4 Manufacturing

Bringing the revolution to SMEs

Report for stakeholders

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Introduction

Industry 4.0, or the "4th Industrial Revolution" (4IR), represents a transformative opportunity for industry. It is clear that when implemented well, digitally based technologies and systems can transform manufacturing, helping realise a more productive, prosperous future. If the UK is to respond convincingly to this opportunity, then it is imperative that SMEs are engaged.

Through its "4Manufacturing" initiative, KTN has developed, tested and refined an approach to SME engagement focused on 4IR. We have helped over 175 SME manufacturers, on a one-to-one basis, to take their first steps along the 4IR journey, driving and enabling innovation and business improvement. We have engaged many more through events.

Key barriers

Confusion, resource concerns, uncertain benefits and the language of 4IR were all identified as key barriers for SMEs. Common questions and comments during a 4Manufacturing pilot study included:

- 1. "We don't really understand all the jargon and terminology"
- 2. "Where do we start?"
- 3. "Where can I see it?"
- 4. "What is government doing?"

A joined-up approach

4Manufacturing has drawn upon KTN's impartiality and its ethos of collaboration. The initiative has thus benefited greatly from the support of the HVM Catapult, GTMA, the Manufacturer magazine, IMechE, IET, Gambica and a highly skilled network of subcontractors with focus and expertise in particular regions and sectors.

4Manufacturing has demonstrated that it delivers what manufacturing companies need in a structured and planned approach to 4IR that will benefit UK economic growth and productivity goals.

Approach

The 4Manufacturing initiative was developed and delivered by a core team within KTN, supported by staff from across KTN and a team of contractors skilled in engaging with manufacturing SMEs.

It has developed a framework for engaging SMEs on a one-to-one basis which has been deployed in a pilot study to over 175 manufacturing SMEs.

This breaks down the broad topic of 4IR into a manageable set of 22 themes which structures the dialogue, enables assessment of capabilities, identification of opportunities, and tracks progress. In a two-way dialogue with an advisor, the companies select a number (typically one to three) of these themes that they wish to engage with. Within each of these themes we have defined a structure of five attainment levels, from (1) basic awareness to (5) exemplar, with descriptive text outlining what each attainment level looks like for a manufacturing business. Thus, the framework establishes a starting point and an aspiration for the company's 4IR journey. The advisor then helps develop a plan of action and enable this journey via advice, support with regard to finding suitable partners, solution providers and funding. As progress is made it is captured using the same attainment levels.

4Manufacturing support "provided focus on areas of opportunity that could provide greater efficiencies and cost savings." Manufacturing SME



The Knowledge Transfer Network's 4 Manufacturing process helps manufacturing SMEs to innovate, taking a thematic approach and making compelling connections to partners & funding.

The framework also:

- builds appreciation of the full breadth of 4IR – even in those themes that the SMEs are not familiar with – and helps build a balanced approach
- helps aggregate results attainment, appetite and progress can be broken down by sector, theme, geography etc. and thus establish the need for particular actions (eg. a need to help a particular sector or region through targeted funding)

KTN is uniquely well placed to make targeted introductions that match needs with capabilities to create opportunities for both parties. We have been making introductions and connections on behalf of these SMEs to carefully selected solution providers, which include:

- the Catapult centres
- Universities
- targeted commercial solution providers and developers - many of whom are themselves SMEs. These smaller solution providers are often harder to find but can offer notable benefits including more tailored and costeffective solutions.

We also support identification and applications to the appropriate funding options to enable such collaborations.

We have captured the aspirations the SMEs have for progressing in their selected themes, and will keep in touch with this cohort of manufacturers to see if progress matches aspiration. As we follow these businesses we will also be developing case studies which will help inspire others. These will be more compelling, of course, where companies are prepared to share the full extent of their gains.

This one-to-one business support has been valued very highly by the SMEs - particularly in

the context of a topic as multi-faceted and allencompassing as 4IR. One-to-many workshops, online tools etc. are useful but cannot provide the benefits that one-to-one engagement can.

Indeed, in parallel with our one-to-one engagement we have also engaged with manufacturers at a series of events across the nation – eg. in collaboration with The Manufacturer, Autodesk, and the different parts of the High Value Manufacturing Catapult.



One of the demonstrations featured at the 4Manufacturing event at AMRC's Factory 2050, Feb 2017

The name "4Manufacturing" resonates strongly with both manufacturers and with stakeholders. The name helps to provide a focal point for joined-up UK approach, based on KTN's "network of networks". It does not put off those who are unfamiliar with the notion of the 4th Industrial Revolution, but helps them to engage.

Results

Results are presented here for the 175 SMEs that KTN has engaged through 4Manufacturing, covering a range of sectors.

Analysis of the themes that the companies are engaging with, summarised in the chart below, is yielding compelling insights into how UK stakeholders should work together to help SMEs engage in 4IR.

There are insights and actions at both ends of the spectrum. How, for instance, should we support the appetite for the popular themes such as robotics and automation? (It is no coincidence that KTN have just set up a renewed Special Interest Group (SIG) in this space). At the other end of the spectrum, why are the less popular themes not attracting interest; are there opportunities that are being missed?







Themes selected by the 4Manufacturing SMEs

Case Studies

Tecforce

Tecforce refurbish and remanufacture equipment for the rail sector. Based in Derby, and employing 45, its customers include the likes of Siemens. Much of Tecforce's work is manual, and relies on the skills of their employees. They work on a high variety of different assets from fuel tanks to bogeys, and volumes for each are fairly low and unpredictable.

KTN staff visited Tecforce in February 2017. It was identified that Tecforce might benefit from investigating:

- 1) Digitising their procedures removing the need for printed copies. This would make for better usability and easier updating.
- 2) Product identification via barcode or RFID tag. Data could for instance be recorded about the status of an item upon receipt, what has been done to the item throughout the refurbishment process, etc. This would enable more thorough traceability, and potentially additional value to be realised from the data eg. by selling it to the operator to monitor failures.

We captured this insight in the 4Manufacturing "tracker" as shown below and have been following up on the opportunities highlighted above, by for instance making introductions to the likes of Warwick Manufacturing Group, the Manufacturing Technology Centre, and Cranfield University's Through-Life Engineering Services team.

"Very useful process [which] enables the business to take stock and evaluate what we do and more importantly what we can do... Assists us with our development for growth and expanding our knowledge base. Identifies gaps we have so supports our strategy to develop our skills and services. doing what Keep vou do. Supporting SME's is essential and really contributes to helping our businesses develop."

lan Briggs, Tecforce

Attainment level	5 (full maturity/exemplar)	Aspiration for 16/02/18					
	4	16/02/2017		Aspiration for 16/02/18			
	3		Aspiration for 16/02/18	16/02/2017			
	2				Aspiration for 16/02/18	Aspiration for 16/02/18	
	1 (basic awareness)		16/02/2017		16/02/2017	16/02/2017	
	Chosen innovation themes:	Factory floor and production systems	Sensors	Systems Integration	Robotics & automation	Digital processes	

Total Control Pro, Zircotec and IDSL

Total Control Pro (TCP) is another SME that KTN has assisted as part of the 4Manufacturing initiative. They have developed cloud based software combined with a barcode system to track and control manufacturing processes. This solution is innovative and yet easy and cost-effective for the manufacturer. Working with TCP over recent months, along with manufacturers that are adopting their solutions, has yielded valuable insights.

Zircotec are a specialist manufacturer of heat shielding for automotive applications. They need to plan and control their orders through the factory. These include both batches of parts for OEMs, and individual orders for specialist vehicles - a tricky balancing act to manage.

Recently they have deployed TCP's cloudbased software to interface with their sales order processing software. This allows Zircotec to know where all orders are in the factory and plan for scheduled deliveries as well as giving accurate delivery information for the customers of the bespoke work. The system works with barcode scanners and a monitor at each work station in the factory. As a result, staff know what jobs are coming up next and managers know when orders will be ready for shipping and invoicing.

IDSL are a door manufacturer who use tracking technology to monitor materials and orders through their factory. They use TCP's software finding it to be quickly scalable, suitable for multi-site application, and simple to install and to use. It was key to IDSL that the software would link into legacy systems and not tied to specific large commercial software vendors.

Hyde Aero Products

Another early adopter was Hyde Aero Products, a division of Hyde Group based in greater Manchester with less than 500 employees across one design and nine manufacturing companies. Their first goal was to improve schedule adherence and, instead of hiring several new employees with project, schedule, tracking, reporting and capacity planning expertise, Hyde Aero Products implemented middleware to integrate the various manufacturing and ERP systems. They can now run manufacturing planning scenarios

"KTN support has been first class." Manufacturing SME

and accurately predict delivery so that delivery schedules to customers are met, and machine utilisation has increased by an average of 10%. Hyde Aero Products are now working on developing and integrating other business critical systems to ensure the right data is delivered to the right people at the right time.

Whilst the technical delivery of each of the examples above is different, the common elements, as the 4Manufacturing pilot study shows, are widespread. Namely: companies have legacy systems and new software needs to integrate with these systems; scalability is often important; and ease of implementation and cost effectiveness of the solution is very important to reduce the barrier to SME adoption.

Key Findings

The integration imperative

This was probably the biggest challenge that KTN identified through the 4Manufacturing initiative. SME manufacturers lack knowledge of digitisation as it might be deployed across the business, and in particular how to integrate with existing processes and technology. 4Manufacturing uncovered major business challenges, particularly around assessing options for new software. Key questions are:

- How do I start to select a solution?
- Will this solution do all I need it to?
- Will it integrate with my current system?
- Will the data flow in both directions?
- How will I compare different solutions?
- How can I assess value for money & return on investment?
- I have a real problem getting two (legacy) systems to talk. Who can I turn to for help?

The integration can take considerable time even if the company has their own technical staff. If they do not, finding the skills they need is difficult. Some vendors undertake a degree of integration but will not necessarily have the detailed knowledge of how to link their system to those legacy systems already in place.

New business models

Not only will manufacturers need to develop new business models but their suppliers (including middleware and software solution providers) will also need to review their business models if the benefits of digitalization are to be fully realised. Servitization, profit sharing and monthly subscription business models can be vital in encouraging companies to take their first steps in deploying digital technology (rather than the conventional models of selling product or buying annual software licenses).

Company evolution, national revolution

If a company is to digitise, there is a need to build competence and confidence, whilst taking account of ongoing day-to-day resource demands, and gaps in knowledge and skills. Companies have been struggling to find support that offers this whole business perspective. Indeed, business advisors who both (a) understand digital and (b) are skilled at engaging manufacturing businesses are uncommon.

KTN's 4Manufacturing approach is based on starting small and growing step-by-step. This has been very attractive to the SMEs that we have engaged, encouraging these resource limited companies to take their first steps in digital technology and to generate momentum, supported by a roadmap. Only step-by-step evolution over time, aggregated and integrated across supply chains and geographies, will add up to a revolution.

Fit for digital

Companies need to be in a fit state to benefit from adopting new technologies (machines or software). If they are not ready, benefits will be compromised and return on investment will not be realised.

Companies need advice to help them make informed decisions about designing and

optimising production lines and systems, as opposed to single machine installations.

Based on our experience deploying 4Manufacturing, KTN advocate the deployment of approaches similar to "lean" that also tackle system-level optimisation and continuous improvement.

Skills gap

Through 4Manufacturing, KTN has identified (as have other digital manufacturing initiatives) a significant requirement to tackle skills and education.

Technical staff will need to adapt, and programmers with a strong knowledge of manufacturing will be required.

For example, Operational Equipment Efficiency (OEE) will need to be effected for each machine using correct parameters. The next generation of skilled technicians will need to be able to optimise OEE for the line to meet the return on investment requirements relating to digitisation.

Software and middleware vendors will likely only have limited understanding of the integration that has taken place with all their customers' companies and systems. In this context, their technical staff will need to ensure that software upgrades will not negatively disrupt other systems within a business.

There is an opportunity for these skills gaps to be addressed in conjunction with the Department for Education (DFE).

A network of networks

KTN's "network of networks" (our close working relationship with partners and stakeholders across the nation) is a proven outreach model that can deliver local provision of a national programme, and this is our approach to scaling up 4Manufacturing into the future. KTN are now working hard to find the right partners that can deliver across the nation.

This approach will also allow us to fine tune geographic needs to local skills, and draw on the existing relationships and reputations that regionally based providers of SME engagement already have.

One-to-one support

4Manufacturing is predicated on sustained one-to-one dialogue, and we have found that this is critical both in driving awareness and appetite, and in generating engagement and outcomes. Many manufacturing SMEs are focused on the day-to-day and have limited time to think strategically; to attend events and read publications. However, through the right engagement on a one-to-one basis, that takes account of their particular circumstances, these companies can be made aware of the benefits of digitisation. By sustaining dialogue, trust and insight is developed; and by following up on agreed actions over time the companies feel supported and encouraged, and thus maintain progress.

"I always prefer face to face discussions, especially when being introduced to something new." Manufacturing SME

Recommendations & Next Steps

- Develop software integration support for manufacturing SMEs at a UK level. This might be something that the Digital Catapult could coordinate.
- Encourage vendors and developers to develop new business models that enable manufacturing SMEs to afford digital solutions
- Support companies to become Fit-for-Digital across their production line and not just push for new technology purchases which addresses an isolated issue
- 4. Expand 4Manufacturing as a support program that drives evolution at a company level in order to realise the 4th industrial revolution at a national level
- 5. Develop 4Manufacturing as a nationally recognised program that is delivered locally by trained individuals who have an excellent track record in supporting change and innovation in companies.
- Popular themes like robotics and automation are developing their own momentum - however 4Manufacturing has shown a balanced approach is needed.
 Opportunities in less popular themes like mass customisation are perhaps being missed. A new approach to all 22 themes needs to be taken on board for marketing the broader benefits of digital manufacturing.
- 7. Long-term, nationally co-ordinated funding mechanisms for 4IR will enable companies to plan investments.
- 8. The UK has an opportunity to develop machinery that comes with integrated software that will enable manufacturers to purchase "plug and play machines". The software skills in our computer gaming industry and history of machine tools

could allow the UK to take a global lead in this area. This is a strategic move to drive 4IR standards, optimisation and integration as a new business model with significant export potential.

KTN is uniquely placed to address the above points and we are thus developing plans for broader roll-out of the 4Manufacturing initiative, building on the success of the pilot. It is critical, of course, that we continue to collaborate with the right partners and a particular focus now is developing the right working relationships with those partners that can give access to manufacturers at a regional level.

Through this approach KTN plan to provide a focal point for a joined-up approach to 4IR, delivering benefits across the UK.

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