

For more information please visit [www.quintiq.com](http://www.quintiq.com)

# Products at your service is way forward

Manufacturers that service their products after sale or on a rental basis are in the vanguard of a trend which can revitalise the sector

## SERVICE MODEL

CHARLES ORTON-JONES

**W**hy own when you can rent? This question is one of the most intriguing issues of business today. Zipcar offers cars by the hour. Suddenly the concept of buying manufactured hardware seems obsolete. HSS offers tools for hire. Builders get the kit they need when they need it. They avoid blowing big bucks on specialist instruments they might only need once every six months. Businesses today rent everything from diggers, data storage and computing power.

It's more than a niche. The switch from manufacturers selling products in a one-time transaction to a rental service, complete with after-care – a model known as “servitisation” – is the biggest thing to hit manufacturing since the internet.

In fact, the concept pre-dates the web. The likes of Xerox, Rolls-Royce and Alstom have been doing it for more than 20 years. Rolls-Royce began offering aircraft engines as a service, rather than a product, back in 1997. Now almost all their Trent fleet of engines are supplied as part of a complete service package, called TotalCare.

Repairs, maintenance, even complete engine replacement are included in the TotalCare fee. It means aircraft makers and airlines avoid up-front capital expenditure. And the deal guarantees annual recurring revenue for Rolls-Royce.

Medical device manufacturer Stryker has made the transition from product seller to service provider. Hospitals take Stryker's devices on a pay-as-you-go model. The medical devices are connected to the web, so usage can be monitored remotely. Stryker's technical partner Gemalto manages the billing and usage monitoring.

Jamie Longmuir of Gemalto explains the model works particularly well in the United States, where there's a complex interaction between hospitals and the insurance companies which fund treatment. “It means hospitals don't face budget-based uncertainty, rather they can test devices and pay for them on an ongoing monthly basis in a way that aligns with how much they are in turn paid by their patients' insurers,” he says.

Also, the nature of the relationship between vendor and buyer has changed. Under the previous regime, a product would be sold and that was the end of the conversation. Now Stryker is incentivised to offer upgrades and repairs. And both parties learn from the deal.



Mr Longmuir says: “By switching to a software-based business model, Stryker is able to analyse which features the medical institution is using on the medical device and optimise the features in a way that's best suited to them. Previously products were sold by the manufacturer, who would then have no indication of how their device was being used by the customer and, in turn, be unable to offer any additional features.”

In order to monitor usage rates, manufacturers are connecting devices to the internet. Tractor maker John Deere is now a world leader in software and location-based services, which were developed to help customers maximise farm yields. The modern combine harvester is fitted with sensors that track the exact loca-

tion of the vehicle, and can tie-up with sensors on, for example, fertiliser equipment, to monitor nitrogen and potassium levels and cross-reference it with yield data. It's the sort of service usually expected from a big data or software company.

The trend for servitisation is sweeping almost every industry in its path. Even niche sectors are being transformed. HP offers printer ink as a service. Pick one of three plans, occasional, moderate or frequent, and pay a monthly fee. When the printer is low on ink a new cartridge is posted automatically. A review by consumer magazine *Which?* concluded: “If you regularly print colour pages or photos, Instant Ink is likely to work in your favour – and it saves you trips to the shops to buy cartridges.”

The solar power industry has realised the service model makes more sense than selling panels as a one-off deal. Consumers just don't have the cash to pay up-front. Origin Energy offers solar-as-a-service. There's no up-front fee. Consumers switch to Origin and get locked in to an energy fee which is lower than their current average bill. Installation of the solar panels, plus maintenance, is paid for and managed by the supplier.

The IT sector is sold on servitisation. Adobe made the switch in 2012, with the introduction of the Creative Suite subscription for products including Photoshop and Illustrator. Computer-aided design software maker Autodesk has moved to a subscription model. Asif Moghal, UK manufacturing industry manager, reports the move dramatically lowers the traditional cost barriers to entry while providing access to advanced design tools in a highly scalable way. He says: “We believe that's where the industry as a whole is heading, espe-

Rolls-Royce supplies its Trent fleet of engines as part of a complete service package called TotalCare

cially with the advent of speedy internet and unlimited cloud storage.”

At Cranfield University, where manufacturers come to learn the art of servitisation, course director Professor Ian Jennions says companies that ignore the trend will probably go out of business. He's helped the likes of Triumph Motorbikes, Babcock, and train companies all grasp the nuances of servitisation. But not all do. He warns: “Some are like Kodak in the age of digital photography.”

Manufacturers love to talk about innovative products. But the truth is that today the biggest improvement a manufacturer can make is not the product, but the way it's sold.



## SERVITISATION IS A WIN-WIN

Tim Murdoch, director of digital services at Cambridge Consultants, outlines why servitisation is a success.

“Pretty simply, assets work better when properly looked after,” he says. “That tends to get a bit lost in the discussion about innovative new business models. But for those who keep the focus on this primary purpose, the business is there – whichever model they choose.”

“With servitisation the original equipment manufacturers really know about both the state of the asset and how it is being used. This allows them to take some risk in its operation; the

prize they are after is to gain some of the upside of their customer's business. In return, the operator hands off some risk while at the same time hoping for greater utilisation through better maintenance. Both businesses are able to focus on what they are good at. It's a win-win.

“The billing structure is just a way to make this work and is typically a midway house between manufacturer and operator, with an initial capital outlay matching the cost structure of the manufacturer and then an ongoing operational fee matching the income of the operator. Much of this is a

consequence of a much more competitive and dynamic global market, which makes these costs and revenues pretty transparent to all parties.

“The closer the manufacturer gets to their client's business, the more they see opportunities to build better products, often in real time and with deep insight through the vast volumes of data servitisation generates, which added to the competitive nature of their business means quicker product improvement. This means operational data scientists are fast becoming the most valuable part of a manufacturer's design office.”

## PRIMARY MOTIVES OF UK MANUFACTURERS' SERVICE OFFERINGS



Source: Barclays/The Manufacturer/Hennik Research 2016

# Efficiency of production

The Achilles' heel of UK manufacturing is low productivity, but there are strategies to beat the problem that has plagued the sector for far too long

**PRODUCTIVITY**  
ALISON COLEMAN

**M**anufacturing is one of the UK's most important sectors, delivering 10 per cent of national GDP, employing 2.7 million people and widely seen as holding the key to tackling the nation's continuing productivity gap.

While the latest Office for National Statistics figures show a rise in output in the second quarter of this year, the UK still lags behind other major economies, trailing the average of the G7 group by 18 per cent.

Across the sector, opinions are divided on both the causes of the problem and the solutions, which include investing in new technologies, increased automation and more manufacturing apprenticeships. But, in reality, what are companies doing to solve the UK's productivity puzzle?

Having worked with hundreds of manufacturing companies, Asif Moghal, UK manufacturing industry manager at Autodesk, has seen first-hand efforts to make processes more productive. He says: "The problem is that many are focused purely on the shopfloor, bringing in robots and automated billing, and so on, to

save costs and reduce risks. A more effective strategy would be to focus on making the product design and engineering processes more efficient. "One hydraulics manufacturer we work with has created an automated standard design template for its products that can be customised for each client's requirements. With less time wasted going back and forth, and fewer mistakes, they have increased productivity by 40 per cent and revenues by 150 per cent, without increasing headcount."

While new technologies, such as automation and robotics, can undoubtedly increase output, concerns have been raised about the impact their increased presence in the workplace will have on labour relations, and ultimately on the discretionary human effort that drives higher output.

But some firms are finding ways to engage staff in the implementation of new technology. Sign Build, which

creates signage for the UK house building industry, recently invested £500,000 in new technology on its factory floor, purchasing three machines that boost productivity, labour relations and training, as the machinery requires a new level of skill from staff using the equipment.

Director Mark Cowin says: "Investing in new machinery is one small piece of the productivity puzzle. Those involved in the actual performance of a task are more qualified than anyone else in the business to tell you how things actually work, not how it should work. Spending money on new machinery without understanding the difference it will make throughout the whole business is the single worst and most common mistake made. Be wise enough to invest in people as much as plant."

Chronic skills shortages in the UK manufacturing sector have impeded efforts to increase productivity and many consider this issue a top priority with apprenticeships increasingly seen as important.

Antony Bourne, global manufacturing industry director at IFS, says: "While university degrees across core disciplines are still highly beneficial for a career in manufacturing, the on-site experience and skills earned by apprentices now makes them equally

attractive for prospective employers. Manufacturing methods are also adapting so rapidly that on-site skills are often the most highly valued among new recruits."

There are plenty of manufacturing facilities that are mechanically sound but require regular manual intervention and could lift productivity by introducing more modern monitoring and control approaches, typically involving a smaller investment than upgrading an entire facility.

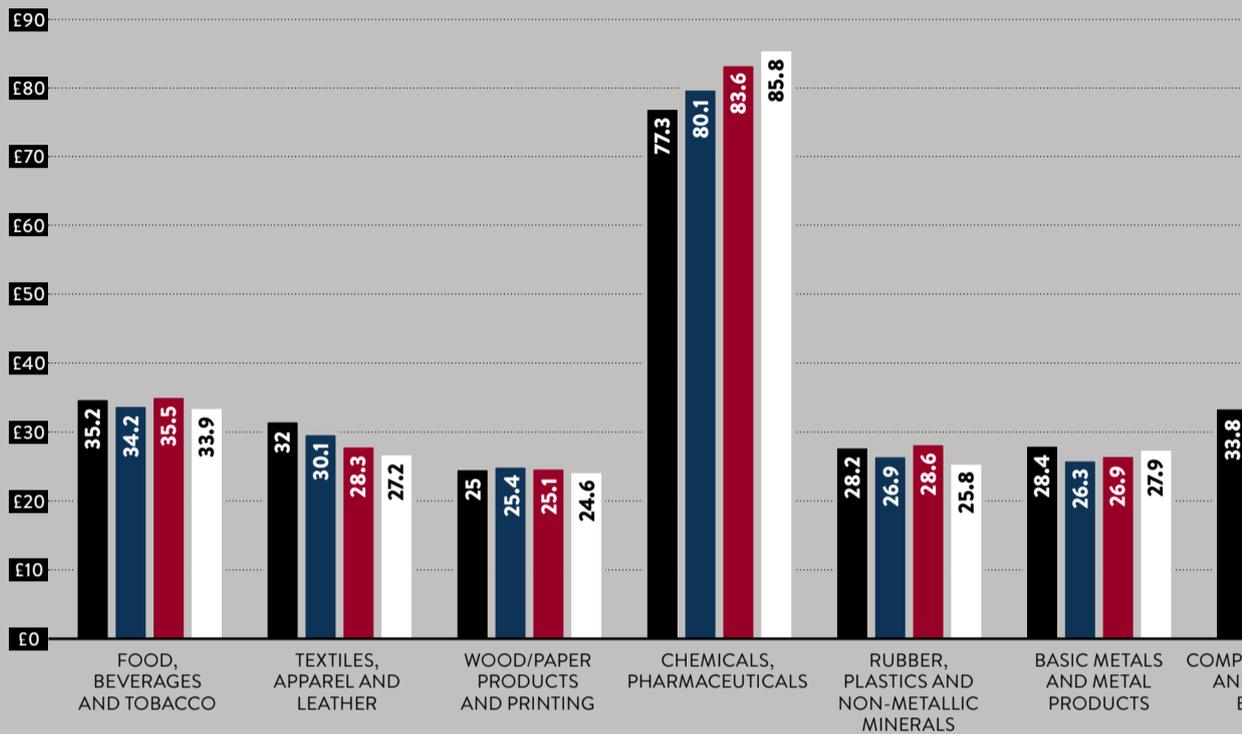
Andrew Strong, manufacturing innovation manager at Cambridge Consultants, explains: "These processes include collecting and analysing manufacturing data to enable continuous process feedback, enabling improved 'end-to-end' process control and greater output, and reduced waste. As manufacturing equipment becomes more complex, condition monitoring and predictive maintenance to detect the onset of machine

“Be wise enough to invest in people as much as plant”

# UK PRODUCTIVITY CHALLENGE

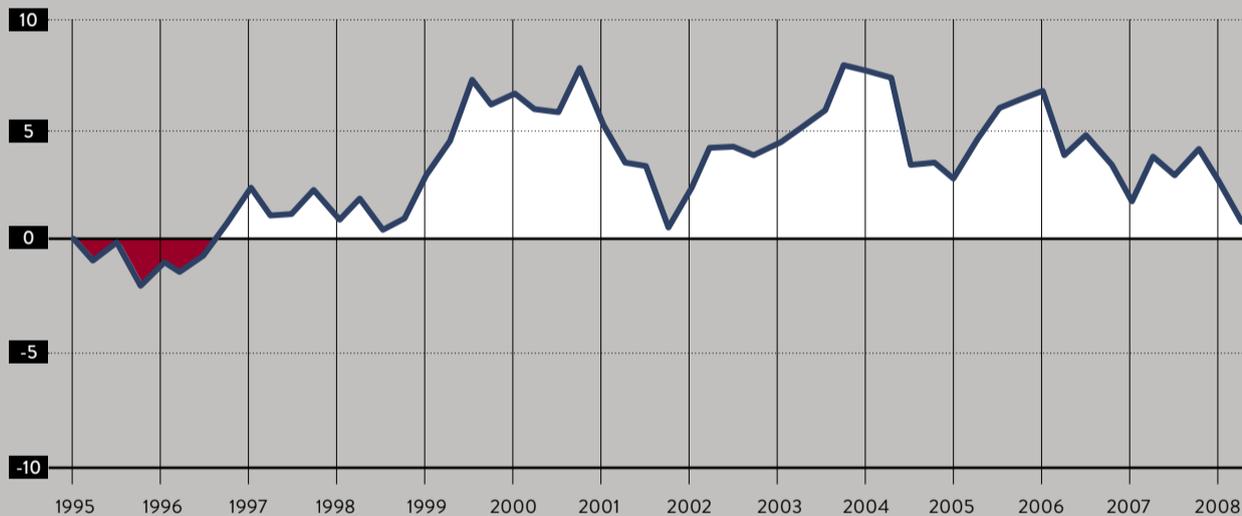
## MANUFACTURING PRODUCTIVITY LEVELS VARY BY INDUSTRY

Annual percentage changes in gross value added per hour worked – a key measure of labour productivity



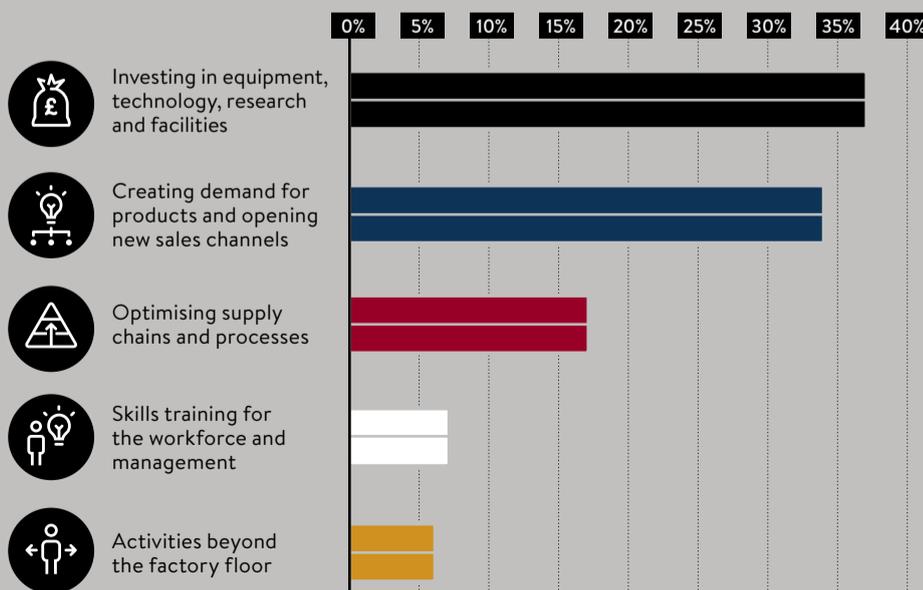
## MANUFACTURING OUTPUT

Annual percentage change in quarterly output per hour



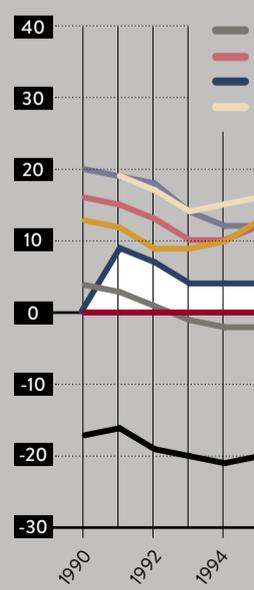
## FACTORS THAT MAKE THE BIGGEST DIFFERENCE TO PRODUCTIVITY

Survey of UK manufacturers



## G7 LABOUR PRODUCTIVITY

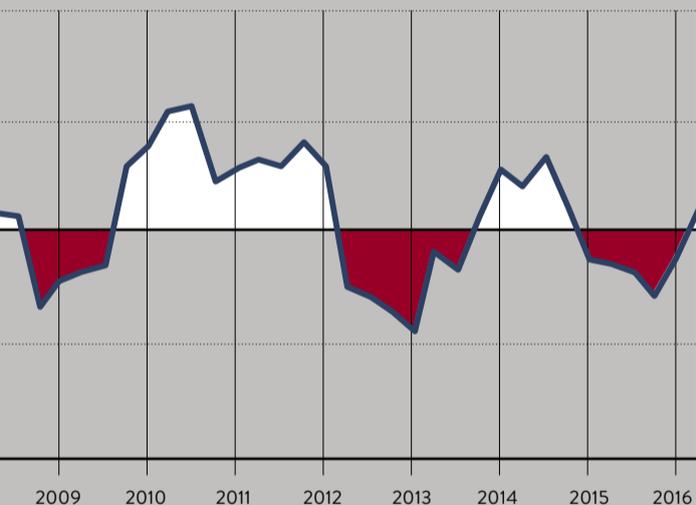
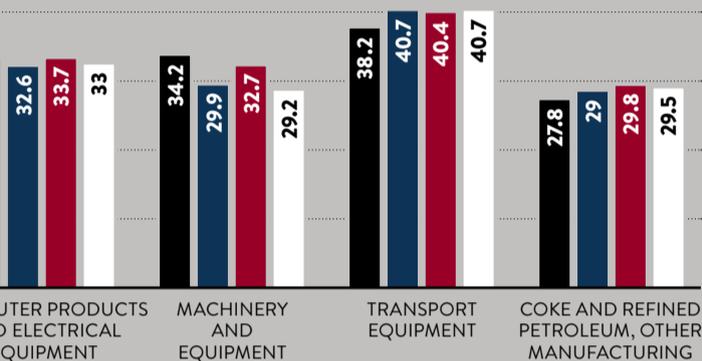
Percentage difference with UK



# NGE

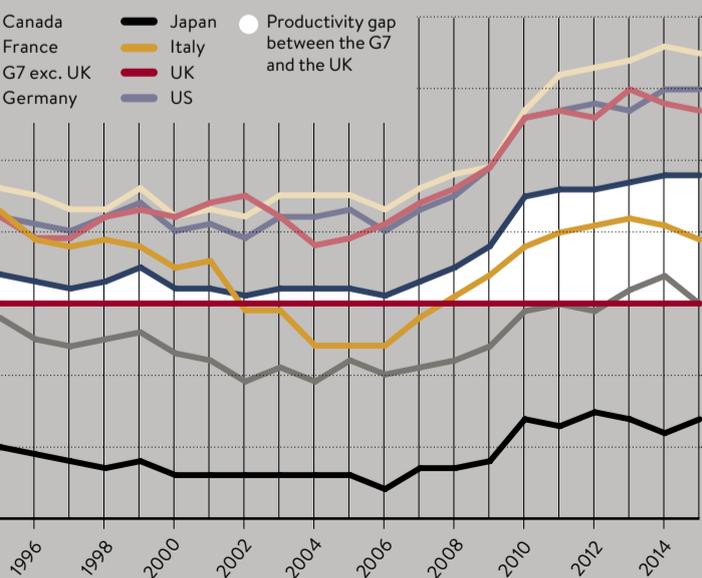
● 2012 ● 2013 ● 2014 ● 2015

Output per hour declined in seven of the ten manufacturing industries in 2015



## PRODUCTIVITY

The UK in current price GDP per hour worked



## MOST PRODUCTIVE COUNTRIES IN THE WORLD

Rank	Country	Productivity*	Hours worked
1	LUXEMBOURG	£45.71	1,643
2	NORWAY	£36.36	1,427
3	AUSTRALIA	£29.81	1,664
4	SWITZERLAND	£28.35	1,568
5	NETHERLANDS	£28.35	1,425
6	GERMANY	£25.95	1,371
7	DENMARK	£24.14	1,436
8	UNITED STATES	£23.66	1,789
9	IRELAND	£23.12	1,821
10	SWEDEN	£22.58	1,609
11	AUSTRIA	£22.03	1,629
12	FRANCE	£21.21	1,473
13	CANADA	£20.30	1,704
14	FINLAND	£18.95	1,645
15	ICELAND	£18.76	1,864
16	UNITED KINGDOM	£18.64	1,677
17	JAPAN	£16.72	1,729
18	SPAIN	£15.63	1,689
19	ITALY	£15.62	1,734
20	NEW ZEALAND	£15.58	1,762

\*Productivity is defined as GDP per capita divided by hours worked

Source: Expert Market 2016

problems and schedule a repair before it breaks down can reduce downtime and improve output.”

Manufacturers that overlook opportunities to collaborate are also missing a productivity trick. Steve Lindsey is the founder and chief executive of Lontra and designer of the Blade Compressor, a product built in the UK thanks to Lontra’s partnership with another British company, Shield Engineering.

“If your business revolves around a new invention, it’s virtually impossible to succeed without the assistance from peers and partners, and much of our success is owed to collaboration,” he says. “We believe the combination of disruptive technology from relatively small companies like Lontra and established British businesses like Shield could hold the key to reigniting Britain’s productivity in the manufacturing sector.”

A collaborative approach is at the heart of the High Value Manufacturing (HVM) Catapult, a government initiative set up five years ago. Following the example of countries such as Germany, HVM Catapult centres take some of the risk out of the innovation process by providing access to equipment, expertise and a collaborative environment. Last year alone, more than 3,000 companies, over half of them small and medium-sized enterprises, worked with the HVM Catapult.

Chief executive Dick Elsy says: “Manufacturing companies are extremely diverse and there is tremendous, and often untapped, scope to learn from each other. Taking technology innovations that have been tried and tested in one sector, and adapting and implementing them in another sector can yield significant success at greater speed and less cost. Improvements do not always need to start from square one; the solutions are often already out there and merely need adapting to meet the needs of specific sectors and settings.”

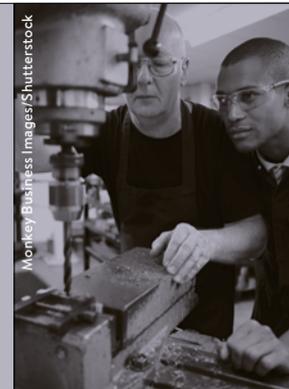
Established continuous improvement methods have proven their validity, albeit gradually. However, if UK industry is to thrive in the competitive global markets, the pace of improvement has to increase, driven by technology innovation.

Smart factory technology, for example, creates an environment where all available information, from shopfloor and across the supply chain, is captured in real time, made visible and turned into actionable insights.

The use of digital modelling and simulation in the design and build of factory layouts helps to minimise space and maximise process efficiencies, and intelligent robotics enabling robots to work safely alongside humans and to heal themselves when something goes wrong are areas that will prove critical in driving up productivity.

“Combined with the internet of things and other Industry 4.0-related technology, this is set to transform the way we make and use products,” says Mr Elsy. “Technology innovation is the way to achieve real step-change improvements that can make the difference between being a cottage industry and a global leader.”

## CASE STUDY: UNIPART



The Unipart Group, whose operations span many sectors including manufacturing, has taken its own approach to increasing productivity. While it sees fourth-generation technologies as vital to higher productivity, the company’s real focus is on people, and ensuring they have the skills and knowledge to use these technologies to maximum effect.

Their approach to achieving this is known as the Unipart Way, a philosophy of working that is underpinned by a set of tools and techniques that form the basis of their knowledge management system.

As Unipart’s chairman and group chief executive John Neill points out, the answer to the UK’s productivity issues is not more money, but a commitment to improving performance. He says: “We coined a simple phrase ‘creativity before capital’ or ‘grey matter before the greenback’. You have to harness the talent and the creativity of your people to take waste out of the system by working in teams, using problem-solving tools and improving productivity.”

In 1993, the company also built the UK’s first corporate university, Unipart U, and set up faculties on the floor at many of its global sites, giving employees a body of knowledge and creating a management culture which allows that knowledge to be deployed.

“If you are striving for long-term performance, you have to take a long-term view, and you need great coaches who know what good looks like and can teach you the techniques of how to do well,” he says. “You need a body of knowledge to do problem-solving in a systematic way. Our people learn how to define the problem and the desired outcome, and use our tools and techniques and a coach to work how to achieve it. As they get better at it, they can tackle bigger and more complex problems. It’s great for our people, who get satisfaction from using their creativity and their talent to find solutions, and it’s great for the company. There are no trade-offs here.”

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# Driving the car business post-Brexit

The UK automotive industry is a heavy-hitting global success story, but what does it need to secure its future competitiveness in post-Brexit Britain?

## AUTOMOTIVE

RICHARD AUCOCK

Think Britain doesn't build cars anymore? Think again. This year it's on track to build 1.6 million vehicles – more than 70 models from over 30 different manufacturers. By 2020, the UK should beat the 1972 record production high of 1.92 million cars, an increase in output of 50 per cent over 2011 recession-hit levels. Car production in Britain was hollowed out in the 1980s, but it has since been revived sufficiently to make the UK Europe's third largest car producer.

Cars built in Britain are high value. The average sale price of a UK car is £20,900. More than three in four cars built here go overseas, 57.5 per cent to Europe. Britain exports cars to more than 100 countries globally, but Europe is by far its top trading partner. The next strongest destination for exports is the United States at less than 11 per cent, while China took 7 per cent of production volume in 2015. For every one UK-built car that

went to China, more than eight went to the European Union, which is why Brexit has the industry worried.

Ahead of the June 23 referendum vote, the Society of Motor Manufacturers and Traders (SMMT) revealed that more than three-quarters of members, the automotive industry trade, favoured remaining in the EU. "We want this success to continue

rather than jeopardise it by increasing costs, making our trading relationships uncertain and creating new barriers to our single biggest and most important market, Europe," said SMMT chief executive Mike Hawes.

Brexit, however, now seems a reality. And the industry

is uneasy. "I don't like the uncertainty at the moment," says Kenneth Gregor, chief financial officer of Jaguar Land Rover. He is not alone. Few automotive companies are, at this stage, willing to comment on Brexit. "At Honda, we're not going to tell the UK government what to do," says its UK managing director Philip Crossman. But most agree there are certain imperatives to ensure the UK automotive industry continues to

“ Government must maintain economic stability and secure an EU deal which safeguards UK automotive interests



01



02

01 Honda, which is producing its new five-door Civic in Swindon, has invested £2.2 billion in the UK over the past 30 years

02 Jaguar Land Rover is the UK's largest car manufacturer, with 36,000 of its 38,000 employees working here

03 Production plant for Vauxhall's Astra Sports Tourer in Ellesmere Port

thrive: tariff-free trade, unrestricted access to the European workforce and commonality of regulations.

The SMMT is looking to prime minister Theresa May to deliver this. "Government must now maintain economic stability and secure a deal with the EU which safeguards UK automotive interests," says Mr Hawes.

The concern is not restricted to the carmakers. The UK automotive industry accounts for nearly £70 billion in turnover and more than £15 billion in value added. It employs 800,000 people and accounts for 11.8 per cent of total UK exports. Any reversal in fortunes for the industry would have nationwide implications.

Effects could stretch Europe-wide. Germany built 5.7 million cars in 2015 and exported 810,000 of them – over 14 per cent – to the UK, more than any other country in the world. Most of these are high-value models. The German automotive industry also has more than 100 facilities in the UK.

It's common for only a third of parts in a British-built car to be UK-sourced. Even where manufacturers would like to source more in the UK, close to their manufacturing sites, they find the supply base is present. "Until recently, we were sourcing plastic fuel tanks from overseas," according to a Vauxhall spokesperson.

Italy serves as a sober warning of the risks when an automotive industry loses competitiveness. It built two million cars a year 20 years ago. Today, it builds just 500,000. "If the UK doesn't want to suffer the same fate as Italy's car industry, it must be concerned to retain full access to the single market," warns Matthias Wissmann, president of Germany's VDA automotive industry association, the equivalent to the SMMT.

## FUTURE TECHNOLOGY



Bloomberg/Getty Images

An opportunity for the British automotive industry, even post-Brexit, is next-generation technology. It is a nascent sector in which the UK has notable successes. The world's best-selling electric car is the

Nissan Leaf – and it is built at the Japanese company's facility in Sunderland. Its high-added-value electric batteries are also produced there in a £420-million facility opened in 2013. It is Europe's largest lithium ion battery plant and has since received a further £26.5-million investment.

The National Automotive Innovation Centre (NAIC) at the University of Warwick, which opens in 2017, aims to help UK manufacturing capitalise on future technology shifts. It will act as a research centre, linking academia and industrial

research and development with the automotive industry. Some £150 million has been invested by Jaguar Land Rover, Tata, WMG and Warwick University. There is a shortage of R&D expertise across the UK automotive industry and its supply chain, and NAIC aims to address the skills gap.

It dovetails the Advanced Propulsion Centre (APC), whose central hub is also based at the University of Warwick. Established in 2013, the APC is a ten-year commitment between the government and, through the Automotive Council,

the automotive industry. Government and industry both committed £500 million to position the UK as "a global centre of excellence of low-carbon powertrain development and production". It seeks out low-carbon ideas and matchmakes them with manufacturers.

Bristol's National Composite Centre was established, following the government's 2009 UK composites strategy, to research future lightweight materials. Today, it is investing in automotive R&D, to create lightweight materials and processes

for mainstream adaptation. The UK aims to develop the car platforms of the future, as well as the electric powertrains to drive them.

Autonomous technologies will also grow. Britain has a coincidental advantage as, unlike other European nations, the UK never ratified the Vienna Convention that states a driver "shall at all times be able to control his vehicle". Connected and autonomous vehicles can thus be driven on public UK roads and trials are already underway. The Society of Motor Manufacturers and Traders believes this gives

the UK a two-year head start on other countries in an industry that may contribute more than £50 billion to net GDP by 2030. It could create 300,000 jobs – and prevent 25,000 accidents a year.

Volvo is bringing 100 self-driving SUVs to London for autonomous car trials in 2017. And the story could get more interesting still as Volvo has just agreed a \$300-million self-driving project with Uber. And Uber's mapping cars are increasingly being spotted in Britain. An example of how a small advantage in legislation can help a new industry thrive, even post-Brexit.



03



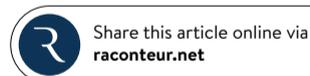
An unfavourable hard Brexit would make it less likely that new contracts are won

Winning the contract to build a new model is a competitive process within car companies. Since the recession, UK automotive has secured win after win. The most recent success was production of the new Honda Civic in Swindon – it will become the sole global production hub for the new five-door Civic. Some £200 million was invested as part of this, taking Honda's total British investment over the past 30 years to £2.2 billion.

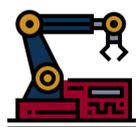
An unfavourable hard Brexit would not see manufacturers immediately terminating contracts and closing plants, but it would make it less likely that new contracts are won. Britain would lose competitiveness and this would make the tenders of UK facilities less appealing alongside alternatives. As with Italy, the decline could be gradual, but painful.

Despite these risks, the automotive industry has since received a confidence boost courtesy of Nissan. It recently confirmed a new Qashqai will be built in Sunderland from 2019, after the UK's expected withdrawal from the EU – and as an added bonus, a new X-Trail SUV will also be constructed there from the first time. The current Qashqai is a UK top-five best seller and only Jaguar Land Rover makes more cars in the UK than Nissan. The announcement is thus very significant.

It came after Nissan chairman and chief executive Carlos Ghosn met prime minister Theresa May at 10 Downing Street in October. It is not clear what assurances, if any, were made to Nissan should any post-Brexit barriers to inhibit trade or undermine competitiveness develop. But Nissan seems confident there will be no medium-term penalties to producing cars in Britain and that the UK's competitiveness will not be damaged post-Brexit. As other new model contracts approach renewal, the rest of the automotive industry may now be seeking similar assurances.



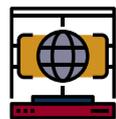
**UK AUTOMOTIVE MANUFACTURING FACTFILE**



**100+**  
specialist brands



**8**  
major premium and sports car manufacturers



**13**  
research and development centres



**7**  
commercial vehicle manufacturers



**9**  
bus and coach manufacturers



**6**  
design centres

Source: SMMT 2016

COMMERCIAL FEATURE

# LISTENING TO THE MACHINES

*Monitoring the performance of machines with in-memory technology can boost the UK's productivity*



There has been much attention in recent months, not least from government, about how UK businesses can improve productivity. There is good reason for this. Figures from the Office for National Statistics show the UK lags behind rivals Germany, France and the United States in terms of productivity, and is below the average for the G7 economies.

In the manufacturing sector, the concept of industry 4.0 – or “smart factory” as it is known in the US – has long been established and is finally beginning to get traction in the UK. Essentially this revolves around using information that can be gleaned from machines to help identify potential issues, whether that's at a country or factory level, or a problem with individual machines or components.

Andrew Steele, managing director of Forcam UK, a provider of advanced shopfloor management technology, believes huge efficiencies can be made in manufacturing production simply by gaining a better understanding of how shopfloors are running. “Even the more forward-thinking plants often don't fully understand what is happening on the shopfloor from a management standpoint and because of that complexity things don't work as efficiently as they could,” he says.

“If you can get to a stage where you can understand those complexities in a digital environment, you can have the machines talk to the rest of the factory and create massive efficiencies by being more organised.” This can include identifying events that may otherwise go unnoticed, such as a machine tool which might only be in use for 30 per cent of the time or a device which regularly needs to be restarted and can waste several minutes every hour.

Often organisations are aware of what is happening at a macro level, but fail to identify smaller issues which can cause significant inefficiencies. “If you start to look at service information, you might



see that a spindle bearing is wearing out,” he says. “That information is there, but it's simply getting at it and pairing it with something useful, and giving it to the right people.” Having access to such information in real time, rather than relying on metrics such as key performance indicators which can be three weeks out of date, means organisations can respond to issues there and then, eliminating unnecessary downtime.

The technology to gain this kind of insight already exists, but needs to be accompanied by a broader cultural change in management philosophy. “A system like this will provide a mirror to what is happening on the shopfloor,” says Mr Steele. “But, from a business leader standpoint, it's going to do nothing if you don't make some fundamental changes in your business and outlook.” Many UK organisations still see the people working on the shopfloor as the cause of inefficiencies, rather than as valuable resources who can help provide insight into how things could be done better.

The sheer amount of information that can be derived from machines through the use of big data can also be problematic; something

Forcam's solution has been able to resolve. “Our approach is to have in-memory technology, so when we take 20 signals out of a machine, we can process it there and then, and direct it to the right area of the business,” he says. “Simplifying this at source means information can be usable and functional.” The system is also backwards-compatible with older machines and enterprise resource planning systems, he adds, so any organisation can benefit from greater insight into how well their business is performing.

Ultimately, Mr Steele believes organisations will have to make better use of technology if they are to improve productivity and compete effectively with international businesses. “It's the way the industry is going,” he says. “There will be rapid change over the next five years.”

**Forcam's technology monitors the performance of more than 60,000 machines every day, in organisations including Mercedes-Benz, Audi, BMW, MTU, Heidelberger Druckmaschinen and Hilti, with customers reporting productivity increases of over 20 per cent in less than 12 months. To find out more visit [www.forcam.com](http://www.forcam.com)**

“Organisations will have to make better use of technology if they are to improve productivity and compete effectively with international businesses

# MANUFACTURING THE FUTURE

**Sir Terry Morgan**, knighted earlier this year for services to UK infrastructure, skills and employment, is chairman of Crossrail, the HS2 College, Ricardo plc and until recently the High Value Manufacturing Catapult's Manufacturing Technology Centre. Here he reflects on the future of manufacturing and infrastructure in the UK

The UK's manufacturing and infrastructure sectors are at the heart of our economy. However, these are uncertain times for industry, when even incomplete or unverified data is immediately seized upon as proof of a post-EU referendum boost or bust. The government's intention to have an industrial strategy couldn't be timed better and is exactly what we need to do.

Having lived and breathed manufacturing for the last five decades I would like to outline my view on the key pillars that are needed in the government's strategy.

Firstly, we need to continue to develop, implement and commercialise our technology. The UK is a world leader in technological research, but has traditionally allowed too many inventions to be commercialised overseas. Think of the lithium ion battery: invented in the UK, yet almost entirely produced in the Far East.

Over the last five years we have tackled that problem with the introduction of the Catapult programme. I chaired one of the centres in the High Value Manufacturing (HVM) Catapult and saw first hand how it helped companies bring new technology to market using open access to the latest industrial-scale equipment, world-leading expertise, and a space for companies and universities to collaborate.

The HVM Catapult works and delivers solid economic results. We should build on this and have more of the same successful formula.

Secondly, we need more people with the right skills to develop and run the factories of the future. Investors will not come to Britain just because we have great equipment; they need to see we have the skills too. Our young people are key to our future national productivity. If I look at countries such as China and India and at the numbers of engineering graduates they produce, it is clear the UK has a challenge ahead.



© Crossrail

I'm a real advocate of apprenticeships. I started my career as an apprentice and know that a successful career can be built on vocational education as much as on academic qualifications. Some people in industry have baulked at the idea of a levy to fund apprenticeships. I would urge them to think again and implore the government to preserve earlier commitments to this programme. I believe this is the most efficient way to ensure we have the talent we need for the future. We need to show our young people that an education and a career in engineering is exciting, interesting, well paid and open to anyone.

We need to tap into our entire talent pool, including young people from all backgrounds and of course women; huge sections of our economy could be revitalised if we attracted more women. Whereas the science sector has embraced the potential of female talent, manufacturing and construction



**ABOVE**  
Elizabeth Line tunnel, Crossrail project

**ABOVE RIGHT**  
Sir Terry Morgan

**LEFT**  
The Manufacturing Technology Centre in Ansty

**BELOW LEFT**  
Flowformer at the Advanced Forming Research Centre in Glasgow, part of the High Value Manufacturing Catapult

have been much less successful. At Crossrail, women represent 25 per cent of our intake, but only around 8 per cent of registered engineers nationally are women. It's not anywhere near enough and puts the challenge into perspective.

Thirdly, we have entered the fourth industrial revolution, driven by digital data, connectivity and cyber systems, and are creating new and previously unimaginable business opportunities for those who are innovative and agile. In manufacturing we are used to using digital technology to make things. Of course, there are still manufacturing jobs that are physically demanding, but far more jobs now involve 3D and 4D design in virtual worlds, coding, modelling, simulating and communicating. Buildings such as the so-called Cheesegrater in the City of London were designed and test assembled in a virtual world many times before they were manufactured in a factory and then pieced together on site.

The digital era is now upon us and we need to grasp the opportunities that it offers. We can further boost our productivity by increasing the uptake of automation and robotics, for example. These can make companies more agile and better equipped to respond to, or even act ahead of, the quick pace of changing consumer demands, supplier conditions and technology availability.

Finally, the government is strengthening the foundations of our industrial strategy through its National Infrastructure Plan, investing more than £400 billion in large-scale

“The government's intention to have an industrial strategy couldn't be timed better and is exactly what we need to do



capital projects. Large projects can act as a real stimulus within the economy. Crossrail took this seriously and placed over 95 per cent of its business supply chain in the UK.

Such projects not only create value, but can act as agents for change and drive innovative technology solutions that involve the best possible processes and procedures in areas such as health and safety, sustainability and project management. They develop an army of highly skilled people and accumulate many truly invaluable lessons, which can be shared more widely through mechanisms such as the Crossrail Learning Legacy project. I believe they can prove instrumental in driving up performance and the competitiveness of UK industry.

Regardless of the deals we eventually secure with trading partners, one thing is certain: Britain must get fitter to compete. We may be the world's fifth biggest economy, but we are far less productive than all other G7 countries bar Japan and the gap is widening.

I see so many examples of UK excellence. In manufacturing, we need to promote, celebrate and share these examples more widely. We must invest in things that work, such as the HVM Catapult centres, which transfer technologies and processes developed in successful sectors such as aerospace and automotive, and apply them in other industry sectors, and we must learn from large, successful projects such as Crossrail.

Anyone with a passion for manufacturing and engineering has a role to play in shaping the future for UK industry by promoting the strong case for "Made in Britain". We've some great capabilities and a government that recognises the importance of having a rich seam of high-value manufacturing in our economy. These are key ingredients and good reasons for confidence in our future.

for more information please visit [hvm.catapult.org.uk](http://hvm.catapult.org.uk)



# Attracting top talent to UK engineering

Manufacturing has suffered an image problem which has resulted in a shortage of engineers needed to take UK industry forward, but things might now be changing

**FUTURE WORKFORCE**  
CHARLES ORTON-JONES

“As an employer, I can tell you that finding young qualified technical, project or quality engineers with up to five years’ experience is near impossible,” according to David Davies, managing director of Axiom Manufacturing Services, a contract electronics maker based in South Wales. He’s desperate to find qualified engineers.

But, like so many UK firms, he can’t. And why? “Despite the fact that we live in a technology-driven age, the view many students hold of engineering is that of 40 years ago,” he says. “They think of men working in dirty factories, rather than the scientifically skilled professionals who are responsible for the development of their smartphones.”

Tragically, he’s right. The UK has a shortfall of engineers, which is crippling the economy. And at its core is a reputational travesty. The department for business polled British children in 2014 asking their views on manufacturing. It revealed only 15 per cent would consider a career in it, with 40 per cent calling it boring and more than half believing it to be dirty. Of female university students, 12 per cent wanted a career in manufacturing.

The result is a catastrophic shortfall. Industry body EngineeringUK reckons the nation needs to be producing 69,000 more engineers every year to meet current demand. That is a low score. More engineers means more prosperous employers, so demand would rise as graduation numbers grew. Training provider ECTA Training calculates that even a niche such as installing smart meters is underserved by 6,500 engineers.

Verity O’Keefe, skills policy adviser at EEF, the manufacturers’ organisation, says: “Our research shows that three-quarters of manufacturers have struggled to fill engineering positions in the past three years. Almost two-thirds of companies say that one of their key recruitment difficulties is that applicants lack the right technical skills.”

Demand spans disciplines. Ms O’Keefe explains: “Those most in demand are production and process engineers. Forty four per cent of manufacturers plan to recruit these positions in the next three years. There is also strong demand for mechanical engineers, design and development engineers, as well as engineering technicians.”

Sexism plays a role. Professor Brian Rubineau of McGill University in Canada conducted a long-term study of 700 female engineering students. The survey included vol-



Most engineers I know want to go on to solving the next problem and that is a life worth living

software which can check software output, why would we wish to spend four years educating an engineering student to replicate the work of a software package?”

There’s no doubt the situation needs to change. Arts majors routinely struggle to find fulfilling work. In the United States, half of 22 to 27-year-old college graduates are “underemployed”, defined as in a job not requiring a degree. Arts graduates are two to three times more likely to be unemployed than STEM graduates. Engineers are happier in their work. The Women’s Engineering Society says 80 per cent of female engineers in the UK are either happy or extremely happy with their career choice.

Perceptions are changing. EngineeringUK says the number of 11 to 14 year olds who believe engineering is desirable has risen from 27 per cent to 43 per cent in the last five years. It’s an improvement, but with a huge distance to go.

Part of the solution is persuading the brightest school leavers to stick with engineering rather than entering financial services. Alex Caccia, founder and chief executive of Oxford-based startup Animal Dynamics, which develops propulsion systems inspired by nature such as the dragonfly and dolphin, says: “Clearly the lure of the City and financial institutions is drawing talent away from engineering, and this is a terrible waste.”

Mr Caccia believes the industry simply needs to convey the joys of engineering. “Engineering is a highly creative pursuit. Solutions are first imagined, modelled, and then made and tested. It is creativity with an edge because things have to work. It is real creativity. The problems that need solving are infinite and fascinating, and far more interesting than trading coins or producing an M&A prospectus,” he says.

“I have seen many intellectuals dulled at the age of 45 after years in finance, whereas most engineers I know want to go on to solving the next problem and that is a life worth living.”

It’s a message we all need to communicate.

untary diary entries to log their experiences. Professor Rubineau concludes: “Many of the women in our study experienced blatant gender bias in their project teams and internships. Much of the hands-on aspects of engineering are treated as men’s work, with women relegated to more secretarial duties.”

He says this pushed a high number of women into a different career path. Currently the Institution of Engineering and Technology estimates only 6 per cent of British engineers are women and only 3 per cent engineering technicians.

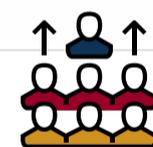
That’s the bad news. Time for the good news. The industry knows it has a problem and for some time there’s been a huge push to change perceptions. There are dozens of brilliant schemes, such as Ada Lovelace Day, which celebrates women in science, technology, engineering and maths (STEM) – annually on the second Tuesday of October. Ada Lovelace wrote the first computer programme, devised in correspondence with her friend Charles Babbage. The letter with her earliest musing in 1843 on the idea programming can be seen in the John Ritblat Gallery of the British Library.

This year Suw Charman-Anderson, founder of Ada Lovelace Day, called for more women on industry panel events, actions against unconscious bias and for the media to make an effort to talk to more women in STEM.

Companies are taking action directly. Tata goes directly into schools and universities to evangelise. JDR, which manufactures sub-sea cables for the off-shore energy industry, runs a series of school events. Tim Ibell, professor of civil engineering at the University of Bath and until recently the president of the Institution of Structural Engineers, laments: “Engineering is not taught at school and this leads to ignorance. As you know, most people believe that we fix engines or wear hard hats permanently.”

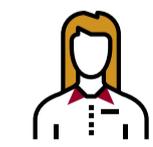
Professor Ibell also points the finger at universities. “Engineering degree programmes worldwide have a reputation for being rather boring. This is largely an accurate reputation, I’m sorry to say. This must change,” he says. “Engineering degree programmes need to be fun, holistic and inspirational to match the profession itself.”

Creativity, he stresses, is now at the heart of the profession. “Traditionally, engineering degree programmes have focused near-exclusively on the mathematics and physics, but computers now dominate this space,” he says. “After all, when we have



**69k**  
more engineers are needed every year to meet the current demand

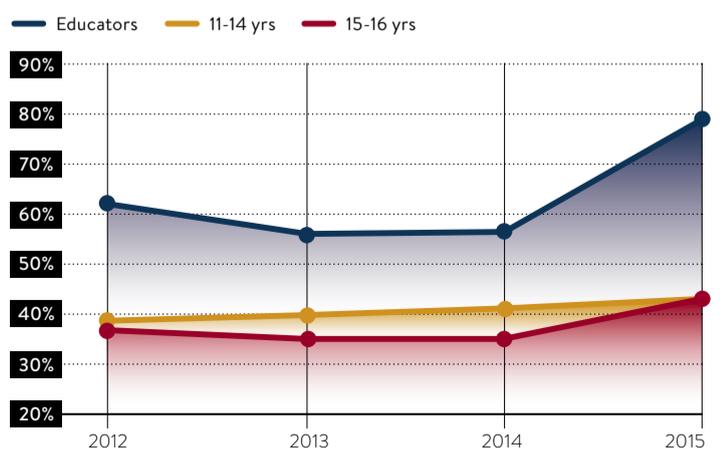
Source: EngineeringUK



**24%**  
of applicants for higher-education engineering disciplines in 2014/15 were female, compared to 14.5% in 2008/09

Source: UCAS 2015

## YOUNG PEOPLE AND EDUCATORS WHO BELIEVE A CAREER IN ENGINEERING IS DESIRABLE FOR THEM/THEIR PUPILS



Source: EngineeringUK 2015

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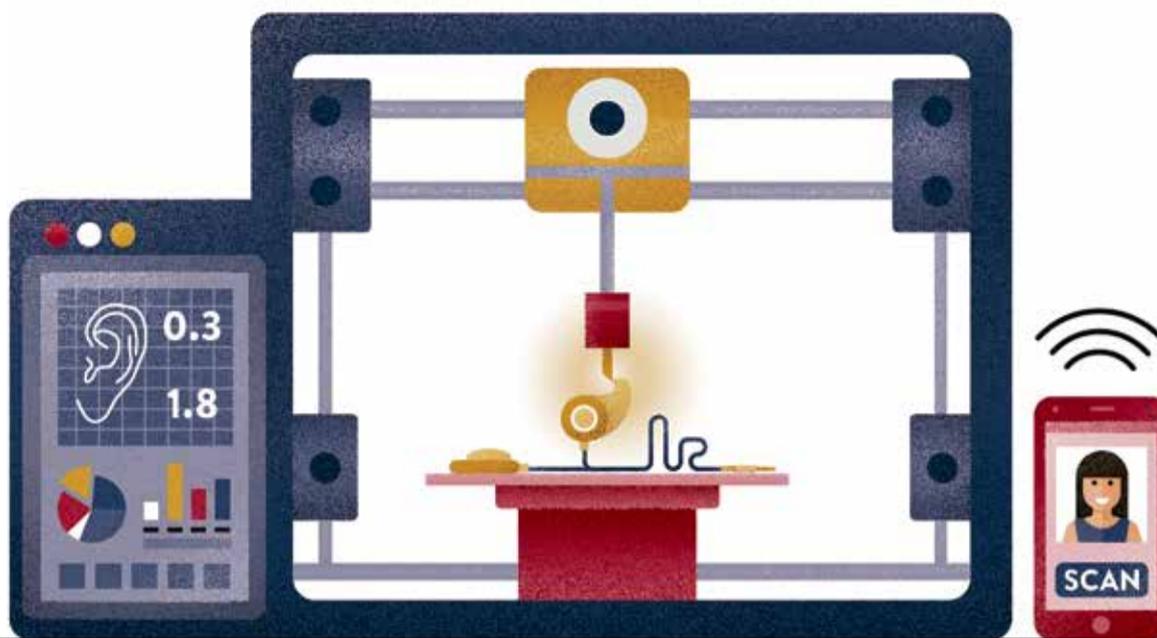
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# Get personal to customise your business

Manufacturing is changing fast to customise goods for an increasingly demanding and personalised market



**CUSTOMISATION**  
WILL STIRLING

“  
Mass customisation, the ability to make variations in products in high volume, is becoming the norm

The new manufacturing revolution will be defined by speed, quality, flexibility – and customisation. “The customer is king” has never been more relevant and manufacturers have to react or risk perishing.

Henry Ford’s famous line “A customer can have a car painted any colour that he wants, so long as it is black” set the tone in 1909 for the mass production of near-identical products. Today mass customisation, the ability to make variations in products in high volume, is becoming the norm.

The iconic JCB backhoe loader has 50 main variants and then a further 150 attachment combinations, creating 7,500 main product permutations. “Within each of the 50-plus variants, there is almost an unlimited number of specification variants, according to choice of paint colour, tyre choice, trim, air con/no air con and more,” says JCB’s communications director John Kavanagh.

This high degree of variation needs to be managed across four production lines globally and re-

quires huge investment in information technology that synchronises orders with each production site, to schedule each unit for the right on-time delivery.

Such customisation in the automotive and machinery sector is now routine; giving the customer what they want is now a business pillar, rather than a differentiator. Bespoke mobile phone maker Vertu has taken this to a new level. With its Made to Order service you can design the phone from a pre-defined selection of materials, while the Bespoke service lets you literally create your own. Coverings such as calf and alligator leathers and embedded precious stones make

each phone unique. The cost? “In the Made to Order programme, a top-of-the-range handset would cost about £25,000, in the Bespoke programme there literally is no limit,” says Vertu’s brand manager Peggy Li.

BAC Mono is not a mass-produced car; production of the Liverpool-made street-legal racing car will climb to 50 cars a year in 2017. But it was designed from the start to be different, a one of a kind. Customers have a personal fitting; both the steering wheel and seat are moulded to fit the owner. The steering wheel is then 3D printed, a fast and responsive method, while the seat is cut from the mould and finished individually.

“We use a personalised paintwork configuration tool to explore the possibilities with each individual customer – what the client wants, the client gets,” says Ian Briggs, BAC co-founder and design director. “Modern technology has enabled us not only to react to customer demand faster than ever before, but also to offer a level of bespoke fitment that would have been cost prohibitive only a few years ago for a low-volume, luxury car manufacturer like BAC.”

But the big potential for customisation lies in the technology to manufacture normal, functional products the way the market wants them and to reduce the time from order to delivery.

Booth Dispensers in Blackpool makes coolers and drinks dispensers. The company reduced the lead time for their main product from eight weeks to 24 hours. This was achieved because the company completely re-engineered the product from one with many variations where each is assembled to order at different stages. Now Booth, which exports 40 per cent of its output, makes a single base unit in series, using modular construction, and does all the customisation as late as possible. This is not just a different plastic facia for each customer, the engineering and the control system are also customised.

“It is how we can compete with cheaper Far-Eastern imports,” says managing director Phil Booth. “Through re-engineering for configurable manufacturing, we can now turn around a product in 24 hours. Our Asian competitors cannot do that.”

US company Normal allows the customer to scan their ear with a smartphone and then sends him or her a tailor-made, 3D-printed earphone. “It’s one of the most brilliant examples of a business customising a product for a market of one,” says manufacturing industry manager at Autodesk, Asif Moghal. Normal is clever; it keeps the rest of the package mass produced –

the speakers, cables and the 3mm jack. They have personalised the bit that adds the most value.

“The secret of mass personalisation is to offer people the ability to change the geometry, performance and specification of the product, and then feed it into a range of manufacturing techniques to exploit the personalisation,” says Mr Moghal. This could mean some companies scrapping a load of redundant machine tools and filling their factory with 3D printing robots – not a realistic strategy for many. The path to personalised manufacturing will be incremental for many as they customise small, high-value bits first and buy the new flexible technology as they can afford it.

Software, of course, is at the heart of the evolution. Product life cycle management (PLM) systems now integrate at a deeper level with enterprise resource planning systems (ERP), where ERP can tell the PLM system whether a degree of product variation is unprofitable for the business.

“Personalisation is often delivered through software,” says Theo Boudewijns, PLM specialist at software developer PTC. “We are developing a system where a company can link its PLM system to a physical product and deliver personalised software into those devices.”

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## CASE STUDY: LAMBERT ENGINEERING



In an age of digital manufacturing, Lambert Engineering is blazing a trail. The Tadcaster-based company makes manufacturing machinery for companies producing mainly healthcare products where demand for customisation is increasing. Turnover this year is already up 30 per cent.

“For one application in the healthcare sector we have developed a new feed system that works in a completely different way using robotics and vision systems,” says Lambert Engineering’s sales director, Matthew Cox.

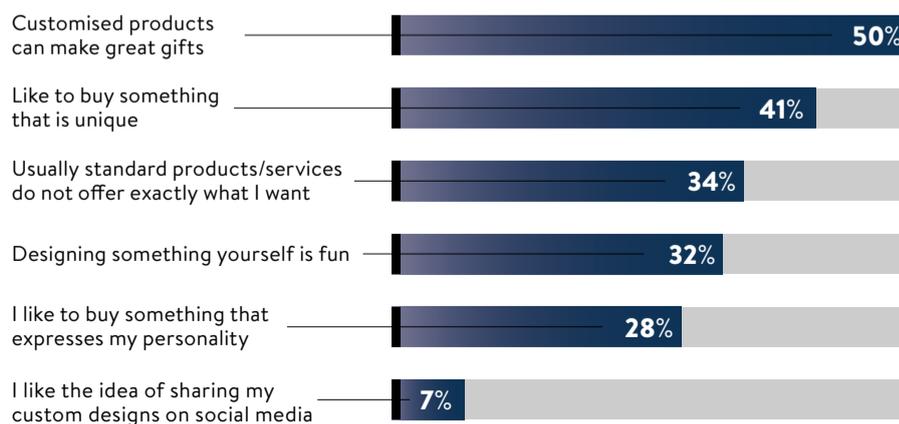
“While this design is initially more expensive, it allows the system to be flexible in what it can feed. For example, one

part, of which there are many, can be two different sizes with 30 different colours or patterns and the machine will know which one it is processing at any one time.

“The machine is linked to the factory via a wireless system into MES (the manufacturing execution system) so it ‘knows’ what it needs to make and tells the factory what it actually has made, so everything is connected and far more efficient.”

Flexibility is the key. The number of variants the system can handle is set, but can be easily adjusted with software upgrades as new variants are designed by the customer. This means that whole or “through-life” costs are significantly reduced and the producer can be far more agile in serving the demands of the marketplace.

## TOP REASONS CONSUMERS WANT PERSONALISATION



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