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An SMEs guide to **Smarter Digital Manufacturing** and the benefits of Industry 4.0 adoption

July 2022

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Foreword

by Jack Semple - Secretary for EAMA

EAMA is an alliance of trade associations working with government and others to strengthen the machinery and component supply chain in the UK.

"Industry 4.0" has been an important subject for EAMA. It's been more than four years since the alliance held a reception in the House of Commons to raise the subject with parliamentarians and EAMA member businesses alike.

When considering investments, technology understandably dominates much of the discussion. But it is clear that the right processes, company culture, workforce recruitment and skills are all essential for the success of a manufacturing company.

How does the board of an SME (small to medium-sized enterprise) go about adopting Industry 4.0? What are the factors that the directors and senior managers should consider in building their strategy? This short introduction to Industry 4.0 seeks to address these issues by using globally-recognised methodologies.

I am hugely grateful to Alastair Crawford and his colleagues at LMAC for drafting this guide. It is based on their own experience, gained in working with SMEs both in the UK and in New Zealand, where they had outstanding success with SME manufacturers as part of a national Industry 4.0 scheme.

The guide aims to prompt debate and action within companies, and to help them on their journey. We would welcome your comments.

Executive Summary

This guide is designed to provide companies with a down to earth and pragmatic summary of the different pillars of Industry 4.0, the impact they have on costs, KPIs and some brief examples of them in action.

Manufacturers are constantly being told they need to 'adopt Industry 4' and to 'make use of their data' but often without the context, or with blanket advice that isn't applicable to them. In reality, despite many efforts, Industry 4.0 is a buzzword that doesn't really have one solid definition.

Everyone reading this can appreciate that challenges, such as rising labour costs, increasing material costs, international competition and many other factors in the economy, reinforce the necessity of improving your manufacturing operations.

We are at an exciting point in the manufacturing arena. The convergence of new technologies is opening up a new world of possibilities. Previously, automation was only feasible in highly repetitive and high-volume environments. With the latest technology, machines can be quickly taught or even teach themselves, making automation of small variable quantities possible.

Some of the real step changes are coming from how data is being used.

Artificial intelligence (AI) is being used to improve efficiency, using all the data available to run thousands of simulations to select the most efficient production schedule. AI then monitors the effectiveness of the plan created and builds in any new learnings to improve for the next time. Low volume parts can be designed, and 3D printed on site within hours. This is more effective as it uses less material.

New staff can be trained quickly and repeatedly in a safe environment through the use of virtual and augmented reality. These are just a few examples of what is already being done to overcome some of the headwinds we face.

There are thousands of publications and books covering Industry 4.0 and the digitalisation of manufacturing, but few meet the needs of busy leaders and managers needing succinct information.

Often, the examples given are taken from large multinationals showing lights out factories with fully automated processes. For the SME business owner, this can be daunting and put people off taking the next step. It can come across as too complicated, too expensive, and not addressing the immediate challenges that businesses face. There is no one size fits all. Being informed about the opportunities is an important first step before building a bespoke roadmap that meets the budget and strategic goals of your business. There are off-the-shelf solutions that don't cost the earth, can be implemented quickly, and would have an immediate benefit to your operation. The trick is to find the right ones and get started on becoming a 'Smarter' manufacturer. We urge you to start the discussion within your team and get your team investigating some of the advanced manufacturing principles that would help your business.

Ultimately, we hope that by reading this document you will gain a high-level understanding of how Industry 4.0 principles could support your business to get ahead in the relevant areas.

The need for change

UK manufacturing is at a critical turning point. The government has identified an imperative to **"reverse the historic decline in manufacturing in the UK"** *(Levelling Up White Paper, 2022.)*

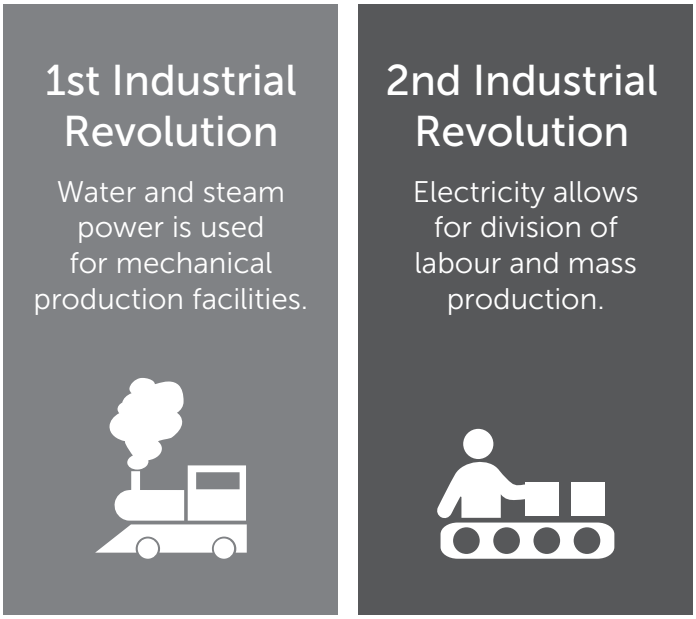
There are several headwinds that we are facing including:

- Shortage of skilled labour
- Rising energy, labour and material costs
- Geopolitical instability
- Sustainability challenges
- Supply chain disruption

To prosper in the next few years, manufacturers need to make changes that quickly increase their productivity, competitiveness and agility in the face of shifting demands. New technologies and ways of working need to be adopted at pace to combat the listed challenges and provide the step-changes required.

Overview of Industry 4.0 and Digital Manufacturing

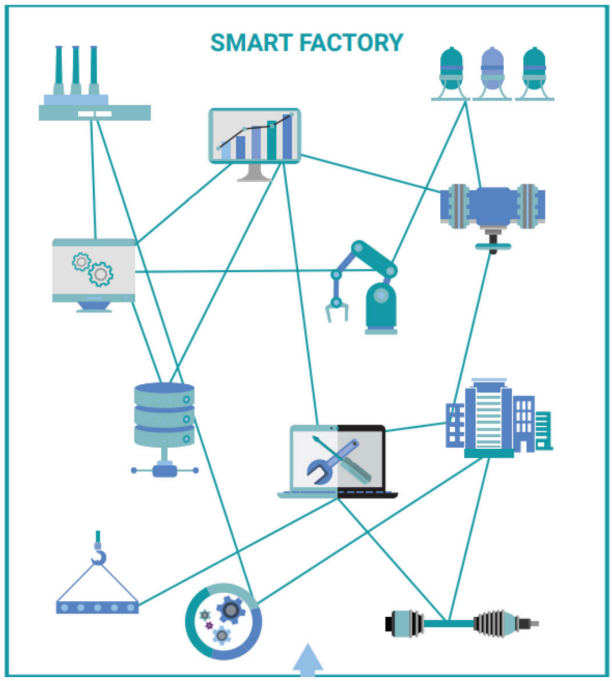
Industry 4.0 was coined in 2011 at Hannover Messe, Germany. The diagram on the right gives a summary of the four industrial revolutions.



The 3rd Industrial revolution was all about automation of the material flow, made possible through advancements in computing and machine programming. Software to manage the information flow such as Enterprise Resource Planning (ERP) software was introduced and adopted by larger companies. This has helped to simplify and streamline manufacturing processes. Many SME's are still to implement some of the technology that was common in the 3rd revolution. In our experience, the smaller companies we are working with are implementing a blend of industry 3 and 4 solutions.

There are a lot of differences with the 4th industrial revolution, but the key difference is that the physical shop floor equipment and systems can cooperate with each other, and with the virtual / IT systems. Effectively, this means that we are moving towards an environment where an IT system can control and coordinate all of the supply chain, sending real-time messages to the various production processes and telling them what to do. These production processes can talk to other processes to coordinate production and feedback real-time information to the controlling IT system. The easiest analogy is to think about the human body. We are connecting all the muscles and organs together using the nervous system and using the brain to make all the decisions based on the information it is receiving.

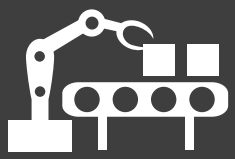
This is effectively what can be replicated in our workplace and is often referred to as a SMART factory. Most firms do not need to have a fully automated SMART factory – the objective is to move in that direction and become a SMARTER manufacturer.



Smarter Manufacturing links the processes - like a human body. SOURCE: INCIT

3rd Industrial Revolution

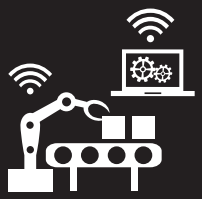
Automation through IT systems.



2000s

4th Industrial Revolution

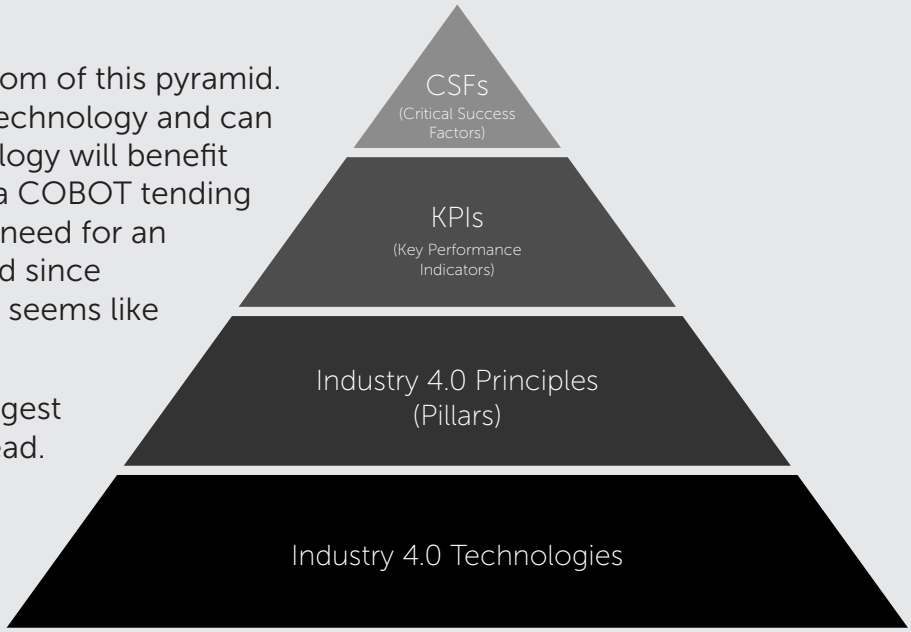
Cyber-physical systems, IoT and Artificial Intelligence automate complex tasks intelligently.



TODAY

A lot of businesses start at the bottom of this pyramid. They have seen some impressive technology and can see how implementing the technology will benefit their business. An example is with a COBOT tending a CNC machine. It can reduce the need for an operator doing a mundane task and since everyone is struggling for labour, it seems like the perfect solution.

However, this might not be the biggest problem you need to fix to get ahead. A better way to approach this is to work down from the top.



Beware of starting with a technology solution looking for a problem.

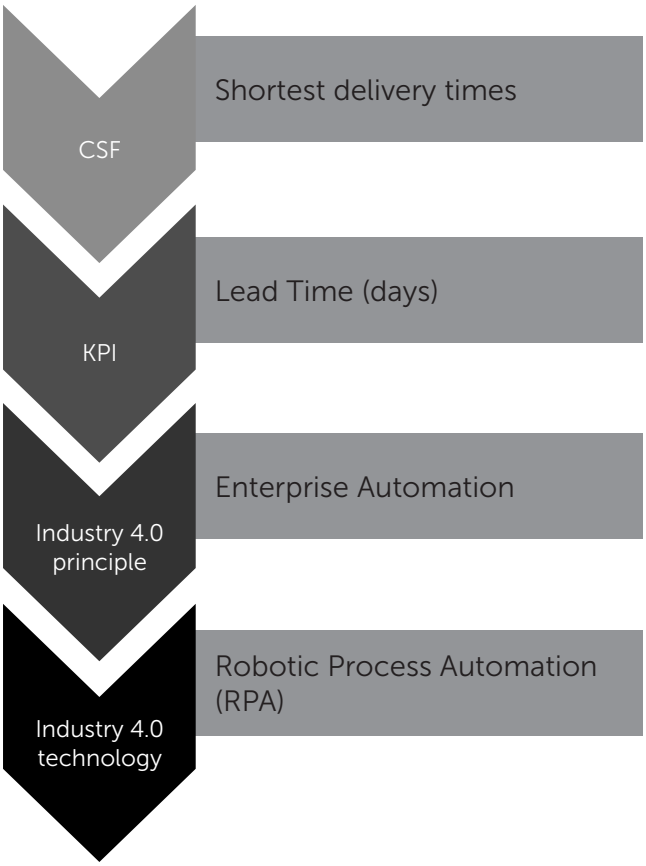
Clarify Critical Success Factors (CSFs) – What differentiates you from your competitors? Are you the lowest cost, shortest lead time, best quality, or something else?

Key Performance Indicators (KPIs) – What are the measures you use to see how well you are delivering against your Critical Success Factors?

Industry 4.0 principles (Pillars) – Based on your CSF's and prioritised KPI's, which of the Industry 4.0 principles is the appropriate one to focus on for the best results?

Industry 4.0 technologies – What are the specific technology solutions available to you within that Pillar that would give you the best return on investment towards your CSFs?

Example:



In this example, the company makes one off bespoke fabrications and wins business based on having the shortest delivery times from order.

They measure how they are doing by focussing on lead time and measure it in days from order to delivery. They identified that the bottleneck was the job setup process taking 2 days due to availability of resources.

The industry 4.0 pillar to focus on was identified as Enterprise Automation (automation of back-office functions).

The appropriate technology solution identified was Robotic Process Automation (RPA). This is where you train a 'virtual bot' to perform a task based on a specific set of rules and instructions.

The result was that 90% of jobs can be set up automatically within 1 hour from receiving the order, saving nearly 2 days.

Industry 4.0 maturity assessment

LMAC use the Smart Industry Readiness Index (SIRI) as the framework to review the current maturity of an organisation in its digital transformation and to prioritise focus areas for improvement. We have therefore used the same framework to summarise the different pillars of Industry 4.0. (We have used INCIT examples / visuals)

More information on SIRI can be found through the following webpage https://siri.incit.org/about

Small & medium sized enterprises (SMEs) should consider the different aspects of Industry 4.0 in order to successfully analyse and decide which technologies will progress them towards their strategic goals. Below is a brief overview of these different aspects – referred to as 'pillars'.

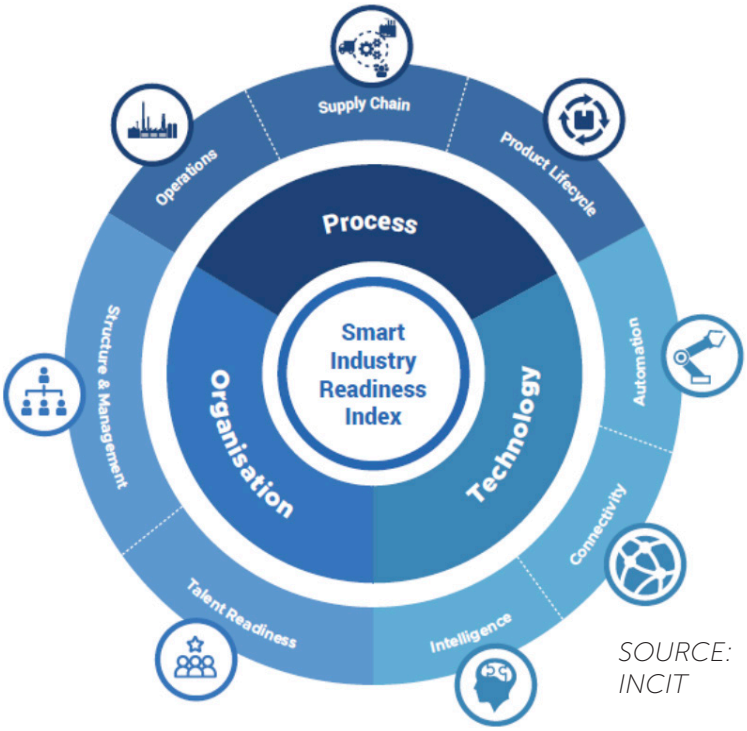
The key takeaway here is that successful Industry 4.0 adoption arises from a balanced view across process, technology & organisation. Putting an equal focus on having good processes and the organisational structure to support the technology will help you realise your full potential.

Finally, you do not need to excel in all these dimensions, the key to the SIRI framework is that it will prioritise the ones that are most important for your business.

What is the SIRI assessment?

In a nutshell, the SIRI process is a short assessment of a manufacturer's digital maturity and future priorities. This is carried out by certified and experienced assessors.

By taking advantage of workshops that rely on the knowledge & experience of an internal team, the current state of maturity can be agreed against the various dimensions of SIRI. In addition, the Key Performance Indicators (KPI's), competitive advantage and cost profile are also agreed upon. We can now highlight where the business's focus should lie when it comes to investing both time and resources. The World Economic Forum has endorsed SIRI as the internationally recognised best practice for Industry 4.0 benchmarking and transformation. It is also being adopted by various countries as their standard framework.



SOURCE: INCIT

A business should only be choosing to increase its maturity in the areas that are going to have the greatest impact on their priority KPI's and cost factors. Below are the standard manufacturing KPI's and cost factors that are used in the SIRI model, coupled with a summary of why you would want to focus on them.

Key Performance Indicators

Your Leadership team need to be in agreement with what makes your business successful. This is achieved by working as a team to select 5 priority KPI's for your business and focussing your efforts on improving them. By prioritising which of the following KPI's are going to best support your strategy, your organisation will be aligned, and resources will be focussed in the right areas.

Speed Measures

- **Time to Market:** If you are in the business of releasing new products, this could be an important metric for you. It focusses on reducing the time from concept through to commercialisation of a new product.
- **Time to Delivery:** The time it takes from customer order to delivery. Lead time is a competitive advantage in many businesses and this measure will focus the organisation on making improvements in this area.

Productivity Measures

- **Asset & Equipment efficiency:** To make the best use of the equipment and get the best return on the asset. Particularly important if you have automated, expensive production lines.
- **Inventory Efficiency:** To manage the level of inventory and balance inventory holding costs with delivery times. Particularly important if you have high inventory costs and stock a large variety and volume of products to meet customer lead times.
- **Materials efficiency:** To measure how effective the business is at getting the most from its raw materials. Particularly important if you have high raw material costs and need to drive down the usage or waste. This is a key focus for many firms in showing their progress on sustainability.
- **Utilities efficiency:** To drive down the cost of energy used to produce your products and improve sustainability. Particularly important if you consume a lot of energy in making your product.
- **Workforce efficiency:** This KPI focusses on measuring and improving the productivity of your workforce and is often measured in units produced per labour hour.

Flexibility Measures

- **Workforce Flexibility:** Having a multi-skilled team can be a key advantage, especially if you have a high variety of different processes with variation in demand. This KPI aims to measure how flexible your workforce is compared to your ideal state.
- **Production Flexibility:** This is an important measure if you manufacture a large variety of products, low volume runs and variation in demand. By improving this KPI, you will become a more flexible business with the ability to quickly switch between different products to meet customer demands with short lead times.
- **Planning & Scheduling Effectiveness:** Like the other flexibility measures, this one is important if you need to respond quickly to variable demand and changing situations. It improves your ability to handle market and supply volatility, taking on and fulfilling orders at short notice without disrupting the manufacturing operation and efficiency. If delivery in full and on time (DIFOT) is one of your success factors, then planning and scheduling effectiveness could be the focus area.

Quality Measures

- **Process Quality:** This measures and drives the improvement of your internal processes and helps to minimise potential disruption between connected processes. This is important for most businesses and is one of the foundations of a Lean operation. It is particularly important in the world of fast-moving goods, where when a process is out of control, you can quickly generate lots of defects and eat into profit.
- **Product Quality:** Whereas process quality is looking at your internal defects, this measure focusses on the quality of your finished product. In theory, if you get your process quality in order, your finished product will be good as well. However, there are certain businesses where it is critical to have extra focus on this. E.g. if the cost to repair your product in the field is high and would cause significant problems for your customers through it being unusable. An example would be an electricity transformer for a power company. Another example would be if you are making a premium product and any defect in the product would tarnish your reputation.
- **Security:** Extremely important if you are in the defence sector for example. This aims to measure and improve the security of both your physical facility as well as your systems and data.
- **Safety:** Safety is always an important measure. In this scenario, you need to decide if additional focus in this area is required to support your business objectives.

Cost categories: *Source: INCIT*

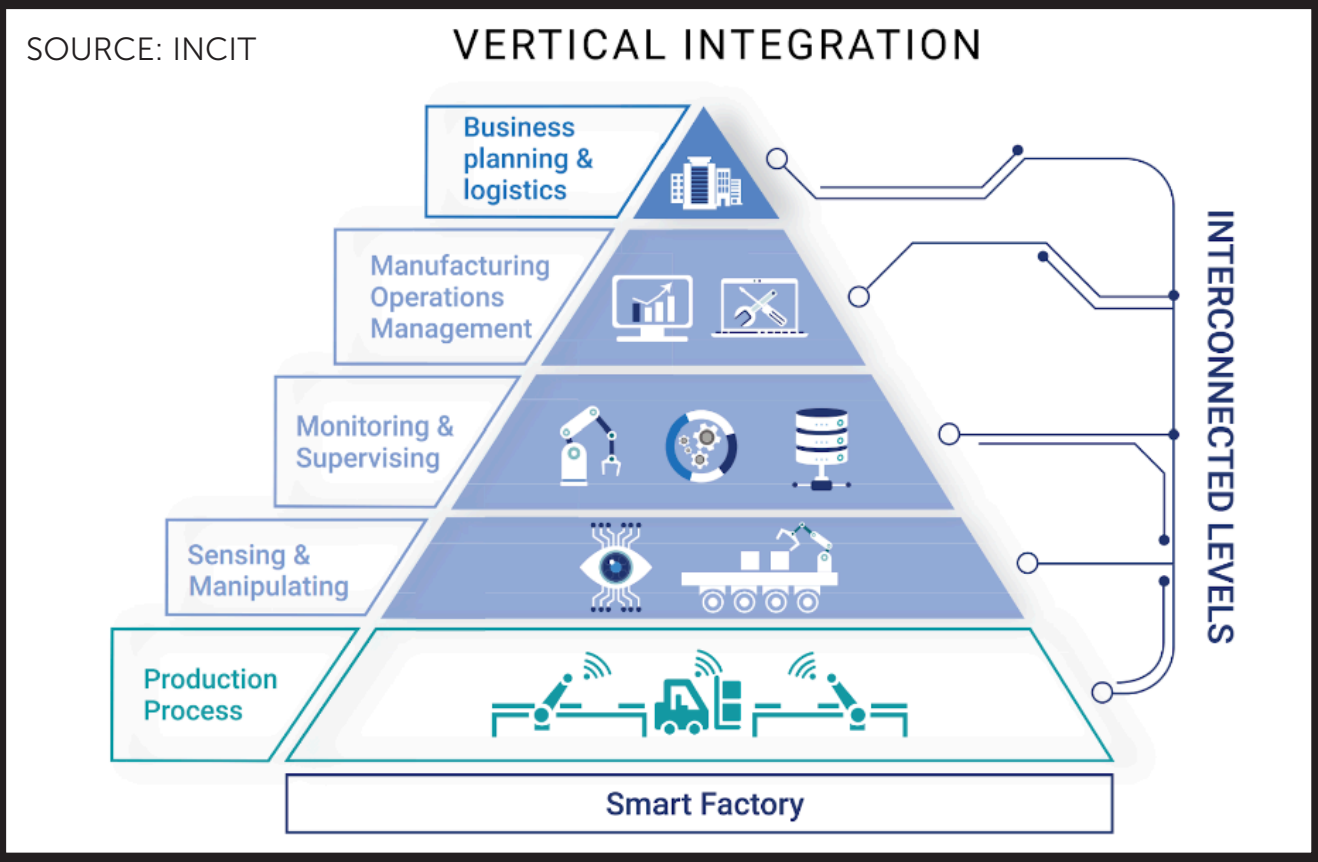
Below are the 10 common cost categories. By analysing these, we can prioritise which pillars will have the greatest returns. For example, if labour is your number 1 cost, 'Shop Floor Automation' may well be the logical staring point for you.

 Aftermarket / Services	Expenses that the company expects to or has already incurred for the repair or replacement of goods that it has sold. The total expense is limited by the warranty period that the company provides.
 Depreciation	A non-cash expense representing the portion of all fixed assets owned by the company that has been considered consumed over an accounting or financial period.
 Labour	The sum of all wages paid to employees, as well as the cost of employee benefits and payroll taxes paid by an employer. This includes employees who are directly involved in the maintenance and production processes, and support teams that ensure the smooth running of the entire facility.
 Maintenance & Repair	All expenses required to bring capital assets - such as building, infrastructure, equipment, and machinery - back to good working order, or to keep them operating at optimal condition. This includes fixing broken assets and routine servicing.
 Raw Materials & Consumables	Raw materials and consumables costs include both direct materials, which are incorporated into the final product, and indirect materials that are consumed during the production process but not incorporated into the final product.
 Rental & Operating Lease	Costs associated with the use of assets which the company does not own. These include but are not limited to property, plant and equipment.
 Research & Development	All expenses relating to activities for the development or improvement of products or processes. Such activities can include product design improvement and production process enhancement.
 Selling, General & Administrative Expense (SG&A)	All operating expenses which are not directly tied to the cost of making a product or providing a service. It includes corporate, accounting, legal, sales, and marketing expenses.
 Transportation & Distribution	All expenses relating to the transportation of goods from one location to another. It includes the cost of transporting goods from suppliers and to customers via methods such as trucking, shipping, and freight (land, air and sea).
 Utilities	Cost of electricity, heat (gas/fuel), sewer, and water used by a factory or plant to ensure the smooth running of both the direct manufacturing process and its surrounding environmental conditions.

Industry 4.0 Pillars

In this next section, we are going to summarise the 8 pillars of Industry 4.0. This will help to develop your understanding and identify some of the key benefits. We have given some examples of what a mature business might look like over the next few pages. There are small logical steps to take towards this and you don't need to excel in all the pillars.

PROCESS PILLAR ONE: Operations & Vertical Integration



Simply put, this refers to the extent to which data and information can flow between machines, shop floor teams and the relevant systems in your business, such as Manufacturing Execution Systems (MES) & Enterprise Resource Planning systems (ERP) in both directions.

Having a real time, efficient flow of data between your systems, equipment and people will allow for decisions to be made faster. The delay in getting information to the right place causes a significant amount of inefficiency and businesses are often left chasing their tails and reacting rather than being in control and planning ahead.

In this modern world, being agile is critical and having real time information is the foundation to making the right decisions with confidence.

For instance, imagine if it took 5 minutes for your brain to process that you had picked up something hot. After this length of time the damage would already be done. This serves as a perfect analogy for what is happening often in the workplace processes.

As we move to a more sophisticated system, we can start to detect problems and react before they happen. E.g. The brain is using our senses, combined with previous data to determine that something is hot and knows not to pick it up.

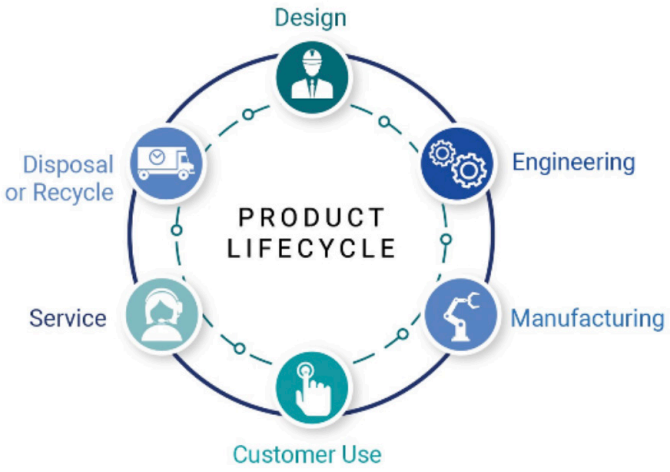
PROCESS PILLAR TWO:

Supply Chain & Horizontal Integration

The interconnectedness and data flow with suppliers and customers (can also include internal operations). Having an integrated data link with your customers' systems can give you real-time, automated demand information, allowing you to optimise purchasing and scheduling. Similarly, giving real-time visibility of stock to your supply chain can increase suppliers agility to meet your demands.

It can remove the need for several previously manual interactions such as phone calls and e-mails, reducing possible manual errors in translation of information. It will improve the accuracy, latency and efficiency of information whist allowing both parties to schedule their operations more effectively and reduce inventory.

PROCESS PILLAR THREE:



Integrated Product Lifecycle

The Product Lifecycle refers to the stages that your products go through from early design phases through to end-of-life disposal.

Imagine the process of upgrading one of your existing products.

**SOURCE: INCIT*

Would your design team be able to quickly access all your existing products performance data? What manufacturing or in field defects / frustrations / inefficiencies could be designed out? Do Sales, Engineering, Production and Service teams collaborate and communicate to make rapid, informed improvements?

Companies that are mature in this pillar have integrated systems (software), processes and teams that work together to provide more accurate information, quicker feedback loops and reduced time to market.

With digital tools such as Digital Twins, you can model and simulate the product and manufacturing process before implementation. This can save a huge amount of time and cost upfront.

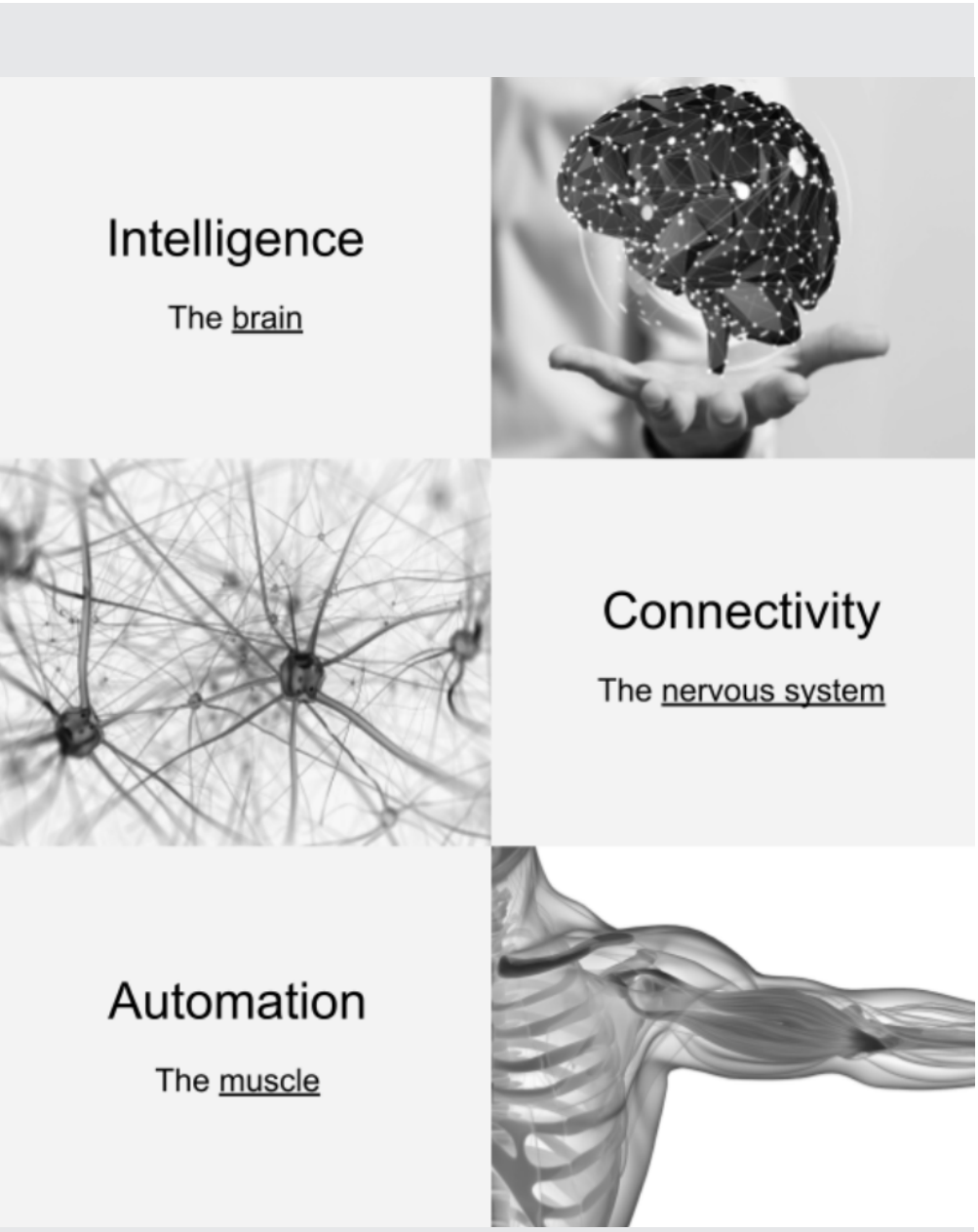
It can also facilitate new business opportunities, where you are supplying the product and you maintain it using live data being fed back. This is referred to as the product as a service model (PaaS).

Technology Pillars

Very often Industry 4.0 is mistaken for just automation, particularly automation in the form of hardware and machinery.

As we'll see here, there are three pillars of technology that best support a manufacturer's investment plan: **Automation, Connectivity** and **Intelligence.**

A simple analogy for this is the human body, where automation relates to the muscles, connectivity to the nervous system delivering data (both ways) and intelligence to the brain processing data and making decisions.



To understand the technology pillars, it is important to appreciate that all three pillars can be applied in three key areas of the business. On the shopfloor, in the enterprise or to the facility.

Shopfloor simply refers to where the manufacturing takes place and the value is added to the product.

Enterprise refers to all the support processes, often based in the office. These can relate to purchasing, engineering and sales.

Facility refers to the building itself, including the utilities used in production such as gas, electricity, and water.

Automation Pillar

This pillar looks at the level of automation you currently have and where it needs to be across your shopfloor, enterprise and facility. Shopfloor automation is usually one that most companies are familiar with and are generally aware of what technology is available in the market. However, opportunities for automation of your back office and support function tasks are often not as well understood and as previously explained, could be a priority focus area. In any automation project, it is critical to confirm that you are automating the correct part of your value chain to achieve your desired result. Focus on the bottleneck or the area that is stopping you achieving your prioritised KPI's.

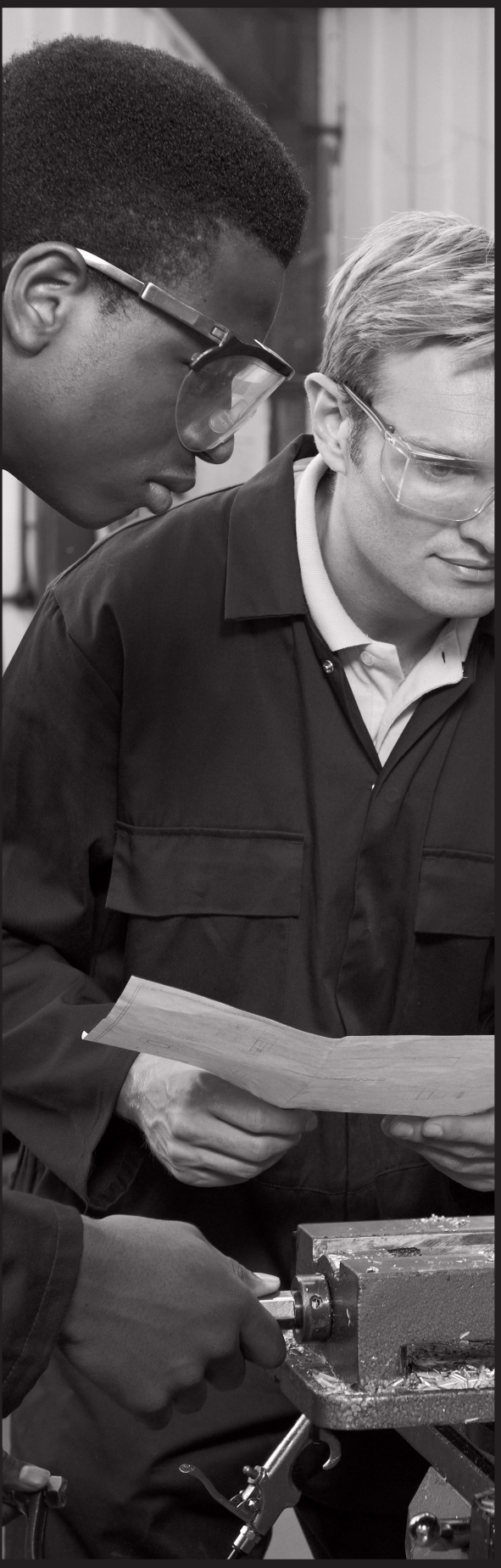
Connectivity Pillar

The ability for machines, systems and other stakeholders to communicate in real-time is a fundamental principle of Industry 4.0 and will yield improvements in many of the target KPI's. For this to be possible, machines and systems need to be connected and able to talk the same language. This is what is evaluated when assessing the connectivity of your shopfloor, enterprise, and facility.

It is now possible to connect a lot of your old legacy equipment and get the data going back into a central source. The key question to ask is **"What information is required to make improvements?"** From this, it is possible to connect the right things up and prevent wasting a lot of resources to produce information that is of no real value.

Intelligence Pillar

As mentioned, this is the brain of the operation. With information now flowing through the end-to-end process, this pillar looks at how intelligently this is being used to manage and improve the business. This could be providing real-time information to your planning person or system, allowing quick decision making that will lead to improved delivery times. Another example is your Engineering team getting information on a critical motor that is starting to fail, allowing them to plan an intervention and reduce downtime.



Talent Readiness Pillar

For a company to get the best value from Industry 4.0 principles, it must devote some time to this pillar. There are 2 dimensions:

1) Leadership competency.

The objective is to get the Leaders to have a good understanding of what Industry 4.0 is about, how it will benefit the business and shape the future of their operation. If they are aware of what solutions are out there and recognise the benefits these solutions can deliver, they would be in the best position to support the change and shape the factory of the future. This upskilling can easily be achieved through SIRI training or other Industry 4.0 education programmes and networking events.

2) Workforce learning and development.

One of the biggest challenges that companies face is the availability of skilled workers. As new technology is introduced, new skills are required to achieve its full potential. This can be used to motivate and retain your current employees. The first step is to identify what skills are going to be required for the next phase of your transformation. It's essential to involve your current team when implementing new technology and upskilling them along the way. This will help to alleviate any concerns they may have, whilst developing their skill sets further to better suit the new requirements.

In the new digital manufacturing workplace, multi skilled, flexible teams are going to be critical for success. Companies must integrate systems or practices that help to identify what skills may be required in the future, ensuring versatility to function effectively and implement plans to close the identified gaps.

Structure and Management Pillar

The last pillar is a fundamental one for any transformation or change initiative. It is also split into 2 dimensions:

1) Inter and Intra company collaboration.

Having teams that can effectively communicate, collaborate and work together has a direct impact on how successful your Industry 4.0 program is. This dimension aims to move companies away from departments working in silos and towards empowered, self-managing teams. One of the objectives is the ability to pull a cross-functional team together and have confidence that they will collaborate to achieve the right outcome for the company. The first step is often to put structured channels in place for departments to come together, share information and agree actions. Just as process design determines how successful production will be, an organisation's structure determines how successful the company will be in achieving its goals.

2) Strategy and Governance.

As mentioned earlier in this guide, there are many priorities for modern businesses. From a SIRI perspective, this dimension looks to develop a vision for the 'factory of the future', allowing a company to develop a logical implementation plan. For SMEs, there are several ways to tackle this.

a. If there is a need to make a quick improvement, the strategy could be focussed on one area of the company. Developing a plan to remove a bottleneck or improve performance and implementing it quickly to get the desired results.
For example, automating a part of the administration or shop floor process to alleviate resource constraints.

b. There could be a medium-term strategic objective for a company that requires multiple areas of the business to be enhanced together to be successful. In this scenario, a few members of the team would need to come together and map out how the new process is going to operate and what changes are required. An example would be the need to reduce lead time by 2 days to win more work. This could require a few changes to be made across various departments and a coordinated project plan.

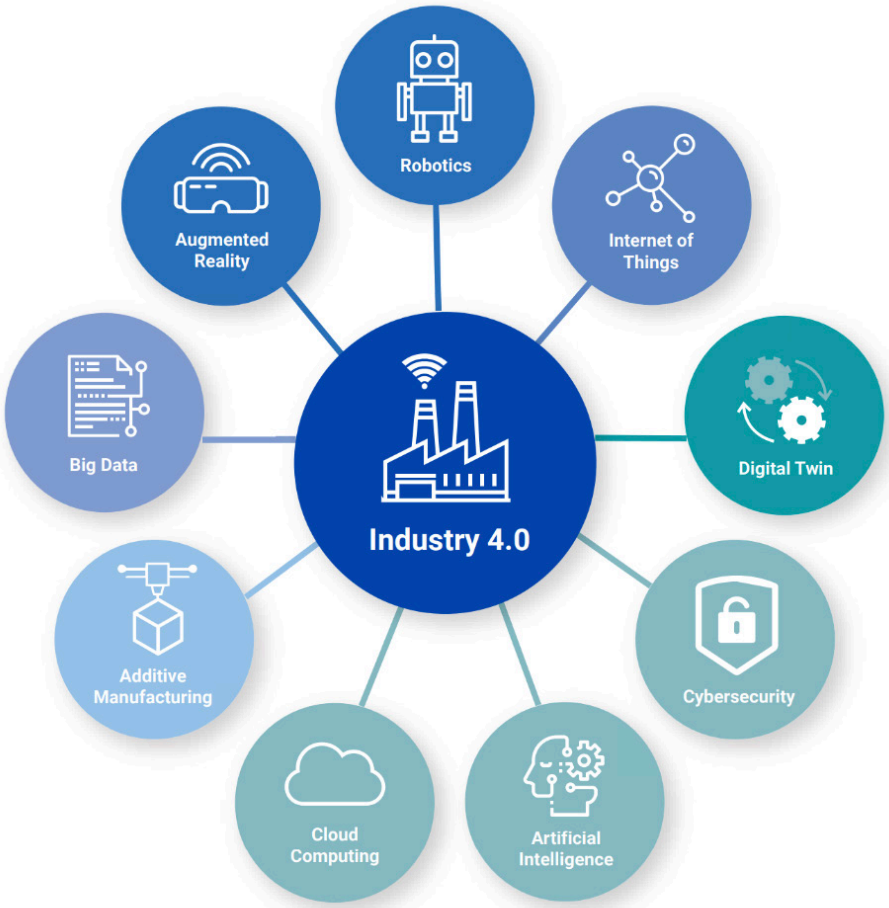
c. The final scenario is where the company does not necessarily have a burning platform and is looking out over a longer horizon (3 years plus) to position itself for the future. For this company, the objective is to develop a high-level vision for the future value chain. Having a clear, documented image of what the future operating model will look like, from receiving an order, making the product, through to delivery and payment. From this high-level image, a staged implementation plan can be developed together with the appropriate investment forecast.

Whichever scenario is selected, the ability for this to be effectively deployed will be vital for the outcome. Using a simple project and change management process to communicate, coordinate and implement this strategy will put a company in the best position for success.

Industry 4.0 Technologies

Some key terms

There is a vast array of new technology out there, but we will focus on key emerging technologies that have converged to enable the fourth industrial revolution.



SOURCE: INCIT

Key Terms:

Internet of Things
Equipment / machinery are fitted with sensors and technology that allow them to connect and exchange data with other devices via the internet or other network. This enables real-time information sharing across the shopfloor and enterprise systems.

Digital Twin
A digital representation of your product or your process. You could model how your product will perform under certain circumstances or how your process will perform under certain scenarios. It can have a big impact on designing new products or processes by allowing you to simulate them before any significant investment is made.

Cybersecurity
With equipment being connected to the internet, it is possible for people to hack into your processes and make adjustments to your equipment. Imagine what would happen if the machine settings / programs were adjusted or deleted. It would cause significant losses for your business. Therefore it is important to develop the appropriate cybersecurity protection as part of your digital manufacturing transformation.

Artificial Intelligence
The simulation of the human intellectual processes used by machines and computers. AI is used to plan production schedules, taking real-time information from customers, suppliers, production processes and producing the most efficient plan to maximise results. It can also incorporate machine learning, meaning it will monitor the effectiveness of the plan it made and learn from its mistakes and successes.

Cloud Computing
This is a generic term which refers to the delivery of hosted services over the internet. In the previous examples, where machines are connected, and AI is making decisions based on supplier and production process performance, the ability for systems to access all this data and communicate in the cloud becomes critical. It brings with it some concerns regarding data security, hence the need for good Cybersecurity.

Additive Manufacturing
The ability to 3D print a product brings huge advantages, such as using less material to create products with the same functionality. With customisation and flexibility being some of the emerging requirements, this will enable companies to be competitive, make products locally and reduce inventory levels.

Big Data
The processing of large amounts of data. This data could be from your manufacturing process, your information systems, your suppliers, your product in the field etc. With all this useful data, various programs and technology can utilise this data to make decisions, improvements, calculations etc. For example: Vibration data being collected from a motor can, over time detect when a bearing is starting to wear. This data is used by the predictive maintenance software to generate a work order for the bearing to be replaced asap.

Augmented Reality
Augmented reality is the combination of digital information with the company's real-life environment in real-time. Unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information over the top of it. For example, an operator learning a new task on an assembly line using AR glasses. Digital information is being overlayed to tell the operator the next part to pick, and any quality key points.

Robotics and automation

This is not a new development and robots have been around for many years. There are a couple of key differences here to be aware of.

- Flexible robotics – The ability to quickly teach a robot. Previously, you would have to rely on a highly skilled programmer, whereas with some of the latest models, you can literally move the robot arm yourself through a set motion and record it. This breaks down some of the previous barriers to entry and supports lower volume, flexible manufacturing.
- Cobots – Collaborative robots that can work safely alongside people without the need for safety fences. These enable small parts of a process to be automated, for example picking a part and presenting it to the operator for assembly.
- Automation of non-manufacturing processes. There are lots of examples of how technology is being used to automate processes that are not directly involved in production. E.g.
  - Inspection processes with smart vision systems to perform quality checks
  - Back-office administration functions being automated using robotic process automation as described earlier
  - Transportation and logistics – The use of automated guided vehicles to collect and deliver parts

How to get started

Over the last few years, LMAC has refined its approach to provide the answer to this question and support manufacturers to accelerate the adoption of the right solutions. For more information on our Smarter 4.0 Roadmap offering, please visit the following page on our website: https://lmacuk.co.uk/smarter-4-0-roadmap/

This guide offers your company the first step towards attaining the undeniable benefits of implementing Industry 4.0 principles. We recommend highlighting this topic on the agenda of your next board / senior leadership team meeting, for this guide to be distributed as preparation and used to stimulate an open conversation. Following this, the appropriate next steps, and responsibilities can be assigned to start the journey towards becoming a SMARTER manufacturer.

The key points to consider when looking to start the adoption of Industry 4.0 principles are outlined below:

a. Have a clear understanding of your competitive advantage and what you need to be good at moving forward. Remember to have a clear starting point, where the focus is on providing a solution to a particular challenge / opportunity from the top down, observing the Critical Success Factors.

b. Avoid having multiple strategies. e.g. A technology strategy, sustainability strategy etc. There should be one overarching strategy for the business. It should pull it all together and prioritise projects that will deliver the objectives, whether they are quick wins, medium-term or strategic projects. Often, businesses have developed plans and strategies in isolation. On their own, these plans appear to be achievable and logical, but the difficulty comes with combining these plans that didn't consider the bigger picture. As a result, companies end up spreading themselves too thinly, thus impacting team morale. This can lead to team members feeling burnt out and frustrated with the lack of tangible progress.

c. Raise the understanding and engagement with Industry 4.0 and the opportunities it can create. This can be done through formal education of your directors and senior managers, attending events, visiting other companies and building it into your learning and development framework etc. Adopting Industry 4.0 is a change management exercise and the first stage of this is to create a vision for the future and a sense of urgency to get there. This is achieved through showing your team what is possible and getting them excited. If they can see the benefits and how their roles could be more interesting with new opportunities to learn new skills, then you are on the right path.

d. Once you have your objectives understood, and your team is familiar with Industry 4.0 concepts, you can identify the appropriate areas to focus on for your business. Ideally you would build a high-level plan of your future Manufacturing Value Chain. This doesn't need to be complicated and will show where you will use some technology to improve your business. However, if you are not ready to do this, there is nothing wrong with picking 1 priority and getting started on this.

e. With the priority's clear and a vision of your future Industry 4.0 Manufacturing operation, you are now able to investigate potential solution providers and appropriate technology. We advise that you have a clear business case developed with expected ROI, scope of work and requirements for the solution. This enables you to evaluate solutions in a logical way without getting distracted by some of the other functionality.

f. Start with a small pilot, if possible, to prove the principle and iron out any kinks.

g. Follow a structured change management plan.
   - Evaluating the impact on people, process, stakeholders
   - Communicating why you are doing it, what is going to happen and how it may affect people
   - Engaging people in the trial with opportunities to have input and clear methods to raise issues
   - Regular communications throughout and celebrating successes
   - Formal end of pilot review to capture learnings, standardise the process ready for scaling up

h. Scale it fast across the business and move onto the next focus area

If you are unsure where to start with any of the above, there is help available through:

- High Value Manufacturing Catapults - https://hvm.catapult.org.uk/
- Made Smarter - https://www.madesmarter.uk/
- LMAC - https://lmacuk.co.uk/smarter-4-0-roadmap/

We hope that you have found this guide useful and that it will support you to take the next steps to realise the benefit of implementing Industry 4.0.

If you have any questions or would like any more information to help, please contact:

EAMA on jacksemple@eama.org.uk | https://www.eama.info/

LMAC on 01858 414370 | https://www.lmacuk.co.uk/

Links to useful materials

SIRI / INCIT website: https://siri.incit.org/about

lmac CONSULTING | eama Engineering and Machinery Alliance | MTA THE MANUFACTURING TECHNOLOGIES ASSOCIATION