4Manufacturing®

Bringing the revolution to SMEs

Report for stakeholders

August 2018

Innovate UK
Knowledge Transfer Network

Executive Summary

4Manufacturing® is the Knowledge Transfer Network (KTN)'s approach to helping manufacturers, particularly SMEs, understand and adopt digital technologies. Developed in 2016 with the support of Innovate UK, BEIS and HVM Catapult, 4Manufacturing® has now been deployed in engagements with 230 SMEs across the UK, providing one-to-one support to drive productivity, competitiveness and growth. The main aim of the work carried out during this period (Oct 2017- Aug 2018) was to explore scaling up the reach of 4Manufacturing® by working with regional partners across the UK.

A large majority of SMEs currently show low digital technology maturity, but with a clear ambition to develop over the coming years, providing an opportunity for UK stakeholders, including KTN (eg. through 4Manufacturing®), to have a large impact on the adoption of digital technologies. Progress to date was found to be lower than expected due to manufacturers having limited time, resource or funding for innovation, and limited knowledge and awareness of new technologies.

A key aim of 4Manufacturing® is to raise awareness of new technologies and the support available for manufacturing SMEs. KTN has refined its list of 22 themes and attainment level descriptions which assist in this aim. Complemented by a new digital platform and website, 4Manufacturing® aims to increase engagement, awareness and understanding, giving SMEs manageable technology areas to develop and integrate.

The place-based model developed for further deployment of 4Manufacturing® compliments the focus on place highlighted in the Industrial Strategy[1], and has been well received by regional stakeholders such as LEPs, Growth Hubs, devolved administrations, trade associations and manufacturing alliances. The project will now continue into its next phase, with deployment through a select group of regional partners utilising the new digital platform.

4Manufacturing® is now at a stage where national deployment is a realistic objective. And, when supported by the right stakeholders and delivered as a coordinated platform, it can deliver national and regional impact at scale.

[1] https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

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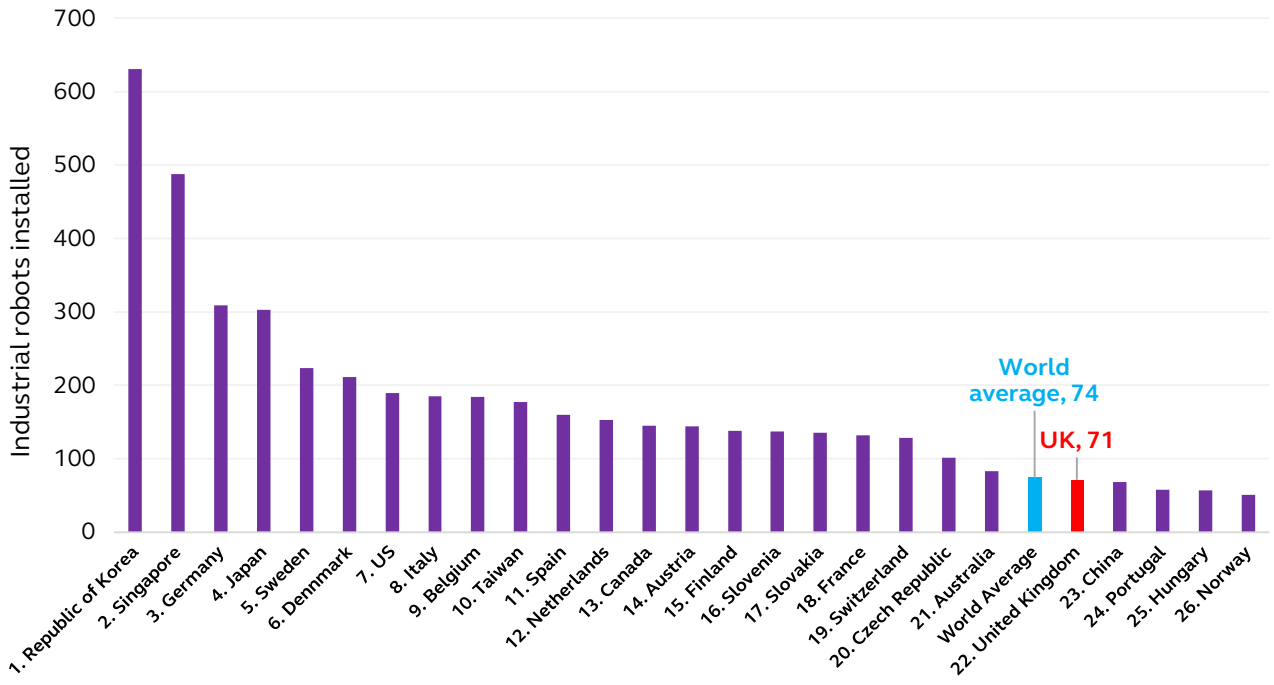
1. Introduction

Context

Industry 4.0, or the 4th Industrial Revolution (4IR), represents a transformative opportunity for industry. Industry 4.0 is an umbrella term used to describe industrial digital technology advancement. From a manufacturing perspective, it represents technological advances, often digital, providing opportunities to improve manufacturing performance. When implemented well, these technologies can transform manufacturing, helping to increase productivity, lower cost, and improve quality. If the UK is to respond convincingly to this opportunity, it is imperative that SMEs (Small and Medium-size Enterprises) are fully engaged.

It is broadly recognised that manufacturing SMEs find it difficult to innovate and adopt new technologies, therefore not taking advantage of the considerable productivity benefits that digital technologies offer. One widely used indicator is the number of installed industrial robots per 10,000 employees, where the UK holds the 22nd position globally, just lower than the world average (Graph 1).



Graph 1: Number of installed industrial robots per 10,000 employees in manufacturing in 2016 [Source: International Federation of Robotics]

The Made Smarter review found that *"the positive impact of faster innovation and adoption of Industrial Digital Technologies could be as much as £455 billion for UK manufacturing over the next decade, increasing manufacturing sector growth between 1.5 and 3 percent per annum, creating a conservative estimated net gain of 175,000 jobs throughout the economy, and reducing CO_2 emissions by 4.5 percent.*[2]*"* Furthermore, a recent study by PWC found that *"manufacturing companies expect that annual production efficiency can be increased by 3.3% annually by embracing digital technologies.*[3]*"*

4Manufacturing®

4Manufacturing® is the Knowledge Transfer Network (KTN)'s approach to helping manufacturers, particularly SMEs, understand and adopt digital technologies. Developed in 2016 with support from Innovate UK, BEIS and HVM Catapult, 4Manufacturing® provides the manufacturer with one-to-one support to help with the adoption of digital technologies, and drive productivity, competitiveness and growth in the UK's manufacturing sector. 4Manufacturing® has now been used in engagements with 230 SMEs across the UK.

Activities described in this report cover work carried out during financial year 2017-18 to scale up and deploy the 4Manufacturing® framework.

'Industry 4.0 is a revolution which is happening at a pace at which all types and sizes of businesses can get on board. So, if you're an SME, it is not too late to be part of this revolution. My advice is to work out which technologies work for you to improve your productivity and find support such as 4Manufacuring® within our excellent ecosystem, to signpost and de-risk your project.'

Jürgen Maier, Siemens

[2] www.gov.uk/government/publications/made-smarter-review

[3] https://www.pwc.nl/en/assets/documents/pwc-industrie-4-0.pdf

2. Activities & Analysis

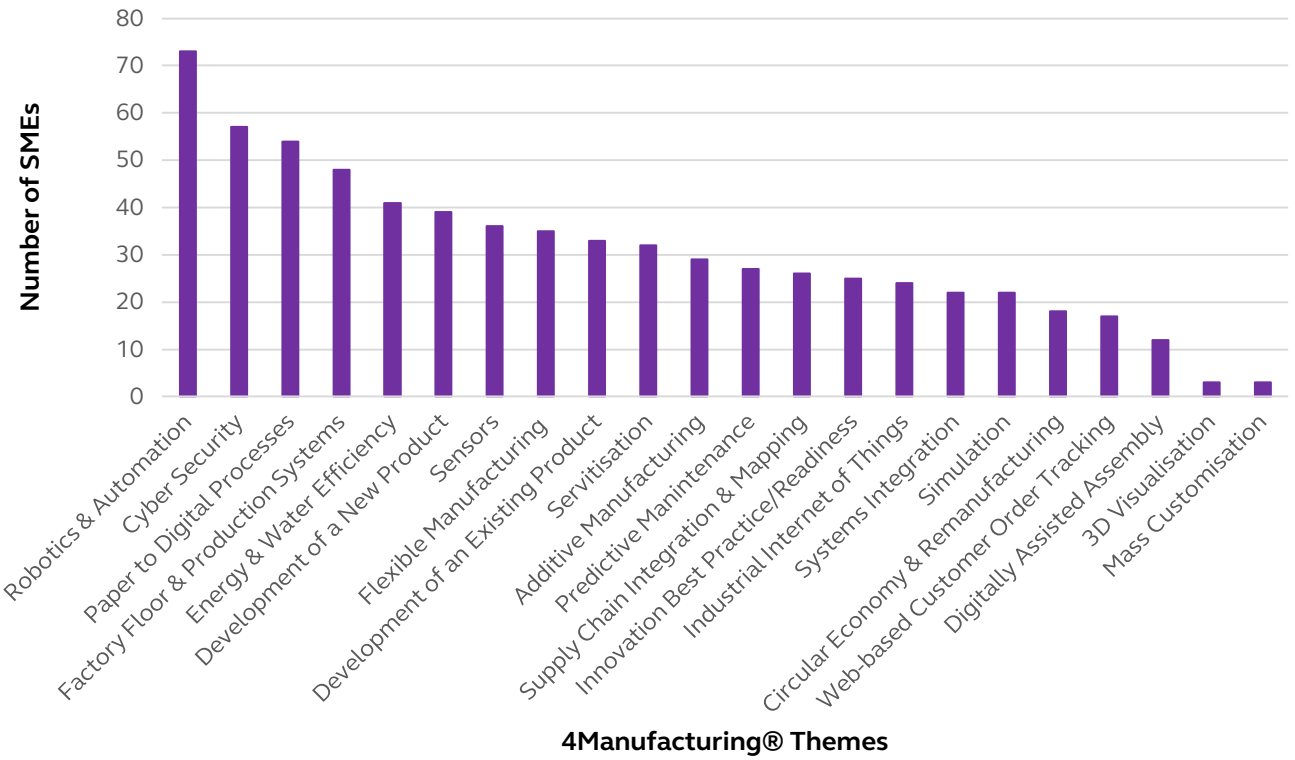
SME Engagements

It was a key aim to engage with SMEs across the UK. Figure 1 shows the distribution of SMEs engaged through 4Manufacturing®. With one or two exceptions (Scotland in particular, where a key regional agency has been developing its own toolset), it broadly reflects some of the key clusters historically associated with manufacturing across the UK.

During each 4Manufacturing® engagement, a number of technology themes are selected that represent the development priorities of the company. The engagement approach was consistent with that used during phase 1, as described in the 2017 report[4]. Graph 2 shows the number of SMEs that selected each theme.

Figure 1: 230 4Manufacturing® SME engagements (2016-18)

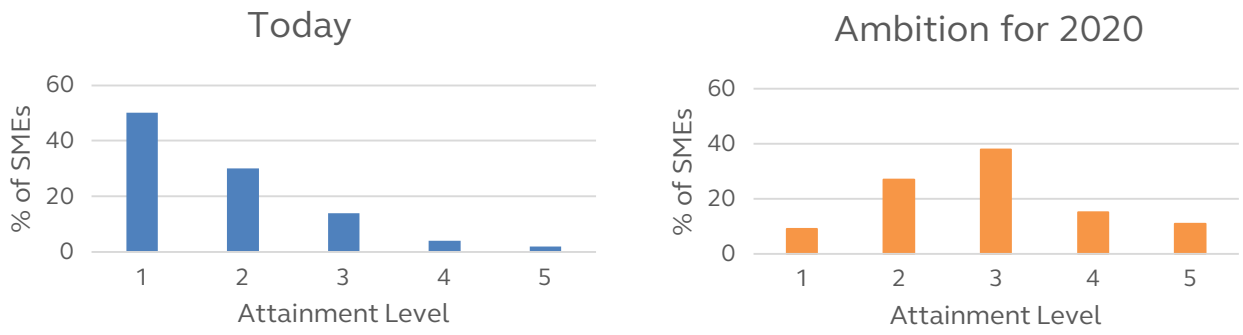
[4] https://admin.ktn-uk.co.uk/app/uploads/2017/11/4Manufacturing-stakeholder-report-281017-Innovate-2017.pdf



Graph 2: Number of SMEs who selected each 4Manufacturing® theme

A clear bias towards development in certain themes can be seen in Graph 2, with Robotics & Automation being a priority for manufacturers, primarily due to the potential productivity benefits available. This type of data provides KTN, and other UK manufacturing stakeholders, with an insight into which areas to direct focus and expertise to increase the adoption of digital technologies and drive UK productivity. However, it is unclear how much of this trend is down a lack of understanding of certain themes and the benefits it may bring, leading an SME not to select it as a priority. This was an area of development for KTN within this phase of the project.

Analysis of SME Ambition



Graph 3: Attainment levels for all technology themes selected by SMEs. Current state (today) and desired future state (ambition for 2020).

Graph 3 shows the attainment levels selected during SME engagements for all technology themes, expressed as a percentage. On the left is their current state level (where they believe they are today), and on the right is their desired future state (ambition for 2020).

Overall, it can be observed that a large majority of SMEs are currently in the early attainment levels (1 and 2), which provides an opportunity for UK stakeholders, including KTN (eg. through 4Manufacturing®), to have a large impact on the adoption of digital technologies. This is strengthened by their attainment level ambitions for 2020, with Graph 3 showing a clear right shift towards attainment level 3 and further. Ambition for further development, to levels 4 and 5, may be limited due to both the applicability of that technology to small businesses, and the high number of unknowns that new technologies bring with them. Continued monitoring and support through 4Manufacturing® will enable more SMEs to reach the highest attainment levels.

In general, actual progress towards a company's ambition has been lower than expected, due to a number of factors:

a. limited time, resource and/or funding for innovation
b. Limited knowledge and awareness of new technologies
c. Limited engagement between 4Manufacturing® visits

The companies that showed the most progress are those who have an existing awareness of the technologies, funding and support available, and a pre-existing innovation culture internally. An example of such a company is detailed in the case study section of this report.

Technology Theme Development

A key element of 4Manufacturing® is to raise awareness of 4IR for manufacturing SMEs. With this in mind, during this period of work KTN has re-defined the 22 themes and descriptions within the framework, with the aim of increasing levels of awareness and understanding of the different technology areas. Themes are used to select more manageable technology areas to develop, rather than planning for development of 4IR as a whole. For use when deployed by a 4Manufacturing® trained advisor, each theme is accompanied by a technology description, and 5 descriptive attainment levels to evaluate a company's current and desired state. The redefined themes are as follows:

1. Factory Floor and/or Production Systems
2. Additive Manufacturing
3. Industrial Internet of Things
4. Sensors (including RFID)
5. Big Data and Artificial Intelligence in Manufacturing
6. Digitally Assisted Assembly
7. Robotics and Automation
8. Digital Twin and Simulation
9. Cybersecurity
10. Flexible Manufacturing Cells
11. Augmented and Virtual Reality (AR & VR)
12. Paper to Digital Processes
13. Predictive Maintenance
14. Industrial Energy Efficiency
15. Circular Economy and Remanufacturing
16. Supply Chain Integration and Value Stream Mapping
17. Servitisation
18. Web based Customer Order Tracking
19. Mass Customisation
20. Digital Manufacturing Readiness
21. Design for Manufacture
22. Continuous Improvement

An example of the theme description and attainment level structure is shown in Figure 2:

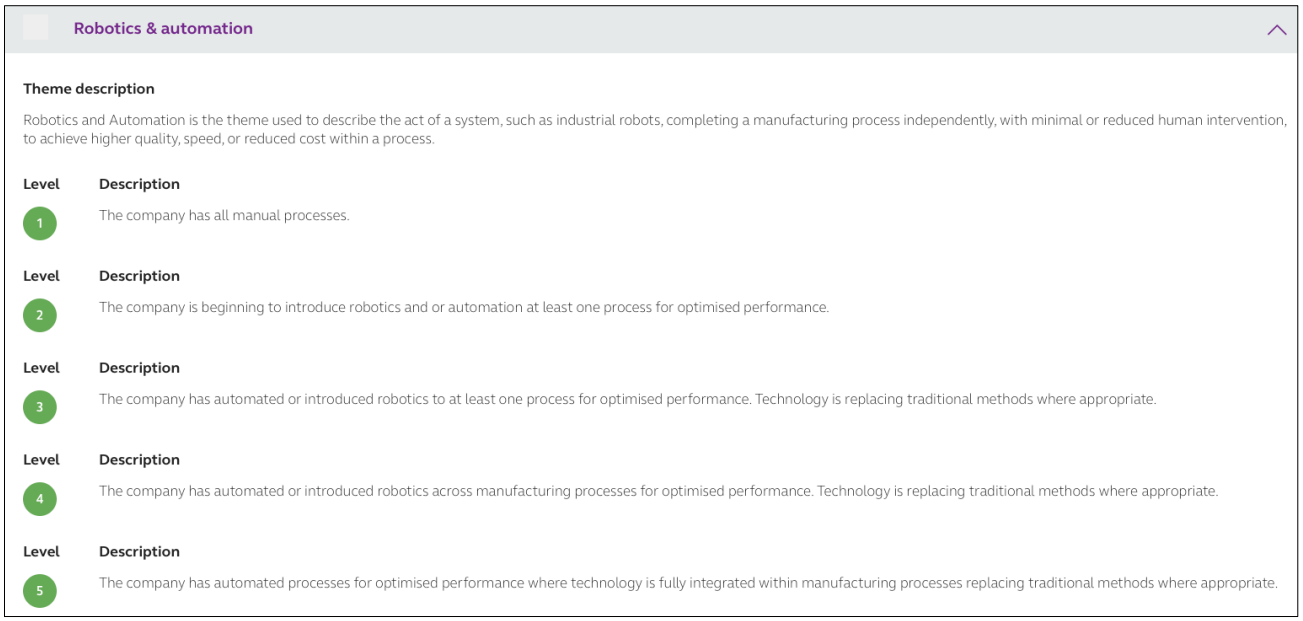


Figure 2: An example of a theme attainment level structure used within the 4Manufacturing® framework

Digital Platform

At the beginning of the project KTN developed and deployed spreadsheet-based documentation to capture information during 4Manufacturing® engagements. To deliver a more streamlined framework during SME engagement, KTN has now developed a digital platform for recording engagements, project details, and associated outcomes. This will enable scale-up and deployment through multiple agencies across the UK and is complimented by a public website detailing 4Manufacturing® and how to become a registered partner (Figure 3 shows the website homepage).

Figure 3: 4Manufacturing® website[5]

[5] https://www.4manufacturing.co.uk

The new digital platform draws upon all experience gained through engagement of 230 SMEs, as well as valuable input from regional and national stakeholders. The target users for the platform will primarily be regional advisors (i.e. trained advisors in LEPs, Growth Hubs, etc.). The platform enables advisors to effectively capture the first conversation (along with the selection of themes and attainment levels), and then track details of projects, actions and progress over time.

Deployment Model

The deployment model for 4Manufacturing® has been developed around the place agenda. This place-based model compliments the focus on place highlighted in the Industrial Strategy[6], as well as KTN's work in the Smart Specialisation Hub[7]. By taking a place-based approach, initiatives such as 4Manufacturing® offer the potential to deliver targeted support based on regional strengths, with support at a national level for those businesses that will benefit.

This approach has been well received by regional stakeholders such as LEPS, Growth Hubs, devolved administrations, trade associations and manufacturing alliances. Deployment of 4Manufacturing® has begun by engaging regional advisors in multiple regions on a trial basis. They have welcomed the initiative enthusiastically, seeing it as a much-needed way of supporting their manufacturing base.

'We have engaged with the KTN's 4Manufacturing® tool which will help our manufacturers take their first steps into digital for manufacturing. The simple, practical tool makes it easy for our advisors to walk companies through the key areas of digital manufacturing and create a step by step manageable plan for implementation that is now achievable.'

Jon Merrey, Manufacturing and Design Framework Manager, Welsh Government

[6] https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

[7] http://smartspecialisationhub.org

3. Case Study

Autocraft Drivetrain Solutions

Autocraft Drivetrain Solutions is Europe's largest independent engine remanufacturer and assembler, employing approximately 200 people and supplying manufacturers such as Jaguar Land Rover, Ford and Aston Martin.

The challenge for Autocraft when introducing digital technologies was knowing what technologies to adopt, and where to apply them. 4Manufacturing® helped Autocraft to establish the needs of their business, define a plan of action, and connect them to the right partners and funding opportunities (including a successful application for Innovate UK funding). Autocraft found that much of the digital technology they were interested in was proven technology in different sectors, which enabled them to quickly adopt new technologies throughout their engine assembly lines such as sensors, pick-to-light assembly and automated vision systems to accurately measure and control all aspects of their process, ensuring no-fault-forward and improving both quality and productivity.

The next step for Autocraft is to roll these technologies out across the entirety of their business. So, continuing with their 4Manufacturing® action plan, KTN connected Autocraft with Warwick Manufacturing Group (WMG), part of the High Value Manufacturing Catapult. Through this partnership Autocraft has created a plan to introduce digital technologies into all of their product lines to connect all processes from start to finish, providing real time data for a full digital DNA of every engine.

'Digital is very alien to a traditional manufacturing business such as ours, but by using the KTN we have been connected directly to people that can help us. We went to KTN with specific issues, and got introduced to a network of innovation companies, opening our eyes to lots of other opportunities. The advice I give to any manufacturer looking to innovate is to go and get the help of the KTN - it is much faster, and at a lower risk, than doing it yourself'.

Mike-Hague Morgan, Co-Owner and Commercial Director, Autocraft Drivetrain Solutions

Conclusions

4Manufacturing® is now at a stage where national deployment is a realistic objective. When supported by the right stakeholders, aligned with initiatives such as the Industrial Strategy[8] and Made Smarter[9], and delivered as a coordinated national platform, it can deliver impact at scale.

4Manufacturing® has now engaged a cohort of 230 SMEs across a great breadth of regions and sectors in the UK and an approach to deployment beyond the finite resources of KTN has been investigated. Several learnings have been taken from these activities:

1. The adoption of digital technologies takes time, resource and funding, and benefits from regular, ongoing support.
2. No one individual can be an expert in every aspect of 4IR, therefore stakeholders and advisors will benefit from knowledge sharing.
3. Advisors benefit from access to and awareness of the best resources, contacts and facilities to support businesses, with a starting point based on geographic proximity and regional assets.
4. Not every business is ready to adopt digital technologies. The 4Manufacturing® framework must be deployed in a way that enables an advisor to quickly establish what is appropriate for each company.
5. Some SMEs will benefit more from support in areas other than digital manufacturing, such as lean manufacturing and operational excellence.
5. Technology trends and themes may change and evolve over time as 4IR is realised, but the use of an attainment level structure must remain constant in order to track progress.

[8] https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

[9] www.gov.uk/government/publications/made-smarter-review

5. Next Steps

Moving forward, KTN plans to continue engagement with a select group of regional partners, utilising the new 4Manufacturing® digital platform, to prove the deployment model and platform structure. Through the data capture and tracking that the digital platform enables, 4Manufacturing® will continue to deliver increasing impact both regionally and nationally. The next steps of the project will aim to:

1. Continue to provide support and track the progress of companies and partners already engaged, building evidence-based case studies at (a) business and (b) regional partner level
2. Refine the support processes and materials from the perspective of KTN and the regional partners, in order to enable engagements of a consistent high quality.
3. Explore the potential addition into the framework of objective measures of business performance such as productivity, and the use of randomised control trials, in order to track progress using data driven evidence.
4. Define the strategy and timescales for engagement with additional regional partners, working up to full national deployment.
5. Continue to explore synergies with other initiatives such as Made Smarter, the Digital Readiness Levels tool, etc.

Acknowledgements

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