MAKE uk
The Manufacturers' Organisation

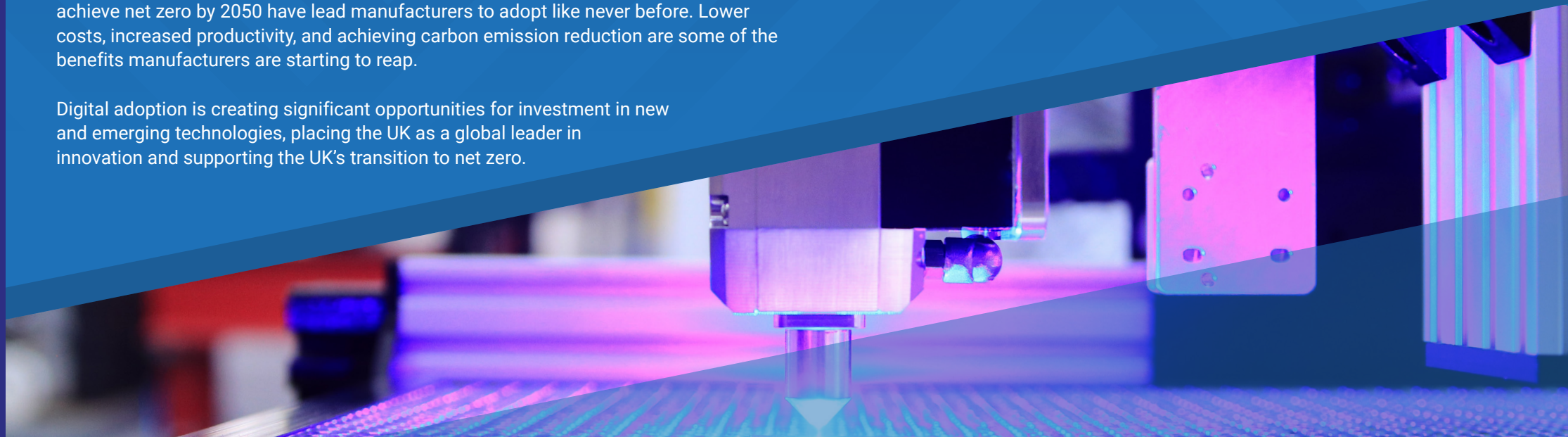
125 YEARS BACKING BRITAIN'S MAKERS

INDUSTRY 4.0
GREEN MANUFACTURING: AN ENABLER

INTRODUCTION

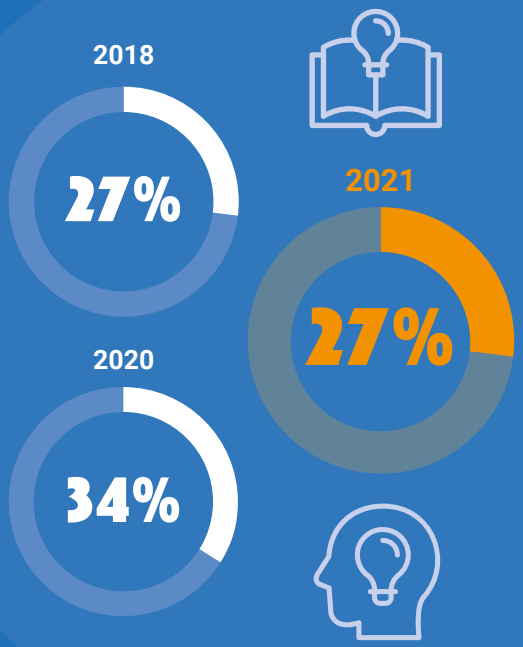
Cutting edge technologies such as 3D printing, the Internet of Things and artificial intelligence (AI) among others are rapidly transforming manufacturing industry as part of the 4th Industrial Revolution. The Covid-19 pandemic and the UK's commitment to achieve net zero by 2050 have lead manufacturers to adopt like never before. Lower costs, increased productivity, and achieving carbon emission reduction are some of the benefits manufacturers are starting to reap.

Digital adoption is creating significant opportunities for investment in new and emerging technologies, placing the UK as a global leader in innovation and supporting the UK's transition to net zero.



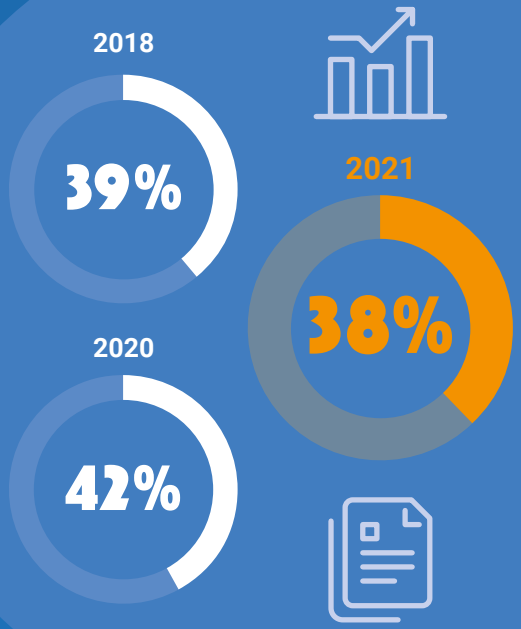
THE THREE PHASES OF THE FOURTH INDUSTRIAL REVOLUTION
WHERE ARE MANUFACTURERS?

CONCEPTION



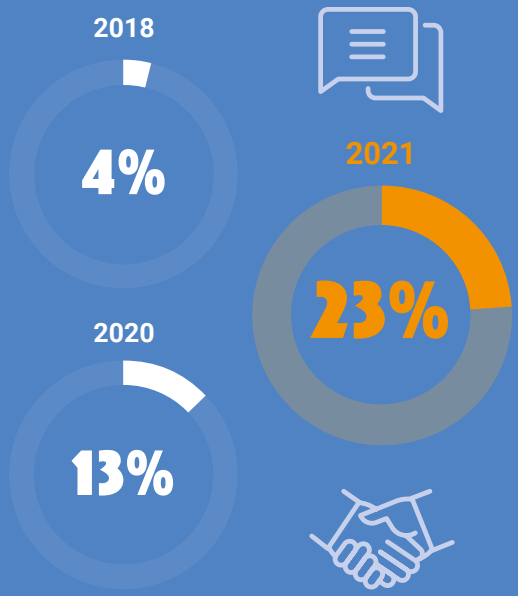
Manufacturers are figuring out what the new digital technologies can offer and how they can be applied to their business.

EVOLUTION



Manufacturers are putting digital tools and technologies in place (e.g., sensors) to create, capture and analyse data to assist in developing projects and changes to their business.

REVOLUTION



Manufacturers are changing the way they derive value and interact with customers and suppliers.

LEVELLING UP

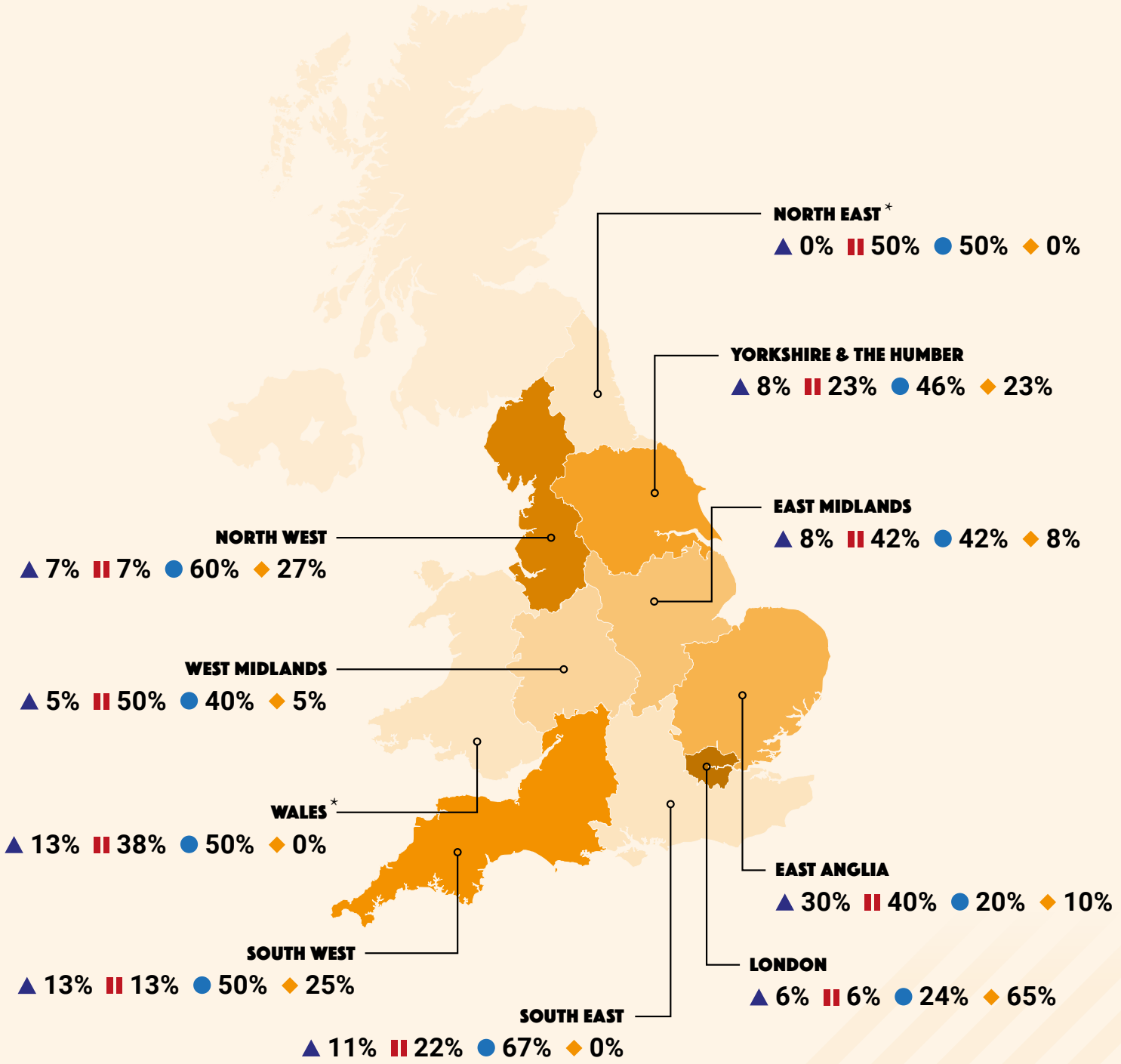
Digital adoption is occurring in every corner of the country, supporting the Government's levelling up agenda.

There are many and varied opportunities for growing business but there are also challenges. Each region has a different business environment and innovation ecosystem. Digitalisation can help support the levelling up agenda. Digital adoption increases productivity, strengthens resilience, and makes businesses more competitive. To accelerate digital adoption across all regions the levelling up strategy must therefore include a local digital adoption strategy that involves capital spending, skills, culture and education.

Key:

- ▲ Pre-conception
- II Conception
- ● Evolution
- ◆ Revolution

Source: ONS, MOD



* Limited sample available for Wales and the North East

DIGITAL AND GREEN

Helping manufacturers to become more sustainable and achieve their net zero goals

The UK manufacturing sector has a key part to play in the transition to a net-zero carbon economy, not only by cutting its own greenhouse gas emissions, but also and more crucially through the innovative products, processes and services that will become an integral part of the green industrial revolution. Implementing new digital technologies and techniques can increase sustainability and improve energy efficiencies within a manufacturing business. These benefits are now being realised across the sector.

55%

OF MANUFACTURERS SAID **ROBOTS, COBOTICS AND AUTOMATION** ARE MAKING **SOME OR A LOT** OF DIFFERENCE

OVER **TWO THIRDS**

SAID THE **INDUSTRIAL INTERNET OF THINGS** IS MAKING **SOME OR A LOT** OF DIFFERENCE

1 IN 2

MANUFACTURERS SAID **VR AND AR** ARE MAKING **SOME OR A LOT** OF DIFFERENCE

58%

SAID **ADDITIVE MANUFACTURING** (3D PRINTING) IS MAKING **SOME OR A LOT** OF DIFFERENCE

6 IN 10

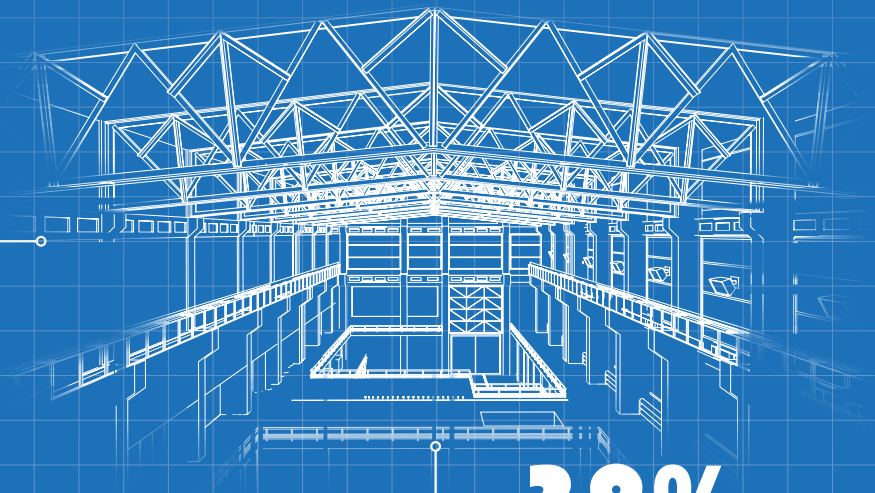
SAID **AI AND MACHINE LEARNING** ARE MAKING **SOME OR A LOT** OF DIFFERENCE

Companies citing what difference adoption of new technologies is making in increasing sustainability and energy efficiencies in their business

TRANSFORMING FACTORIES AND SITES

Manufacturers are using new digital technologies across their businesses

(% companies that said they are using digital technologies across various business functions)



60%
MANUFACTURING **PRODUCT DESIGN** AND **DEVELOPMENT**

56%
MANUFACTURING **PROCESS QUALITY MANAGEMENT**

39%
ENERGY MANAGEMENT

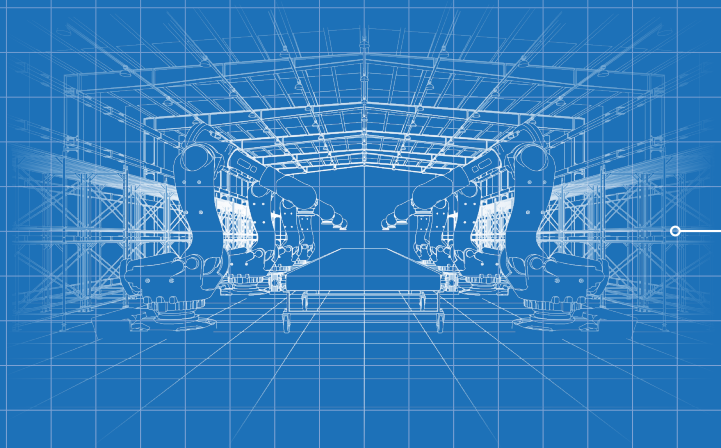
47%
MANUFACTURING **OPERATIONS**
(QUALITY MANAGEMENT; MATERIAL/PRODUCT PROCESSING)

44%
CUSTOMER AND **PRICING**

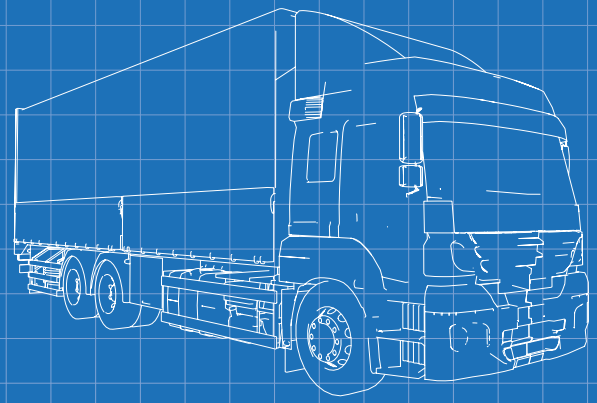
38%
HR PAYROLL

53%
FINANCE INVOICING

36%
TRANSPORT AND **LOGISTICS**



37%
MAINTENANCE AND **SET MANAGEMENT**



IS DIGITAL ADOPTION A COST OR AN INVESTMENT?

With reduced costs topping the table as the main benefit behind the adoption of digital technologies, many manufacturers see it as an investment which reaps many benefits

(% companies citing the benefits of digital adoption)

56% REDUCED COSTS AND IMPROVED PRODUCTIVITY

38% GREATER FLEXIBILITY AND INNOVATION

38% BETTER QUALITY PRODUCTS

36% BETTER ENGAGEMENT AND SERVICE

34% IMPROVED ENERGY EFFICIENCY

33% PROCESS IMPROVEMENTS CONTRIBUTING TO REDUCING EMISSIONS

33% IMPROVED RAW MATERIAL AND WASTE EFFICIENCY

OF
RESPONDING MANUFACTURERS
BELIEVE
DIGITAL TECHNOLOGIES
BRING
NO BENEFITS

EXAMPLE OF DIGITAL TECHNOLOGIES AND TECHNIQUES

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) - can rapidly analyse large amounts of data and detect abnormalities and patterns. AI can extract insights from large datasets and discover new solutions through simulations. It can also forecast or model how trends are likely to develop, thereby enabling systems to predict, recommend, and personalise responses. AI can coordinate machine-to-machine interactions and engage directly with objects.

THE INTERNET OF THINGS (IOT)

Describes the set of physical objects that can automatically collect a wide array of information about people, nature, the built environment, machines, and products and transmit this information over a network.

In manufacturing, connected sensors monitor factory operations in detail not just to improve efficiency and productivity, but to perform predictive maintenance, increase safety, and improve quality control. Buildings equipped with temperature sensors can dynamically control heating and cooling, lowering costs.

AUGMENTED AND VIRTUAL REALITY

There is an expanding range of uses for AR/VR. Perhaps the most widely applicable use is workforce training. For example, an engineer can use AR to follow indicators and instructions overlaid directly onto a machine, or a first responder can practice reacting to different emergency scenarios in an immersive simulation.

DIGITAL TWIN

A digital twin is a digital replica of a living or non-living physical entity. By bridging the physical and the virtual world, data is transmitted seamlessly allowing the virtual entity to exist simultaneously with the physical entity.

SUPPORTING INDUSTRY TO ADOPT

Accelerating digital adoption and helping the manufacturing sector to become more sustainable and innovative

(% companies citing what would encourage them to invest more in digital technologies and techniques)

FUNDING

Half of manufacturers would accelerate digital adoption if it was easier to access funding. 47% said they would do so if there were more schemes like the super-deduction to incentivise short-term investment.

Almost half said schemes such as the Annual Investment Allowance (AIA) to incentivise long-term investment.

On a similar thread of support via tax incentives, two-fifths of companies said an expansion of the R&D tax credit would accelerate adoption.

Almost a quarter said they wanted to see a regionally focused funding body.

KNOWLEDGE

Almost half of manufacturers said they would accelerate digital adoption is they had access to impartial specialist technical advice.

45% would like more information and guidance on how to adopt digital technologies.

Over two-fifths want peer to peer programmes including learning best practice.

LEADERSHIP

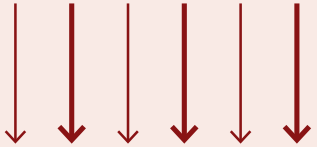
Almost a quarter of manufacturers said greater buy in from senior leaders would drive further digital adoption.

One in five said buy-in from employees would accelerate digital adoption.

RECOMMENDATIONS AND CALLS TO ACTION

The role of Government and industry in driving forward digital adoption

LEADERSHIP



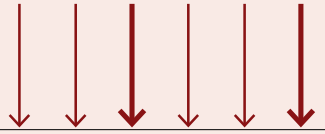
INDUSTRY:

Manufacturers, particularly SMEs, must accept that digitalisation is for everyone, and make it a strategic priority. Without full commitment to adopting new digital technologies, across all sub-sectors and all sizes of business, our manufacturing sector will see its international competitiveness further eroded and will face an increasingly uncertain future.

INDUSTRY:

Regional stakeholders should co-ordinate their efforts: to support their economies. Streamlining the overlapping and competing initiatives in many parts of the country will help to overcome the confusion that SMEs often currently experience.

KNOWLEDGE



INDUSTRY:

Peer-to-peer best practice must be encouraged: There are many great examples of companies reaping the benefits from using the new digital technologies. To help address the barriers associated with adoption, peer-to-peer best practice must be shared and showcased.

GOVERNMENT:

Expand the Help to Grow Digital to other software, designed with manufacturers in mind. The nature of manufacturing means that firms in the sector are unique and thus require bespoke solutions. Help to Grow Digital should be run in coordination with Made Smarter to ensure that Made Smarter's cutting edge insights and insider understanding of how British manufacturers operate can be best applied to help digital adoption in the sector.

FUNDING

GOVERNMENT:

Extend the 130% investment super-deduction beyond March 2023 to incentivise manufacturers, specifically SMEs, to invest, including in digital and green technologies.

GOVERNMENT:

Full roll out of Made Smarter. Dedicated support to manufacturing SMEs should be made consistently available across the country: In England, the best way of doing this is the extension of the Made Smarter SME adoption programme to the rest of the regions.

TURNING DIGITAL TRANSFORMATION INTO A REALITY

Case studies from the manufacturing industry

The company:
TrakRap is a small British company that has developed a revolutionary packaging system that is reducing the consumption of energy and material by food producers. With its cold wrapping technology, TrakRap has not only taken heat and waste out of the packaging line; it is working with Siemens to provide its customers with all the benefits of manufacturing digitalisation.

Challenge:
Individual branded products such as tubs of yoghurt or trays of chicken are usually packed in batches for transit to the supermarket shelf or chilled cabinet. This process, known as secondary wrapping, often involves the application of heat in a shrink tunnel to produce the classic shrink-wrapped package. Because of the amount of energy required, this procedure is both costly and inefficient.

Solution:
TrakRap has created an alternative that requires no heat and reduces waste: an orbital wrapping process that applies a special ultra-thin stretch film to innovative packs that are themselves designed to use less material. Siemens supported TrakRap as it developed a new machine specifically designed to wrap aerosol canisters. Through a collaborative project with several partners, including The Manufacturing Technology Centre (MTC) in Coventry, Siemen's technology has been used to virtually develop, test and commission TrakRap's latest machine using a digital twin, a fully functioning 3D computer model of the machine. The MTC employed NX software to design the machine, the NX Mechatronics Concept Design software to simulate the physical properties of the machine and the Simcenter portfolio of simulation and testing software to simulate and test the two-stage wrapping process in a virtual scenario. The simulation even extended to the control and automation environment. Through the creation of a digital twin TrakRap gained accurate and detailed information, for example the digital wrapping process revealed that the first wrap was critical. Digital simulation showed the direction and force of the film as it touched the pack and demonstrated the specific instability of a group of canisters within a tray. With this crucial feedback from a virtual production run, members of the design team at TrakRap were able to limit the force of the first wrap, use a different orientation for the second wrap and achieve a stable process.

Key outcomes:

- ✔ **Time to market reduced by 40%**
- ✔ **A new business model of 'pay per wrap'**
- ✔ **New digital twin for specific machine management**
- ✔ **Monitoring has led to a reduction in machine down time**
- ✔ **24/7 connectivity, control, and efficiency**

The company:
Photocentric, the UK based inventor of LCD-based 3D printing and materials manufacturer is building on its vision of enabling custom mass manufacture with its innovative additive manufacturing technologies. Their client Phone Skope, a US-based manufacturer that makes precision engineered adaptors for smartphones.

Challenge:
The fast-moving nature of the market requires its products to be compatible with a huge number of new phone models released every year. To create a compatible adaptor for a particular phone, a mould would have to be created for each new case. As well as the time and cost involved in creating this mould there was always a chance that the phone itself may not be a commercial success. This inflexibility meant that Phone Skope had to choose which phone models to support, creating a significant risk for the business if those phone models were not a commercial success. A limited number of models also reduced Phone Skope's growth potential.

Solution:
Incorporating an LCD 3D printer allowed thousands of dollars in equipment costs to be saved on creating a mould as well as huge savings on the product development time - slashed from two months to just two weeks.

Key outcomes:

- ✔ **Product development time slashed from two months to two weeks**
- ✔ **Business investment de-risked**
- ✔ **New markets**
- ✔ **Greater profitability**

The company:
Agemaspark Ltd is a is a precision engineering company that serves industries including aerospace, Oil & Gas, and the food sectors. It assists many businesses to solve their engineering problems to produce many individual components for a wide range of sectors.

Challenge:
Conventional mould tool making has limitations, meaning the moulds are being designed larger and larger so they can take more impressions to increase numbers of components and keep up with demand. As a result, the moulding machines are being supplied as large operational units taking up significant factory space and requiring high energy for operation. Investing in new and pioneering 3D metal printing technique is resulting in major reductions in cycle times for multi-impression mould tools.

The current cooling channels are straight drilled and cause lengthy and uneven cooling, which often results in the formation of hot spots and high scrap rates. Conformal cooling works by creating a suitable cooling channel at a well-defined distance from the cavity—which is impossible using a conventional drilled cooling mechanism—thereby reaching areas where it is difficult to do so using conventional methods. The temperature sensors embedded on each cavity will enable effective control of the cooling.

Solution:
Agemaspark sought overcome these barriers by developing a highly efficient advanced manufacturing process for the production of laser sintered mould tools with a novel ceramic coating. The mould tools will make use of the breakthrough process utilising conformal cooling channels embedded with temperature control sensors enabling localised temperature control. This will overcome inherent deficiencies in the current plastic caps and closures mould tooling technology. The company has now completed extensive trials on conformal cooling of multi-impression plastic injection mould tools and is working with companies across Yorkshire using the technique to produce their components helping its customer to comply with new EU regulations.

Key outcomes:

- ✔ **Reduction in energy use with increased impressions, Environmental advantages with this method by increasing the impression on the same envelope or reducing the size of the tools and therefore the size of the mould press, reducing energy consumption**
- ✔ **Huge reduction in cooling water from tens of thousand liters in 24hrs to only 10-20 litres Environmental advantages with this method by increasing the impression on the same envelope or reducing the size of the tools and therefore the size of the mould press, reducing energy consumption.**

The company:
Zircotec are specialists in heat management, in plasma-spray processing and the production of high-performance surface coatings and finishes. The company's technical specialists are able to provide advice on most thermal barrier, heat management and surface engineering issues.

Challenge:
The goal was to deliver new and cutting-edge technology to enable businesses to increase volumes in order to meet higher demand. The challenge was to develop a full micro-factory, which offered high levels of automation to ensure that the quality and consistency of the coating facility can be delivered on their customer site or their global tiered supplier base.

Solution:
Zircotec conceptualised and developed a portable solution, named POD (Production on Demand) through partnerships with Innovate UK, Advanced Propulsion Centre and CNH Industrial (being an Automotive OEM partner and route to market). Zircotec set out to incorporate CNH's Industrial entire plasma coating process into a standalone unit. With the focus on green technology and reducing CO2 emissions throughout supply chains, it was an important project to aid Zircotec to meet both the customer requirement along with meeting the Zircotec growth strategy within these target markets. The POD concept delivers a solution which is both commercially viable and practical along with assisting in the sustainability programmes demanded by its customer base.

Key outcomes:

- ✔ **Operations effectiveness, providing the ability to scale up delivery to OEM production levels at repeatable high quality**
- ✔ **Laser adoption means a cleaner, controlled, efficient and more cost-effective solution**
- ✔ **Elimination of surface preparation media and the waste generation of airborne dust particulates, process control and reduced takt times**
- ✔ **Using intelligent process automation, takt time efficiency is up 50% and waste reduced by 90%**

HOW YOUR BUSINESS CAN PRESS AHEAD ON ITS DIGITAL JOURNEY

SOME PROGRAMMES AVAILABLE FOR MANUFACTURERS

- For manufacturers wanting to start slow; **Digital Manufacturing on a Shoestring** provides great solutions that don't require big resources Find Out More
- **Made Smarter Innovation Challenge Fund** Find Out More
- **Made Smarter Adoption Programme, available in North West**, coming into Yorkshire and Humber, **West Midlands** and **North East**
- **R&D Tax Credits,** if your company carries out R&D on its products, processes, or services, you may be able to take advantage of the UK Government's R&D tax credit scheme. Find Out More
- **Innovate UK Competitions** Find Out More
- **Knowledge Transfer Network** Events
  Industrial Strategy Challenge Fund – Clean Growth
- **Universities** have their business and innovation hubs with the aim to support SMEs, please look into your local University for support.
- **Help to Grow**, government scheme funding softwares and management training Find Out More
- **Manufacturing Technology Centre (MTC)** Find Out More
- **AMRC** Find Out More

Make UK is backing manufacturing – helping our sector to engineer a digital, global and green future. From the First Industrial Revolution to the emergence of the Fourth, the manufacturing sector has been the UK's economic engine and the world's workshop. The 20,000 manufacturers we represent have created the new technologies of today and are designing the innovations of tomorrow. By investing in their people, they continue to compete on a global stage, providing the solutions to the world's biggest challenges. Together, manufacturing is changing, adapting and transforming to meet the future needs of the UK economy. A forward-thinking, bold and versatile sector, manufacturers are engineering their own future.

As part of Make UK's commitment to the environment and sustainability, we are able to offer our members a course/workshop in IEMA Leading with Sustainability. This enables senior executives to understand the business case for environmental sustainability and to question whether the organisation's current strategy is fit for purpose.

IEMA Leading with Environmental Sustainability | Make UK

www.makeuk.org
@MakeUKCampaigns
#BackingManufacturing

For more information, please contact:

Nina Gryf
Senior Policy Manager
Make Uk
ngryf@makeuk.org

Verity Davidge
Director of Policy
vdavidge@makeuk.org

Brigitte Amoruso
Senior Energy and Climate Specialist
bamoruso@makeuk.org

MakeUK.org

Make UK is a trading name of EEF Limited Registered Office: Broadway House, Tothill Street, London, SW1H 9NQ. Registered in England and Wales No. 05950172

~~21.07.NDI.FK.NB~~