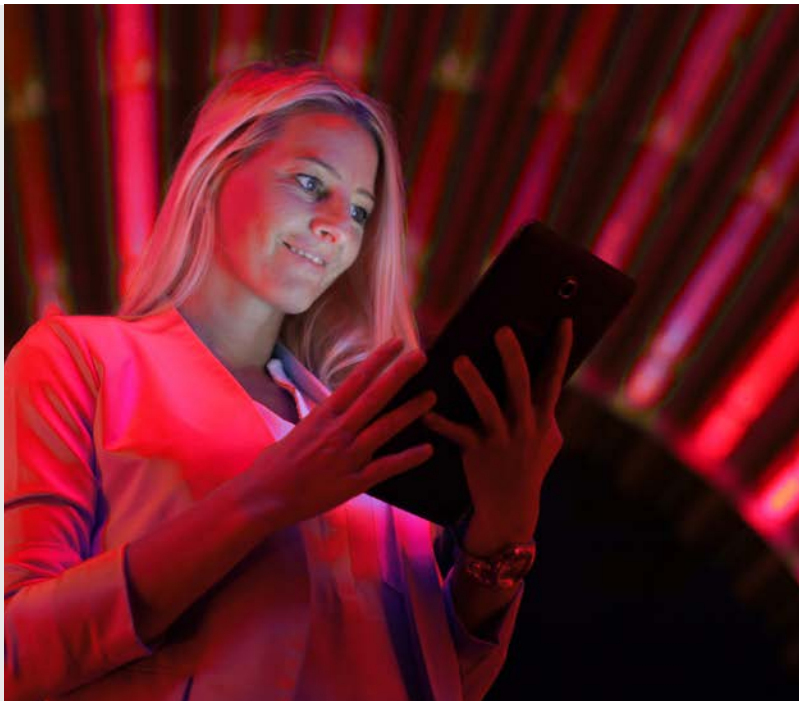
DIGITAL TRANSFORMATION REPORT 2019

A NEW ERA OF MANUFACTURING

EMBRACING A FUTURE OF DIGITALISATION

IDEAS | PEOPLE | TRUST

BDO



UK MANUFACTURING AT A GLANCE

EMPLOYS **2.7 million** PEOPLE

REPRESENTS **10%** OF UK **OUTPUT**

MAKES UP **45%** OF **UK EXPORTS** TOTALING **£275bn**

RANKED **9TH LARGEST** IN THE WORLD

REPRESENTS **69%** OF BUSINESS **R&D**

UK'S **TOP 3 EXPORT DESTINATIONS** FOR GOODS

UNITED STATES	GERMANY	FRANCE
£43.1bn	£33.3bn	£21.7bn

Source: Make UK - UK manufacturing facts, 2018/19

A NEW ERA OF MANUFACTURING

TOM LAWTON, PARTNER AND HEAD OF MANUFACTURING

There are 200 million people in the world working in manufacturing and logistics.

If digital software or hardware improves the efficiency of each of those people by even 1%, the value creation is worth billions. Digital transformation is inevitable. The question is how UK manufacturing manages this transition and copes with the changes required.

Digital transformation is likely to cause job losses, particularly in semi- and low-skilled areas. There will be job creation, but likely in the higher skills areas. This shift will require changes in education and training. On this, there is little sign of forward thinking from a Government mired in Brexit, seemingly forgetting there are changes in the world that will have a much bigger impact.

Businesses are being disrupted and markets are being created by a convergence of physical and digital products, services and environments. Manufacturing is being transformed and the pace of change will increase as computing power increases and the benefits of digital transformation become more apparent.

Digital transformation is also about business disruption. The most obvious example of a sector being impacted is automotive. The function of the vehicle – moving people from A to B – will not change in the future. But the powertrain and levels of automation will be totally different.

In the UK, car producers such as Jaguar Land Rover, Ford and Nissan are having to fundamentally change their businesses due to pressure on companies to meet climate change targets. Tesla, Dyson and others want to mass produce electric cars with increasing automation, if not driverless. Many think driverless vehicles will never happen, but as computing power increases the safety and business dynamics will become compelling. Imagine the impact of driverless vehicles in the transport and haulage industries, as well as how we use cars for business and social purposes.

In the digitalisation of manufacturing, many will think about using technology to cut, form, fabricate and assemble components more efficiently. But there are many ways digital technology can improve a business.

Our second study of digital transformation in manufacturing, following our 2016 report, shows not just the factory floor reaping wins but also back-office areas improving, through connections to the supply chain. The biggest improvements include marketing, finance, supply chain and, crucially, customer connectedness. Digital transformation wins transcend the factory floor.

Yet there is still more UK manufacturing needs to do to become "digitally fluent" and more efficient. We are competing against countries much further ahead in adopting digital transformation. Germany, Japan, China, US, Korea and even small manufacturing countries in Europe are further on the smart factory journey, by some measure.

I would like to thank all who completed the survey and those who worked on the survey and report. I hope you find it a useful barometer of how manufacturing is engaging with the unstoppable rise of the digital world.

EXECUTIVE SUMMARY

Digitisation is transforming information into a digital format. Digitalisation is using that digital information to improve business processes.

Digitalisation is and will continue to increase productivity and create value across manufacturing. However, the move to digital transformation (back office and factory floor) often involves high upfront costs and sometimes challenging changes to manage. But the direction of travel is all too clear and we can see global OEMs demanding more and more digital change from their supply chains. Companies that do not change are likely to be negatively impacted as the world moves on.

Despite this, the key finding from this survey is that UK manufacturers are still cautious about adopting many high-profile digital technologies. But it is also clear that digital transformation is gaining ground and the survey also shows much higher knowledge and appreciation of the benefits than in our previous survey. Several major themes emerged from our research:

"Our experience is that businesses are starting to invest in technologies where they can see a direct business benefit. We are seeing businesses adopt point solutions that meet a business case.

In some quarters there has been a perception that a large investment is required to transform the business. But starting small is where the value proposition is clearer. IoT and analytics are being used for equipment health monitoring or process control.

Adoption of additive manufacturing technologies, often for prototyping, provides businesses a good entry point from which they can explore further opportunities."

PROFESSOR SAM TURNER
CHIEF TECHNOLOGY OFFICER, HVM CATAPULT

MANUFACTURERS INCREASINGLY APPRECIATE DIGITALISATION

The understanding of digitalisation and its benefits has increased in the last three years. In 2019, 46% of respondents had good or significant understanding of digital technologies, compared with 9% in 2016.

- **46%** of respondents had either a good or high understanding of digital transformation
- **53%** said digital transformation will have a high or significant impact on their business
- **85%** said productivity is a key positive impact of digital transformation.

INDUSTRY-WIDE IMPLEMENTATION OF DIGITILISATION IS GROWING

About 20% more companies have a digitalisation strategy in 2019 than in 2016, while those that have no digital transformation strategy but need to plan one has fallen by 20%.

- **53%** have a digital transformation strategy
- Only **7%** did not have a digital transformation strategy and said they didn't need one
- **23%** of respondents said their business was embedding a digital culture.

COMPANIES ARE MORE WILLING TO INVEST IN DIGITAL TOOLS

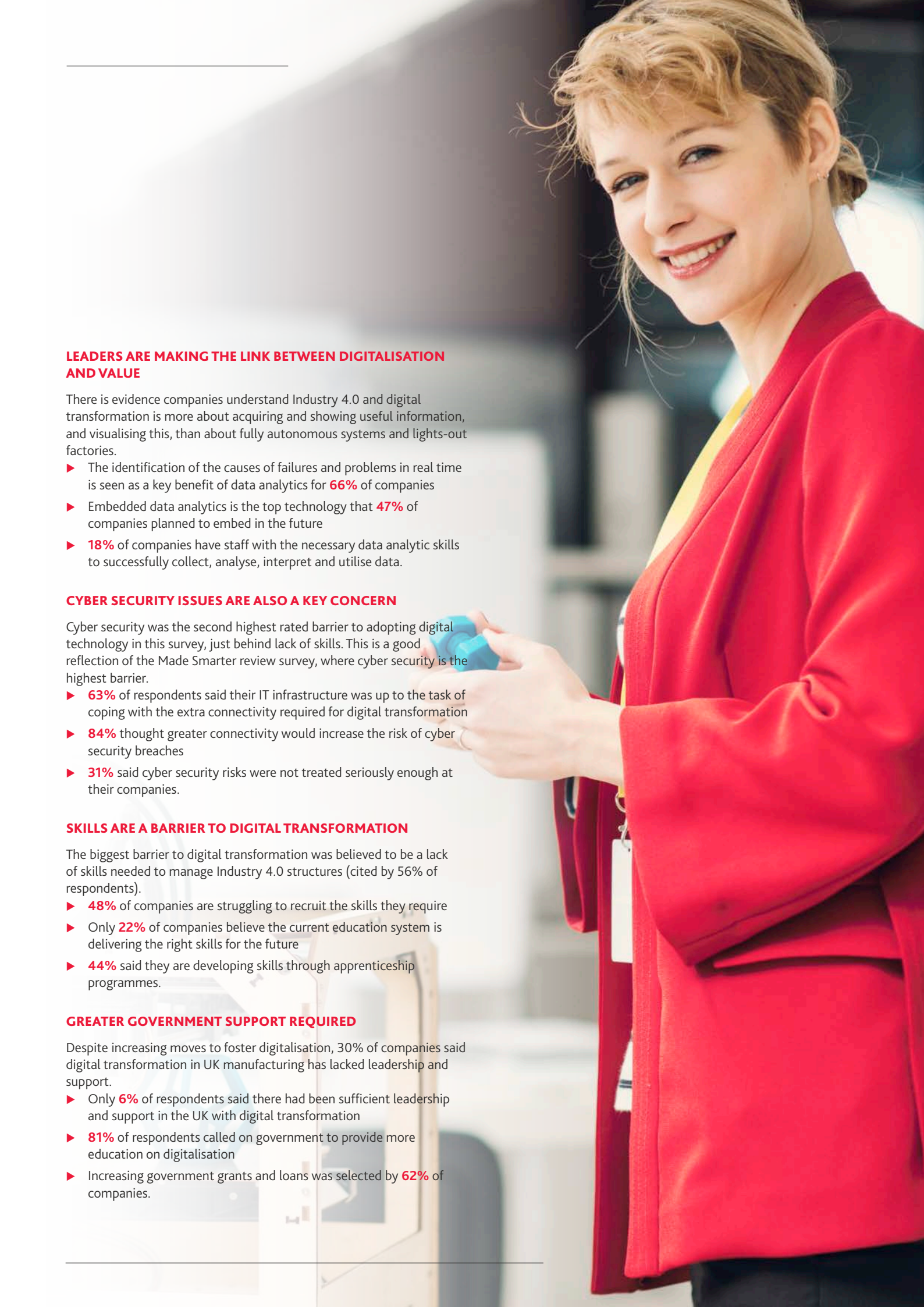
The proportion of companies making no investments in digital transformation has fallen considerably in three years; about half as many companies have made no investments in the last two years, compared to the level seen in 2016.

- **58%** of companies are currently self-funding digital projects, with **52%** expecting to self-fund in the future
- Only **21%** of companies said Brexit had curtailed some or all of their investment plans for digital
- **64%** expected to achieve return on digital transformation investment within two to five years.

CERTAIN TECHNOLOGIES ARE EMERGING AS DIGITALISATION FAVOURITES

The most popular technologies for digital transformation are 3D printing, data analytics, modern enterprise resource planning (ERP) and customer relationship management (CRM) software, and sensors to monitor processes.

- Cloud is the top technology companies have already invested in, cited by **52%** of respondents
- Artificial Intelligence (AI) and machine learning is a key technology for the future, with **44%** of companies planning to embed it
- **68%** of companies plan to focus future digital transformation on supply chain connectivity.



LEADERS ARE MAKING THE LINK BETWEEN DIGITALISATION AND VALUE

There is evidence companies understand Industry 4.0 and digital transformation is more about acquiring and showing useful information, and visualising this, than about fully autonomous systems and lights-out factories.

- The identification of the causes of failures and problems in real time is seen as a key benefit of data analytics for **66%** of companies
- Embedded data analytics is the top technology that **47%** of companies planned to embed in the future
- **18%** of companies have staff with the necessary data analytic skills to successfully collect, analyse, interpret and utilise data.

CYBER SECURITY ISSUES ARE ALSO A KEY CONCERN

Cyber security was the second highest rated barrier to adopting digital technology in this survey, just behind lack of skills. This is a good reflection of the Made Smarter review survey, where cyber security is the highest barrier.

- **63%** of respondents said their IT infrastructure was up to the task of coping with the extra connectivity required for digital transformation
- **84%** thought greater connectivity would increase the risk of cyber security breaches
- **31%** said cyber security risks were not treated seriously enough at their companies.

SKILLS ARE A BARRIER TO DIGITAL TRANSFORMATION

The biggest barrier to digital transformation was believed to be a lack of skills needed to manage Industry 4.0 structures (cited by 56% of respondents).

- **48%** of companies are struggling to recruit the skills they require
- Only **22%** of companies believe the current education system is delivering the right skills for the future
- **44%** said they are developing skills through apprenticeship programmes.

GREATER GOVERNMENT SUPPORT REQUIRED

Despite increasing moves to foster digitalisation, 30% of companies said digital transformation in UK manufacturing has lacked leadership and support.

- Only **6%** of respondents said there had been sufficient leadership and support in the UK with digital transformation
- **81%** of respondents called on government to provide more education on digitalisation
- Increasing government grants and loans was selected by **62%** of companies.

AWARENESS AND IMPACT

KNOWLEDGE OF DIGITAL TRANSFORMATION INCREASES

Awareness and understanding of digitalisation in manufacturing is an important measure that can separate the "buzz" of Industry 4.0 from the value it can bring to business.

Three years ago, awareness of the potential for digital transformation in manufacturing was still in its infancy.

In our report in 2016, 56% of respondents had little or no understanding of the term 'Industry 4.0'. Only 8% had significant understanding.

This year, in contrast, 81% of those responding had from some to high understanding of Industry 4.0, and of that, 17% had a significant understanding.

More companies—53% versus 44% in 2016—said digital transformation will have a significant effect on the business in 2019. But about the same number in both years thought it would have a big impact on their sector.

This shows the flow of digital transformation messages from major OEMs, other countries, the Government, media, academia and trade organisations appears to be getting through to industry. Despite this, awareness of key UK support organisations promoting digitalisation is low.

TOP 5 POSITIVE IMPACTS OF DIGITAL TRANSFORMATION HIGHLIGHTED IN SURVEY

	2019		2016
Productivity	85%	Productivity	51%
Customer relationships	74%	Data analytics	47%
Product development /innovation	72%	Customer relationships	46%
Profits	69%	Lower manufacturing costs	44%
Product quality	69%	Increased profitability	42%

For instance, 60% or more of those surveyed were not aware of the HVM Catapult, Digital Catapult or Made Smarter, the government scheme to increase digital-tech adoption in the North West.

Awareness of support for digital transformation was highest for universities (82%) and the Chambers of Commerce (76%), Local Enterprise Partnerships (65%) and Innovate UK (61%).

FIG.01: AWARENESS AND IMPACT

How would you describe your level of knowledge/understanding of Industry 4.0 technologies and digital transformation in manufacturing?

IMPACT

Over half of our sample said digital transformation was having a high to significant impact on their business (53%) and the whole manufacturing sector (56%).

Meanwhile, 19% said it was having a mid-range impact on their business and 30% cited a medium impact on the industry. Overall, it seems, manufacturing bosses see value in digitalisation.

Unsurprisingly, more companies believed digital transformation was having a positive impact on their business and their industry in 2019 than in 2016.

Respondents said the greatest impact of digitalisation was on productivity (85%), customer relationships (74%) and product development and innovation (72%).

Most companies agree digital transformation will benefit all the areas our survey listed. This shows bosses see digital transformation as something that creates value rather than just a `nice to have' or an area they need to invest in to keep up with others.

Most (74%) said the impact of digital transformation on the manufacturing sector in the UK will be positive.

DIGITAL IMPACT

74% SAID THE IMPACT OF DIGITAL TRANSFORMATION ON THE MANUFACTURING SECTOR IN THE UK WILL BE POSITIVE

In 2018, the Institute for Manufacturing at the University of Cambridge looked at the business impact of digital transformation interventions across the world, analysing 212 use cases from 10 international manufacturing programmes. The study showed:

- An improvement in delivery and service performance of more than 30%
- A reduction in defects and errors of more than 45%
- A reduction in material costs of more than 45%
- A reduction in labour costs of more than 55%
- An increase in outputs of more than 30%.

Process control and optimisation and production planning and control were among the applications that most often recorded improvement from digital intervention.

THE PRACTICAL IMPACT OF DIGITAL MANUFACTURING
A STUDY FOR INNOVATE UK BY POLICY LINKS, INSTITUTE FOR MANUFACTURING (IFM), UNIVERSITY OF CAMBRIDGE

STRATEGY AND BARRIERS

DIGITAL TRANSFORMATION IS SLOWLY BECOMING A STRATEGY

Digital transformation is coming of age: 53% of companies in our survey had a digitalisation strategy, compared with 34% in 2016. And 8% said they were advanced in implementing a digital strategy.

Only 7% did not have a strategy or a need for one, compared to 19% in 2016. The numbers have risen and more companies are embedding these strategies in their overall business goals, although 8% having advanced implementation is still quite a low number.

Despite growing digitalisation activity, British companies are modest about their approach to digital transformation. For example:

- Only 18% of companies rated themselves as innovators, tracking new technologies regularly and adopting the most innovative ones
- Another 28% see themselves as the 'early majority', where appetite to adopt relevant, proven technology is high
- Nearly one third cast themselves as the 'late majority', a group that tries to avoid the risk of new technologies and prefers to adopt them only when necessary—and when costs have dropped
- Finally, 31% are in a late majority that tries to avoid risks with new technology, and 3% are laggards, which don't have the time and funds to innovate.

WHAT'S DRIVING DIGITAL TRANSFORMATION, TECH INTEGRATION AND GREATER CONNECTIVITY? (RESPONDENTS WERE ASKED TO SELECT ALL THAT APPLY)

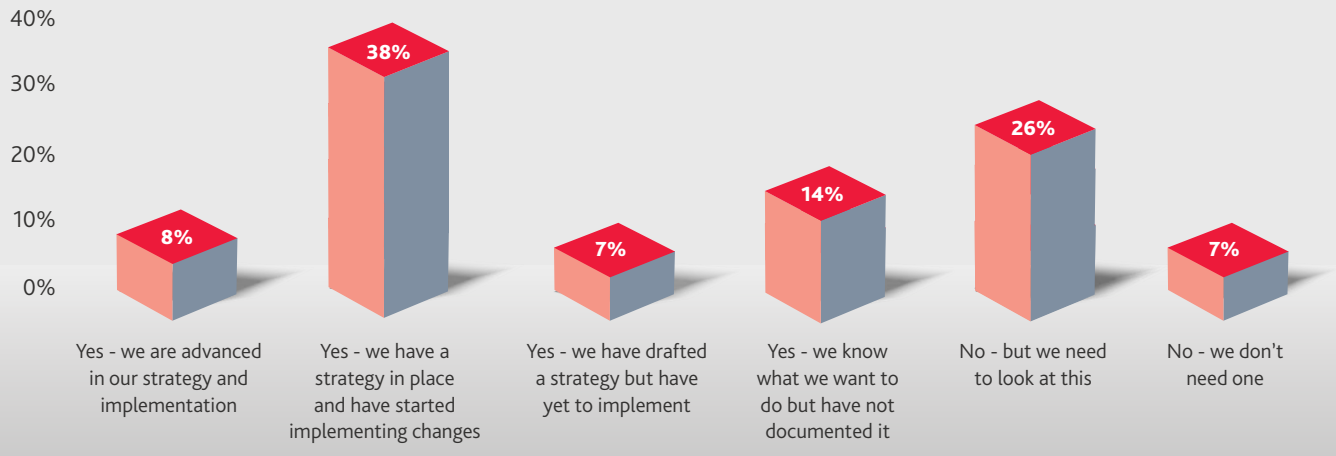
1	Expected cost benefits (cost reduction and increased productivity)	64%
2	Quality assurance and improvement	51%
3	Client demands	42%
4	Supply chain demands	40%
5	Parent company advice	24%

THE DRIVERS

Expected cost benefits (cost reduction and increased productivity) (64%), quality assurance and improvement (51%), key client demands (42%) and supply chain demands (40%) are the biggest drivers of digitalisation adoption.

But what is stopping companies from moving forward with digital transformation?

FIG.02: STRATEGY AND BARRIERS
Does your business have a digital transformation strategy?



A DIGITAL COMING OF AGE

53% OF COMPANIES HAD A DIGITALISATION STRATEGY IN 2019, COMPARED WITH 34% IN 2016

Hosokawa Micron, a manufacturer of industrial powder processing equipment, embarked on Hosokawa Gen4, a data-driven contract manufacturing transformation activity, to augment direct machine sales.

The company used process monitoring and product lifecycle management software tools to record data about processes, see bottlenecks, improve production efficiency and have greater digital visibility.

These smart factory initiatives underpinned the business case for an investment of £1m-plus in a contract manufacturing suite over the next three years. The company is targeting a 200% increase in contract manufacturing capacity by 2020, compared to a 2013 baseline.

DIGITALISING MANUFACTURING CONFERENCE 2018 AT MTC

BARRIERS

In our research, the top five barriers to digital transformation and technology integration were:

- Lack of skills or talent to manage a more complex Industry 4.0 structure: 56%
- Concerns regarding cyber security: 49%
- Other priorities for capital expenditure: 42%
- Lack of appropriate digital infrastructure: 38%
- Lack of knowledge of digitalisation and how it can help the business: 35%.

Interestingly, cyber security was the second-highest barrier to adopting digital technology in this survey, just behind lack of skills. This is a good reflection of the Made Smarter review, where cyber security was the highest barrier, followed by lack of technical skills.

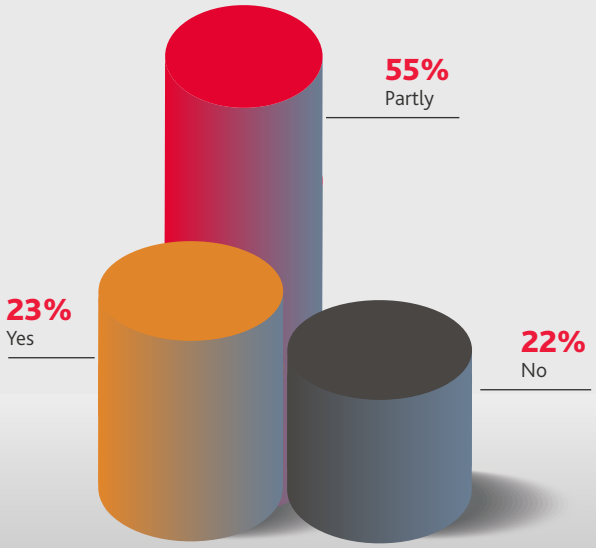
The lowest barrier to digital adoption was an unclear business case, showing the benefits of digitalisation are more obvious and accessible today than previously.

The government's Made Smarter review acknowledges that small and medium-sized enterprises (SMEs), in particular, perceive significant risks around cyber security and a lack of common standards allowing different technologies to connect. To speed up digitalisation, Made Smarter proposes more digital advocate leaders, more rapid adoption of technologies and better marketing to show industry and the world the UK intends to be a leader.

Last but not least, our research showed leadership could play an important role in bringing about the culture change needed for digital transformation. Only 22% of respondents said they had yet to begin embedding a digital culture.

FIG.03: STRATEGY AND BARRIERS

A digital culture and strong leadership are key to the success of a sustainable business digital transformation programme. Is your business embedding a digital culture?



INVESTMENT, ROI AND FUNDING

A RETURN ON INVESTMENT WITHIN FIVE YEARS

Three years ago, about a quarter of firms had no investment plans for digital in the next five years. In 2019, that is down to only 5%.

The number of companies spending or planning to spend up to £250,000 on digital interventions has increased since 2016.

Compared to three years ago, twice as many large companies plan to spend £5m or more on digital transformation in the next five years. So far, though, companies have been cautious about spending large sums on digital transformation.

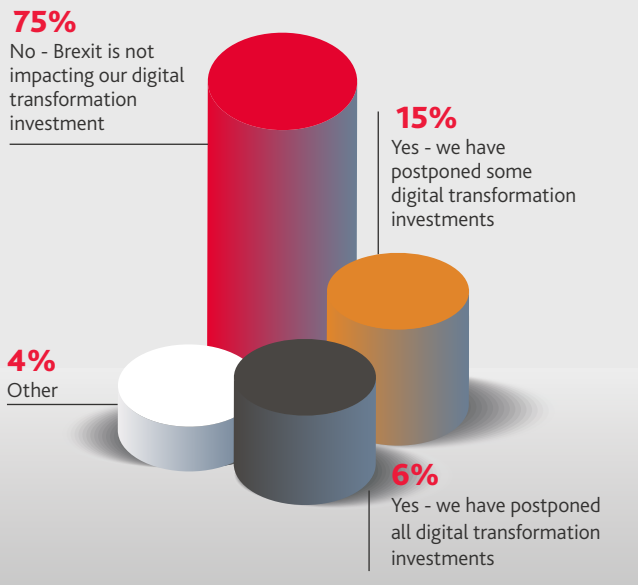
So while digital investment intent in this survey is fairly strong, is it being tempered by Brexit uncertainty?

Interestingly, only 21% of companies said Brexit had curtailed some or all of their investment plans for digital, three quarters claimed it had not affected their company's digitalisation programmes.

Since our survey was completed, overall manufacturing output volume growth weakened marginally in the three months to March 2019, according to a Confederation of British Industry survey. The survey said a quarter of 358 companies were stock building, while others saw depressed investment and demand due to difficulty in obtaining export orders.

FIG.04: INVESTMENT, ROI AND FUNDING

Is Brexit impacting your digital transformation investment plans?



INVESTMENT IN DIGITAL TRANSFORMATION

	Last 2 years	Next 5 years
No investment	16%	5%
<£100,000	39%	27%
£100,000 - £250,000	7%	10%
£251,000 - £500,000	3%	7%
£501,000 - £1m	6%	3%
£1m - £5m	3%	12%
£5m+	10%	14%
Don't know	16%	22%

Lower sales could affect corporate appetite for digitalisation investment, since 58% of companies had self-funded digital projects in the past and 52% expected to do the same in the future. The next most popular forms of funding were bank loans (13%) and alternative finance (14%).

HOW ARE BUSINESSES FUNDING CURRENT AND FUTURE INVESTMENTS?

	Historic/ current	Future
Alternative finance/non-bank funding	**14%**	**17%**
Angel investors	3%	3%
Bank	**13%**	**13%**
Family/friends	2%	4%
Flotation/IPO	1%	2%
Private equity investment	7%	7%
Self-funding	**58%**	**52%**
Venture capital	2%	2%

Despite this, the UK remains a comparatively good place to source funds for digitalisation, according to the 2017 European Union Digital Transformation Index. The study placed the UK 11th in a ranking of digital readiness, with strengths including an entrepreneurial culture, e-leadership and access to finance.

BREXIT BLOCKERS

21% OF COMPANIES SAID BREXIT HAD CURTAILED SOME OR ALL OF THEIR INVESTMENT PLANS FOR DIGITAL

Assuming they can secure funding for their projects, 64% of respondents believed they would see a return on investment (ROI) on digital investments in two to five years.

HOW LONG WILL IT TAKE TO ACHIEVE ROI ON CURRENT OR PLANNED INVESTMENTS?

1 year	13%
2 - 5 years	64%
5-10 years	12%
More than 10 years	4%
Other	7%

Compared to capital machinery and equipment, even accounting for depreciation, this is a short payback window. It shows the confidence with which businesses expect Industry 4.0 technologies to generate value. Only 12% expected to see the payback in five to 10 years, and 13%, a significant proportion, anticipated a payback within just 12 months.

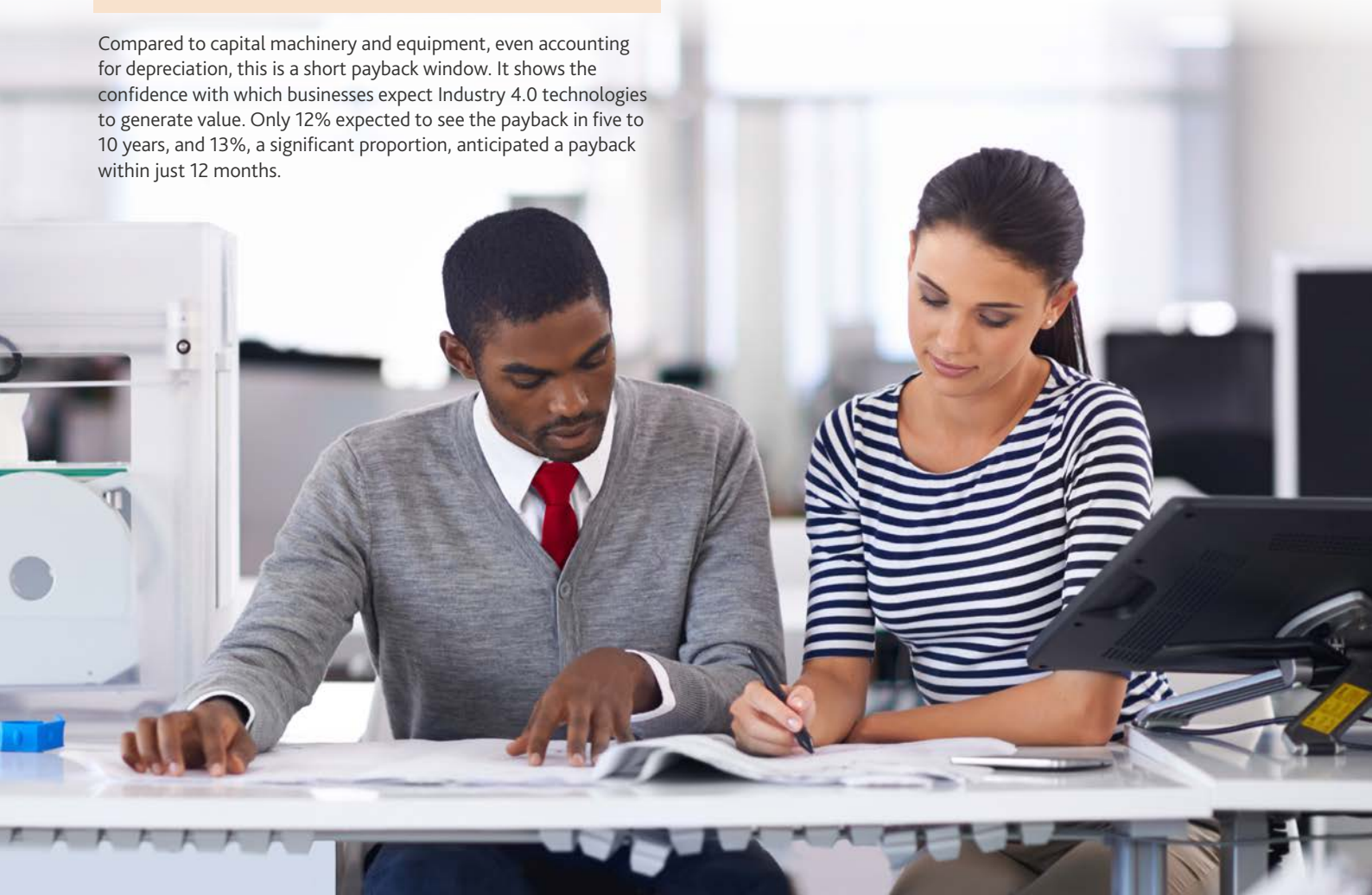
HOW TO KNOW YOUR COMPANY'S DIGITAL READINESS

It's always a worry: you know you should invest in digitalisation but have no way of knowing if it will work in your business. Until recently, you had to trust your gut. But now there is an online tool to assess your digital readiness.

The Digital Readiness Level Tool, created by a consortium including Innovate UK and HVM Catapult, benchmarks your readiness to make the most of new technologies and helps you prioritise the steps along your journey to digital maturity.

You can compare your digital readiness to that of other companies of similar size, sector and region, in an anonymised way. The tool gives you a score from 1, or 'Digital Outsider', to 9, or 'Digital Champion'.

Find out how digital ready your business is at **drl-tool.org**.



TECHNOLOGIES AND WHERE YOU FIND THEM

ARTIFICIAL INTELLIGENCE ON THE HORIZON

Recent headlines might have you believe all manufacturing jobs are about to be given to robots. That's not quite the picture for now, though.

Our survey found the most popular digital manufacturing technologies used by companies were:

- Cloud computing: **52%**
- Modern ERP and CRM software: **47%**
- 3D printing for prototyping: **46%**.

It is perhaps surprising to see nearly one half of the companies surveyed using 3D printing, given the novelty of the technology.

Less than 50% of companies using ERP is also a surprise, since most manufacturing businesses need some form of enterprise software. The finding suggests some companies use ERP but do not define their software as 'modern'.

Based on our research, embedded data analytics is the current must-have technology, with 47% of companies planning to embed it. And what of robots? About 20% of firms have already implemented collaborative or autonomous robots, our survey found.

"Technology continues to disrupt the manufacturing sector creating new possibilities, driving efficiency and value through its supply and distribution chain. To harness the best advantages, technology needs to be put to work harmoniously with the engineers and technicians to enable business growth."

TONY SPILLETT
PARTNER AND HEAD OF TECHNOLOGY & MEDIA AT BDO UK

A further 29% of companies plan to embed these tools. A collective 50% of firms using or intending to use robots is high, given that this is quite new technology and the UK is generally regarded as lagging in robot adoption internationally.

At the other end of the spectrum, only 10% of companies are making use of artificial intelligence and machine learning. Given the rise in media citations of these technologies in 2017 and 2018, one might expect this level to be higher. Encouragingly, 44% plan to embed artificial intelligence and machine learning in the future.

WHICH OF THE FOLLOWING TECHNOLOGIES HAS YOUR BUSINESS ALREADY EMBEDDED OR PLANS TO EMBED IN THE FUTURE?

	Already embedded	Plan to embed	N/A
3D printing for prototyping	**46%**	8%	46%
5G infrastructure	4%	33%	63%
Additive manufacturing for production parts	21%	26%	53%
Autonomous or collaborative robots (Cobots)	18%	29%	53%
Artificial Intelligence (AI) and machine learning	10%	**44%**	46%
Blockchain	2%	22%	76%
Cloud solutions	**52%**	32%	16%
Data analytics - capital equipment with embedded data analytics	**31%**	47%	22%
Generative or advanced design tools	27%	29%	44%
Modern CRM and ERP	**47%**	**37%**	16%
Predictive data analytics	24%	**43%**	33%
Sensors - capital equipment with embedded sensors	**28%**	**41%**	31%
The Industrial Internet of Things (IIoT)	18%	**40%**	42%
Virtual Reality (VR)/Augmented Reality (AR)/Mixed Reality visual devices	19%	31%	50%

Finally, and again despite widespread hype, a nominal 2% of companies are using blockchain technology.

WHERE IS DIGITAL TRANSFORMATION TECHNOLOGY BEING IMPLEMENTED?

Manufacturing companies are applying digital transformation in all departments, from finance to logistics and sales to production.

Nevertheless, production, research and development, and product development and logistics were the top areas for digital transformation in 2016 and 2019.

And a new, popular area for digital transformation in 2019 is customer connectivity, or the ability to learn about customer needs using digital tools.

While production, R&D, logistics and customer connectivity will remain a large part of digital transformation in the future, our study shows some back-office areas may have an even bigger role for digitalisation.

Areas expecting to see more digital engagement include recruitment (up to 69% from 35% today), finance (70%, from 47%) and supply chain connectivity (68%, from 50%).

KEEPING UP WITH THE PACE OF CHANGE

Despite this trend towards widespread adoption, more than two thirds of the survey believed it will be difficult to keep up with digital change. This is a genuine concern, given the pace at which technology is evolving.

Furthermore, there are indications that rapid technology development in itself is not the only challenge facing companies looking to embrace digitalisation.

Regulatory frameworks may also make it hard to keep up with technological change, hampering adoption.

FIG.05: TECHNOLOGIES AND WHERE YOU FIND THEM

Do you think it will be difficult to keep up with the pace of change/integration?

WHICH AREAS OF THE BUSINESS ARE YOU FOCUSING ON AS PART OF YOUR DIGITAL TRANSFORMATION AND WHICH AREAS DO YOU PLAN TO FOCUS ON IN THE FUTURE? (RESPONDENTS WERE ASKED TO SELECT ALL THAT APPLY)

	Currently		Future
R&D/product development	74%	Finance	70%
Production	68%	Recruitment	69%
Customer connectivity	63%	Supply chain connectivity	68%
Logistics	59%	Warehouse – inventory management	67%
Administration departments	56%	Marketing	64%
Procurement/purchasing	51%	Sales/order processing	59%
Supply chain connectivity	50%	Logistics	59%
Sales/order processing	49%	Administration departments	59%
Warehouse – inventory management	47%	Procurement/purchasing	57%
Finance	47%	Customer connectivity	52%
Marketing	45%	Production	51%
Recruitment	35%	R&D/product development	44%

DATA ANALYTICS

DEALING WITH DATA

One area of digital transformation that deserves special attention is data acquisition and analysis.

About two thirds of respondents reported gaining benefit from data derived from digital transformation. The main benefits were:

- Identifying the causes of failures and problems in real time: **66%**
- Optimising and improving operational efficiency: **66%**
- Developing longstanding customer relationships: **64%**

The prominence of optimising operational efficiency is consistent with most research and the prevailing sense that most Industry 4.0 technology for factories is purchased to achieve productivity gains.

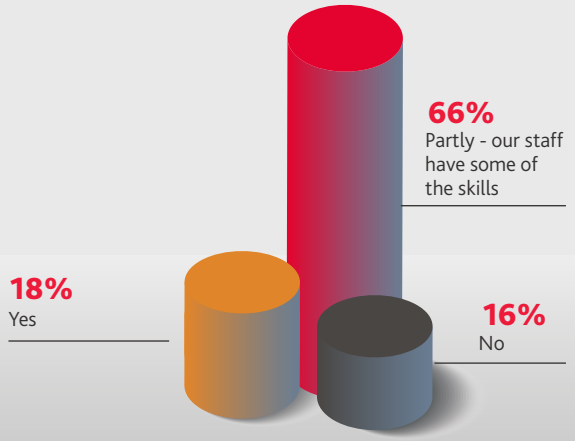
The slightly higher incidence of using digital in order to detect failures is notable. Many factories, especially high value and just-in-time operations such as car and engine plants, invest highly in preventative - and increasingly in predictive - maintenance technology. The need to keep the assets and the line moving 24/7 has never been greater, due to intense competition, rising raw material prices and the "drumbeat" of efficiency these plants operate to. More factories are deploying predictive maintenance and analytics into their operations to foresee, and prevent, unplanned downtime.

Less than a quarter of respondents said greater connectivity would benefit the personalisation of service delivery, which is interesting considering that personalising manufactured goods is often cited as being one of the main benefits of Industry 4.0.

While having access to data is all well and good, companies also need to have the skills and resources to interpret the information they are gathering. Earlier on we noted that skills were a challenge for digital transformation generally.

FIG.06: DATA ANALYTICS

Do you have staff with the necessary data analytic skills to successfully collect, analyse, interpret and utilise data?



For data analysis specifically, though, it appears the skills gap is not so severe. The employees of 66% of manufacturing companies have some of the skills to successfully collect, analyse, interpret and use data, respondents said.

And encouragingly, only 16% said they do not have the necessary skills at all. One fifth said they have all the skills their business needs in the data capture and analysis area.

WHAT DO YOU SEE AS BEING THE KEY BENEFITS OF DATA DERIVED THROUGH GREATER CONNECTIVITY? (RESPONDENTS WERE ASKED TO SELECT ALL THAT APPLY)

Identification of the causes of failures and problems in real time	66%
Optimising and improving operational efficiency	66%
Develop longstanding customer relationships and improve experience	64%
Improve the quality of decision making	61%
Real-time forecasting and monitoring	55%
Compare operational KPIs with suppliers, or partners and customers	47%
Develop stronger supply chain relationships	47%
Ability to mitigate risk and fraud	34%
Greater anticipation of market demands	34%
Improve organisational security	28%
Personalisation of service delivery	23%
No benefits	5%
Improvement of social value creation	3%

Specialist Castings and Engineering company Grainger & Worrall begins a new digital factory project with Warwick Manufacturing Group.

As part of the project, a digital twin of their factory will help Grainger & Worrall plan what improvements are needed and how to increase throughput and reduce waste. One driver for the project is to connect all of the legacy machines Grainger & Worrall uses with their more recent cutting edge equipment.

These machines still have serviceable life, and the digital factory will be able to monitor each machine's performance, showing any potential bottlenecks and inefficiencies in the process.

The benefits of the data analysis include:

- The ability to use virtual and augmented reality with the digital factory twin for training purposes
- Real-time planning with the ability to predict bottlenecks and delays in delivery
- Full traceability of work in progress, including scrap management
- Digital route cards and work instructions
- Real-time maintenance
- Monitoring of people performance.

SKILLS IN STOCK

18% OF COMPANIES HAVE THE SKILLS TO SUCCESSFULLY COLLECT, ANALYSE, INTERPRET AND USE DATA

SUPPLY CHAINS, RISK AND CYBER SECURITY

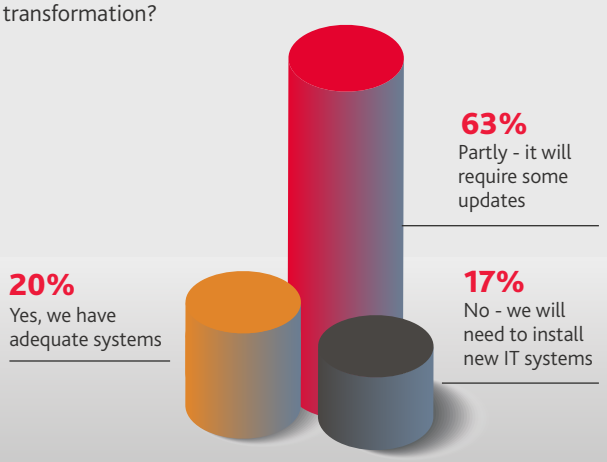
IS CYBER SECURITY UP TO THE TASK?

Digital transformation isn't just about buying a robot or 3D printer and plugging it in. You need to integrate the new technology into existing systems and make sure it stays safe from hackers.

In our survey, 63% of respondents said their IT infrastructure was up to the task of coping with the extra connectivity required for their digital transformation programme. Only 17% will need to install new IT systems.

FIG.07: SUPPLY CHAINS, RISK AND CYBER SECURITY

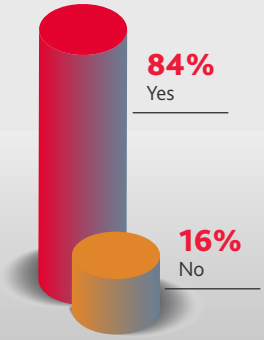
Does your business have suitable IT infrastructure to deal with the greater connectivity brought about by digital transformation?



At the same time, though, 84% said more connectivity could increase the risk of cyber security breaches. This suggests cyber security risks could be an impediment to digital transformation.

FIG.08: SUPPLY CHAINS, RISK AND CYBER SECURITY

Do you think greater connectivity, both internally and externally, will increase the risk of cyber security breaches for manufacturing businesses?



"Manufacturer's vulnerabilities can be linked to the age of their equipment and the networked nature of production facilities," says Romaney O'Malley, Head of Industrials Segment, AIG UK in a 2018 report with Make UK (formerly EEF).

"Just as sprinklers and fire doors are installed to prevent the spread of fire through your property, so too should strong security measures be taken to ensure a networked building cannot be hacked and exploited.

Industrial equipment that is 10 years or older was never designed to be part of a networked environment. These legacy components can exacerbate the threat as the production environment becomes ever-more connected."

CYBER SECURITY FOR MANUFACTURING AIG AND MAKE UK REPORT, APRIL 2018

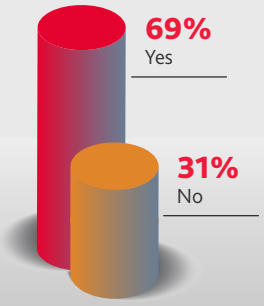
Only 41% of respondents said their company had adequate IT infrastructure, including firewalls and virus detection, to prevent cyber security breaches. This poor preparedness for cyberattacks in the sector is well documented.

Insurance company AIG and Make UK commissioned a study by The Royal United Services Institute in 2018 that found nearly half of manufacturers have been victims of cybercrime. Manufacturing is now the third most-targeted sector for cyberattacks.

The study said 41% of companies did not have enough information to even assess their true cyber risk. And 45% felt they did not have access to the right tools for the job. Given this vulnerability to cyberattacks, it is worrying that 31% of our respondents said IT security is not taken seriously enough at their company.

FIG.09: SUPPLY CHAINS, RISK AND CYBER SECURITY

Is cyber security taken seriously enough at your firm?



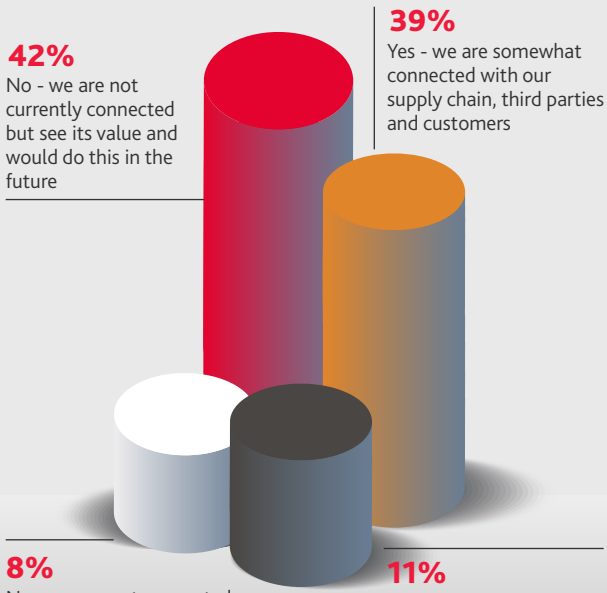
IN REACH OF A BREACH?

84% OF COMPANIES THINK GREATER CONNECTIVITY WILL INCREASE THE RISK OF CYBER SECURITY BREACHES

But 42% of the companies surveyed are not digitally connected to their supply chain, third parties and customers. This seems high and a huge business opportunity. Only 11% of those responding say they are strongly connected with their supply chain, third parties and customers, despite the fact that many of the digital tools to connect firms to these parties - like CRM and demand planning softwares - are mature.

FIG.10: SUPPLY CHAINS, RISK AND CYBER SECURITY

In addition to internal connectivity, digitalisation offers opportunities to connect better with your supply chain, third parties and customers. Is this something you are currently doing or will do in the future?



42%
No - we are not currently connected but see its value and would do this in the future

39%
Yes - we are somewhat connected with our supply chain, third parties and customers

8%
No - we are not connected and wouldn't do this in the future due to risks

11%
Yes - we are strongly connected with our supply chain, third parties and customers

SKILLS

DELIVERING A DIGITAL WORKFORCE

The technology needed for digital transformation is all there.

The question for many manufacturers is: who can I get to implement it? Access to skills is a significant issue in our survey, which showed:

- As many as **48% of companies** are **struggling to recruit the skills** they require
- More than **two thirds (67%)** of companies are investing in **retraining their workforce** for digital transformation
- A **substantial 44%** are developing skills through **apprenticeship programmes**
- Only **a quarter** say they have **no need to invest in Industry 4.0 skills** as this will happen in normal training
- Only **19% of companies** have the **skills required** to successfully collect, analyse, interpret and utilise data for digitalised manufacturing
- Only **22% of companies** believe the current **education system** is delivering the right science, technology, engineering and mathematics skills for the future
- A **vast 84%** say the **Government should be doing more** to deliver future skills for the sector.

Thankfully, several public and private initiatives are starting to tackle the UK's growing demand for digital skills. As well as universities offering degrees in computer science and data analytics, the Catapult Centres run apprentice training centres.

The University of Sheffield's Advanced Manufacturing Research Centre (AMRC) near Rotherham and the Manufacturing Technology Centre (MTC) near Coventry each take on between 100 and 200 apprentices per year. The AMRC's Advanced Training Centre alone has trained over 1,000 apprentices to date.

These initiatives have also been joined by the Marches Centre for Manufacturing and Technology, a £5m Shropshire training facility covering machining, metrology, hydraulics, pneumatics, welding, materials testing, robotics and more.

Its training covers digital manufacturing without requiring majors in hard disciplines such as informatics, data transfer protocols and data science. It also offers more than 100 upskilling courses.

Make UK also has the Technology Training Centre in Birmingham, which has had multi-million-pound investment in state-of-the-art machines, high-tech computer labs and robotics. The facility offers training for apprentices who want to kickstart their manufacturing careers, as well as offering manufacturers courses to train and upskill their existing workforces.

In a similar vein, in February 2019 the Government put £115m into funding more than 1,000 Masters and PhD courses in artificial intelligence at 16 Centres for Doctoral Training run by UK Research and Innovation.

The funding was topped up to a total of £200m by companies including Cisco, Google and BAE Systems.

The Government acknowledged the programme is a bid to keep up with artificial intelligence developments in countries such as the US and China. The question for UK manufacturing is: will these efforts be enough?

MAKING DIGITAL SMARTER

THE GOVERNMENT-SPONSORED MADE SMARTER REVIEW SAYS IT WILL BE CRITICAL TO UPSKILL A MILLION INDUSTRIAL WORKERS TO ENABLE DIGITAL TECHNOLOGIES TO BE ADOPTED AND EXPLOITED THROUGH A SINGLE INDUSTRIAL DIGITALISATION SKILLS STRATEGY.

GOVERNMENT SUPPORT

EDUCATION AND FUNDING ARE VITAL

Despite increasing moves to foster digitalisation, 30% of companies said digital transformation in UK manufacturing has lacked leadership and support.

However, with 64% saying there has been "partly" enough leadership and support, perhaps the truth is that the will to drive digital transformation is there but just needs more effort.

In our study, 81% of people called on government to provide more education on digitalisation and its benefits.

This suggests that although government's Made Smarter review for promoting digitalisation was launched with a fanfare and £20m, and received more funding in November 2018, its penetration is still low nationally.

HOW CAN THE GOVERNMENT BETTER SUPPORT YOUR JOURNEY TO IMPLEMENTING INDUSTRY 4.0/DIGITAL TRANSFORMATION? (RESPONDENTS WERE ASKED TO SELECT ALL THAT APPLY)

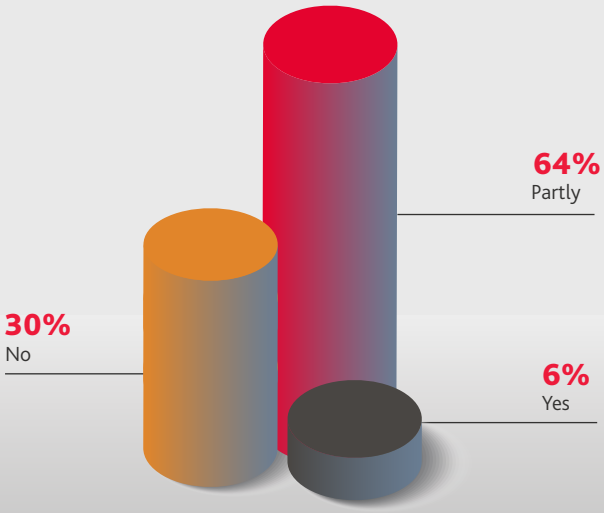
More support with education on Industry 4.0, digitalisation and technology benefits	81%
Increased availability of government grants and loans	62%
Education system overhaul to deliver future skills for the sector	57%
Practical support and best practice to implement technologies	56%
Simplify tax to encourage investment	52%
Long-term sustainable Industrial Strategy set for 15-20 years	52%

Increasing grants and loans (cited by 62%), an overhaul in the education system to deliver future skills (57%) and practical support to implement technologies (56%) were also selected as major points that government could take on to improve digitalisation.

Of 12 areas where the government can help, seven were selected by 48% or more of the sample, proving digital transformation is an area the private sector believes needs more state intervention.

FIG.11: GOVERNMENT SUPPORT

Do you think there has been sufficient leadership and support in the UK with digital transformation in the manufacturing sector?



One of the biggest economic challenges facing the UK is our stubbornly low levels of productivity. Being able to resolve it would improve wages and skills, and in turn help close inequality gaps.

All of the G7 economies saw a sharp drop off in productivity immediately following the 2008 global financial crash. Recovering productivity has been particularly difficult for the UK, however.

To deal with this, the first thing to acknowledge is that there is no single policy initiative that will remedy the problem. Low productivity is entrenched in the UK economy and it will take a significant amount of time and investment to resolve. Nevertheless, specific policies could begin to make a difference.

In our New Economy report, we proposed that the government should place a moratorium on UK corporate tax changes until 2022 or when the Brexit transition period is over (whichever comes first) to give businesses some certainty in difficult times.

And before this freeze is implemented, we would like to see one significant change: an increase in the annual investment allowance (AIA). In his 2018 Autumn Budget, the Chancellor Phillip Hammond increased the allowance to £1m until January 2021.

This was a welcome step, but we would like to see him go further. An increase to £5m for the next five years would provide a major incentive for mid-sized businesses to invest in capital assets, such as plant and machinery, that will drive growth after Brexit.

Increasing the AIA from its current rate of £1 million to £5 million would more than double projected business investment growth, according to analysis conducted by Cebr. The research found that business investment would increase by up to 4.1% - setting the UK on a significantly higher growth trajectory.

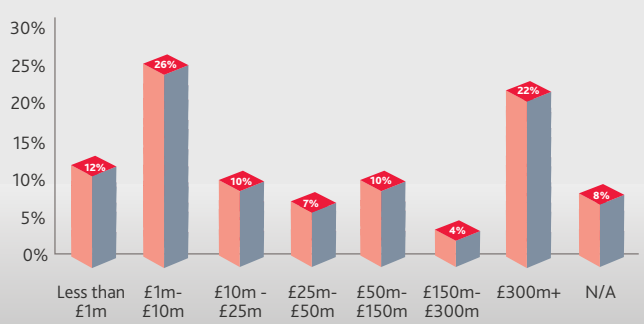
THE SURVEY SAMPLE

This report is based on a survey of manufacturers carried out by BDO in October and November 2018.

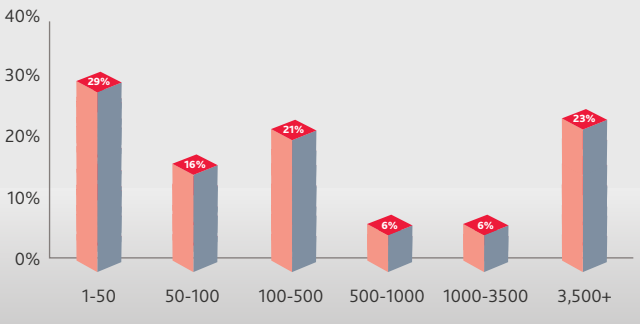
In total, 110 companies completed the survey, ranging in size from less than £1m turnover (12%) to more than £300m (22%) and from fewer than 50 employees to more than 3,500.

They were distributed across the UK and hailed from all manufacturing sub-sectors, with a small predominance in automotive, aerospace and machinery and equipment manufacturing.

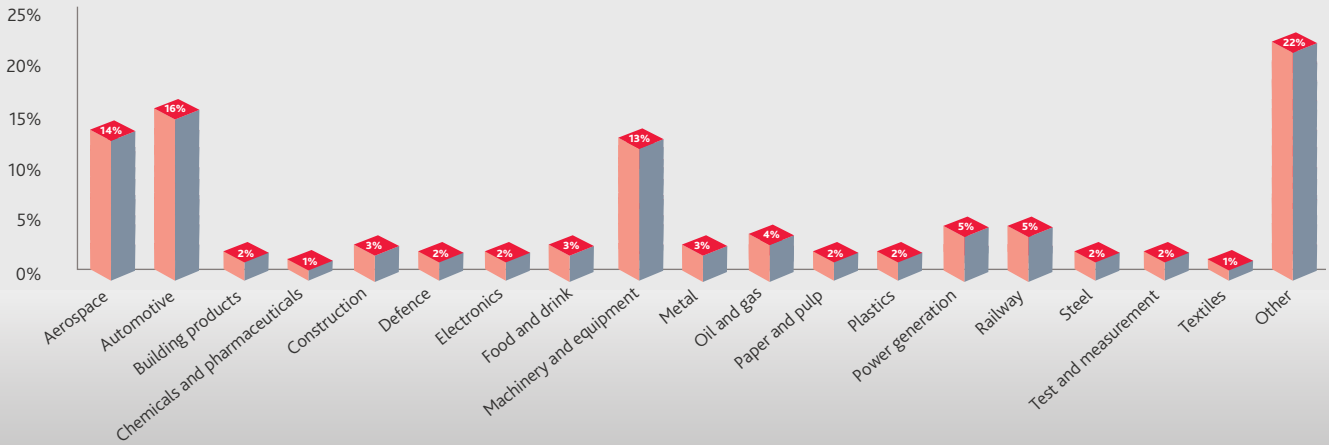
COMPANY TURNOVER



EMPLOYEES



SUB-SECTORS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Aerospace
Automotive
Building products
Chemicals and pharmaceuticals
Construction
Defence
Electronics
Food and drink
Machinery and equipment
Metal
Oil and gas
Paper and pulp
Plastics
Power generation
Railway
Steel
Test and measurement
Textiles
Other

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