

RACONTEUR

Roadmap to Transformation in Manufacturing



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CHANGE

Roadmap to manufacturing transformation

Manufacturers face a constant challenge to transform processes, but can reap the considerable benefits of digital technologies

Daniel Thomas

When Harley-Davidson wanted to boost productivity at its motorcycle plant near Philadelphia in 2015 it turned to technology. The US firm placed networked sensors and smart devices throughout the factory so it could collect data on its machines and production processes.

The insights gleaned through this internet-of-things solution allowed it to shrink a fixed 21-day production schedule for new orders down to just six hours.

It also cut operation costs by \$200 million, improved production efficiency and reduced downtime, accelerating its build-to-order motorbike service by a factor of 25.

Welcome to the world of manufacturing transformation, where industrial companies find themselves in a near-constant state of evolution as they strive to improve performance and efficiency. Technology and customer needs are changing rapidly, so producers must keep tweaking their systems and strategy to gain a competitive edge.

But it can be challenging, with a firm often finishing one round of transformation only to find that it must start another just to keep pace.

Stephen Phipson, head of manufacturing lobby group Make UK, believes this process will only get more intense as disruptive technologies, such as the internet of things, robotics, virtual reality and artificial intelligence, keep changing the way we live and work.

“Rapid technological change will impact in every facet of design and process, from customer choice to supply-chain automation,” he says. “It is so fundamental to the future of the sector that all companies of whatever size or sub-sector will need to embrace it. The risks of not doing so are not an option.”

New technologies can have a big impact on operations, as Harley Davidson and others have found. Take carmaker Ford, which is using drones to perform safety inspections at its engine plant in Dagenham, Essex.

Using small drones fitted with cameras, it is able to inspect the highest parts of its plant, rather than sending staff members to heights of 60 metres. The firm previously had to stop production and use specialist scaffolding or elevated platforms to do the job safely, but this took too much time and man power. Now, it can save time and money while also improving safety.

Digitalisation

Another key area of manufacturing evolution is digital transformation. The internet and the potential to harvest swathes of intelligent data online has revolutionised consumer-facing companies and is starting to do the same in manufacturing.

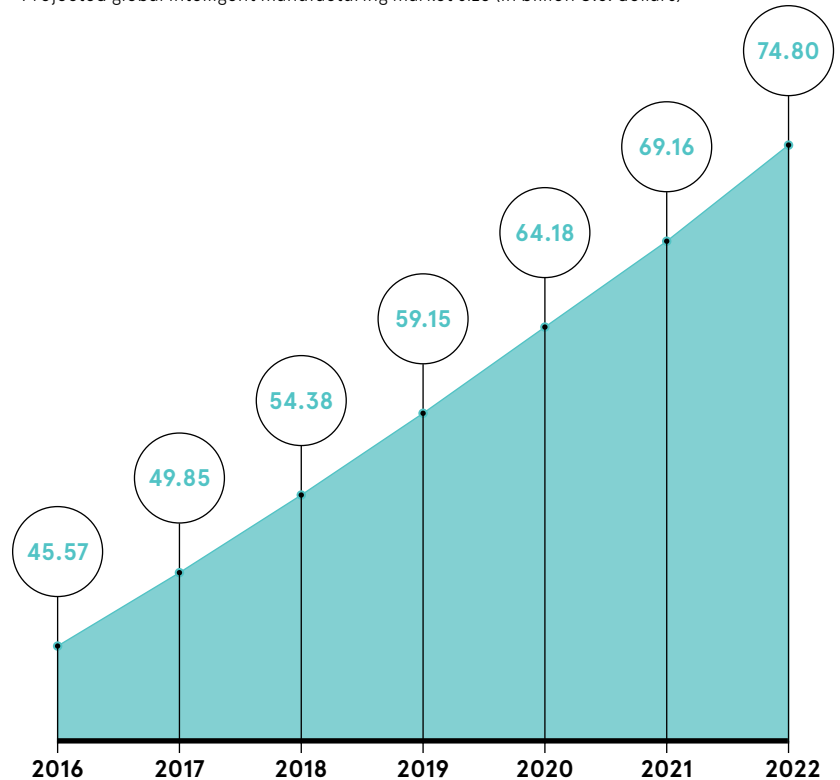
This is because firms want to get a better sense of who their customers are. So many have created direct-to-customer business models that harness the power of web.

Take the way US tractor manufacturer John Deere has launched its own online store selling everything from lawnmowers to fertiliser. Chemicals giant BASF sells clothing and accessories on its web store, while plane-maker Airbus offers everything from watches to model airplanes online.

The point is that such portals Hoover up reams of data on the firms’ business customers, while also driving new revenue streams. “Manufacturing companies are building these business-to-business ecosystems to get closer

MANUFACTURING IS GETTING SMARTER

Projected global intelligent manufacturing market size (in billion U.S. dollars)



Microsoft 2019

to customers,” says Jan Burian, research director at IDC Manufacturing Insights. “It creates this whole new universe which helps them to understand the demand.”

The other big benefit of digital transformation is manufacturers can collect data from “under the bonnet” of the company and not just from the shop floor. Data on everything from sales to supply chains, to human resources and finance can be integrated and analysed, yielding insights on how the company should be run.

“All these areas should be digitalised and integrated together. The key is to have a seamless data flow,” says Mr Burian.

Pain points

Manufacturing transformation can yield huge benefits, but pulling it off is rarely painless. Mr Burian says factories often struggle to retrofit legacy sites with the latest tech or to integrate equipment from multiple vendors. Technology is also evolving in ever-shorter cycles, making it hard to keep up with the latest innovations or see through hype.



Rapid technological change will impact in every facet of design and process, from customer choice to supply-chain automation

He advises companies should bring in a systems integrator to help them deal with the complexity. “Some companies try to avoid implementing complicated stuff; they go for low-hanging fruit. They are focusing on a certain problem, but forgetting scalability for the future,” says Mr Burian.

“After a couple of years, they find out they need to add new systems, from new vendors, and they face issues in unifying their IT landscape. Then they are looking for some sort of miracle solution that doesn’t exist.”

In addition, manufacturers need to think about talent management, says Make UK’s Mr Phipson. As tech transforms the way they operate, they will need the right personnel to manage new systems and processes. But talented data scientists and other such experts are in short supply in many markets. This means existing staff will often have to be trained up through in-house training programmes, which requires more investment.

“Whether it is recruiting new staff or upskilling existing staff, manufacturers will need to

\$642.35bn

Expected size of global market for digital transformation in manufacturing by 2025

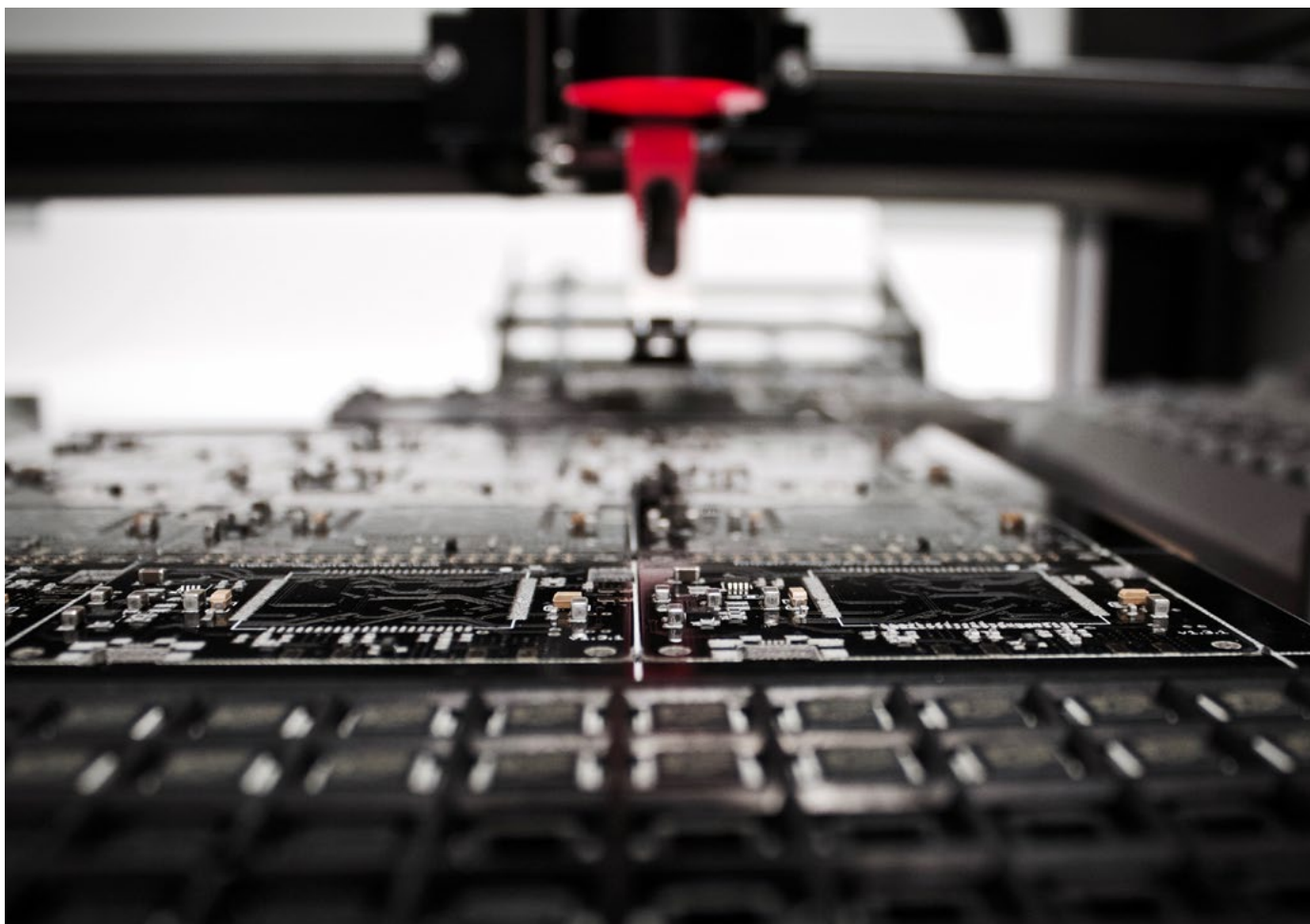
Adroit 2019

invest significantly in digitalisation skills to ensure employees are able to maximise their use to improve productivity and optimise company performance,” says Mr Phipson.

Whatever the challenges, manufacturing transformation is not something that can be ignored. Companies hungry to achieve a global position need to be thinking about improving productivity and not just on the factory floor, but throughout their whole supply chain.

“When it comes to the tech itself, almost everything is possible in this world, all it takes is money. But not everyone has that luxury,” says Mr Burian. Instead he recommends manufacturers forge strategic alliances with vendors, university research and development facilities, as well as investors to help bring down the costs of transformation.

He concludes: “Transformation is tough, so it is important to create these ecosystems. You can test your solutions, meet people from the academic and corporate side, and make the process easier.” ●



CULTURE

Why manufacturing must digitally transform

Digital transformation without the right culture is meaningless and companies that fail to appreciate its importance risk stumbling at the first hurdle

Emma Woollacott

From the very first days of the Industrial Revolution, British engineering and manufacturing industries were in the vanguard of change. These days, however, they may not always seem to be the earliest adopters. Data from management consultancy Russell Reynolds Associates shows that only 48 per cent of industrial manufacturing firms have a digital strategy, compared with 62 per cent of automotive firms and 56 per cent of companies in consumer products. “They seem to be a little bit behind some of the other sectors,” says consultant Catarina Abrantes.

But while engineering and manufacturing may not be leading the charge in terms of digital transformation, there’s a lot going on behind the scenes.

“Many manufacturers have been embracing digital technologies and techniques for years, through gradual evolution, and many are actively taking steps to determine the ways in which they can incorporate these steps,” says the manufacturers’ association Make UK.

Over 4 per cent of new manufacturing jobs will be in digital tech

Research carried out by Oxford Economics in 2016 revealed that revenue related to digital capacity in the manufacturing industry was growing at 3.2 per cent a year, putting it behind only tech services, retail and construction. Manufacturers told the researchers



that they expected more than 4 per cent of new jobs to relate to digital technologies over the following two years.

“Robotics is such a promising area; it increases our speed, quality, and minimises errors,” according to the chief information officer of a mid-sized manufacturer based in Yorkshire and the Humber.

However, there’s a great deal more to digital transformation than simply buying new kit. It also involves a complete overhaul of an organisation’s processes and creating a corporate culture to suit.

This, says the EFF, is harder for some engineering organisations than others. “Medium-sized companies have the highest instances of issues relating to a lack of culture in the business towards change and not understanding how the technologies can help their business,” the Make UK says.

Focussing on culture is the secret to digital transformation

Last year Boston Consulting Group (BCG) assessed around 40 digital transformations and found that the proportion of companies reporting “breakthrough or strong financial performance” was five times greater – 90 per cent – among those focusing on culture.

“A healthy culture provides the guidelines – the tacit code of conduct – that steer individuals to act appropriately and make choices which advance the organisation’s goals and strategy,” says BCG’s Jim Hemerling.

However, businesses need to be sure this culture permeates right the way through the organisation.

“I think there are some things that need to be top down as without the right leadership, nothing will change. But there also needs to be empowerment at the bottom,” says Mark Enzer, chief technical officer at Mott McDonald, who leads the digital transformation workstream within the Institution of Civil Engineers.

Manufacturing companies need employee buy-in to go digital

The key to this is likely to be communication and a focus on how a digital transformation mindset can improve the working practices of all employees.

“For businesses that have a top-down process in initiating projects, some may find there can be a lack of buy-in from employees, and those not at senior management or board level may feel left out of the process, or a lack of communication of these transformations means employees do not see the value of the changes,” the EFF warns.

“There are also many companies using these technologies that do so because of suggestions and initiatives of those on the shop floor, who often have first-hand knowledge of what can be streamlined, improved or adapted within the manufacturing process, as well as what products could help them to improve these aspects.”

The key, of course, is communication, with the most successful transformations involving regular input from employees at all levels of the organisation. According to Russell Reynolds consultant Sarah Galloway, this means paying special attention to middle management.

“As the senior management lead the change and the younger population are de facto ‘digital natives’, middle management needs the most help to trigger the change,” she says. ●

UK MANUFACTURERS THINK DIGITILIZATION COULD IMPACT THEIR BUSINESS IN SEVERAL WAYS

Opportunities of industrial digitalization for manufacturing industry in the United Kingdom (UK) in 2018

Using digital technology to transform way we work from designing products to making them to engaging and retaining customers

85%

Digital technology will help broaden customer base via service-based offering

79%

I could now move my production line back to the UK thanks to the connectivity and business improvements I can make

75%

My CEO is totally onsite and we’re allocating budget for major investment in digital technology

75%

We need to get digital technologies so we can prosper

71%

Digital technology will be massive growth driver in manufacturing

66%

We’ve found the right solution – we’re working smarter and faster with digital technologies

62%



TECHNOLOGY

Drone developments: massive potential for manufacturing

Drones used in manufacturing are still very much in their infancy, but the possibility for aerial imaging, asset monitoring and safety inspection is exciting industry experts

Stephen Armstrong

Technology tipping points are hard to predict. The first time drones were used in battle was the Vietnam War when the bulky, difficult-to-control Ryan Model 147 Lightning Bug reconnaissance drones were deployed by the US military. The programme was mothballed in the 1970s, then re-emerged in the early-1990s, claiming their first kill in 2001, over Kandahar in Afghanistan. The first commercial drone permit was issued five years later, but it took another five years and smartphone technology to create a real market.

Many people working in the drone industry were originally flying hobbyist aircraft, powered by electric motors and lithium-polymer batteries making them lighter, quieter and more reliable than military jets. Cheap smartphone microcontroller chips initially provided autopilot software for these planes. The final stage, according to Professor Dario Floreano, director of the Swiss National

Robotics Centre, was the price of accelerometers, used as tilt sensors in smartphones, coming down rapidly. Suddenly a cheap quadcopter that knew its orientation and direction of movement was possible.

Also like smartphones, people soon started thinking about bringing drones into the workplace. In 2013 Amazon announced its plans for a drone-based delivery system while in 2018 management consultancy PwC set up a dedicated UK drones team and predicted the market for work carried out by drones could be worth a whopping \$127 billion worldwide. And yet, given that sales of commercial drones last year were just \$2.4 billion, according to Gartner, the question is: are drones really going to transform the way many companies do business or are they just another overhyped fad?

Drones slowly making their way into business

Silicon Valley is backing the tech. “Whenever you see more automation with less weight, like the trends in battery size that’s driving the drone market, it’s worth keeping an eye on,” says Philippe Botteri, London-based partner at Accel venture capital and an early backer of Chinese drone platform startup DJI. “While flying cars are almost a sci-fi joke, battery tech has reached the stage where I can throw eight rotors on a drone and carry four people around. It’s as significant as the driverless car.”

At the moment, the heaviest commercial users are in entertainment and photography (42.9 per cent) and real estate (20.7 per cent), according to a survey from BI Intelligence. Industrial uses come in at roughly 25 per cent of which manufacturing accounts for just 1.5 per cent. The problem is that high-speed automotive assembly plants can be as complicated for drones as a battlefield, from robots that shoot welding arcs to machinery that can interfere with drone communication.

Nonetheless, drones are already being deployed in asset-monitoring, checking inventory by scanning radio-frequency identification chips and barcodes, and visual inspection. The most obvious area for growth, according to Jonathan Wilkins, director at EU Automation, is to expand drones capacity for doing what they’re best at, recording information in ways that are too difficult, dangerous or boring for humans.

495

drone-powered
service providers
in the UK

Nesta 2018

“Drones should have a positive impact on quality assurance,” he argues. “By performing a variety of aerial imaging and sensing tasks, such as those using infrared and thermal technology, they could detect problems with equipment on the production line or even the environment that it’s operating in.”

How drones are being used for monitoring and inspecting

Oil and gas companies are already replacing helicopters with drones for routine pipeline inspections. Last June, Shell vice president Hilary Mercer announced the company was using drones to help build its new \$6-billion US ethane cracker plant in Pittsburgh. The drones



take “thousands and thousands” of pictures of the site on a weekly basis. In August, carmaker Ford began deploying drones to perform difficult inspections on overhead gantries that had previously required shutting down production to complete safely. The drones also give Ford a clear plant maintenance record.

To improve inspections, drone manufacturer 3DR has started adding infrared cameras, initially for firefighting drones, according to Jim Merrick, director of marketing for Qualcomm’s internet of things business. He believes the monitoring drones could be a crucial part of factory health and safety in the near future.

Indeed, the US Occupational Safety and Health Administration (OSHA) began using drones for inspection last year. Similarly, OSHA not only used drones to inspect unsafe areas, it also used them for technical assistance in emergencies and during compliance assistance activities.

Drones about to take off in manufacturing

Compliance presents drones’ biggest problem. Although Amazon’s plan to use drones for home delivery appears to have hit a regulatory hurdle, in November car technology manufacturers ZF became the first company in Germany to use drones to fly spare parts, such as sensors or control cards, from the central warehouse to work areas. ZF’s six-motor drones carry up to five kilograms and fly over the roofs of plant buildings, only crossing driveways where there is no alternative.

76,000

drones operating in the UK’s skies

628,000

jobs in the drones economy

4,186

estimated number of drones in manufacturing and construction by 2030

PwC 2019

“

The most obvious area for growth is to expand drones capacity for doing what they’re best at, recording information in ways that are too difficult, dangerous or boring for humans



Audi is developing a system known as Paula, which follows a defined route set on a navigation system, but also picks up on any obstacles with laser scanners, intelligently working its way around them. Meanwhile Ocado, the UK online grocer, is building a robotic warehouse in the south of England for the French retailer Casino in which pre-programmed drone caddies move along metal rails sorting and moving goods.

Jamie Dargie, vice president at Design Group, points out that drone technology is still in its infancy. He expects to see them fulfilling more roles, from loading pallets through picking and packing to replacing sedentary robots in the manufacturing process itself. Drones in manufacturing, he concludes, are about to take flight. ●

TALENT

Manufacturing talent: what can you do to bridge the gap?

As the engineering and manufacturing sectors continually evolve, filling the gaps in talent created by technological change remains a constant battle

Karam Filflan

From 3D printing to blockchain, automation to predictive analytics, the fourth industrial revolution is changing how the manufacturing industry is operating. However, with this rapid transformation comes manufacturing talent challenges, exacerbated by an industry that has struggled to recruit the right people.

According to a survey by industry body Make UK, 29 per cent of manufacturing vacancies were considered hard to fill by employers in 2018, a small improvement on the 30 per cent reported in 2015 and 2013. Add in the UK's ongoing shortage of engineers and

a rapidly ageing workforce, and it becomes increasingly hard for leaders in manufacturing to know where to start when it comes to talent planning.

"Engineering businesses have always required a unique combination of technical and soft leadership skills, and it remains in short supply," says Carol Burke, managing director at Unipart Manufacturing Group.

The fourth industrial revolution is affecting all aspects of business because process is no longer about machines and people, but now about data. It is crucial that our employees have the imagination and creativity to realise the full potential of digitisation and end-to-end integration."

Creating a stronger manufacturing talent pipeline

To facilitate this growing demand, Unipart co-founded the Institute for Advanced Manufacturing and Engineering (AME) with Coventry University in 2014, with the aim of solving three key challenges for the business: solving skills shortages in manufacturing and engineering; increasing its capacity to fund research and development; and improving commercial benefits to its customers.

The institute houses state-of-the-art machinery and provides students with access to Unipart's operations, giving them a "live" environment in which to test their skills. Its first cohort of students graduated in 2018, with all either entering industry or going into postgraduate research.

"Our new talent pipeline is a mixture of AME graduates and apprentices. We want agile, flexible, creative and entrepreneurial employees, and this is vital in the digital world," says Ms Burke.

For others in the industry, finding the right balance between the skills new technology requires and upskilling existing talent pools is the key challenge.

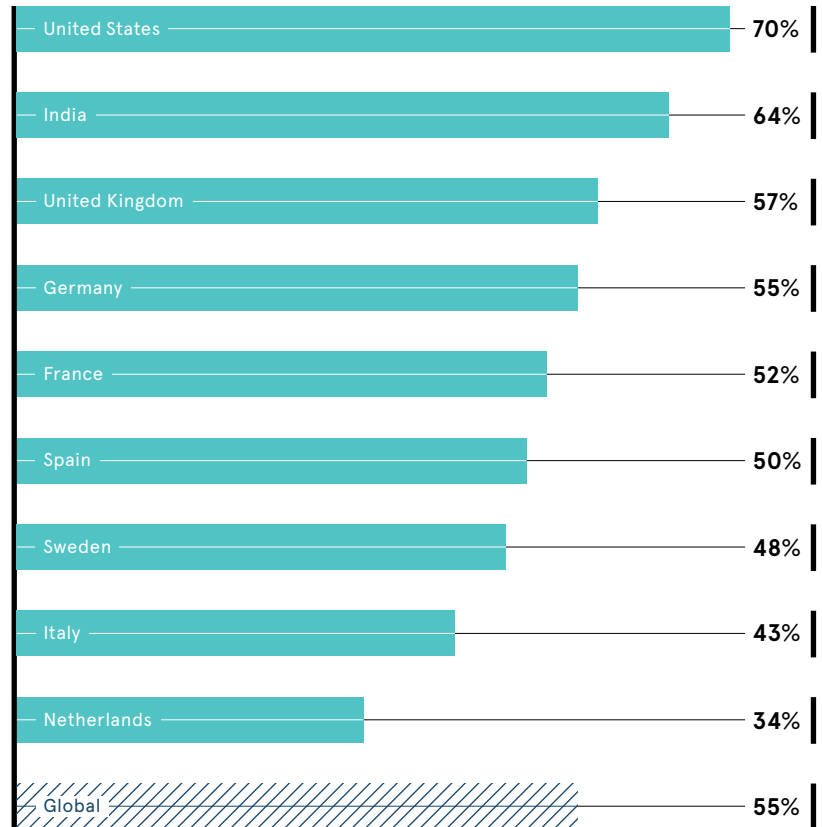
Gap in the middle when it comes to manufacturing talent

Siemens went through a period of structural reorganisation in 2014 to prepare it for the challenges facing the manufacturing industry, with industrial digitalisation being a key component of its Vision 2020 strategy. Commenting on the reasoning behind the changes in 2018, Siemens president and chief executive Joe Kaeser called digitisation "the greatest transformation in the history of industry".

Brian Holliday, managing director of Siemens' Digital Factory, the German manufacturer's data integration wing, says: "From a talent perspective, many new roles are emerging in app development, connectivity

THERE IS A GLOBAL DIGITAL TALENT GAP

Percentage of organisations responding to a widening of digital talent gap, by geography



Capgemini 2018



Dealing with this manufacturing talent gap is a major headache for an industry already struggling to meet demand

and software engineering. Technology won't replace people in future factories, but it will augment human effort through artificial intelligence and 'co-bots' [robots that work alongside people on the shop floor], so finding the right balance will be crucial to our survival.

"We won't build factories in the future without full digital simulation and we will be increasingly reliant on data for decisions. Our engineers and managers will need to continuously develop new capabilities and embrace new tools."

Like Unipart, Siemens is hoping to create industry-ready graduates by partnering with universities on research and qualifications. It has seven partner universities in the UK, including the universities of Cambridge, Manchester and Lincoln. The latter houses its newly opened Digital Mindsphere Lab, which

is a hub for developing its cloud-based operating service Mindsphere.

However, as with many industrial companies, Siemens' workforce largely consists of mature engineering talent, and apprentices and graduates, with a significant gap in the middle, says Mr Holliday.

Manufacturing talent gap is a challenge to be embraced

Dealing with this manufacturing talent gap is a major headache for an industry already struggling to meet demand. According to the Make UK, two fifths of manufacturers say 40 per cent of their workforce is above the age of 50. The looming Brexit deadline cannot be ignored either, with European Union nationals making up 11 per cent of the average manufacturer's workforce and proper guidance on post-Brexit rules still to be decided.

For Rockwell Automation's UK director Mark Bottomley, Brexit isn't manufacturing's defining issue for coming years, but rather the industry's ability to . He believes this is what will govern future success and talent strategies are key to fostering this change.

"The single most exciting thing about the fourth industrial revolution is the breadth of manufacturing talent that can find expression, the breadth of skills that can be developed and where these attributes are taking

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Until manufacturers can close this numbers gap, workforce planning will remain a significant challenge

the industry. There are barriers to overcome, but the biggest risk comes in not embracing the challenge," says Mr Bottomley.

A 2017 IDC FutureScape report into global manufacturing trends supports this view, predicting that 60 per cent of the largest 2,000 manufacturers will be reliant on digital platforms for processes by 2020 and 80 per cent of human-to-machine interactions using immersive interfaces such as augmented reality by 2030.

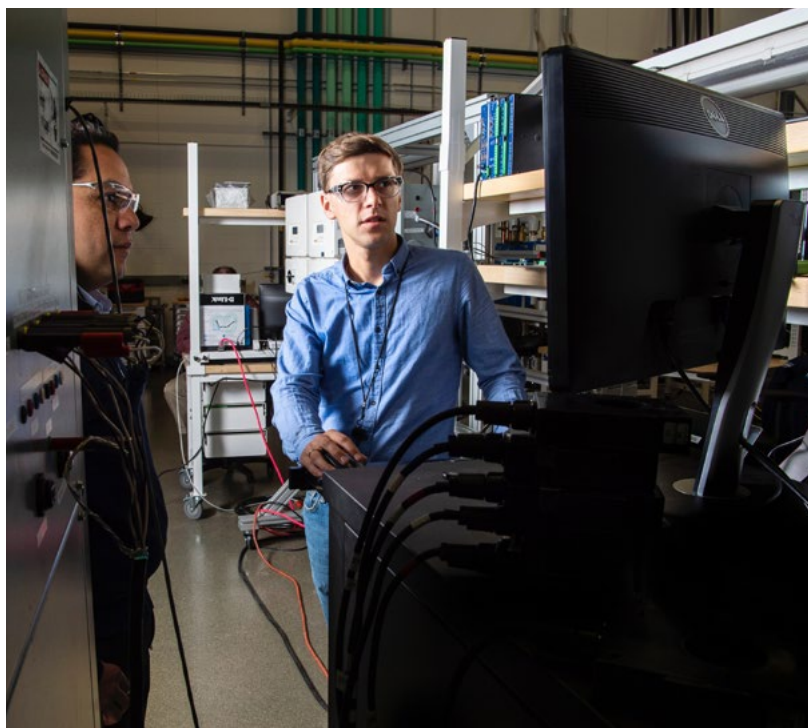
Key to beating talent shortage is training

To meet this, Mr Bottomley recommends a two-pronged approach to manufacturing talent planning with inward and outward strategies.

"Investing in the people you have is hugely important. Your people already understand what you do, but do you really understand what they could do if given the right opportunities? Offering your people the chance to learn and further their own careers also makes you more appealing to other skilled talent you'll need to recruit," he says.

"The other half of the equation is about looking into the future and outside your company to understand the skills you'll need down the line. Some of these skills can be redeployed through the use of automation technologies to free up existing workforces, but industry in general still needs an influx of engineers for the future."

Perhaps this is the crux of the issue. While digitalisation is certainly the future of manufacturing, in talent terms the present is still a challenge. According to Make UK, the sector needs to find 124,000 new employees with level 3 and above engineering skills each year, but faces a deficit of 54,000 annually. More government help is required as programmes like the Apprenticeship Levy and National Retraining Scheme are yet to have the desired impact. Until manufacturers can close this numbers gap, workforce planning will remain a significant challenge. ●



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Columbus[®]

Publisher Richard Hadler

Project manager Sarah Callaghan

Editor Peter Archer

Designers Kellie Jerrard, Jack Woolrich

Head of production Justyna O'Connell

Digital marketing manager Kyri Rousou

Contributors

Daniel Thomas

Experienced journalist working for BBC News online in London. Previously he edited a trade journal and freelanced for titles such as the *Telegraph*, *GQ*, *Fund Strategy* and the *Rough Guides* series

Emma Woollacott

Specialist technology writer, she covers legal and regulatory issues, contributing to *Forbes* and the *BBC*

Stephen Armstrong

Contributor to *The Sunday Times*, *London Evening Standard*, *Wired* and *Monocle*, he is also an occasional broadcaster on BBC Radio

Karam Filfilan

Freelance business editor and journalist specialising in human resources, the future of work and innovation. Previously he was deputy editor of *Changeboard*

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