

Annual Manufacturing Report 2020

THE SEARCH FOR STABILITY

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Annual Manufacturing Report 2020

THE SEARCH FOR STABILITY

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Foreword

Welcome to the 2020 edition of the Annual Manufacturing Report, researched and produced by *The Manufacturer*

A very warm welcome to *The Manufacturer's* Annual Manufacturing Report 2020. When I wrote the foreword to last year's Report, I did not anticipate that 12 months' later I would still be talking about the uncertainty blighting business and investment. And yet, here we are, with another year of negotiations (and no doubt political posturing), heading in the direction of a Brexit that seems to be harder than anything even the hardest Brexiters originally asked for. History is going to have much to say about how we got here, but right now, it is how we get through it that matters.

And the cheering news on that front is that businesses will cope. They may not like the adjustments being forced on their processes by the political dislocation caused by Brexit but this report demonstrates that manufacturers are, in the main, confident of making their way in this troubled world, confident in their search for stability. Inevitably, there is barely concealed scorn for some of the political decision making that has brought us to this pass, and a real sense of urgency in the continuing need for some real leadership on the issue of skills and training. This report talks a lot about technology, but people are our future. Talking of technology, we decided to find out which of the newest technologies being discussed in the sector are actually being adopted. It makes interesting reading.

We could not have produced this report without the extremely generous support of our sponsors PwC, Avanade, Palo Alto Networks, Board, and Hunter. Like anyone who works with the UK manufacturing sector, they recognise and appreciate it for being a shining example of innovation, talent and drive. We are very grateful for the strong interest in the sector they display by supporting this report.

So, enjoy this Annual Manufacturing Report 2020. We believe it throws a positive light on a manufacturing sector that is buzzing with ideas, confident about what is in their control, still nervous about what is not. Stability is something one never really notices until it's gone. Let us hope that as the year progresses everyone's search for stability is a fruitful one.



A handwritten signature in black ink, appearing to read 'Nick Peters', written in a cursive style.

NICK PETERS, EDITORIAL DIRECTOR
n.peters@hennikgroup.com

Introduction

To the Annual Manufacturing Report 2020

This report is based on a survey of manufacturers conducted by *The Manufacturer* magazine in December and January 2019/20 to determine how UK manufacturers feel about their lot over the coming year. We have been doing this for over 10 years now, as part of our service to the UK manufacturing sector.

Methodology

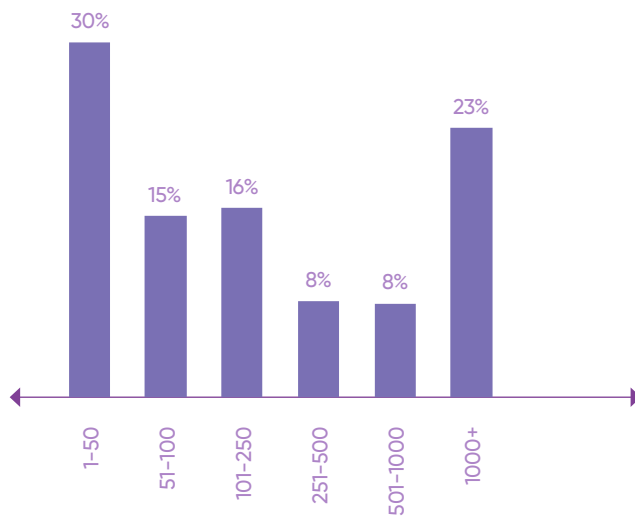
We asked survey respondents to choose between diametrically opposing points of view and then drew our conclusions from where they landed on a Likert scale. Therefore, when you look at the graphs in this report you will see for each issue two questions,

positive (left) and negative (right), and judge from the percentages the relative strength of opinion. When referring to percentages 'for' or 'against', we aggregate the three either side of the centre line.

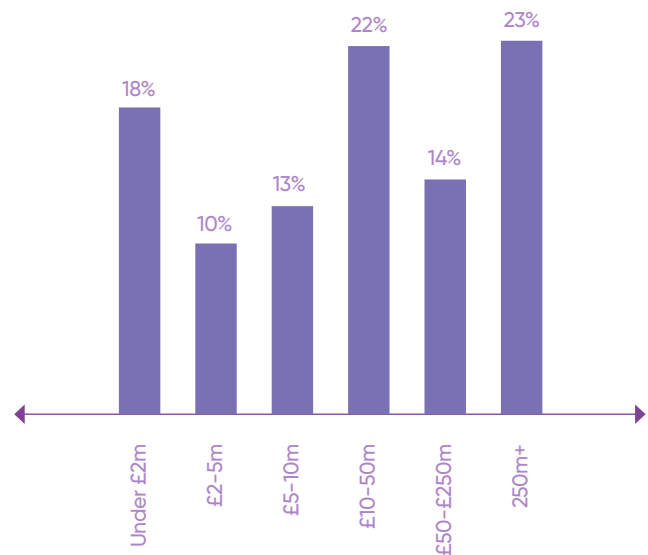
Due to rounding, not every graph will add up to 100%.

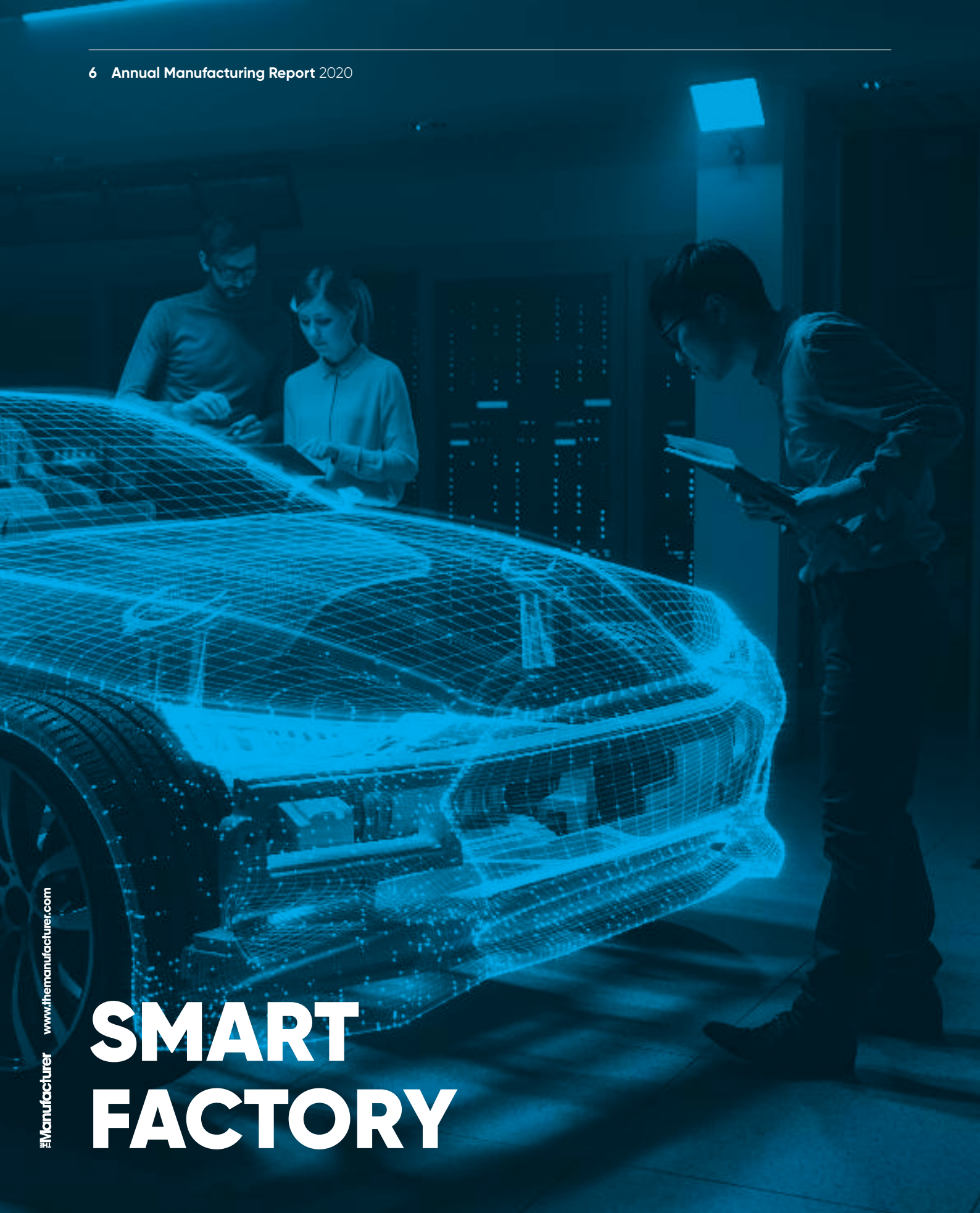
We interviewed some of the respondents to add qualitative content to our quantitative research. We offered them the chance to be quoted anonymously, because otherwise we would only have been able to run quotes from people senior enough in their own companies to speak their minds on the record.

NUMBER OF EMPLOYEES



TURNOVER OF PARTICIPATING COMPANIES





#Manufacturer www.themanufacturer.com

SMART FACTORY



Successful manufacturers are looking beyond industry trends to become future ready

Standing still isn't an option for manufacturers. Neither is simply moving forward with a "business as usual" mindset. Because today's manufacturers face a perfect storm of challenges.

Products need to get to market faster and more cost effectively than ever before. Meanwhile, personalisation demands are increasing in complexity, emerging technology is changing the way business processes are executed, and the widening employee skills gap needs urgent attention.

For many manufacturing organisations, keeping pace is enough of a headache, let alone achieving a digitally transformed future-ready state.

Digital transformation fatigue

Avanade – a provider of digital and cloud services – recently conducted research to understand the struggles organisations face as they seek to address these challenges.

The findings are stark. Whether it's legacy systems, siloed departments or an array of misaligned technology systems, companies that fail to tackle digital transformation are seeing profits erode by as much as 5.1%, compared with industry peers.

We also found that 94% of industrial equipment manufacturing (IEM) leaders agree their marketing, ERP and CRM systems are no longer fit for purpose.

That's probably why we also found that over 90% of consumer goods manufacturers see digital transformation

as a top three priority, with 84% agreeing with the ERP and CRM unfit for purpose situation. Embracing new technology and achieving greater innovation are the two main transformation drivers for IEM and consumer goods business leaders.

Yet 43% of businesses are encountering so many roadblocks, they're now reporting digital transformation fatigue.

Finding the route to a future-ready state

Researchers at the MIT Sloan Center for Information Systems Research (MIT CISR) have identified two crucial drivers for successful digital transformation and getting on a route to becoming future ready: an organisation's customer and employee experience maturity, and its operational efficiency.

Companies that are able to master these see big business benefits – including cost efficiency and improved innovation potential.

They're able to use disruptive technologies like the internet of things (IoT) to create new experiences for their employees and customers. They're capable of harnessing emerging technologies to connect workers. And they're willing to embrace artificial intelligence (AI) and automation to augment and free up workers to perform higher-value tasks.

Ultimately, they're future ready.

Expanding on evolutionary thinking

Building on the MIT CISR approach, we've broadened the digital transformation model to embrace three

key areas: efficiencies, experiences and innovation. But it's crucial those dimensions are complemented by intelligence – including analytics, AI, machine learning and broader disciplines such as data science.

Manufacturers seeking to respond and adapt to the market trends of Industry 4.0 can improve their chance of success by following this transformation path. By capitalising on this future-ready model, manufacturers can adapt quickly to changing economics, regulations and competition. In fact, they can do more than adapt. They can lead, forcing competitors to adapt to them.

Here's what that all means when it comes to your bottom line: companies that become future ready tend to enjoy margins 16% higher than the industry average, according to MIT CISR.

Chris Lloyd-Jones

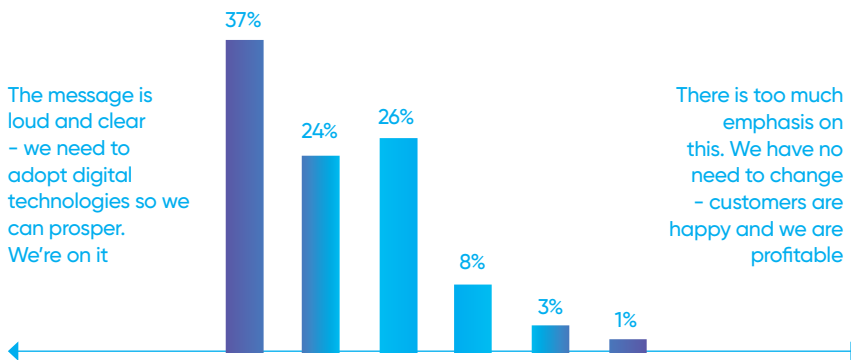
Global Emerging Technology and Engineering Leader, Avanade

www.avanade.com/future-readynow

Formed in 2000 by Accenture and Microsoft, Avanade works with manufacturers across the globe to create cultures that embrace transformation, to shape strategies and to execute consistently on their plans with a measurable return on investment. We focus on helping businesses to become future ready now by ensuring they can build operational efficiencies, invest in customer and employee experiences, and unleash continual innovation.

It is the defining feature of modern manufacturing: the drive to adopt smart factory, or digital manufacturing, technologies. Every year, we see a change in manufacturers' attitudes, from those days four to five years ago when there was a combination of resistance and incomprehension, mostly among SMEs, to the point now where close to 90% agree with the need for UK manufacturers to 'get on it'. The figure last year was 76%.

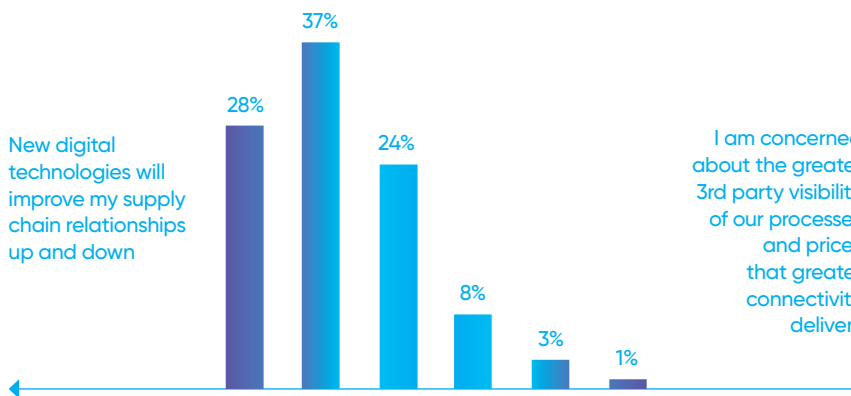
DIGITAL MANUFACTURING TECHNOLOGIES - IS THE MESSAGE GETTING THROUGH?



We would caution against anyone suggesting that this obvious support for the adoption of digital manufacturing technologies means the game is won. As the chart on page 20 (adoption of advanced technologies) demonstrates, there is still a long way to go. This at a time when our industrial competitors appear more ready to invest in modernising their businesses, and when other strains such as political uncertainty make investment decisions hard.

In terms of what digitalisation will do for their businesses, a similarly large number understand the enormous benefits that can be derived from having greater visibility of their supply chain up and down. This goes quite a way to counter the fear that used to be widely expressed, that greater third party visibility of processes poses a risk in terms of IP and pricing.

DIGITAL TECH AND THE SUPPLY CHAIN



That said, there are still some who feel that hierarchy inevitably rules in the supply chain.

87%
say we need to adopt digital technologies so we can prosper.

“

Industry 4.0 is not the end game for industrial digitalisation. In today's world of perpetual change, the solution is not another industrial revolution, but a transformation of products and how we make them. We call this Industry X.0. Using new technologies like IoT, analytics, AI and digital twin, manufacturers can unlock new revenue and work with customers, employees and partners on a whole new level.

CHRIS LLOYD JONES
Global Emerging Technology and Engineering Leader, Avande

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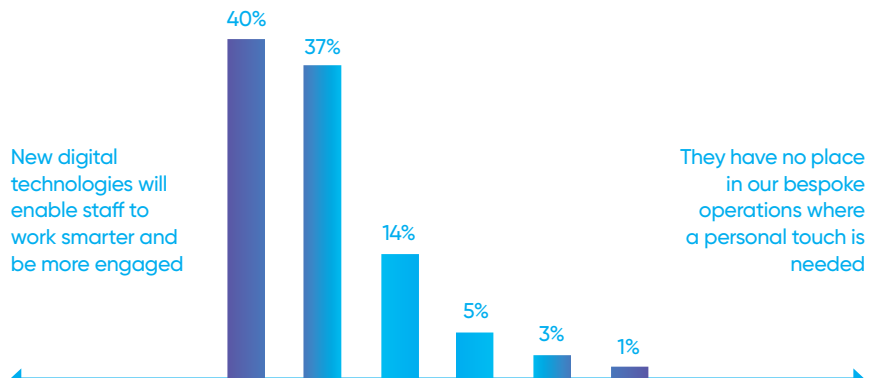
Customers want open book (but without opening theirs). Trust in product and process has never been more important. There is also a need to protect IP within SMEs through non-formal methods (as opposed to formal protections via patents.)

Tony Dumbreck, Managing Director, Innovate Foods Ltd

And there is concern that pressing these new systems, which involve whole new technologies such as cloud computing, on companies that don't have the skills to understand them, nor the money to hire them in, will be problematic.

You will note elsewhere in this report (People and Skills on page 38) that manufacturers believe that digital manufacturing technologies will drive the upskilling of the workforce.

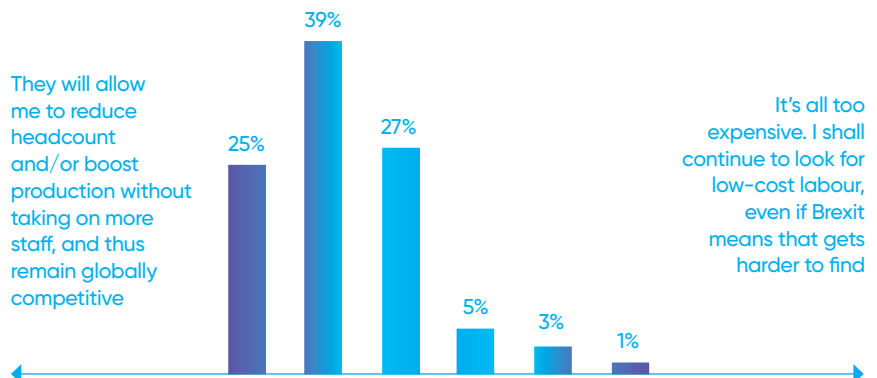
WORK SMARTER, MAKE SMARTER



What we see here is that there is a dividend in terms of retention, because making smarter definitely allows staff to work smarter, and therefore be more engaged with outcomes.

The productivity dividend from digitalisation is equally accepted. We gave respondents the opportunity to reduce headcount and produce the same amount or keep the headcount and produce more.

PRODUCTIVITY DIVIDEND



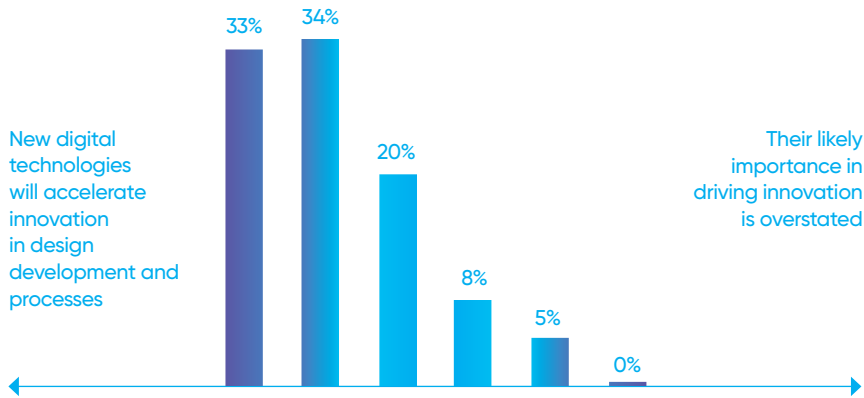
Both of the options we presented, to be fair, constitute an improvement in productivity, they are just two different ways of achieving it. It is satisfying to see such an overwhelming majority supporting the notion of retaining staff and going for growth. But progress comes at a cost.

“

We have a business model that wraps technology around the heart of people both team and clients. I however need to finance the digital requirements to deliver on this. As a small business that has carved out a niche offering in textile development, my labour costs are my highest component, as all on living wage. This is crucial. I can offer a more productive, effective and global service if supported to transition to digital, which in effect would lead to creating more jobs, not less.

Christina Mackay, Managing Director, BeYonder Ltd

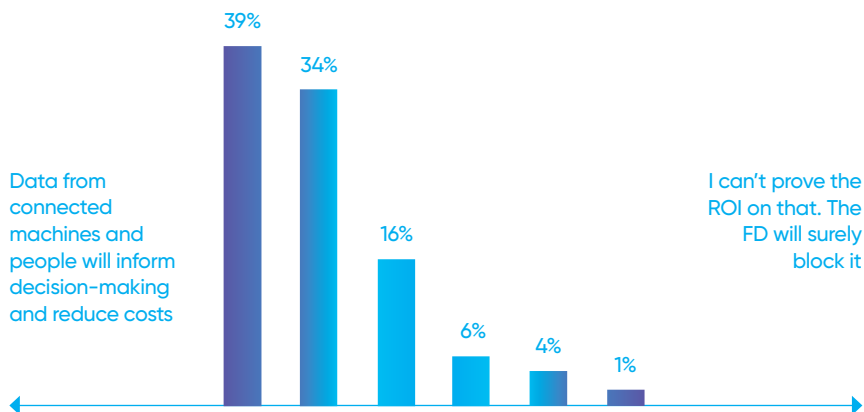
DIGITAL TECH IMPACT ON INNOVATION



It is almost a no-brainer that digital manufacturing technologies will accelerate innovation in design development and processes. The extent to which digital twins and additive manufacturing are becoming commonplace, and the tremendous strides being made in CAD systems, means that it is no longer a question of whether a manufacturer should adopt them, but how quickly.

It follows that if our respondents agree overwhelmingly that digital technologies will improve their supply chain relationships, workforce engagement and innovation/product development that they will also understand the benefits that flow into decision making and customer service.

DATA DRIVEN DECISION MAKING



89%
of manufacturers believe Smart Factory technologies will improve their supply chain relationships

87%
believe smart factory technologies will accelerate innovation and design development



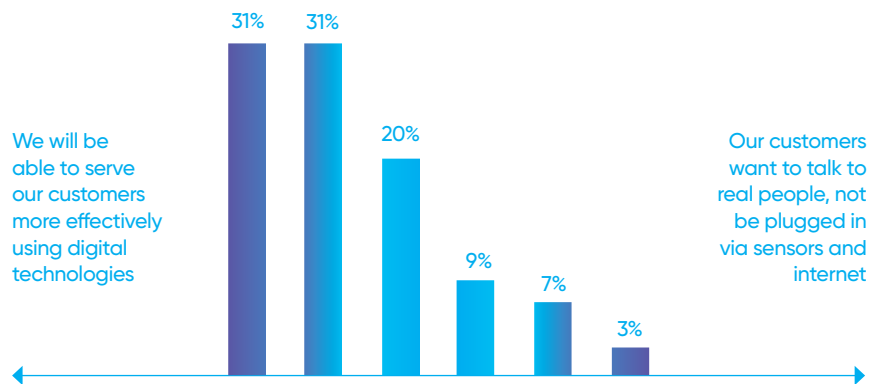


It is perhaps one of the most compelling arguments for digitalisation, that the ready availability of information about the business, available in real time and not hidden on spreadsheets, will improve efficiency.

As we argue at the end of this chapter, however, policymakers and perhaps even larger companies in the supply chain, need to understand that simply demanding SMEs in the supply chain ‘go digital’, as some large companies do, is not enough. More imaginative ways of offering digitalisation support to SMEs must be considered.

And of course, everything ends with the customer, whose satisfaction or otherwise with manufacturers’ products will decide their fate. The ability for manufacturers to improve their customers’ experiences by gaining digital insights into the customer relationship, and by improving it through value-added services, is well recognised.

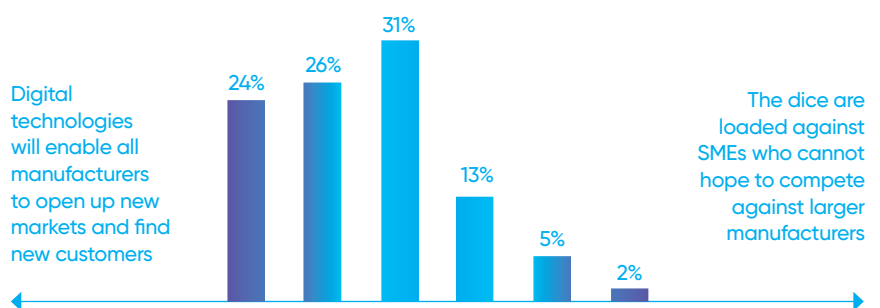
DATA IMPROVES CUSTOMER SERVICE?



In the end, the UK’s success as a manufacturing nation will be decided by how the various players in the digitalisation debate – government, solutions providers, advisory services and manufacturers themselves – iron out the many difficulties and challenges adoption poses.

Only 20% of the respondents tend to believe the digital dice are loaded against SMEs. It’s a positive sentiment echoed in all of the responses in this chapter of the Annual Manufacturing Report.

DIGITAL TECH WORKS FOR ALL COMPANIES?



We believe it is important, however, to report there were voices of caution among our respondents who rightly say that it is one thing to declare digitalisation a universal good, quite another to make it happen.

For us, this is one of the reasons why, in hindsight, the start of the Made Smarter North West Pilot last year, while in itself an admirable project, was unfortunate, as trialling it in just one region suggests that everyone else in the country can put their plans on hold and wait to see how the North West gets on. That could be quite a while.

We therefore agree with the comment below that the entire country needs to get its digital act together quickly.

“

SMEs need support to adopt. Made Smarter rolled out nationally would help.

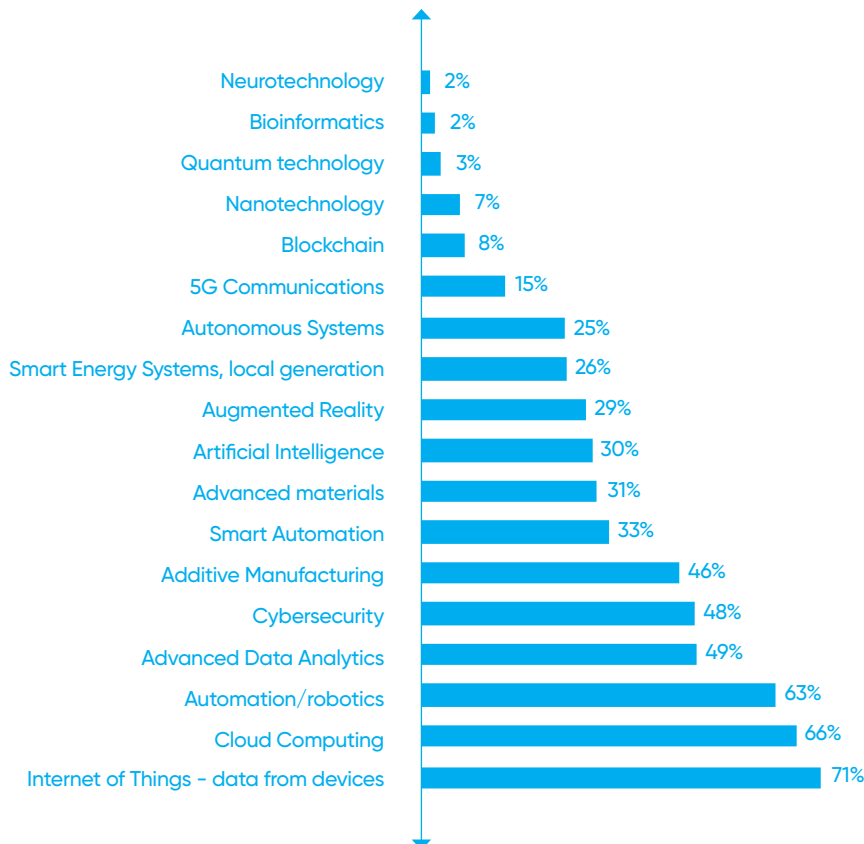
Andrew Hodgson, Strategic Lead – Digitalisation, Siemens UK

A final question about the adoption of digital technologies by UK manufacturers. Just how advanced is it?

In his address to the Manufacturing Leaders’ Summit in Liverpool, November 2019, Henrik von Scheel, the technology strategist who first used the term “Industry 4.0”, offered a list of technologies manufacturers need to be considering now, and in the coming years. Some of these technologies are now quite standard, some extremely rarefied, but they will all be part of the manufacturing landscape in time.

We asked our respondents: which of them have you adopted, or are you actively considering? It is interesting that only three of the technologies commonly thought of as being Industry 4.0 cross the 50% threshold.

THE ADOPTION OF ADVANCED TECHNOLOGIES BY UK MANUFACTURERS



81%
said digital technologies will enable all manufacturers to open up new markets and find new customers

91%
said they will enable them to increase productivity levels per headcount

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Manufacturers seeking to respond and adapt to the market trend of Industry 4.0 can improve their chance of success by becoming future ready.

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CYBERSECURITY



The enemy at the gate

Since the Industrial Revolution began some 270 years ago, manufacturing has not just come of age, it has learnt to adapt and evolve with multiple waves of technological change; but never has so much change come to bear so quickly as the sector is facing in the early years of the 21st century.

The Fourth Industrial Revolution is bringing digital transformation through the deployment of up to 17 different technologies. All these technologies are competing for your time, money and effort, cybersecurity being just one component.

Our early research with *The Manufacturer* suggests cybersecurity is understood as a critical pillar of Industry 4.0, with 85% of respondents identifying it as part of their digital transformation, though perhaps only at a basic level.

Palo Alto Networks further explored how cybersecurity is understood in manufacturing; for example, principles such as Zero Trust in the IT environment have been widely explored, but what about how to build a consistent security posture across IT and OT environments?

We identified five primary ways to address and deliver effective cybersecurity in a manufacturing environment.

Ensure you consider:

- Secure unification of the IT and OT environments
- How to uphold the availability of manufacturing operations
- Protection of your intellectual property
- Confidentiality, availability and integrity of

the entire supply chain (e.g., are third parties as secure as your business?)

- How to secure new routes to market and customer engagement

Palo Alto Networks continues to drive the need for a cohesive approach to embed cybersecurity in all aspects of your IT landscape, from the programmable logic controllers on the factory floor to the use of cloud-based machine-learning to drive faster remediation and lay the foundations for smart factories.

Whilst many manufacturers recognise some of this, they certainly haven't extended this thinking into securing their increasingly global supply chains or even the chairman's personal mobile phone on the weekend.

Cybercriminals are everywhere; the risks are not just for banks and governments. Everyone and everything that is connected could be a target. In our evermore connected world, it becomes harder to stay 'safe'.

Industrial businesses routinely tell *The Manufacturer* that cybersecurity isn't a priority: 'who cares about a widget manufacturer?'

Don't underestimate the cost of being hacked.

From downtime to loss of production, damaged equipment, loss of reputation or even ransom demands, it can be immense – and it can happen to anyone.

Greg Day
VP & Chief Security Officer, EMEA
Palo Alto Networks

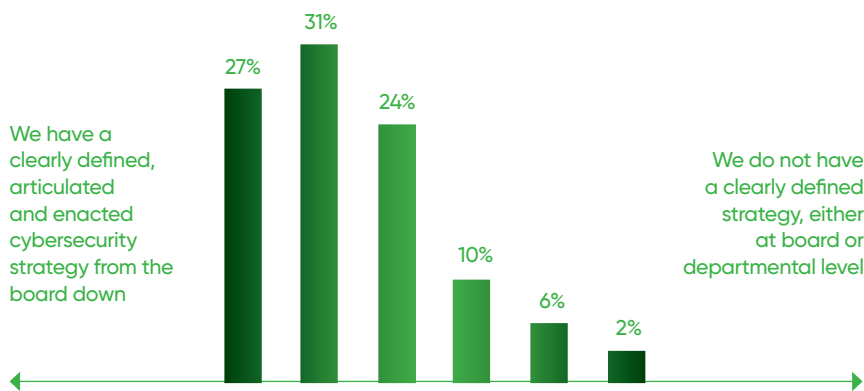
www.paloaltonetworks.com

The threat to manufacturers from an attack on IT systems has grown exponentially in recent years thanks to the greater level of connectedness between companies and the outside world, and by the growing adoption of sensors and other devices connected via the Industrial Internet of Things (IIoT). All this is the inevitable consequence of Industry 4.0, one of whose fundamental features is the gathering of data from industrial processes and their transmission via IP (Internet Protocol). That can be transmission within the factory, to partners via the supply chain, or to third party data processors and analysts in the cloud.

Whichever way one looks at it, the days of being able to lock a filing cabinet full of company information and regard it as secure are gone. As recently as 2016, an executive from a niche car manufacturer told *The Manufacturer* his company rejected the notion of connectedness to the outside world by saying all product data, specifically IP, was held on one computer that was not hooked up to the internet. That may still be desirable in some instances, but any manufacturer keen on embracing a digital future will have to understand that the threat from cyber criminals is a necessary part of digital transformation. That is not the same as doing nothing about it. Modern cyber defences are sophisticated and effective.

In this section of the Report, therefore, we sought to discover manufacturers' attitudes to cybersecurity, the internal cultures they believe necessary to enforce it and how they might have confidence that all parts of their value chain are secure.

DO YOU HAVE A CYBERSECURITY POLICY IN PLACE?



We found the very positive response to this question quite puzzling, because in the past manufacturers have suggested to us they don't see cybersecurity as a priority. It is therefore surprising and gratifying that a clear majority of respondents say they have a clearly defined cybersecurity strategy, rather bucking that impression. It is of course entirely possible that the people who said they didn't see cybersecurity as a priority were not the people responsible for it. Perhaps it just wasn't on their personal radar. Or perhaps it is yet another demand on limited resources for some companies.

“

We want this to be a priority, however affordability is an issue.

Christina Mackay, Managing Director, BeYonder Ltd

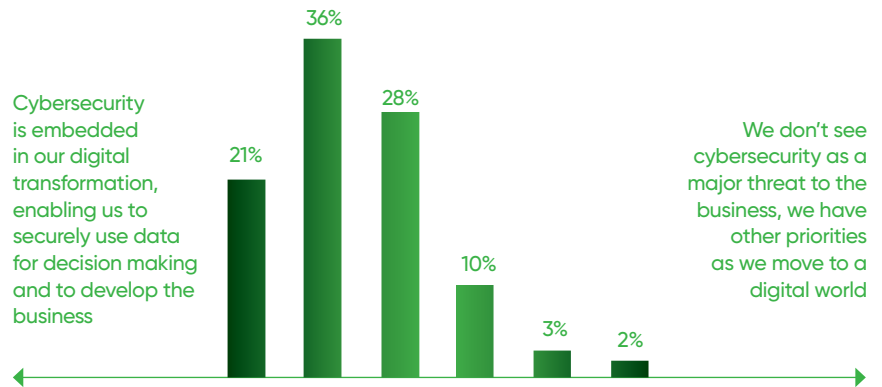
84%

said cybersecurity is the responsibility of everyone in the business

82%

have a clearly defined, articulated and enacted cybersecurity strategy

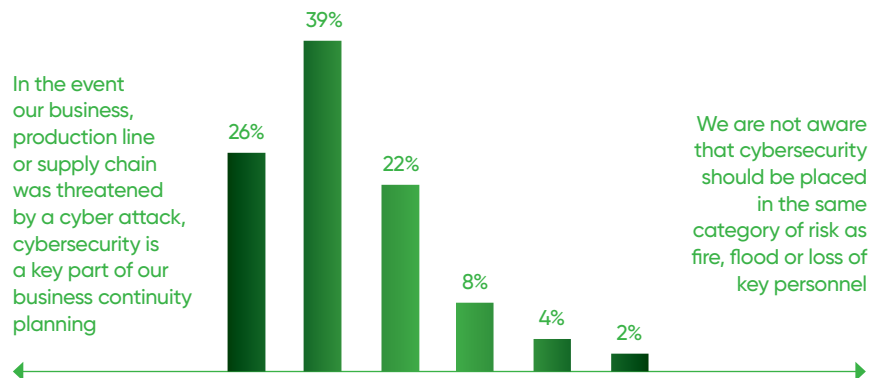
CYBERSECURITY AND DIGITAL TRANSFORMATION



As mentioned earlier, the advent of digital manufacturing technologies that rely on IP connectedness means that protection against cyber attack is of critical importance. It follows that a similarly large majority of 85% say cybersecurity is embedded in their digital transformation, which enables them to share data securely inside their plants and with supply chain partners.

But what if there is a breach? As the case of aluminium smelters Norsk Hydro in March 2019 demonstrated, a ransomware cyberattack can be seriously damaging, as damaging as any other external event such as fire, flood and acts of God, against which companies routinely insure themselves. (The attackers encrypted company files and demanded a ransom to unlock them.)

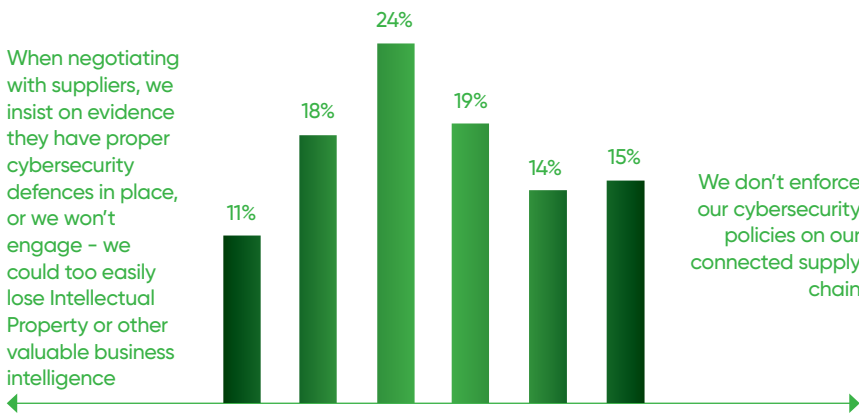
BUSINESS CONTINUITY PLANNING



The response shows that awareness of the threat to business continuity is very high. We did not extrapolate from that question to see whether manufacturers had bought specialist cyber insurance, because it is unlikely the majority of our respondents would know of their companies' insurance coverage. It is important to note that most standard business continuity insurance policies will not cover cyber attack up to the full extent of loss. As well as ensuring systems are protected, it is necessary to ensure the business is properly insured too.

The next issue to consider is the point at which increasing connectedness in the supply chain with customers and suppliers might be perceived as a threat rather than an opportunity.

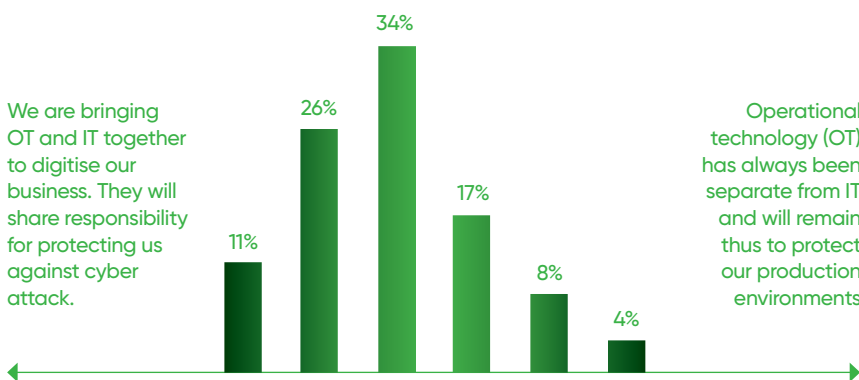
CYBERSECURITY AND OUR SUPPLY CHAIN



It is clear manufacturers are far more confident about cybersecurity in their own systems than they are in those of their supply chain partners. Only a small majority have cybersecurity on their radar when working with supply chain suppliers. Just as cybersecurity is becoming a feature of business continuity, it won't be long before solid cyber defence becomes as important a part of supply chain contracts as quality and payment terms. Our survey suggests it is an area that is evolving, but not yet the done deal.

When it comes down to safeguarding your systems, where do you lay your defences? This is critical, because as software and data capture are increasingly embedded in manufacturing operational technology (OT), IT and OT increasingly work together. Indeed, in future there may be no distinction between the two. Is this already happening?

IT/OT CONVERGENCE



That is not an entirely positive response, suggesting that internal cultures are not evolving as rapidly as digital technologies are being adopted. We suspect this is an area of vulnerability, if the disciplines that have normally been the most aware of security threats – IT – are not effectively overlapping with OT, where the new vulnerabilities exist every bit as much as they do in areas previously regarded as exclusively IT.

53%

insist on evidence supply chain partners have cybersecurity defences in place

73%

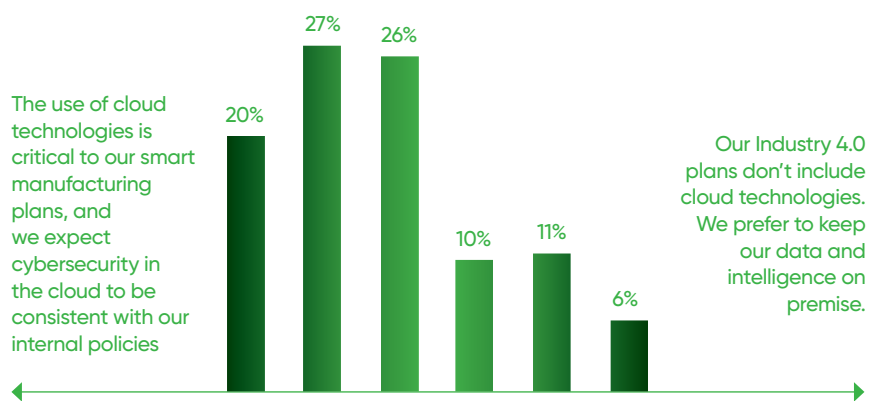
expect cybersecurity in the cloud to be consistent with their own internal policies

“

Our Business Systems department is very keen on cybersecurity, but the rest of the business is mostly unaware of the threats and dangers.

Tom Greenwood, Process Engineering Manager, JRI Orthopaedics

CYBERSECURITY IN THE CLOUD



Cloud computing is an integral part of digital transformation. Many software systems recommend that data that is of immediate real-time use, such as information from sensors attached to a machine, should be processed on-premise (otherwise known as Edge computing).

Data that is non-time critical can be handled more cost-effectively in the cloud, and it is therefore inevitable that manufacturers must have confidence that cloud tech is robust and safe from hacking.

The responses suggest that, largely, they are, indicating faith in the security deployed by the main cloud platforms, and why not? Giants like Google, Microsoft and Amazon will be in a much better position than most to keep your data safe. Where manufacturers should be concerned is when they are connected to multiple platforms that have different interfaces.

That creates the potential for confusion.

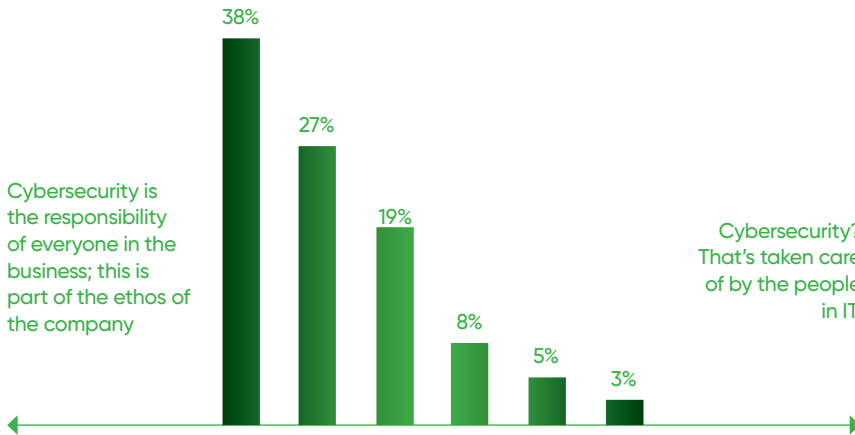
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People are generally the weak link in cybersecurity breaches. It is important to understand when cloud connectivity is necessary, and when Edge deployment is a better option. A good digital solution will be a hybrid of connectivity options.

Iain Crosley, Managing Director, Hosokawa Micron

That last respondent's reference to people generally being the weak link returns us to the issue of internal culture and its importance in getting as close to total defence as possible.

WHO IN YOUR BUSINESS IS RESPONSIBLE FOR CYBERSECURITY?



When it comes to whose job it is to guard against external cyber intruders, there's an element of defiance in the response, "We all take responsibility..."

While not wishing to second guess our respondents, I wonder if that's more an aspiration than a reality. And again it returns us to the way some companies have evolved from the days when cybersecurity was the preserve of the IT team, siloed in solitary splendour in a remote corner of the building, to today when awareness of IT and its potential – and dangers - runs throughout the factory.

Or should.

Young people entering manufacturing expect connectedness and transparency of communications in a way that even ten years ago would have seemed extraordinary. Not only do manufacturers have to be on the same digital page as their Millennial workforce, they must harness their awareness and understanding as part of a 100% defensive attitude to cybersecurity.

“

Cybersecurity and vigilance against scams and fraudsters is the responsibility of everyone in this business - we educate them on what to be aware of.

Wayne Hine, Managing Director, Inductotherm Heating & Welding Ltd

84%
said cybersecurity
is the responsibility
of everyone
in the business

71%
said they are
bringing OT and IT
together to digitise
their business. They
will share responsibility
for protection against
cyber attack.



Secure Manufacturing for Industry 4.0

Industry 4.0 builds on the Third Industrial Revolution's continuing adoption of computers and automation by adding smart, autonomous systems driven by data and machine learning.

Read this new e-book to learn the five primary ways to address demand for effective cybersecurity in manufacturing.



Automation
machine

Products

BUSINESS TRANSFORMATION





The catalyst of uncertainty

What a difference two years can make. In 2018, PwC's 23rd *Annual Global CEO Survey* revealed a record level of optimism regarding worldwide economic growth but, as UK CEOs look ahead to 2020, economic growth is now their top concern with more than half expecting global GDP to decline.

Uncertainty is fuelling this shift - something I am sure those in manufacturing can relate to. Change is all around us and how we prepare, transform and pivot is key.

According to our CEO survey, many UK businesses are responding to this uncertainty by focusing on practical measures to improve efficiencies while targeting new products, services and markets.

Manufacturers are going beyond the promotion of new technology and embracing the whole journey of business transformation: learning new habits, acquiring the right talent and implementing organisational changes.

They're carefully thinking through how to best use technology to increase their efficiency, effectiveness and, ultimately, productivity. And they are focused on using technology for the capability it gives and ultimately the value it can create.

It is not straightforward, however, and the holistic approach to how this is applied in practice is the truly transformative part and directly links to success.

People and skills are vital to the application of new technology. PwC's *New World, New Skills* analysis shows that one in three jobs is likely to be disrupted or to disappear in the next

decade because of technological change. One of the most pressing problems that society has is the growing mismatch between the skills people have and the shortage of qualified talent for the new digital economy.

We're helping organisations anticipate the skills they will need in the future and work together to find the comprehensive solution. It's a wide discussion we need to have across society, government and business. We all have our part to play.

You could have the ultimate smart factory with all the right talent but if you don't have the product and business model that your customers desire, then failure may still come. Companies in the manufacturing industry are shifting towards a more service-orientated business model.

This Annual Manufacturing Report survey shows that this is really being embraced and that UK manufacturers that offer aftermarket and service support are growing. This is so encouraging - adding value to customers and aiding collaboration and closer relationships.

Cara Haffey
UK Leader of Industrial Manufacturing
& Automotive,
PwC
cara.haffey@pwc.com
www.pwc.co.uk/manufacturing

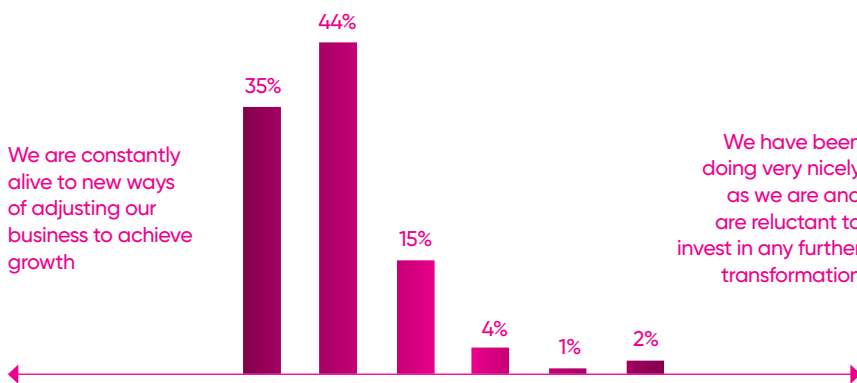
Note: Conducted in September and October of 2019, PwC's 23rd Annual Global CEO Survey, which involved 1,581 chief executives in 83 territories, explores the sources and manifestations of uncertainty and how CEOs are taking action to address it.

According to PwC, who sponsor this section of the Report, “Business Transformation is a major shift in an organisation’s capabilities and identity so that it can deliver valuable results, relevant to its purpose, that it couldn’t master before.” Inevitably it involves change at every level of a business, from organisational culture, to technology, product range and delivery. (For clarity, the topic of Digital Transformation, which is often used to describe a business adopting digital manufacturing technologies, is dealt with separately in the Smart Factory section of this report, although as noted, technology does form part of the wider Business Transformation issue.)

Business transformation is too large a topic to address through a short series of survey questions. But we can get a picture of how ready UK manufacturers are to embrace it by gauging their agility in responding to some of the many and varied challenges and opportunities that exist in today’s unpredictable world. Essentially, we wanted to discover if they are continually scanning the horizon for those challenges and opportunities or are hunkered down, content with business as usual.

Our first question was quite simply designed to gauge the transformation mindset among manufacturers.

TRANSFORMATION AWARE?



That is a seriously positive response, with only a small handful of respondents demonstrating any significant caution.

“

The “Age of Transformation” should not be viewed as moving from one set-up to another. It is more a continuously evolving status that we will always have to stay ahead of.

Roy Haworth, Engineering Manager, Airbus

However, it is one thing to say you are constantly looking for ways to improve and grow, quite another to follow through on that when faced with significant external challenges.

94%

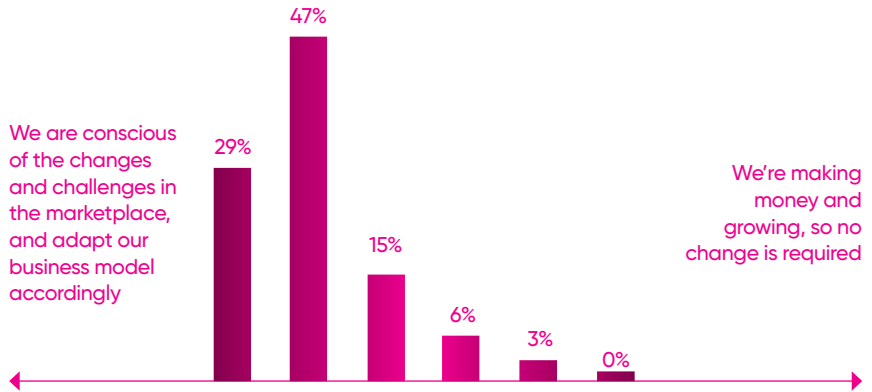
of manufacturers
are alive to
new ways of
adjusting their business
to achieve growth

57%

say their attitude
to growth is
unaffected by political
and economic
uncertainty

To what extent do manufacturers have the internal systems – and the mindset - in place to react to challenges with agility?

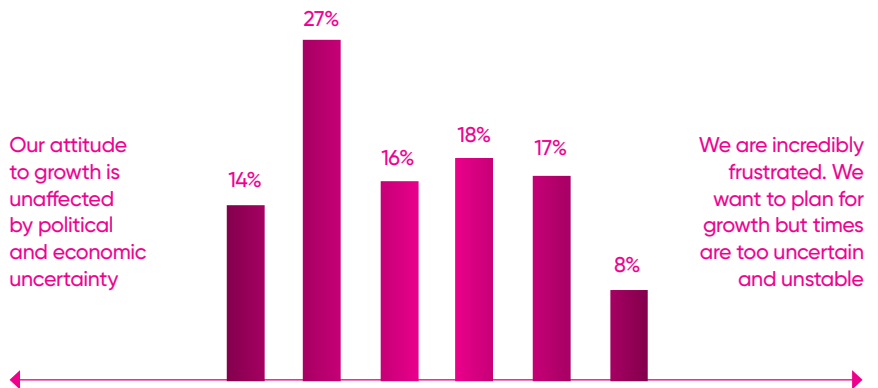
RESPONSIVENESS TO MARKET CONDITIONS



That is a convincing response. Into the challenges category we would most definitely place Brexit and the accompanying political cliffhanging drama of deadlines that came and went, a General Election, and then, on 31 January, Brexit itself. What flows from that is yet another chapter of political uncertainty as horse-trading over a new relationship with the EU begins and a newly 'independent' UK seeks new trading relationships around the world.

Clearly there is a significant degree of frustration and ambivalence about the way political uncertainty, in the main driven by Brexit, has impacted our sector.

ATTITUDE TO GROWTH



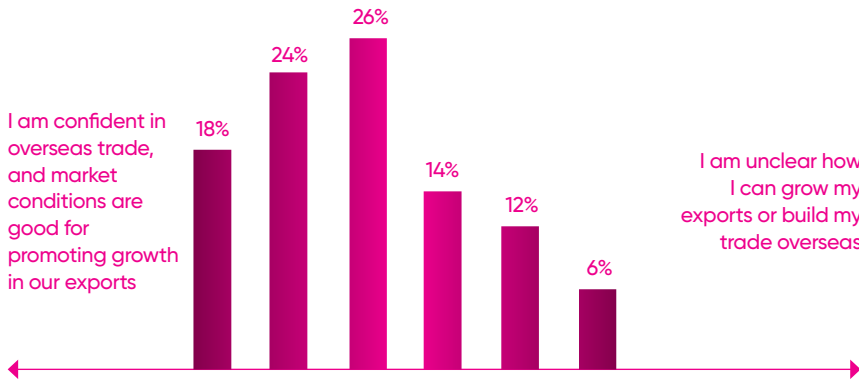
“

The transformation of a business starts with the transformation of a strategy and the people are centric to its delivery. We recognise external political, economic factors but build relationships that come from trust, reliability, technology, and ultimately the delivery of solutions that meet our customers' needs.

Wayne Hine, Managing Director, Inductotherm Heating & Welding Ltd

The growth that really counts comes from exports, and the government understands that, with its drive to counter the loss of access of the EU single market with a campaign to encourage more manufacturers to export across the globe. Are manufacturers up for the challenge?

EXPORT CONFIDENCE



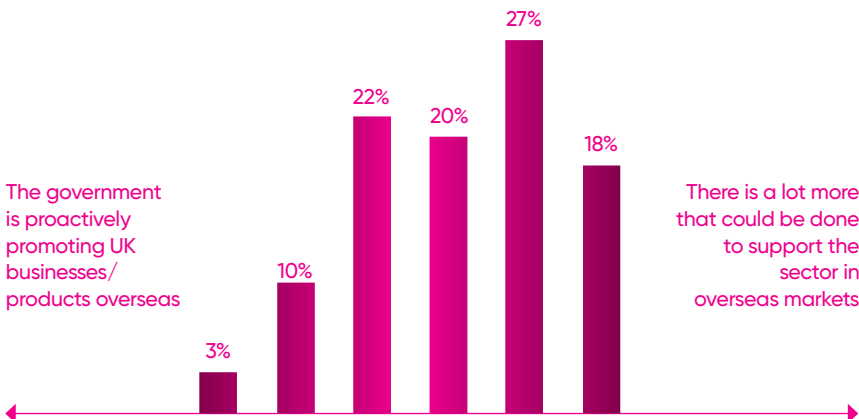
“

We are a UK manufacturer who exports to China. Our UK sales have fallen by 80% over the past three years owing to the EU debacle and an incompetent government. Our exports have increased to 80% of our turnover which, despite the UK turndown, has improved our profits.

Graham Naisbitt, Chairman & CEO, GEN3 Systems

That is surprisingly positive. But are manufacturers equally positive about the support on offer from government – support that could make all the difference to the government’s post-Brexit trading policy? The answer is a resounding no. That is stark. Manufacturers are clearly very

HOW GOOD IS GOVERNMENT AT TRADE PROMOTION?



68%

say they are confident in overseas trade and conditions are good for growth into new markets

65%

say the government should do more to support the sector in overseas markets



unhappy with the level of government support. They say A LOT more could and should be done to support UK manufacturing in overseas markets, which is clearly critical as we are now out of the EU and apparently on the way to a golden future of international trade.

“

There are too many changes happening at the moment with digital, political, market, social - it is difficult to keep up. Regulation needs to ease up and businesses supported by government rather than bashed.

Rizvan Khalid, Managing Director, Euro Quality Lambs

“

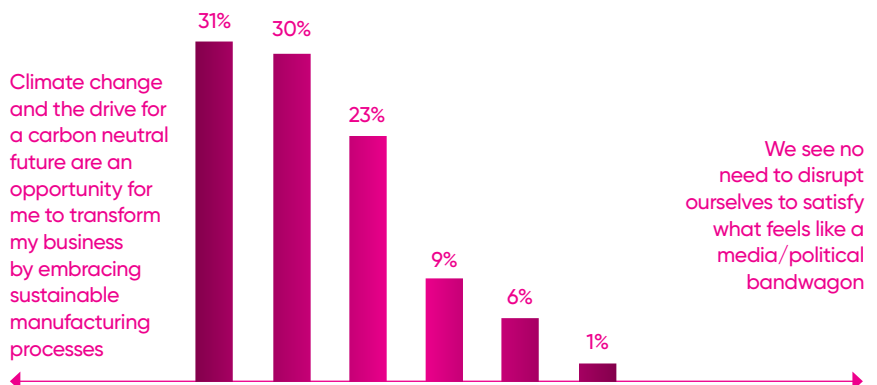
Domestic political polarisation, global economic slowdown, geopolitical conflicts, cybersecurity and environmental concerns are currently combining to present a climate of unprecedented challenge and uncertainty for business.

Richard Ennis, Chairman, Creative Composites Limited

As noted in the comment above, another challenge facing our sector is climate change, and how manufacturers should regard the inevitable changes to processes and materials that this will demand of their businesses. In terms of business transformation, this could easily become a long-term issue whose importance will ultimately have significantly more impact than Brexit or fractured politics. Our own research at *The Manufacturer* already suggests that consumer demands for products that reflect their deepening concerns around climate change might well have profound implications in the coming years and decades.

Considering this, do manufacturers regard climate change as simply another burden to endure or an opportunity to be grasped?

CLIMATE CHANGE = GROWTH OPPORTUNITY

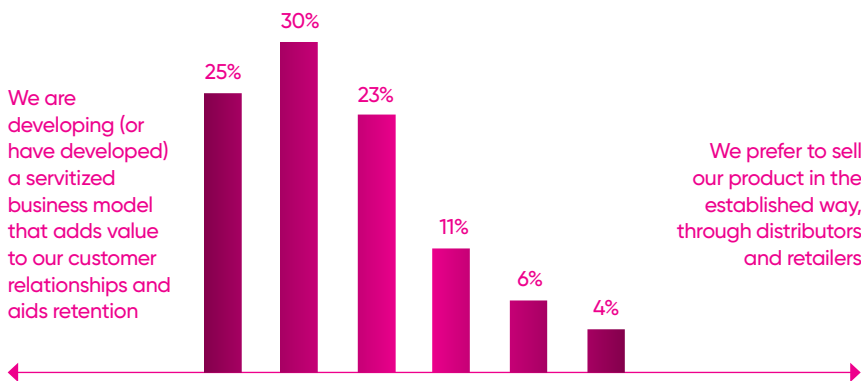


So climate change and the drive for carbon neutrality is seen as a really strong driver of growth. Manufacturers relish the opportunities presented by the need to develop more sustainable manufacturing processes. Knowing UK manufacturers as we do, we expected nothing less.

The final topic on which we quizzed respondents in this section is servitization. There is some controversy around this. One respondent described servitization as “a rubbish, made up buzzword, (the product of) trendy management theory.” However you regard the word, though, the fact is the process of manufacturing-as-a-service does offer manufacturers a new dimension to growth and customer service. Of course, it is not new, with Gillette, Xerox and Rolls-Royce plc outstanding early examples of the genre.

Generally, however, most manufacturing has over the decades been ‘fire and forget’, with little visibility of where products ended up once they’d left the factory. The advent of digital technologies that offer transparency throughout the supply chain, and therefore greatly enhanced customer communication and service opportunities now means that the servitization model is open to many more companies. And it can bring great benefits to manufacturers who might struggle to compete on price with products from countries enjoying cheaper costs, but can now win and keep customers with superior service-based products.

PRODUCTS AS A SERVICE



It is more than clear that servitization is growing apace among UK manufacturers, with 78% saying they are developing business models that add value to customer relationships, aiding customer retention in the process.

“

Changing from a traditional business to a servitized business model is a challenge to a lot of people as it requires a complete change of philosophy, thinking value rather than thinking price. With 75% of our business being overseas, and the unclear future of British overseas trade, new opportunities are essential if businesses are to survive and grow.

Iain Crosley, Managing Director, Hosokawa Micron

With the caveat that government must work very much harder to earn the respect of manufacturers, the UK sector as reflected in these findings is displaying a refreshing degree of resilience and vigour in the face of significant challenges.

Or perhaps we should describe them, as these results would seem to indicate, as opportunities.

84%
say climate change
and the drive
for a carbon
neutral future
are an opportunity
to transform
their business

78%
say they are
developing (or have
developed) a
servitized business
model that adds
value to
customer relationships

Transforming manufacturing businesses

We combine our business expertise with technology innovation to solve our clients' important problems.

#TransformingManufacturing

pwc.co.uk/manufacturing





FINANCING INVESTMENT



Empowering British manufacturing through data confidence

Brexit has happened. But the uncertainty that came with it is by no means over.

The Brexit process was particularly tough on British manufacturing, an industry also trying to come to grips with globalisation and an increasingly volatile supply chain. Not all manufacturers survived this period, even if they believed they were in a strong - and safe - position.

The problem that these companies faced was simple. They did not truly understand their business. How can business leaders set strategy and plans when they only have visibility over a fraction of their business and how it's performing?

But this is how many manufacturers are still operating today: on hunches and guesswork. And if businesses continue in this way, it's hard to see how the British manufacturing industry won't continue to struggle on the global stage.

However, as *The Manufacturer's* report shows, there is a clear shift in confidence in the industry, and the confidence to invest back into the business - something that it has been in desperate need of for several years now. And with reports that Manufacturing Purchasing Manager's Index rose to 50 in January 2020, a mindset change has clearly occurred.

And this is wider than just manufacturing. Deloitte research shows that 63% of CFOs believe their role will shift to focus on analysis, prediction and decision support. Forward-looking businesses have realised that it's no longer enough to react. They

must predict and improve decision-making for their organisation to succeed.

At Board, we have over 20 years' experience in improving decision-making and helping companies succeed. Globally, we have worked with leading manufacturers like Ricoh, ZF, Honda and Mitsubishi Electric to help them understand their businesses better.

We help organisations transform all parts of their business from day-to-day operations to global sales, to strategic planning and analysis. At Mitsubishi, we helped 'give the business back control and help drive the business forward'. And at ZF we were able to provide their business leaders with 'a single point of the truth from which to guide their company'.

It's only with this control of your business through complete visibility and confidence in the data in front of you can manufacturers truly thrive in this challenging time. Businesses without this might be able to survive, but a long-term approach to your corporate planning is the only way to ensure long-term success.

Ask yourself: do you trust your data?

If not, get in touch to see how we can help you and your organisation succeed in challenging times.

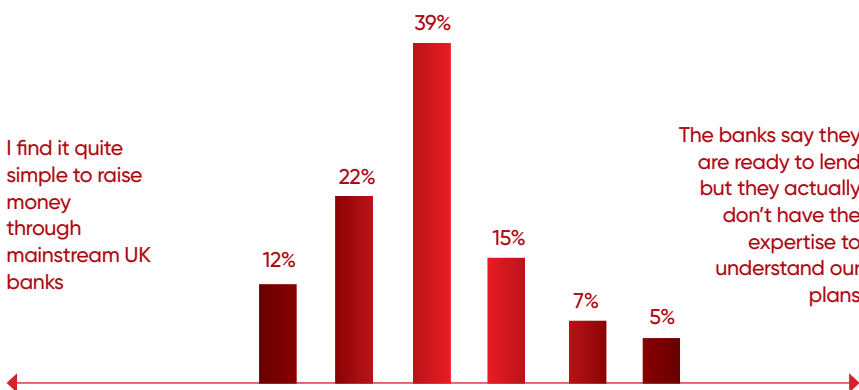
David McKenzie
 Manufacturing Lead,
 Board International
dmckenzie@board.com
www.board.com

Manufacturing in the UK has been suffering from low investment and declining confidence in recent years. There are no prizes for guessing what some of the core components of that are.

But it is also fair to suggest that the way we structure business in the UK, from start-up through to plc, is perversely geared away from making life easy for companies. There is little political capital to be had in supporting business and little general appetite for growing businesses, even were conditions more amenable. We have a cash-out culture in this country, with bright young businesses eagerly snapped up by foreign investors, and very few homegrown investors interested in keeping them British.

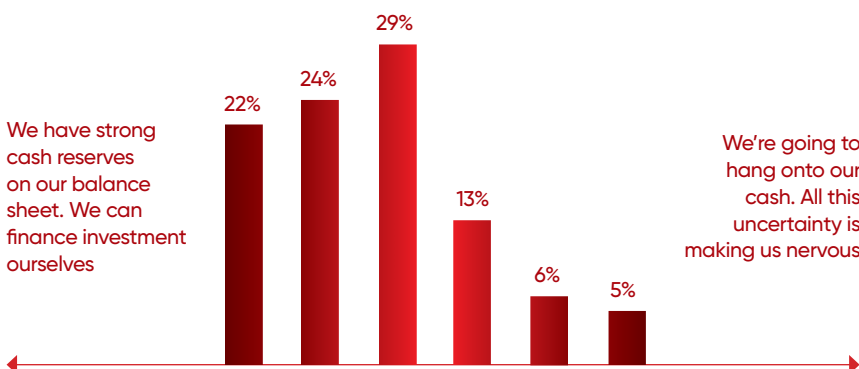
Also, we are familiar with the "Valley of Death", where manufacturers find it near-impossible to commercialise innovative technologies so, again, they either fail or take their work abroad. It is hardly surprising therefore that banks routinely come in for criticism in this report, and this year is no exception. Support for the notion that they are properly engaged with and knowledgeable about the manufacturing sector, and therefore a reliable or useful financing partner, is tepid at best.

HOW GOOD ARE BANKS AT SUPPORTING MANUFACTURERS?



With banks considered to be less than reliable finance partners, and with insufficient support coming through from the alternative finance sector, it follows that in order for manufacturers to be able to invest with confidence, they have to store cash on their balance sheets. And they are proving ready to invest, even though across the board business investment is down.

READINESS TO SELF-FINANCE INVESTMENT



75%
 have strong cash reserves on their balance sheet and can finance investment themselves

86%
 say they are ready to invest in new, digital technologies to boost their competitive position





Self-investment only works if one's business has the ability to generate enough reserves, and that is not a luxury afforded many companies. Add to this the growing, and highly cynical, readiness of large companies to make small companies wait longer than a reasonable 30 days for payment, and there is the inevitable perception that the deck is stacked in favour of large businesses who have the power to lobby government, while being able to brush off the - so far weak - efforts by government to encourage a "Pay in 30 Days" culture in the UK.

“

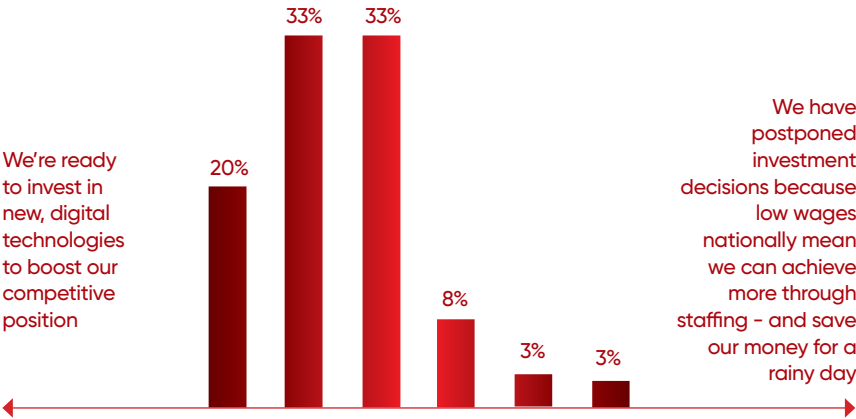
We are a micro-SME as are 93% of the electronics industry in the UK; 93% of around 47,000 "Electronic Systems Community" businesses have less than 19 employees, yet this sector yields around 7% to UK GDP.

It's this sector that needs support, not the larger companies.

Graham Naisbitt, Chairman & CEO, GEN3 Systems

An oft-cited reason for low UK productivity is that businesses have chosen to postpone investment because they have access to low-cost labour. Our respondents say this is not the case in manufacturing, where, as we know, there is a skills gap.

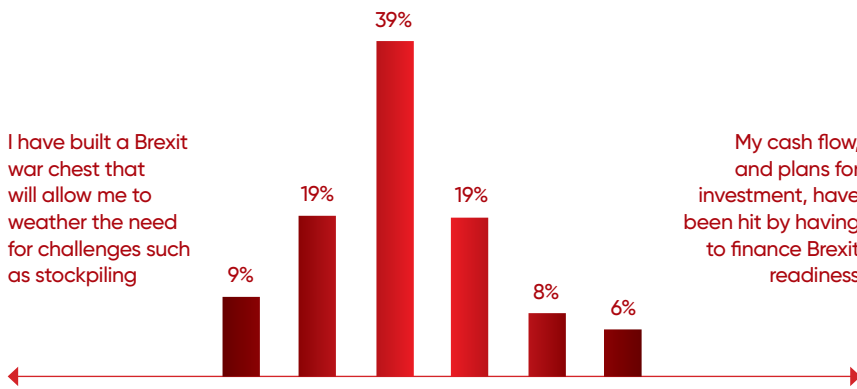
IMPACT OF LOW WAGES ON INVESTMENT DECISIONS



This is made evident by the fact that average pay in manufacturing is significantly higher than in the service or public sectors. So, there is the evidence that manufacturers are ready to invest in digital technology, rather than relying on labour for profits.

The extent to which that holds true will, however, depend on which part of the manufacturing sector one is discussing. It is fair to suggest that some companies in food and drink, for instance, have routinely relied on low-wage, unskilled labour for years.

IMPACT OF BREXIT ON FINANCES

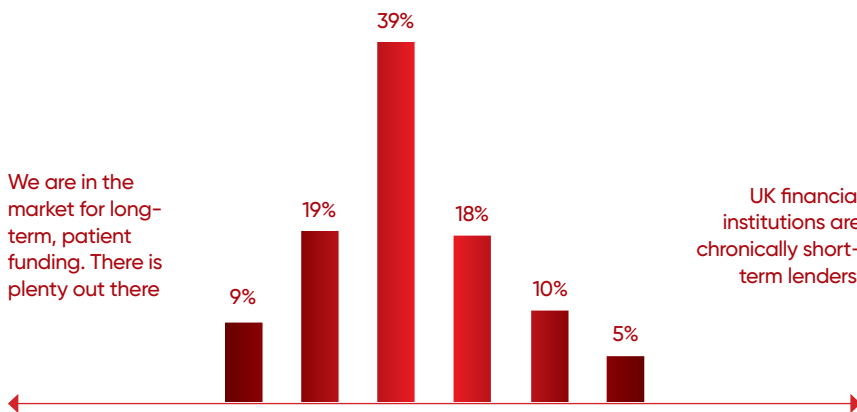


For many manufacturers, the tortuous stop-go Brexit process has put them under unforeseen financial pressure and is likely to be the gift that keeps on taking.

Many manufacturers were stung in 2019 by the coming, then passing, of deadlines for the UK to leave the EU. 31 March and 31 October were false starts that cost many manufacturers significant cash in stockpiling and close downs. With Brexit now a reality this is of less importance, but clearly there are large numbers of manufacturers keeping a nervous eye on further financial impacts from the uncertain year that lies ahead of us, as the government seeks a new future trading relationship with the EU, the US and everyone else.

This will have an impact on financial planning across the board, particularly for those manufacturers trying to plan for the long term, looking for the kind of long-term patient funding that manufacturers in particular need, when ROI on some capital investments takes years to manifest.

LONG-TERM FINANCING



That must qualify as a weak response, and demonstrates that the City is not geared to offering the kind of finance manufacturing needs.

This is particularly important when we consider the oft-stated need for the UK to develop many more medium-sized companies (the M in SME): the fabled, yet elusive "Britlestand". Too often it seems the chance to develop medium-sized powerhouses is lost to companies being snapped up by foreign companies or PE houses.

67%

have built a Brexit war chest to weather the need for challenges such as stockpiling

92%

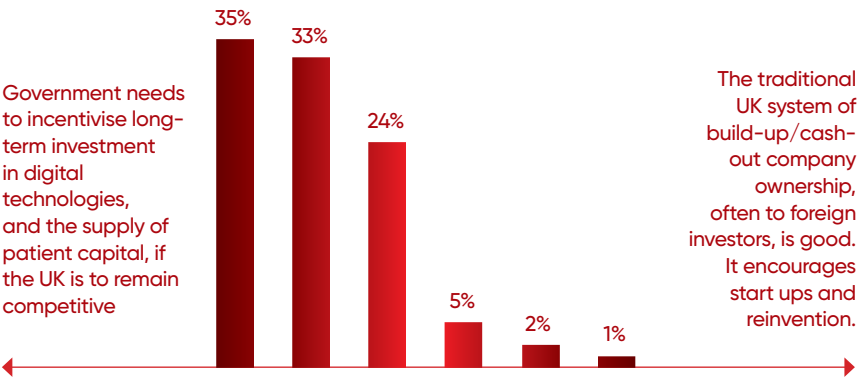
say government needs to incentivise long-term investment in digital technologies, and the supply of patient capital, if the UK is to remain competitive



Our respondents wholeheartedly agree and suggest the government should incentivise long-term investment in digital technologies so that businesses can chart much longer growth periods.

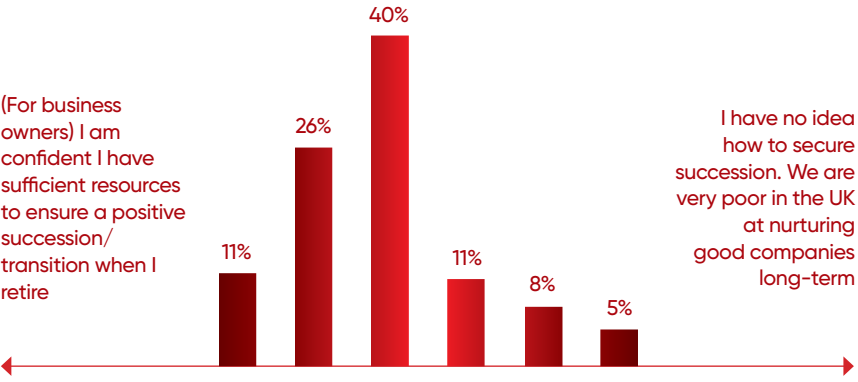
Inevitably, this relates to the Smart Factory section where respondents remarked on the need for SMEs to be incentivised into adopting digital technologies if we are to develop a broader base of decent-sized companies in the UK. So much of the background to this is both political and ideological: political, in that there is a horror in some parts of the political establishment at the thought of 'picking winners', and ideological because for some in politics creative destruction is the only way to keep the body economic healthy. It is not clear how many who hold that view have ever tried to start a business.

NEED FOR LONG-TERM, HOMEGROWN BUSINESSES



But for those who have started a business, there is the question of what to do with it when retirement beckons. As already mentioned, cashing-out quick holds its charms, and why not? A big pay day followed by a gentle ride into the sunset has its obvious attractions. And yet it is a characteristic of so many manufacturers we meet that they are not in it for the big pay day alone. They do care what happens to their business and their workforce.

TRANSITION OF COMPANY OWNERSHIP



That is not a powerful endorsement of the notion of succession planning, which is part of the process of developing medium-sized companies that have the chance to grow over the course of generations, which implies a positive approach to succession, whether it be through founders' families or employee takeover.

Business owners do not seem completely confident that they know how the future of their business will play out, and that will clearly impact whether they will grow as a UK asset or risk being snapped up by foreign companies who routinely demonstrate greater faith in the quality of UK companies than we do.

“

Succession planning across the sector's SME's is notoriously poor. We often hear that Brexit or being slow adopters of digitisation will be the downfall of many businesses. In reality it is quite simply a lack of leadership capability across senior management teams, deeming many highly successful and profitable businesses un-investable from an investor point of view.

Owner-managed businesses often find it difficult to relinquish control whilst building future leadership capability. The sign of a true leader is someone with the ability to build capability within their team, so that should they have to suddenly step back, the business would continue to function with minimal disruption.

Anonymous

And then there are companies who have chosen creative succession routes.

“

The majority shareholder of our company is an Employee Benefit Trust. As such, we plan and execute over a longer term than many other companies. Our financial strategy is based on prudence, which also allows us to undertake swift action when needed or when an unexpected opportunity arises.

Barely a week goes by without us receiving an approach from one bank/company/institution who wishes to invest in our business.

Rupert Broome, Group Managing Director, Killgerm Group Ltd

That last sentence may appear a bit cynical, but it reinforces a definite sentiment in the sector that when it comes to financing business in the UK, banks and institutions appear to want a one-way bet, and are only really ready to invest in companies that are already winners.



The background of the top half of the page is a photograph of a factory floor. It shows several robotic arms and industrial machinery. The entire image is overlaid with a semi-transparent blue filter. The text is positioned in the center-left of this area.

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Board's Decision-Making platform empowers manufacturers by providing them with the actionable insights they need to make better decisions. Board combines planning, simulation and analytics allowing organisations to align strategic & financial plans with factory-floor operations. Board is already helping some of the leading manufacturers in the world such as Ricoh, ZF, Honda & Mitsubishi Electric to transform their Decision-Making process.

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PEOPLE AND SKILLS



Skills: The perennial issue

Britain's manufacturers are facing the largest shortage of skilled workers since 1989 with many citing this shortfall as their biggest challenge. Despite post-Brexit immigration rules being unclear, companies still need to be able to access skills at all levels without heavy costs or bureaucracy.

If we are to see the sector continue to thrive in the post-Brexit era, UK-wide perception of the industry must be addressed. We are faced with a myriad of negative influences which place manufacturing low on the list of career options young people of today want to pursue.

We are seen as a post-industrial nation. That we don't make things anymore. Manufacturing jobs are seen as male-dominated, dirty, low-paid and monotonous.

This is perpetuated by a decreasing number of parents and grandparents who have or have had jobs in manufacturing and a lack of teachers who truly understand the career opportunities in the sector.

Government policies such as the Apprenticeship Levy have actually managed to send recruitment into reverse. And, there is the inevitable drive to send children to university, even if a vocational career would be more suitable, because education budgets are geared to incentivising schools to cram as many children as possible into 6th form. And, even if children do decide to try for an apprenticeship, the quality of training on offer in some FE colleges is dismal, after years of budget cuts.

Very large companies have become a magnet for the best talent emerging from schools

and universities, and they provide excellent career pathways. However, because we have such an abundance of small manufacturers and very few medium-sized ones, the war for talent is fierce.

The manufacturing industry needs to speak with one voice and take responsibility for what is required to move forwards, steering away from the 'government should provide' attitude we currently hold. A fine example of a country doing this well is Germany, where training is organised and specified by manufacturers and the government provides the teaching facilities.

Due to an array of voices including associations, trade bodies and education providers, it's hard to see how we could ever emulate Germany. But we have seen brilliant examples of companies working together to devise their own local and regional training facilities, such as the Marches Centre of Manufacturing and Technology in Shropshire, or companies developing their own training courses in-house.

Many companies are already having to devise courses for retraining and upskilling workers whose jobs are being taken over by automation, so the more they diversify their courses to include homegrown training for young people and collaborating with other businesses to do this, the more effective and prosperous the sector will be.

But we still have to overcome the bias against manufacturing that infects the national psyche. As some of the respondents in this survey suggested, perhaps it's time manufacturing made more of a noise about itself. Young people should understand that

we are one of the largest manufacturing nations in the world, solving many of the problems that preoccupy their everyday lives. Remember, we are the nation that gave the world the telephone, television, lightbulbs and the electric motor.

We should be promoting our impressive history and vision for the future. That careers in the sector are financially rewarding, exciting and diverse, that there are clear opportunities for progression and skills development.

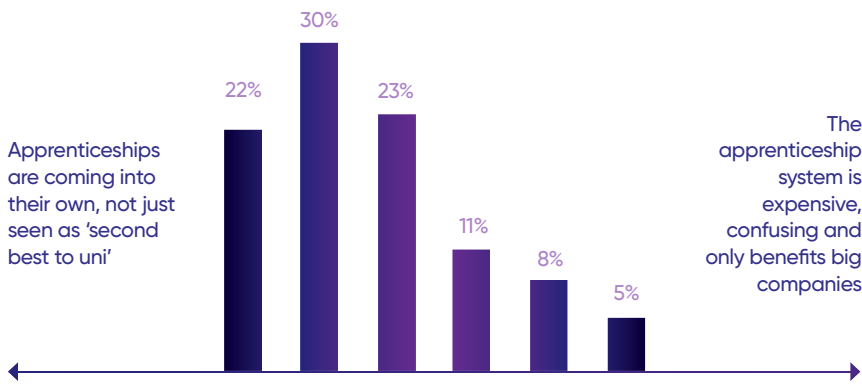
How the manufacturing sector starts to develop that argument is, as always, a tough job, but acknowledging the need is a pretty good start.

Dan Kirkpatrick
Head of Customer Success,
Hunter

dan@trustrhunter.co.uk
www.trustrhunter.co.uk

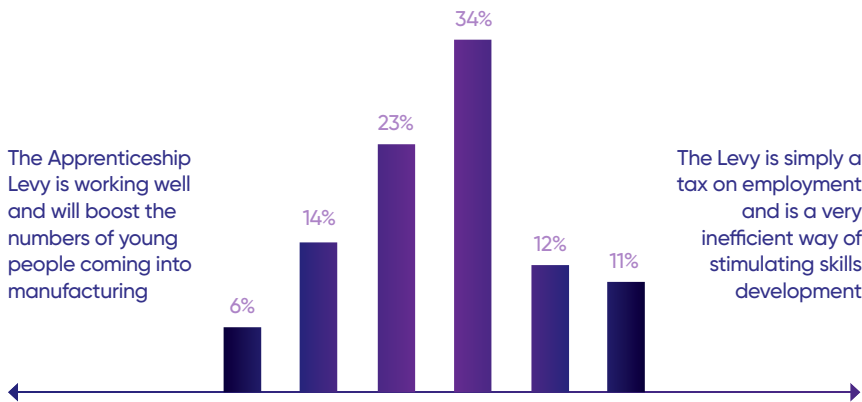
One of the highlights of 2019 for *The Manufacturer* was the chance to interview Sir David McMurtry, the legendary inventor who founded Renishaw. He made a particular point of saying that apprentices are the lifeblood of his company. How much better is it to develop talent that you have brought in at an early stage, he said, than it is to recruit people who have grown up under different value systems? Our respondents agree, as they have increasingly in the last three years, that apprenticeships are a valuable career path.

ARE APPRENTICESHIPS VALUABLE?



But when we ask whether the Apprenticeship Levy, which was devised by the Cameron government as a way to turbocharge apprenticeships by imposing a levy on companies with a greater than £3m annual wage bill, to be used by all businesses to fund training, the answer is emphatically negative.

IS THE APPRENTICESHIP LEVY WORKING?



And it is little wonder. The Levy is accused of being clumsy, complex, and it has had the unintended consequence of actually putting into reverse gear the drive to attract young people into manufacturing careers. This is a complaint we hear often.

Government is like any business – there is the potential for departments to become siloed, and apprenticeships is a classic instance of a policy that the business department, BEIS wants delivered effectively, but the power to do that rests with the Department for Education. Little wonder then that the broader question about how well the government is doing at narrowing the skills gap, so that industry has available a satisfactory talent stream, met with more negativity.

75%

said apprenticeships are coming into their own

57%

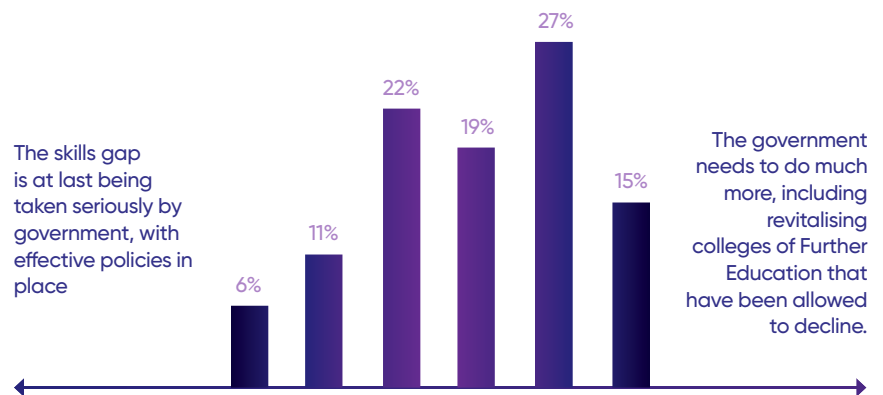
said the Apprenticeship Levy is simply a tax on employment

“

Apprenticeships are working, particularly for big companies such as Rolls-Royce and Dyson with their degree apprenticeships, but they are difficult to access for small companies, with the service providers providing rather dumbed-down offerings. As an SME, we would love to use the Levy to train our own graduates and undergraduates, but it is just too confusing.

Richard Bruges, Chair, Productiv Ltd

GOVERNMENT EFFECTIVENESS ON SKILLS GAP



The system is still geared to the 20-year-old, class-driven mantra that 50% of young people must go to university – whether it is the right thing for them or not. With the inevitable decline in the status and funding of FE colleges that flowed from that policy, it is little wonder that the vocational route to a career is stunted. And manufacturers want, and need, that to change. It should come as no surprise that our respondents believe the entire education system, from early days to graduation, is not working for manufacturing.

The education system may not be wholly monolithic, given the emergence of new types of schools and programmes, but it certainly feels that way. Public debate over liberal arts and music versus technical skills is presented as a zero-sum argument, when there is no reason why both should not be supported.

“

There is too much emphasis on going to university after school. In the Gloucester area all the schools want is a tick in the ‘went on to university’ box. There is little or no true careers advice on what’s available for apprentices, what alternative careers you can do, in what industry. School leavers need to know there’s a whole other world out there that might be a better fit – and without the burden of large uni fees that will need to be repaid.

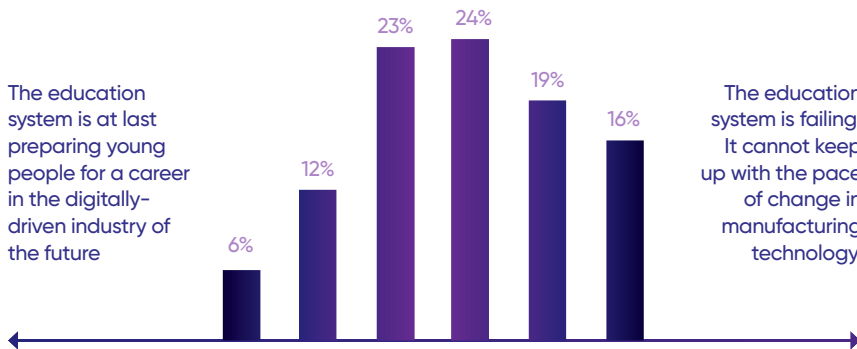
**Peter Miles, Managing Director, Larchtower Engineering,
T/A Forge Motorsport**

“

We find recruitment of skilled CNC Operators very difficult and it is impossible to find CNC machine programmers. Whilst we have a new local “technical college” which has CNC machinery, the students are not allowed anywhere near it. The closest they get is CAD/CAM. In the old days, youngsters did manual turning and milling at school, never mind college. There is too much emphasis on people going to university to get meaningless degrees.

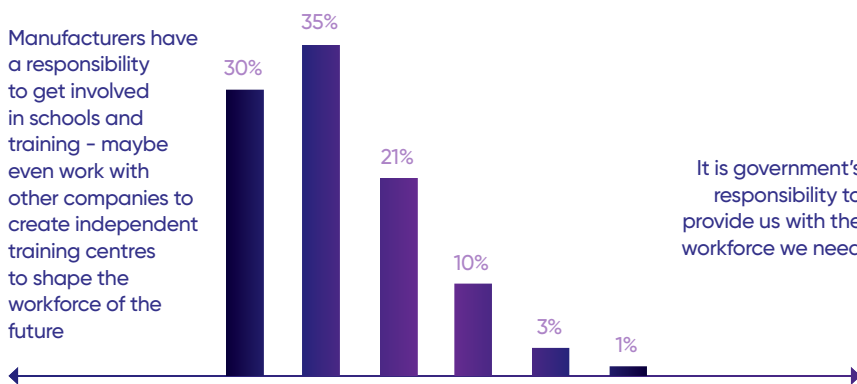
Elaine Slater, Managing Director, Hydraulic Projects Ltd

IS THE EDUCATION SYSTEM SERVING MANUFACTURERS' NEEDS?



Perhaps it boils down to manufacturers stepping up to the plate and taking responsibility for their own skills needs.

WHO SHOULD SHAPE THE WORKFORCE OF THE FUTURE?



Given that manufacturing companies are capable, by dint of their size, to be more agile than lumbering government, there is hope in this positive response. Not least because manufacturers are becoming aware of something the government is unlikely to understand.

This is a profoundly important issue. Anyone from a professional background who has visited schools to encourage young people will recognise the handicap under which schools operate.



59%
said the education system is failing

39%
said the skills gap is being taken seriously by the government

“

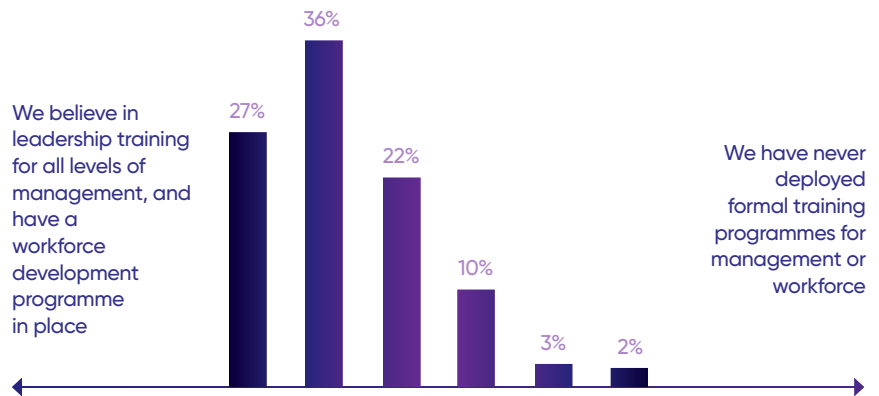
The education system is starting to recognise what needs to be done but unless it moves quickly it will always be behind the business needs. Many businesses are ready to lend their support but Government need to lead the way to help schools change more quickly and bring business and schools together to solve the problem.

Roy Haworth, Engineering Manager, Airbus

For instance, young people are often trained on outdated and obsolete software and equipment, because that is all the school can afford, or all the school understands.

So perhaps it is character that matters.

ARE WE TRAINING FUTURE LEADERS PROPERLY?



Given the paucity of management training in many areas of the economy – the UK has never shone at the ‘soft skills’ business – this is a heartening response. Today’s young manufacturers will produce the leaders of tomorrow. How they understand the critical challenge of the Industry 4.0 era, which is to balance the demand for productivity with the requirement for a skilled workforce capable of delivering it, will be crucial to the future.

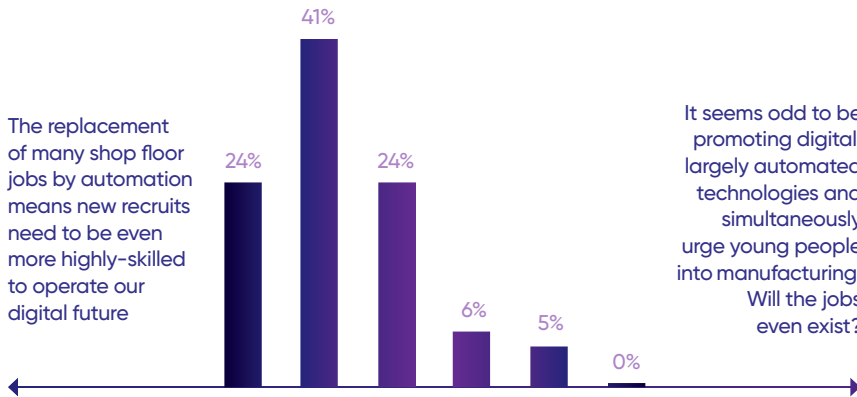
That is why the response shown in the graph overleaf is heartening. Businesses overwhelmingly understand that using automation to save money by shedding staff is a loser’s game.

“

We’re focusing on the wrong things. No one knows what skills the world of manufacturing will require in a few years’ time, as it is changing dynamically. What is not changing is the need to have people with the right attitude, mindset and resilience to go out there and get themselves trained/educated in whatever will be needed, whenever. Our focus needs to move towards life skills and mental strength.

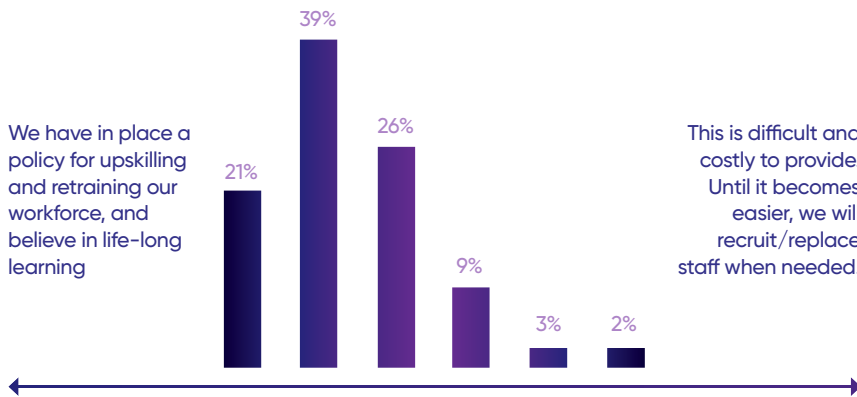
Raam Shanker, Founder, Equitus Engineering Limited

WILL AUTOMATION KILL JOBS?



Which brings us back to the issue of in-house skills training. A manufacturer capable of growing into the future will need to be constantly upskilling and re-skilling its workforce, which is why the response to our final question was so welcome. If there is one imperative to emerge from this survey it is that manufacturers need to take immediate action to bolster their skills budgets and develop quality training programmes. If that is beyond them, they should reach out to similarly placed companies and develop a collaborative solution.

DO YOU HAVE AN UPSKILLING /RESKILLING POLICY IN PLACE?

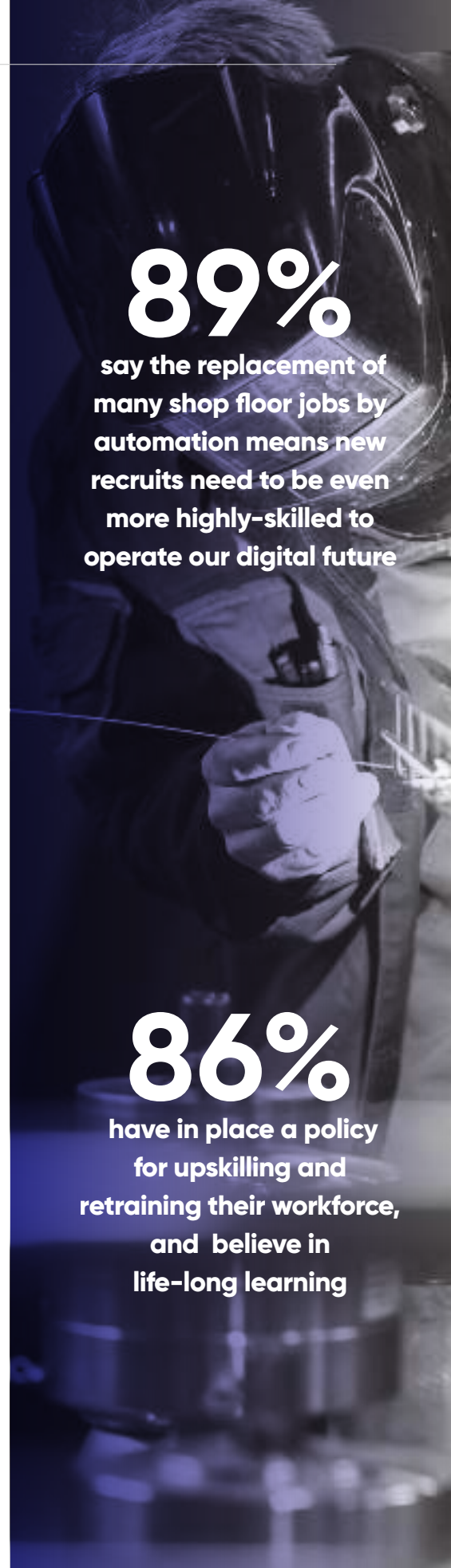


A question we have asked in this survey in recent years involves the image of manufacturing in the UK, and what should be done to improve it. After all, we should want young people to be attracted to the sector. This last comment sums up what we might have been told had we asked that question this year. It is one we should all take to heart.

“

The manufacturing sector needs to get better at promoting itself and aligning its messaging to attract future hires. Younger generations are motivated by purpose and a desire to work in an organisation that is helping solve some of the planet’s problems and not causing them. The sooner companies respect this, the sooner we will see more young people choosing manufacturing as a career of choice, because they will feel connected to what their company does. Engineering and manufacturing businesses will provide the answers to many of the planet’s issues, yet I doubt many young people currently entering the workforce would think that.

Anonymous



89%
say the replacement of many shop floor jobs by automation means new recruits need to be even more highly-skilled to operate our digital future

86%
have in place a policy for upskilling and retraining their workforce, and believe in life-long learning

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