Building confidence in digital technology adoption for UK manufacturers

By Ben Sheridan, Industrial Digital Innovation Sector Lead at BSI

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The use of industrial digital technologies (IDTs) is gathering pace across the manufacturing sector – but what are the drivers of and the impediments to their adoption? To find out, we solicited insights from leading industry experts in the manufacturing technology sector and from within BSI – both on the future of IDTs and on how standards can help UK manufacturers embrace them with greater confidence.

The recurring theme is that there are huge opportunities, because IDTs enable manufacturers to achieve increased control of the business issues they want to address and strengthen their ability to adapt quickly to change. However, there are risks, complications and challenges to adoption.

Challenges to adoption

Cost, or the perception of it, is seen as a significant inhibitor – and it may be that UK manufacturers are overly cost-conscious. "We know that proportionately, technology investment in the UK is lower than that of our international competitors," says James Selka, CEO of the Manufacturing Technologies Association. For example, the UK is 24th on the world league table when it comes to adopting robots. There are some reasons for this relatively low technology investment, including, until quite recently, a very flexible labour force in the UK. "There's also an issue around the attitude of 'How much does this cost', rather than 'What value does it bring'" Selka notes. In some other economies, value delivery may be given higher priority than price in the initial business case assessment.

There's a perception that IDTs are the preserve of big manufacturers who can afford to bring in technology vendors to develop bespoke solutions at a cost that would be prohibitive to SMEs. This may be a flawed assumption since there's a growing ecosystem of small digital solution providers who are only just now waking up to the opportunities that exist for them within SME manufacturing. This can result in IDTs that are developed at a more accessible price point for SMEs. Retroactively fitted IDTs such as sensors on vintage machines will cost in the region of £500 - £1,500 depending on the machine. SMEs can access funding to help pay for this type of innovation.

With integrated IDTs there's concern around data sharing, for instance along the supply chain, with customers asking for more visibility of a manufacturer's operations; or to demonstrate net zero reductions across the whole product lifecycle. This creates opportunities, but Professor Rab Scott, Operational Chair of the High Value Manufacturing (HVM) Catapult Digital Strategy Team notes that it also requires a cultural mindset change. "Traditionally people haven't wanted others to know how effective or efficient they're being." As well, one of the big challenges is manufacturers understanding the benefit to them of exposing their data. "You can expend a lot of effort getting the digital data together," says Scott, "only for someone else to extract the value. So really we've got to move towards an understanding of co-creative environments where it's a win-win for everyone."

Another significant inhibitor of IDT adoption is a digital skills shortage. Jack Semple, Alliance Secretary at the Engineering and Machinery Alliance notes that EAMA commissioned a report on skills in 2020 which found that more than three-quarters of companies surveyed had major skills gaps and that the most common deficit was digital skills.

Scott agrees, and identifies that we're now at a demographic tipping point where predominantly analogue people are still in the C-suite and they aren't acquiring digital skills quickly enough. One result is that decision-makers can't quite visualize how, where and why to deploy integrated IDTs and moreover are apprehensive about exposing their lack of understanding to the digital natives on the shop floor.

Nikesh Mistry, Sector Head of Industrial Automation at GAMBICA also notes a gap between information technology and operating technology skills on the shop floor. "IT and OT people now need to work together, or acquire each other's skills. But in most organizations, they're in two separate departments. So that needs to be addressed."

Nor is the necessary skillset emerging from schools and universities at the moment. One thing manufacturers can do is tell local education providers what they need in terms of new digital skills. Mistry adds, "People say that robots will take our jobs, without recognizing the huge and growing demand for the new skilled jobs that IDTs are creating in areas that didn't exist 10 years ago like data analyst, and other roles in the IDT future as yet unthought of."

Some sections of UK engineering and manufacturing can be too fond of dwelling on past glories. And in the general population, as Selka notes, "There's a huge cultural barrier, with parents still telling their children to go into the professions."

Elsewhere, Scott also speaks of two clock-speeds: "In manufacturing people are proud of the machine they've kept running for 40 years; in the digital world if it's 40 weeks old it's out of date." This mindset can inhibit investment as manufacturers wait for technologies to settle or mature before they fully commit, even though the point of stasis will likely never arrive.

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Drivers of adoption

Against this backdrop, adoption of IDTs varies across sectors, but a common driving force is the pandemic. Mistry points out that overnight people were told to work from home where possible. Manufacturers had to introduce digital technologies that enabled remote machine and maintenance checks. Where this capability already existed, the pandemic drove greater digitization, connectedness and data integration. Seeing the benefits and feasibility of digital technologies promoted more widespread confidence in them.

Relatedly, the pandemic was (and still is) a reminder that we're living in turbulent times. Alongside the shocks of Brexit, increased supply chain fragility, and more extreme weather events, for many manufacturers COVID has underscored that they operate in a hazardous environment and nurtured a desire to build greater resilience.

Globally, this is leading to an upswing in reshoring, with countries including India, the US and Germany introducing policies to encourage more in-market manufacture. Domestically it's driving more IDT adoptions because digital technologies help build resilience by supplying actionable information. Technologies like predictive maintenance systems can drive down service costs, extend the life of machines, remove unscheduled downtime and improve uptime, which is key for a lot of manufacturers.

At the same time, integrated IDTs can collate data in one place where everyone can access it, and present it in usable forms such as dashboards. It can be manipulated to supply hindsight of what's happened in the past and extrapolated into foresight about what will likely happen in future. It supplies real-time visibility and insight into operational activity across the whole business. This enables agility and responsive adaptations in the face of shocks, or rapid change.

A compelling example of this agility and responsiveness can be found in the Ventilator Challenge UK consortium. This saw 33 manufacturing businesses from the aerospace, automotive and medical sectors coming together at speed to build medical ventilators. Established from nothing, seven new large-scale manufacturing facilities were set up, a workforce of 3,500 front line assembly workers were recruited and trained and 13,437 regulator-approved ventilators were delivered in 12 weeks. This could not have happened without the ability to apply digital technologies from initial designs to production lines developed using digital twins.

In addition, the drive to net zero is undoubtedly pushing the adoption of IDTs. Not least, legislation will likely increasingly set targets that manufacturers need to achieve and evidence, including along their supply chains. But whether carbon savings are a goal or a welcome by-product, IDTs can make significant inroads into reducing emissions and lowering energy costs (as detailed below). As well, the mass customization and personalization that IDTs make possible can lead to less ordering of high quantities from low-cost economies, resulting in less transportation and wasteful overproduction.

"Another driver is the recognition that IDTs have the power to attract the next generation of young talent who want to use connected technologies, not dated machines. And an increasingly potent driver will be the growing recognition that IDTs can confer significant competitive advantage and prepare businesses for where their industry will be moving in the future."

The opportunities presented

In consideration of the opportunities presented, IDTs can address a range of business issues. These might include boosting productivity, attracting talent, selling more products, maintaining competitiveness, improving sustainability, increasing servitization[1], or just supporting survival. Whatever the goal, integrated IDTs can enable manufacturers to visualize, identify, evaluate and tackle their business's challenges and problems better. They can increase real-time decision-making capability and optimize the use of resources.

Very often the business goal is to improve productivity and remove non-value adding activities. IDTs can help identify and strip out waste so manufacturers are able to produce more with less resource.

The goal might be to strengthen the supply chain. By sharing data between different sites manufacturers can get a real-time holistic view that enables automatic adjustments that release bottlenecks. The use of integrated IDTs can also help a manufacturer enter new supply chains, just because having that digital capability makes them more compatible and attractive.

The objective might be product improvement, where IDTs can supply digital feedback on how products are used that supports rapid iterative design processes and helps bring the improved product to market more quickly. The goal could also be product reinvention. Additive manufacturing in particular has the power to transform how products are conceived, designed and manufactured.

Increasingly the goal will be to contribute to net zero, whether out of regulatory compulsion, conscience or corporate social responsibility (CSR) commitments. This does not mean an individual manufacturer lowering their own carbon footprint by displacing emissions along the supply chain. IDTs can play a key part in helping manufacturers gain visibility of how and where the whole supply chain is emitting carbon, and understand the true start point from where embodied emissions can be driven down.

Thereafter IDTs can reduce energy and material use. Simple examples are software programs linked to sensors that shut down machines when they're not immediately in use, or that activate variable speed drives or soft starters. Motors account for nearly two-thirds of all the UK's industrial electricity, while air compressors account for 10 per cent of all the industrial energy used in the UK, so significant savings can be achieved.

1. Supplementing a traditional product offering with long-term performance monitoring and post-market product servicing

Sensors on machines can also detect when normal tolerances start to drift, giving operators the chance to make corrections in-process, rather than end up with a product that needs to be scrapped or reworked. This can reduce the energy expended per product manufactured, plus the materials consumed, which can be a significant carbon saving bearing in mind that, for example, 70 per cent of the carbon footprint of a typical metal product is in the primary resource extraction. Integrated IDTs can also play a role in carbon-reduction by revealing how products are used, showing the features that customers do and don't value, and influencing the next iteration, which could be a more efficient version or could be designed for recovery and disassembly. What follows are some short case studies describing some successful recent IDT adoptions.

Success stories

- A large manufacturer in the south of England wanted to reduce energy consumption. It installed energy recovery system software in its refrigeration plant, injection moulding machines, and conveyor belts. The software matches the power supplied to the machine demand. The result is a 26 per cent annual cost saving and a CO2 annual emissions reduction of 2,500 tonnes. ROI was achieved within two years.

- A family-run door manufacturer wanted to improve its fire door manufacturing process. Such doors must be manufactured to precise safety specifications and standards. The challenge was to ensure that beading around the door window panels would hold the glass inserts securely in place. Traditionally an air gun was used to insert the pins holding the beading in place. CAD was used to develop a virtual air gun and then a 3D printed jig to hold the air gun and ensure the pins were consistently going into the door at the right angle. After testing and modification, ten 3D printed jigs were produced, so the company has enough to last for some time. This use of additive manufacturing is now ensuring the repeatability and accuracy of the process and delivering cost savings as fewer doors fail rigorous safety checks.

"The drive to net zero is undoubtedly pushing the adoption of IDTs."

- A small manufacturer of metal cutting solutions to the tube, pipe, and coil processing industries wanted to reduce its energy consumption. Ten Blanchard grinders are used on site, but when running a small load, they waste a large amount of energy. New software calibrates the energy requirement to the load. Against a target of reducing consumption on one grinder by 5 per cent, they achieved a saving of between 13 and 15 per cent – three times the target. The company immediately rolled the software out to its remaining nine machines. It was a fast, easy, deployment with the initial equipment installation happening overnight, plus the solution was easy to use, so grinder operators didn't need additional upskilling.

- An SME that does white van conversions (e.g. putting in racking in different configurations) used to take customer requirements for their van interiors, mock them up in MDF, and then make final adjustments based on customer feedback – a design process that took six weeks from start to finish. The University of Sheffield Advanced Manufacturing Research Centre (AMRC) introduced the company to a virtual reality configurator. This piece of kit enables customers to don a headset and virtually design their own van interior. This low-cost intervention took five days to configure and now reduces design time from six weeks to 30 minutes, plus does away with the cost of the MDF mock-up.

- A traditional northern hand tool manufacturer had a problem with a key process that was so unproductive it was actually losing them money on one of their best-selling products. The process is one of several, but is essential. If it had to be off-shored the whole manufacturing process would have to go with it. The AMRC came in and worked with the company to de-risk the project. The specialist process was captured and a second-hand, low-cost robotic solution was programmed that grinds, linishes and hardens the product. The company can now keep up with high demand and has also begun implementing its second robot.

Where standards fit in

In order to widen the adoption of IDTs, Semple advises manufacturers to develop a business case to identify and understand the value of any proposed digital innovation. "Appreciate the capability of the technology and its benefits and impact," he says, "and ensure you have the skills and processes to take advantage of the additional information and control you get from digital."

For its part, BSI is now working to produce the standards and good practice that will support the development of digital-ready skills, processes and mindsets and help overcome the challenges of IDT adoption. For example, standards can play a role in areas like cyber security and artificial intelligence – creating a harmonized understanding how to safeguard data and develop emerging technologies. Standards will also be critical to interoperability by establishing universal protocols that will enable disparate systems to talk to one another.

Semple adds that standards generally have a big role to play in bringing quality and consistency in a number of digitally enabled industries such as additive manufacturing. He identifies a need and opportunity for wider adoption of process standards for instance to ensure the appropriate quality of materials are used in additive manufacturing.

Standards, alongside legal agreements, can help ensure that acceptable governance processes are in place, so that integrated IDT ecosystems can develop wherein people are more willing to share data because they have confidence its integrity will be respected by all parties. Standards can also supply frameworks to help engender greater collaboration within IDT ecosystems, and give rise to new business risk-sharing models.

Lastly, PAS 1040:2019 is available as a free download. This standard is a guide that can help manufacturers overcome some of the constraints on IDT adoption by giving descriptions of what can be achieved, alongside a methodology for assessing a manufacturing business's readiness for IDT adoption.

Future predictions

Our experts now anticipate an accelerated adoption of IDTs in the wake of COVID-19 and Brexit, and because of a general resulting trend towards greater agility, adaptability and resilience. "I predict a rapid growth, first in understanding," says Semple, "then in people with relevant skills; and then adoption will quickly follow." Propulsive factors include a fear of being left behind and the current squeeze on skilled labour.

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£1m annually

Selka points out that finance is also currently low cost, very available, and technology has never been so powerful. He continues, "We have R&D tax credits and positive encouragement to invest in technology through the annual investment allowance which has risen to £1m annually, and there's also the 'super' deduction, intended to incentivize new capital investments in equipment and machinery – so we should be seeing an enormous acceleration in technology acquisition and deployment, which should help UK manufacturing make a step change in competitiveness."

He says there are lots of world-class companies in the UK, but also many that could hone a sharper competitive edge. "There's the opportunity to leapfrog our international competitors and at the same time be a critical part of solving the sustainability issues we face." He also suggests attending MACH 2022 from 4 -8 April 2022 at the NEC, which offers the chance to see all kinds of IDTs in operation.

Scott advises that manufacturers should identify a challenge they need to overcome, "Then come to the catapult centres and try before you buy. Our role is to de-risk the adoption of new technologies."

Semple adds: "Above all, understand what you're investing in, why, and how you're going to get the benefit." He notes the need to manage the transition carefully, paying attention to the availability of skills and training. Firms should contact their local enterprise partnership or growth hub to see what locally funded support is available. Trade associations can play a role with peer learning and networking opportunities. Manufacturers should also look out for the Help to Grow: Digital scheme which from December 2021 is offering a discount of up to 50 per cent towards the costs of buying approved software, up to £5,000.

Mistry advises that both vendors and manufacturers should build their networks, and establish the business problems that they face, then turn to the available experts to help. "There are so many catapults, government organizations, and funding sources available to help you on the journey," he says. "You're not on your own in any of this. So, my advice would be to find your business problem and then look at all the help you can get to tackle it."

Finally, to accelerate IDT adoption, both manufacturers and technology vendors need to move towards an environment where trust and confidence underpin co-creative relationships. This will be an environment nurtured by standards that supply the governance structures, specifications, frameworks and processes to build reassurance around what IDTs can deliver.

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About BSI

BSI is the UK's national standards body (NSB) - the first national standards body to be created. We represent UK economic and social interests across all European and international standards organisations and in the development of information solutions for British organisations of all sizes and sectors.

Our role is to help improve the quality and safety of products, services and systems by enabling the creation of standards and encouraging their use.

We publish more than 3,100 standards annually, underpinned by a collaborative approach, engaging with experts, government bodies, trade associations, organizations of all sizes, and consumers, to develop standards which reflect best practice and clarity around common outcomes.

BSI is indebted to the contributors to this article who gave freely of their time and expertise. They are: Nikesh Mistry, Sector Head of Industrial Automation at GAMBICA; Professor Rab Scott, Operational Chair of the High Value Manufacturing Catapult Digital Strategy Team; James Selka, CEO of the Manufacturing Technologies Association; and Jack Semple, Alliance Secretary at the Engineering and Machinery Alliance.

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