Made Smarter technologies:

Powering the digital transformation of SME manufacturers

MADE SMARTER

Contents

Foreword

Executive summary

The origins of Made Smarter started with a question: what is holding back UK manufacturing from achieving greater productivity, performance and potential?

At the heart of the complex answer was our failure to take advantage of the digital tools and technologies that emerged from the shift from analogue to digital, the so-called Third Industrial Revolution.

As Made Smarter architect Jurgen Maier said in the influential Made Smarter Review[1] we have left those opportunities to other nations. And as a result, we have fallen behind in our readiness to fully embrace the next great technological leap, the Fourth Industrial Revolution.

This next revolution is marked by the emergence of nine technologies from artificial intelligence (AI) and the Industrial Internet of Things (IIoT) to robotics and additive manufacturing.

Adopting these digital and physical technologies into the value chain at the right time and in the right way is the key to unlocking a myriad of benefits.

As pioneers of the adoption programme model, we have developed expertise in the potential application of those industrial digitalisation technologies (IDTs) and communicated their transformative potential to SME manufacturers.

We learned early on that most businesses needed stronger foundations to start their journey towards the aspirational smart factory of the future. This has meant most (50%) grant funded projects have focussed on data and systems integration technology, as well as sensors to enable factory connectivity.

Business leaders have achieved real-time visualisation of their processes, been able to spot trends in production and labour, correct maintenance and quality issues, and minimise safety, business risk and operational downtime throughout their production.

Meanwhile, automation - both process control and robotics - has been a keen focus of investment (25%) as manufacturers have replaced manual methods of making things. Those adopting these technologies are realising a raft of benefits including an increase in productivity, improved precision, consistency and quality, as well as opportunities to reduce operational costs by allowing machines to take on the burden of repetitive, low-value and sometimes dangerous work.

There have been some early adopters, who have already captured data and linked systems, and are now focusing on analytics and artificial intelligence to get more insight and value from their manufacturing operations.

But the good news is that, with infrastructure now in place for so many Made Smarter supported manufacturers, they are also now ready for more sophisticated, boundary-pushing technologies such as analytics, machine learning and AI, which are evolving at unprecedented speed.

Over the last five years Made Smarter has helped 300 manufacturers invest £22.5m in a range of IDTs and reap a raft of rewards including 1,600 new jobs, 2,850 upskilled roles, all while boosting the economy by £242m.

While we have engaged more than 2,500 makers, that is far from the majority, so we are redoubling our efforts to reach thousands of other manufacturers in the region and to inspire and inform them about the benefits of technology adoption.

Demonstrating rather than telling people how technology is done properly is key to our future success. We have built a growing network of thousands of manufacturers who are learning from each other.

Simultaneously, we have also developed partnerships with industry leading institutions such as NERIC, PrintCity and AMRC NW to better understand the industrial application of technologies.

Afterall, digital isn't coming – it's arrived. And for us to fully unlock and realise the benefits for industry, society and the planet, we must address the challenges together.

Donna Edwards,
Director of Made Smarter's North West Adoption Programme

What is Made Smarter and how does it help with technology adoption

The core principle at the heart of Made Smarter is that people are at the centre of adoption, and that technologies are tools in their toolbox.

Our role is to quickly understand a manufacturer and identify business challenges, highlight opportunities and assess areas for skills support.
Our tried and tested process starts with a fully-funded assessment of needs. Since 2019 our team of technology experts, supported by our Organisational Development Workforce team, have taken 357 companies through fully-funded digital transformation workshops.

The process involves our team assessing a manufacturer's product, processes and people by gathering views from across the factory. We aim to cut through the jargon to identify the most effective technologies to overcome their operational challenges and any skills gaps.

The outcome is a tailored digital roadmap with solution-agnostic advice, offering a clear plan to power towards, one step at a time. Finally, we can offer access to skills and leadership training, and grants towards technology projects.

The process clearly works. Over 300 of those manufacturers have gone on to adopt technologies.

Many have reaped a multitude of transformation benefits across all aspects of their business including:

- Increased labour and resource productivity
- Increased asset utilisation due to reduced machine downtime
- Reduced maintenance costs
- Reduced inventory
- Reduced cost of quality
- Increased forecasting accuracy
- Reduced time to market
- Creating new, higher-paid, higher-skilled jobs
- Increasing exports through competitiveness
- Improving resource efficiency for better resilience to global supply disruptions
- Reducing environmental impact
  Achieving or exceeding industry standards

In this next section we reveal the top IDT's used by SME manufacturers on the Made Smarter adoption programme, and the emerging IDT's that are expected to have the greatest transformational impact over the next five years.

Top Industrial Digital Technologies used by Made Smarter clients

Data and software systems

The much-used phrase 'data is the new oil' has never been more relevant to manufacturers.

Visibility and insight of data within a factory enables a business to increase productivity, profitability and quality.

Capturing, controlling and analysing that data is the domain of software. And there are a range of options from tackling individual operational challenges all the way through to the wholesale solution of an enterprise resource planning (ERP) system.

Production planning and control scheduling

Through this technology, a manufacturer can ensure everything is efficiently scheduled at the right time and can run smoothly. Resources can be allocated, human workers assigned, and priorities ordered so that the work is optimised. A business will also be able to collect effective data from each point of the process too.

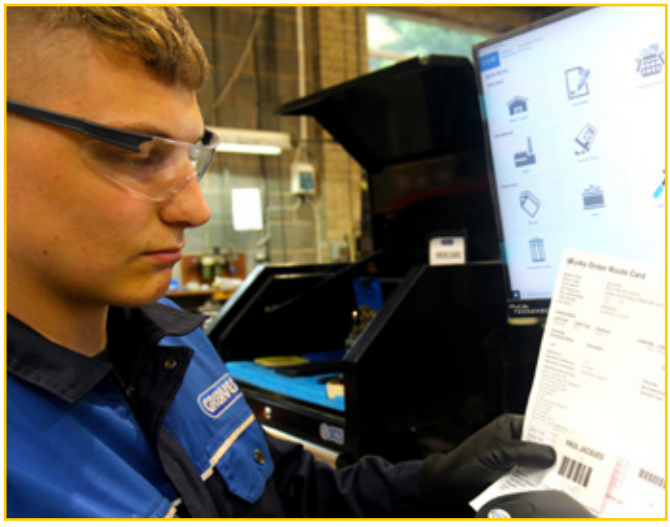
Barcoding/tracking

This is a very simple, but incredibly valuable solution to track products, parts and orders through the manufacturing process all the way through to delivery.

Through barcoding, a manager wouldn't need to visit the stockroom to inspect stock levels. Instead, the system would automatically check it, and can also order additional volumes when necessary.

There are non-invasive tracking systems that can help with traceability and accountability too. These are particularly useful in areas such as quality assurance, or for informing the customer throughout the production and delivery process.

Made Smarter helped Joshua Greaves & Sons adopt this kind of solution.



Joshua Greaves & Sons invested in a CIM50 MRP production data capture system.

Enterprise Resource Planning (ERP)

A simple way of thinking about an ERP is to imagine it as a brain.

It is capable of connecting an entire business from finance and design through to production and supply chain. If a business has the right, complete data, then they have a goldmine at their fingertips.

By connecting your systems, you'll have visibility of all your operations. It means effective analysis can be carried out, inefficiencies can be highlighted, and bottlenecks observed. That helps manufacturers realise how to improve and find the answers to their challenges.

Cloud computing has enabled ERP systems to be hosted remotely enabling more flexibility and the opportunity to collaborate. Cloud-based ERPs can also harness the latest technologies such as AI and machine learning to provide automation, greater efficiency, and intelligent insights.

Made Smarter helped both Evertaut and Fylde Fresh and Fabulous adopt bespoke ERP solutions.

To learn more about data and system integration tools download our guide to using technology to overcome operational challenges.

Flyde Fresh and Fabulous invested in a bespoke ERP system to improve product quality checks.

Institute Spotlight

The Hartree Centre / Smart Manufacturing Data Hub

The Hartree Centre at Sci-Tech Daresbury.

The Hartree Centre at Sci-Tech Daresbury, is part of the Science and Technology Facilities Council (STFC) – one of Europe's largest multidisciplinary scientific research organisations.

It helps UK businesses and organisations of any size to explore and adopt supercomputing, data science and artificial intelligence (AI) technologies for enhanced productivity, smarter innovation and economic growth.

The Hartree Centre is also a leading partner in funding programmes specifically aimed at SMEs including the Smart Manufacturing Data Hub, supporting manufacturers to become more competitive by harnessing the power of their data.

Francis Lee, Business Development Manager, said: *"Our experts collaborate with industry and the research community to explore the latest technologies, upskill teams, and apply practical digital solutions to individual and industry-wide challenges for societal and economic benefit on a commercial basis and through the Hartree National Centre for Digital Innovation."*

Automation

Automation is any type of machine or device used to perform a repetitive process without, or with reduced, intervention from a person.

There are solutions which are useful for making a variety of similar products quickly and enabling quick changeovers like you would see with mechanical cutting or spraying paint.

Then there are solutions for faster, repetitive production like you would see in car manufacturing assembly.

Automation can also be used for making highly variable products and to achieve mass customisation. For example when CNC machine tools are augmented by other equipment such as automated materials handling systems and inspection systems.

One of the key benefits is that automation often improves productivity by allowing staff to focus on more complex, higher value-add, or more intricate and interesting tasks.
Other benefits include improved health and safety, increased material utilisation, higher quality products, reduced cycle times and reduced lead times.

Made Smarter supports automation projects by focussing on the digital connectivity element, ie how the machine links to other systems. For example, we helped Firstplay Dietary Foods replace a manual packing process with a powder packaging machine.

To learn more about automation and read about more case studies visit our expert blog.

Nutree Life invested in bespoke automation to boost productivity.

Robotics

Robotics can reduce or replace repetitive work previously done by humans in the manufacturing process.

This technology usually involves a mechanical arm, which can move in three or more directions, that can be used to complete material handling and pick-and-place tasks faster and more efficiently than manpower alone.

Collaborative robots (cobots) are designed to work safely in the same space as people without the need for safety barriers and can be used for a wide variety of tasks, such as assisted assembly, packing, welding, machine loading, and palletising.

Industrial robots are used for tasks requiring higher speed, heavier tools or products, or in harsh environments. These are more likely used for welding, assembling, or painting cars on a production line.

The introduction of robotics often improves productivity by allowing staff to focus on more complex, higher value-add, or more intricate and interesting tasks. Other benefits include improved health and safety, increased material utilisation, higher quality products, reduced cycle times and reduced lead times.

Hannah Reardon from Bloom-in-Box.

Despite all these benefits, UK manufacturers have been slow to adopt the technology. According to the International Federation of Robotics[2], the UK's use of robotics in 2022 was below the global average and significantly lower than that of China, South Korea and Germany.

But the positive news is that robotics adoption in the UK has risen by 50% over the last five years, and is likely to accelerate. Persistently high job vacancies are forcing manufacturing leaders to look to technology to solve their productivity problem. Add to the mix the reduction in cost and massive tax incentives such as the 'super-deduction' - enabling companies to claim 130% capital allowance on qualifying plant and machinery investments - and robotics is now much more accessible to SMEs.

Made Smarter has helped several manufacturers adopt robotics including GB Engineering, Bloom-in-Box, Storth and JCM Fine Joinery.

There are a wealth of robotics solutions available, which makes choosing one a tricky task. Made Smarter can help define problems and find the right solution to suit. Our advisor's team can then help you access grant funding as well as provide ongoing help and support. To learn more about automation and read about more case studies visit our expert blog.

Institute Spotlight

North of England Robotics Innovation Centre (NERIC)

Stephanie West and Tabs Khojani from NERIC.

NERIC, part of the University of Salford, is a new state-of-the-art facility, commissioned to illuminate just what is possible for manufacturing SMEs through automation.

The £16 million centre consists of three laboratories of robotic equipment, showcasing how robotics and automation can address real-world business problems. NERIC collaborates with industry to give access to specialist equipment and academic expertise to help design, test, validate and de-risk innovation and investments.

Tabs Khojani, Business Development Manager, said: *"NERIC has established itself as a key collaborator in Greater Manchester's business ecosystem, with strong connections across many business support opportunities and can help signpost towards new funding and grant opportunities.*

"The benefits of adopting robotics and automation in the manufacturing sector are clear. Automation can help to address skills shortages, improve quality and efficiency, increase productivity, and gain a competitive advantage. However, the roadmap to automation is often less clear; this is where NERIC steps in. The expert team takes a consultative approach to diagnose the needs of every business they partner with. Every project delivered is valuable, of high quality and has a measurable impact."

Additive Manufacturing

Additive manufacturing (AM) – more commonly known as 3D printing – is the process of creating a physical object by building it layer by layer, as opposed to subtractive manufacturing methods, such as machining.

It has transformed manufacturing by enabling cost-effective, customised production of complex parts, reducing waste, and accelerating prototyping.

Objects that are impossible to make with any other process can now be made using 3D printing, driving innovation.

AM is also helping manufacturers achieve their sustainability goals. The process itself is more resource-efficient and allows for a more lightweight design. Then there are the fuel savings from being able to manufacture components closer to the customer, rather than shipping them. And finally, AM generates opportunities that extend a product's life cycle, lending itself to the circular economy.

Made Smarter has helped several manufacturer's adopt AM. You can read their case studies here: Fusion Implants, Croft AM and Mackinnon & Saunders. Alternatively read our blog.

To learn more about how AM is helping the manufacturing ecosystem visit the Additive Manufacturer Green Trade Association (AMGTA)

Adopting AM correctly needs effective planning and preparation. The Made Smarter team can give you an idea of costs and help determine the best applications for your needs. We can also introduce you to partners like PrintCity and ARMC NW who can work with you to perform small-scale trials.

3D printing can transform manufacturing.

Institute Spotlight

PrintCity

An undergraduate at Manchester Metropolitan's PrintCity facility.

PrintCity is a leading 3D printing facility based at Manchester Metropolitan University, focusing on teaching, research, knowledge exchange and outreach.

Over the last six years, PrintCity has supported over 200 SMEs to develop new products, goods and services using 3D printing. The award-winning facility has over 70 printers and has invested over £2m in equipment in recent years.

Made Smarter has worked closely with PrintCity over the past four years, delivering innovative training for SMEs through the Fast Track Digital Workforce Fund and Leadership programmes.

Companies have worked with PrintCity to understand the benefits of 3D printing and to see where it could add value to their business.

Professor Carl Diver, PrintCity Director, said: *"As well as supporting students to learn the essential skills in 3D Design, 3D scanning and 3D printing, we also have a strong track record of supporting SMEs to leverage the benefits of 3D printing. The PrintCity team has a real drive and enthusiasm to find innovative solutions to complex design and manufacturing challenges. PrintCity is here to help demystify 3D printing to help boost productivity and growth within your businesses."*

The Industrial Internet of Things (IIoT)

The industrial internet of things is a network of smart devices like sensors that monitor, collect, analyse, and exchange data.

In a factory this could be inputs such as light, heat, motion, temperature, pressure, signal, radiation or force.

IIoT allows manufacturers to improve operations with data-backed insights.

Applied within manufacturing and factory environments it can unlock productivity gains, streamline processes, improve yield and increase quality control. It can help predict equipment failure, saving maintenance costs and time, but also making sure to reduce business downtime and avoid failures or accidents.

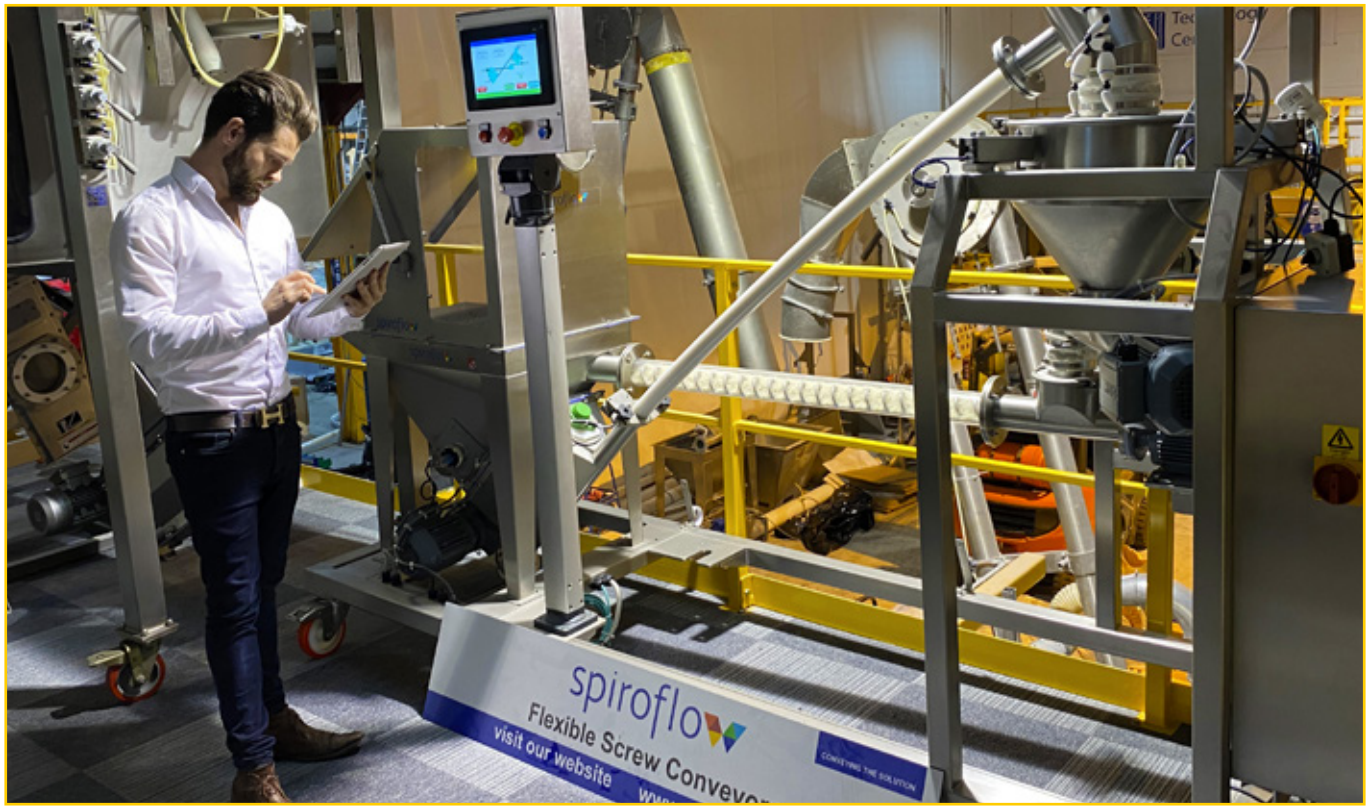
IIoT also helps tackle issues of obsolescence, especially for those SMEs with older machinery and processes.

IIoT can also help manufacturers understand energy use – determining which machines are more energy-efficient and when.

Putting the benefits together IIoT is helping create the factories of tomorrow.

Read how Made Smarter helped Spiroflow reap the benefits of the technology.

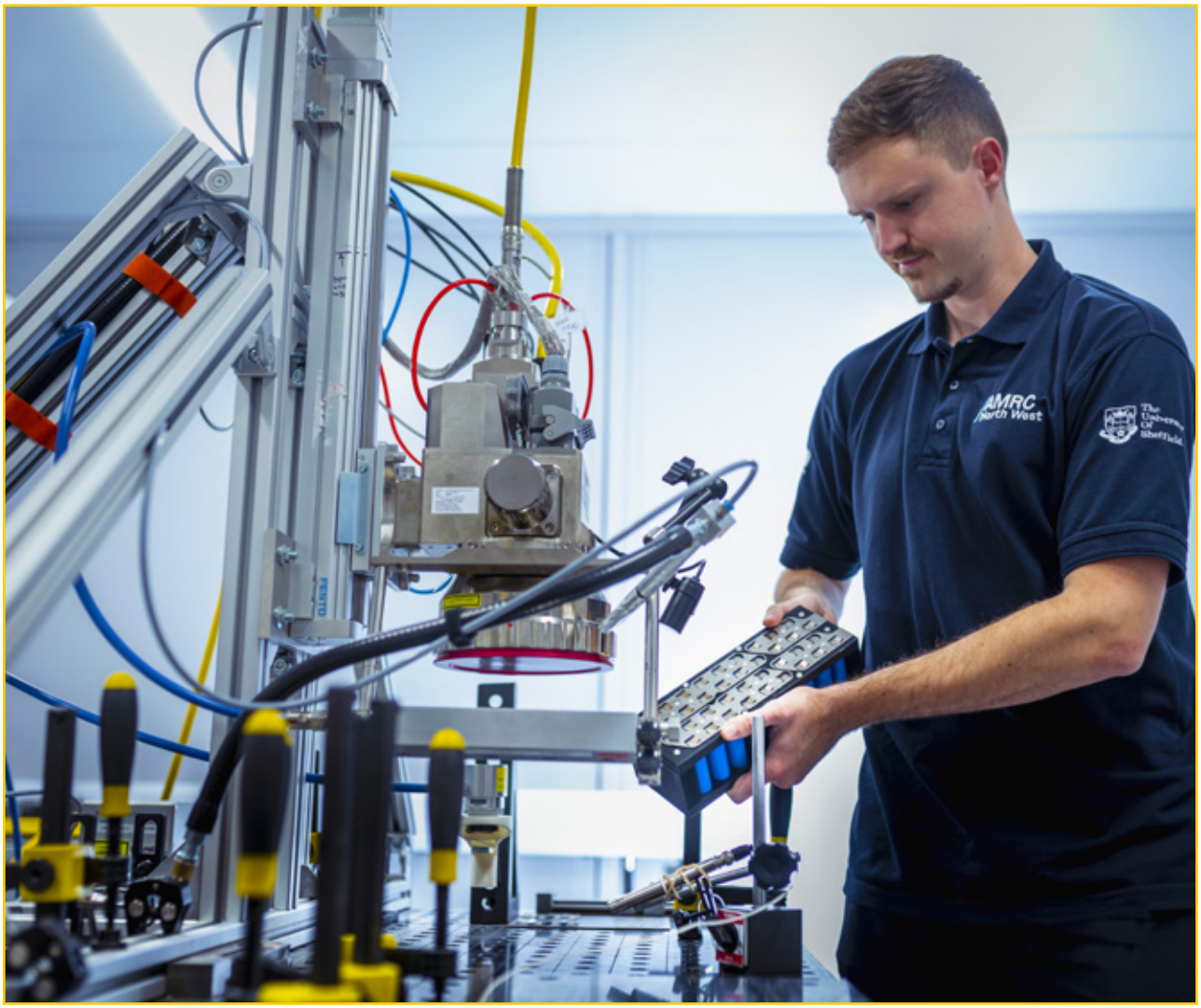
Integrating machinery throughout a factory may seem like a headache, and an expensive one at that, but the reality is that the smart sensors and powerful analytic tools are readily-available for all budgets and applications. The key is getting the right advice, which is what we are here for.



Spiroflow developed a remote monitoring system using IIoT technologies.

Institute Spotlight

AMRC North West



The AMRC's £20m North West R&D facility opened in 2022.

AMRC North West, based in Samlesbury, is part of the University of Sheffield Advanced Manufacturing Research Centre (AMRC), a cluster of world-class centres for innovation and research into advanced manufacturing technologies.

Research and development is accessible to all manufacturers driven by the goal to increase innovation across the wider region, working closely with the extended SME supply chains.

Iain Martin, senior engagement manager, said: *"AMRC North West is driven by industry, for industry - no matter what size your business. Our R&D capabilities are available to any manufacturer that wants to reduce waste, raise productivity, improve quality and make the low-carbon transition while moving up the value chain. We pride ourselves on using the knowledge and expertise gained from our R&D activity to meet the needs of SMEs to large manufacturers in an affordable and beneficial way."*

Cyber Security

Cyber security is the means by which individuals and organisations reduce the risk of becoming victims of cyber attack.

More of a mindset and a set of procedures than a technology, its function is to protect the devices used by manufacturers such as smartphones, laptops, computers, servers, networks and IIoT connected devices, from attack or damage.

It's also about preventing unauthorised access to the vast amounts of valuable data including intellectual property, data on customers and their products.

Protecting your business from cyber security risks can seem daunting but there is plenty of free help out there to make sure you have the basics in place and protect your organisation's data, assets, and reputation.

The UK National Cyber Security Centre (NCSC) supports the most critical organisations in the UK, the wider public sector, industry, SMEs as well as the general public.

The NCSC's A-Z of cyber security is a great place to start or you can download this **Small Business Guide**.

Cyber Essentials is a simple but effective, government backed scheme that will help you to protect your organisation, whatever its size, against a whole range of common cyber attacks.

Made Smarter has also produced a **guide to tackling cyber security**.

If you need help implementing cyber security practices, or would like advice on the current systems within your manufacturing organisation, our specialist business and technical advisers are on hand.

Not only can we support you in uncovering the tools you may need to protect yourself, but we can also discuss how to fill any skill gaps you might have in your workforce.

Cyber security is a vital tool for SME manufacturers.

Emerging Industrial Digital Technologies

Generative AI

Once the arena of data scientists, artificial intelligence tools are now freely available to all, including manufacturers.

Generative AI, an offshoot of artificial intelligence, involves algorithms that can generate new content or data that resembles human-like outputs.

In the context of SMEs, this technology can revolutionise product design and development. For instance, generative AI can enable a small manufacturer to rapidly prototype new product designs, test them in virtual environments, and refine them based on AI-generated feedback, dramatically reducing time-to-market.

Looking to the future, Generative AI's ability to learn and adapt will make it an invaluable partner in the creative process, enabling SMEs to experiment with innovative and customised solutions.

Artificial intelligence tools are now freely available to manufacturers.

Digital Twins

Digital twins offer a virtual replica of physical processes, products, or services.

This technology allows SMEs to simulate and analyse their manufacturing processes in a virtual environment before implementing them in the real world.

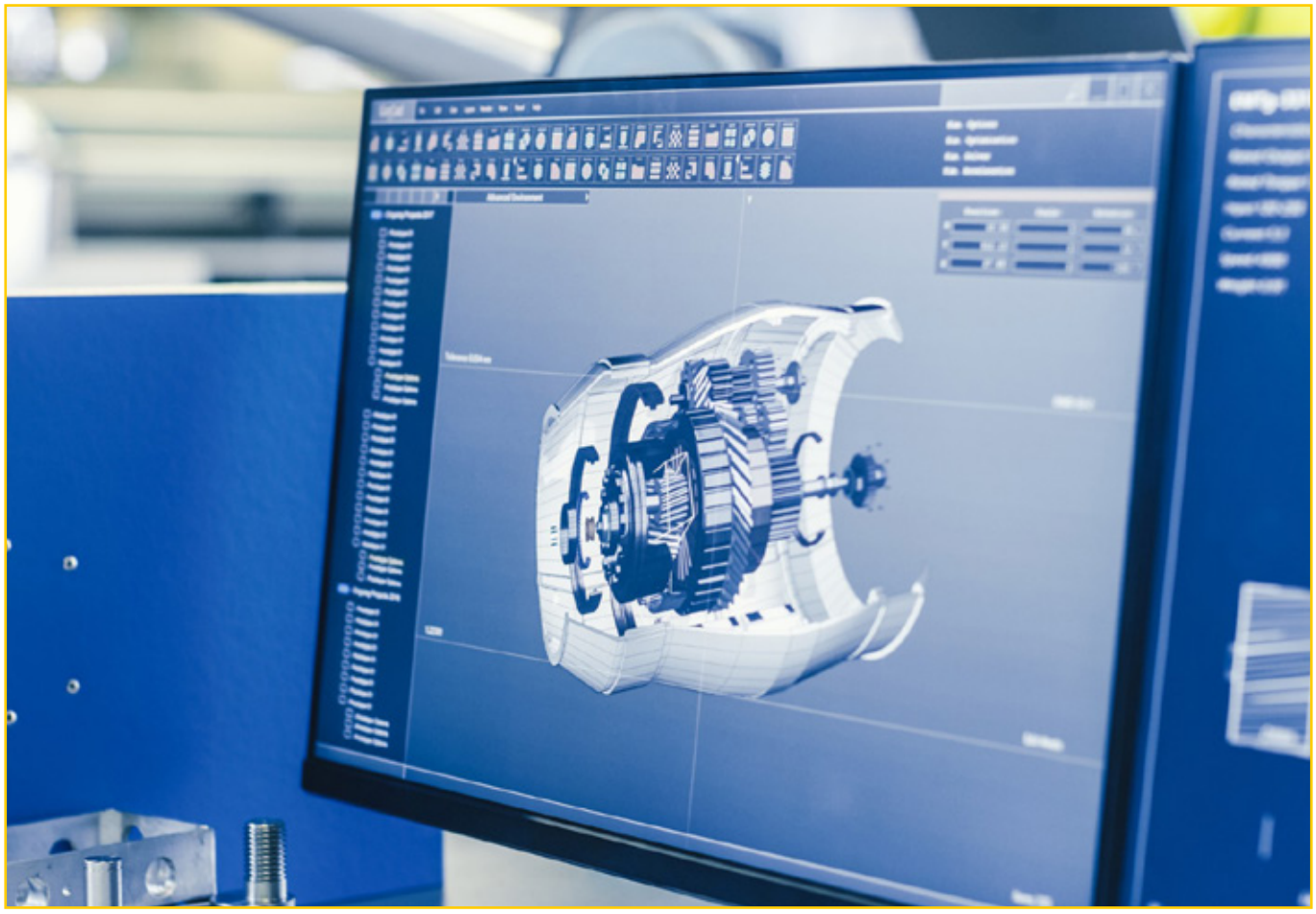
For example, a digital twin could enable a small-scale manufacturer to optimise their assembly line for efficiency and minimal waste, without the need for costly physical trials.

As digital twins evolve and become integrated with real-time data and AI analytics, they will become dynamic tools for predictive maintenance, process optimisation, and strategic planning.

The future may see SMEs leveraging digital twins not just for their manufacturing processes but across their entire supply chain, enhancing transparency and efficiency.

Made Smarter has helped several manufacturers adopt digital twin technology including MSM aerospace.

Capability in digital twins is expected to increase over the coming years through the National Digital Twin Programme (NDTP), a government-led initiative to develop the standards, processes, and tools that will build the foundation of the technology.



A digital twin digitally replicates a physical asset in the virtual environment.

Institute Spotlight

MTC Liverpool

The Manufacturing Technology Centre (MTC) helps SMEs address practical, technical, and strategic challenges.

The Manufacturing Technology Centre (MTC) opened in Liverpool in 2015. Part of the High Value Manufacturing Catapult, supported by Innovate UK, it was established to prove innovative manufacturing processes and technologies in an agile environment in partnership with industry, academia and other institutions.

Housing some of the most advanced manufacturing equipment in the world, the MTC provides a high quality environment for the development and demonstration of new technologies on an industrial scale, supporting skills, productivity and growth across the UK manufacturing industry.

Mark Sutherberry, Senior Business Development Manager, said: "*We know that SMEs are the beating heart of UK Manufacturing. Our SME Support team has been formed to work directly with you whether you are a budding entrepreneur or start-up, going through scale-up pains or matured into a larger established SME. Together we can draw on the extensive resources of the MTC to address your practical, technical, and strategic manufacturing challenges.*

"Our team is ready and able to support the breadth and depth of challenges faced by the UK's SME manufacturing community, from the implementation of new and emerging technologies to factory layout and process flow improvements, robotics and automation, net zero decarbonisation journey, energy transformation, digitisation, technology adoption, new product innovation and much, much more. We have expert engineers in every region of the country – across all industry verticals - so no matter where you are based, challenge us to help you."

Conclusion

There's no doubt that technology adoption and digital transformation has surged in recent years.

Global challenges have shown what can be achieved with greater connectivity and automation, and the need for ever-increasing digitalisation.

Research by the IMF[3] found digitalisation since 2020 has increased by an average of six percent across advanced economies. Small firms, which have historically been slower to adopt technology, gained the most.

Now tech has shown its true colours in the form of growth, investment, employment, productivity and a competitive advantage, the race is on to fully capitalise on the opportunities that exist, and those on the horizon.

Take AI. Its recent democratisation through models like Chat GPT has put a technology with extraordinary potential into the hands of everyone, including manufacturers.

Business leaders therefore need the skills, knowledge and experience to respond to this rapid change.

Demonstrating these technologies in action, showing not just telling, is vital to Made Smarter's success. We are enabling people to get their hands in with these technologies by connecting SME manufacturers with each other through a growing network and building relationships with leading technology institutes. This way we can ensure we keep a finger on the pulse of emerging technologies which can help the sector thrive during this latest industrial revolution.

Get in touch today to start your Made Smarter journey

Further reading

A guide to successfully solving operational issues with industrial digital technologies

A manufacturer's guide to adopting new digital tools

A beginner's guide to augmented reality for manufacturers

How to become a manufacturing leader in digital technology

How to reduce carbon emissions through technology

The ultimate guide to taking cyber security seriously in your manufacturing business

Can makers still adopt technology on a tighter budget?

Sources

1 Made Smarter Review

2 International Federation of Robotics

3 IMF - How Pandemic Accelerated Digital Transformation in Advanced Economies

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www.madesmarter.uk