From Industry 4.0 to Digitising Manufacturing
An End User Perspective

Conference Report

Supported by:
Industry 4.0 - the digitising of the factory and supply chain and the introduction of intelligent automation - is set to be the biggest change in the manufacturing industry in a generation. Although most in the UK manufacturing sector are now familiar with the term, many manufacturers don’t understand what Industry 4.0 actually means, its potential impact on industry in general and their business in particular, and they don’t know how to maximise the technical opportunities.

The MTC conference held in November was aimed at addressing this shortfall. Its content was directed specifically at end-users and those who will be most affected by this digital industrial revolution. It highlighted process implementation case studies to give a clear overview of Industry 4.0 from a manufacturer’s point of view.

The conference looked in particular at what was happening in the rest of Europe especially Germany, which is an acknowledged leader in the adoption of Industry 4.0. Comparative figures between Germany and the UK do not look good. The German manufacturing industry is 2.7 times larger than that of the UK and invests 6.6 times more in automation. This is a key driver of the high productivity for Germany, which is so lacking in the UK, with consequent impact on competitiveness and the resources available to invest further in skills and technology.

But all is not lost. The UK has an impressive record when it comes to innovation. Everything from flat screen television to the World Wide Web started life as a British invention. Industry 4.0 has the potential to harness that innovation for the benefit of the UK manufacturing sector and the country as a whole. UK manufacturers who have embraced new technology have positive experiences, with more than 90 per cent reporting that automation projects exceeded their objectives.

The MTC has been monitoring global Industry 4.0 developments in digital manufacturing technologies, as well as engaging on a national and European level. This conference enabled pioneers of Industry 4.0 in the UK to join manufacturers from Germany, Italy and the Netherlands to share their experiences and develop sound guidance on the implementation of the new technologies that Industry 4.0 offers.
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Setting The Scene
Industry 4.0 - A particular opportunity for British/German co-operation

Dr Peter Ammon, German Ambassador to the Court of St. James’s

Mr. Hickman, Martin, Ladies and Gentlemen,

I am delighted to be with you here in Coventry today. Thank you for the opportunity to say a few words at the beginning of what promises to be a fascinating and insightful conference.

You are all experts in this field and so you don’t need me to tell you how the fourth industrial revolution holds untold potential for the future of manufacturing and industry.

So why is this such an important topic for Germany? As you all know, the German economy relies heavily on industry and manufacturing; it accounts for 22 per cent of GDP, employs 15 million people, and is a major driver of our exports. But we know we cannot rest on our laurels. Making digital information and communication technology useable for industry will be key to maintaining our competitiveness internationally. 80 per cent of German businesses think that their value chain will be digitised substantially by 2020.

Industry 4.0 plays a key part in our government’s strategy to grasp the opportunities of digitisation of all aspects of life, and holds huge promise for future prosperity and growth. It has the potential to revolutionise value chains and create totally new business models in many manufacturing sectors like cars, machine-tools or medical technology. Its implementation is managed by a secretariat called “Platform Industrie 4.0”, and I’m very pleased that its director, Henning Banthien, is here today to share some of his insights.

A recent study in Germany found that industrial companies were predicting that they would invest a total of 40 billion euros in this area by the same date. In the context of Industry 4.0, the government is investing an extra three billion euros in research and development up to 2017. This may be a huge boon for the big, global companies – but what about the small and medium sized enterprises, or the “Mittelstand” as we call it in Germany?

We Germans have to find names – long names if possible – for our strategic concepts, and hope that they find their way into the English language. Those of you who studied philosophy may remember, for example, the word “Überbau” that made it into English. Today’s buzzword in Germany is “Industrie 4.0”, which translates quite easily.

As you all know, high-tech, mostly family-owned medium sized companies are the bedrock of the German economy. Can they manage the transition process into the digital world alone? This is a challenge to management, and replacing existing machinery may be financially difficult, while retrofitting current stock is often technically complicated. So the plan is to create networks and faster collaborations between SMEs and businesses, as well as with research and development institutions like the Fraunhofer Society. The UK is adopting a similar approach with organisations like the MTC and the High-Value Manufacturing Catapult Centre.

Governments can’t and shouldn’t tell businesses what to do, or how to do it, but it is their job to provide the right framework. This includes broadband infrastructure and a workable legal framework for data security. For example, in response to the significant security concerns around companies sharing their data and trade secrets, the German government has supported the development of the platform “Virtual Fort Knox” to maintain a level playing field in the digital age.
Chancellor Merkel has said just recently that we need to strike a careful balance between protection and freedom of data, particularly personal data, but not so restrictive that the development of new products is hindered. This is an area where regulation at EU level, with the General Data Protection Directive, will create the necessary level of certainty for long-term investment.

In my view, this is just one of many examples where the EU can be a catalyst for positive change in industry. I have high hopes as well, that we will soon have a digital single market. This key project of the European Commission will enable businesses that already act and sell internationally to digitise their value chains Europe-wide as well.

EU governments also need to support the telecom industry in the provision of high-speed and super-high speed broadband access for businesses – and not just in cities and urban areas, as is the case now, but uniformly across the country and across Europe, so that remote sensing and steering can happen wherever you are, and wherever your factory is.

The development of 5th generation mobile internet, which will be key to this, is an area in which UK and German businesses and researchers are already collaborating closely.

Ladies and Gentlemen, I think that Industry 4.0 not only holds huge potential for businesses in my country, but also for bilateral co-operation between the UK and Germany in industry, as well as for science and research. There is much that Germany and the UK can still learn from each other, and I hope channels of discussion remain open and are fostered further. That is why we are all here together, and I wish you all an illuminating and inspiring day here at the MTC.
Opening remarks

I am delighted that we are joined here today by representatives of German manufacturing industry as well as His Excellency the Ambassador.

After all, Germany led the way in developing Industry 4.0 and I hope that today represents one of many opportunities to deepen co-operation and sharing of best practice between our two countries.

Introduction

It is clear that modern manufacturing is more than just the production of goods. Manufacturing companies know that R&D, design and services play an important role in their competitiveness.

Manufacturers increasingly understand the value of the data that their processes and products generate and this know-how is opening up new revenue streams and export opportunities. As Commissioner Gunther Oettinger has said “Data is currency!” Through its value chain, manufacturing links extensively with wider economic activity. That’s why it matters to the small businesses supplying manufacturers and the thriving local communities sustained by them. This all means we need to view manufacturing differently, capturing the important activities that take place upstream and downstream of production.

Over the last eight years, we have fallen behind Germany, France and the USA in terms of productivity growth.

Subdued productivity growth matters. In the long run, productivity is the main driver of rising incomes so sustained productivity growth is a crucial factor in improving living standards.

Manufacturing is very much part of the solution to this problem. Whilst manufacturing productivity has increased by 1% since 2008 compared to 0.2% for the economy as a whole, the potential for future productivity gains is much higher in manufacturing than in services and other sectors.

For example, the Copenhagen Business School has estimated that full adoption of SMART manufacturing processes, such as robotics and use of ICT, could result in a 22 per cent increase in productivity in the UK sector.

What this means for UK manufacturing

By building on Britain’s reputation for manufacturing quality, service and innovation we can be at the forefront of a smart manufacturing revolution.

The foundations are strong. Take vehicle production. The sector has been transformed beyond recognition.

Since 2009, productivity in the automotive sector has increased by 70 per cent in the UK. Much of this can be put down to greater autonomisation of production lines, but also the increased use of ICT and big data. It also reflects high levels of investment in the sector - £3.5 billion in capital expenditure and £2.3 billion for business R&D in 2014 alone.

……and on Tuesday, Jaguar Land Rover announced plans to invest a further £450 million in its Wolverhampton engine plant, effectively doubling its size.

Automotive paves the way in mass customisation. If I wanted to buy a new Mini, I can go onto their website and create a bespoke car, choosing from thousands of possible personalisations. Let’s say I choose a nice leather driving seat. The information is shared with the various suppliers, then on the day that my car is going down the Mini production line the chair manufacturer loads my seat into their lorries in sequence so that when it gets to the Mini factory it is offloaded and added to the production line, in exactly the same order as the cars are going down the line. And it is not just the chair in sequence, but dashboards, engines, bonnets.

This example illustrates the importance of digitally connected supply chains and the need for UK manufacturers to be prepared for this in order to remain globally competitive.

It also shows how today, customers demand personalised, reliable and durable products and services, at the time and in the place they want them. Manufacturers need to be geared up to meet these demands as well as future disruptive business models that put emphasis on service rather than product purchase. Leaders will need to be forward thinking and embrace these changes to remain competitive and exploit the opportunities.

We welcome the business-led activity focused on improving manufacturing productivity. This is led by Juergen Maier from Siemens and Sir Andrew Witty from Glaxo Smith Kline, with support from other companies plus the CBI and EEF. They have been looking at opportunities to increase manufacturing productivity and economic growth through areas such as leadership and ambition, innovation and new technologies, skills, organisational culture and employee engagement. They expect to report their findings next year.
The Government’s role

So what is the Government going to do to keep the UK at the forefront of manufacturing excellence?

First of all, the most important thing the Government is doing is to help create the economic conditions which will give manufacturers the confidence to invest in new technology and processes, as well as the skills to make the most of them.

In July this Government published a plan for productivity “Fixing the foundations: Creating a more prosperous nation”. It focusses on the long-term investment in ideas, infrastructure and skills; creating a dynamic economy with open and competitive markets; and encouraging both the adoption of innovation and unlocking barriers to new markets.

The UK’s digital economy is vibrant and growing rapidly. To ensure that these benefits are felt throughout the whole economy the Government will publish a Digital Transformation Plan in due course that sets out concrete actions the Government will take to support the adoption of digital technologies across the economy.

Innovation clearly has a vital role to play, and we have been ramping up activity in the Catapults and across Innovate UK’s portfolio more widely. The inspiration for the Catapults was of course the Fraunhofer model. For over 40 years, Germany has set the gold-standard for bridging the “valley of death” between university activities and industrial requirements. There are currently 68 Fraunhofer centres, including one based in Glasgow, which builds on the strong photonics clusters in Scotland and other parts of the UK.

The Manufacturing Technology Centre – part of the High Value Manufacturing Catapult – has been working with the Electronic Systems Community to develop a path for exploitation of Industry 4.0 for the UK.

The UK cannot be at the forefront of the fourth Industrial Revolution unless we have people with the right skills to develop, exploit and adapt new technology. Digital technologies play an essential role in value creation in all industrial sectors today and can bring about radical transformation to all aspects of manufacturing and related services.

We still require significantly more engineers, but they will also need to be skilled in ICT and design - we need a new breed of “digital engineers” who are able to design, programme and make. We also need data engineers who can help business reap the benefits of big data.

Last year we announced a new integrated model of Higher Apprenticeships for the digital sector, which got under way in September. Digital will also be included in a new network of employer-led National Colleges, to help the UK develop the world-class technical skills we need to compete globally.

Conclusion

The shifting dynamics of global manufacturing is creating an opportunity for a new generation of goods, products and services to be made and led in the UK, Germany and across the EU.

Going forward, we will work with industry, trade associations, Catapults and academia to develop a clear understanding of the capabilities and needs of UK business in adopting Smart Manufacturing processes and related technologies. Greater collaboration between the UK and Germany offers a huge opportunity for leadership on Industry 4.0 across the EU and globally.

The UK is already actively engaged alongside Germany and other member states in Commissioner Oettinger’s roundtables, driving industry co-operation and shaping the digitalisation agenda in the EU.

Both the UK and Germany want to see strong growth in manufacturing across Europe. We have a shared interest in promoting modernisation and enhancing the EU’s competitive strengths.

The more closely we work together, the more successful we will be.
Germany and the UK will grab the chance of Industry 4.0 to remain leading manufacturers in the 21st century.

Dr Peter Ammon, German Ambassador to the Court of St. James's
Session One
Vision and Policy
Industrie 4.0 is a project for society as a whole

Henning Banthien said that in Germany, the Industry 4.0 programme supported the transition into a digital economy. But there are imperatives. Industry 4.0 must be understood as a project of, and for, society as a whole, and it requires a close alliance between the private sector, academia, research, politics and trade unions. Importantly, the conversation needs to be translated into practice and implemented now.

The Platform Industrie 4.0 project aims to achieve both high impact and broad visibility to ensure buy-in by all affected. The combined project team is tasked with drawing up recommendations for action by all involved, initiating new alliances and projects, mobilising small and medium sized companies and building international co-operation. To achieve these requires joint and consistent communications, the communication of good practice and applications, and building social understanding and acceptance.

The project team has set five things to do:
1) Focus on the needs of business and end-users
2) Create a central point of contact for international partnerships and alliances
3) Ensure acceptance through high transparency and participation
4) Develop a common language, objective and key messages
5) Establish clear structures and reliable processes for Platform Industrie 4.0’s day-to-day activities.

The Industrie 4.0 Platform is controlled by a central board made up of representatives from government, business, trade unions and academia. Reporting to the board is a steering committee led by business, and a strategy committee led by politicians, academia and representatives of trade associations and trade unions. These are supported by working groups covering architecture and standards, research and innovation, security of systems, legal frameworks, and employment, apprenticeships and lifelong learning. Further support comes from an academic advisory board, international standards bodies and industrial consortia.
The working groups are extremely important. There are currently five working on their own themes. Participation in these groups is multi-disciplinary and is open for all interested and qualified representatives from business and work councils. Criteria for participation is proven expertise, a mandate from the represented organisation and an ability to facilitate a regional multiplication effect.

A central project office for Platform Industrie 4.0 has responsibility for co-ordinating the network including all working groups and committees, responsibility for organisational matters and project management. The project office also manages internal and external communication and acts as a first point of contact for all enquiries.

The digital transformation of companies in Germany offers significant opportunities. Research has shown that 86 per cent of companies believe it offers huge potential and 58 per cent believe it will have a positive effect on employment. However, only 35 per cent believe it is sufficiently on the agenda of SMEs. Around 47 per cent believe it will result in cost savings, with 31 per cent estimating that costs will remain steady.

Working Group 1: Reference Architectures, Norms and Standardisation
Chair: Dr. Peter Adolphs, Pepperl + Fuchs

Working Group 2: Research and Innovation
Chair: Johannes Diemer, Hewlett Packard

Working Group 3: Security of Interconnected Systems
Chair: Michael Sandner, Volkswagen AG

Working Group 4: Legal Framework
Chair: Dr. Hans-Jürgen Schlinkert, ThyssenKrupp

Working Group 5: Employment, Apprenticeships and Life-Long Learning
Chair: Dr. Constanze Kurz, IG Metall

In Germany, around 80 per cent of companies in the electrical and engineering sectors are dealing with Industry 4.0, with around 20 per cent of these implementing concrete solutions. In the machinery and plant engineering sectors around 22 per cent of companies are actively implementing Industry 4.0 solutions, but 43 per cent have yet to engage. Industrial companies recognise the challenges involved in Industry 4.0 and they put the need for investment (64 per cent) at the top of the list. Other challenges are a lack of skilled workers (57 per cent), a lack of standards (50 per cent), security concerns (46 per cent) and unclear economic benefits (38 per cent).

The project office has mapped out the country and identified 207 cases of Industry 4.0 being put into practice, and 25 test beds. The aim is to inspire SMEs to implement Industry 4.0 technology by seeing what has happened in other factories.

Virtual Map Industrie 4.0
Where Industrie 4.0 is put into pratice already today

207 examples of application of Industrie 4.0...

...within small, medium and large sized enterprises from various branches

http://www.plattform-i40.de/i40/Landkarte
"Europe’s future is digital"

Anne-Marie Sassen said that the European Commission is developing an action plan for the digitisation of European industry, which is building on existing initiatives countries and regions are taking, like ‘Industrie 4.0’ in Germany and Catapult in UK. However, there are common issues that cannot be solved at a national level and therefore it is necessary to have a European strategy as well.

Digitisation means looking at many issues including innovations in all types of products, for example sensors, wearables, embedded software and connectivity. The department is also looking at the digital transformation of processes from logistics and product design to manufacture, and radical changes in business models, blurring the boundaries between products and services, adding value in the supply chain and building on real time information.

The current situation in Europe is mixed. There is strong evidence of digitisation in high-tech industries and in some countries. However, there is a slowness and disparity across some regions and industries, and SMEs and non-technical sectors are lagging behind. There is new competition from non-EU platform owners and a fragmentation of effort in Europe. There is a need for skills and the re-skilling of the workforce and there are gaps in the legislative and regulatory framework.
The digital innovation hubs offer innovation services including mentoring, access to finance and advice. Many digital innovation hubs already exist. The MTC is a very good example of expanding the networks of innovation hubs to regions where there is not such support for companies. There will be the two million euro I4MS Mentoring and Sponsorship programme (open until the end of April 2016), supporting best practice feasibility studies, smart specialisation and links to local funding. Meanwhile the network of digital innovation hubs will be established, drawing up a catalogue of initiatives EU wide, linking those initiatives, sharing best practice and concentrating EU funding on cross-border projects.

DG CONNECT aims to ensure that inter-operable open platforms are available to businesses to support their digital transformation. Resources from industry and regions can be pooled for platform-building and standardisation. Meanwhile, it will be expected that national research and investment funding for platform-building will be available, and public funding will be matched by private investment.

An example of digital platforms in industry is AUTOSAR (AUTomotive Open System Architecture) in the automotive sector, which links car manufacturers with software developers to standardise the development of automotive software. The goal of the EU is to create new success stories like AUTOSAR in different industrial domains, for instance digital automation of factories for connected and autonomous cars.

Another area of the EU’s strategy for the digitisation of industry is to prepare the workforce for the requirements of tomorrow's technology, with the goal of adapting education and lifelong learning. With the commitment of industry, the EU can add value by acting as a catalyst between sectors and regions, linking digital education, re-skilling and learning initiatives, and promoting the exchange of best practice. Digital skills and non-routine skills such as adapting to new situations, thinking creatively, interacting with others, solving unstructured problems and looking for new frontiers will fill the skills gap and prepare the workforce for the 21st century.

The EU also sees the need for smart legislation for smart industry, making regulation fit the digital world. The EU can add value by stimulating the regulatory dialogue on smart issues to move towards a single EU-wide level playing field. The EU can also start dialogue with stakeholders on liability issues for digital systems, safety issues for autonomous cars and robots, and big data issues such as ownership, use and IPR protection.

Success on all of these fronts depends on strong collaborative efforts between the EU, national and regional initiatives, across all EU programmes and across all sectors. That consultation process is beginning.
“Industry 4.0 - a means to an end, not an end in itself”

Dr. Jürjens used Audi as an example of a company linking all of its functions with an understanding of data, and the important role it plays in digital technology. Audi is using data to capture individual customer wishes and the enormous number of models and variants which result, and interpret those into complex logistical processes and the automation of the logistics system, with real-time information availability.

Central: Role of Data is Changing!

Data Management Needs New Skills

- **Ad-hoc query**
  - Ability to reply **any query at any time**
  - **Example:** Which raw materials did we obtain within a radius of 50 km around the nuclear power plant in Fukushima in the first three days after the accident?

- **Real-time transparency**
  - Full transparency about **material and information flow**
  - **Example:** What is the value at risk of our global logistics network at a given moment?

- **Predictive analyses**
  - Use data for **proactive business management** – not for creating problems
  - **Example:** How to use weather and traffic data for controlling the distribution network?
For data management to be used effectively, new skills are required. The data must be capable of answering any query at any time. There must be real-time transparency of material and information flows, and data must be capable of predictive analysis, able to support proactive business management. For example, using weather and traffic data for controlling distribution networks.

Many large businesses are already using data for economic and business benefit. For example, Facebook gathers user data to enhance its own value, US supermarket Kroger is a leader in capturing customer data including purchase profiles, and German automation provider Festo uses data to control the flow of production parts. All of these data-sets have a real economic value.

For effective data exchange between companies there are a number of strategic requirements. These include the sovereignty of data, where the owner decides what happens with it, collaborative governance with industrial users making the rules, the storage of distributed data, the secure exchange of data, open and transparent access to the information infrastructure, certification of service providers and the instant availability of data for digital services.

**Industrial Data Space**: Architectural Design for a »Trusted Data Network«

Industrial Data Space enables the logistics chain of the future by linking data. The use of such links by major companies (i.e. Siemens, Bosch, ThyssenKrupp, and Allianz) in case studies and early trials have demonstrated that Industrial Data Space can integrate Industry 4.0, smart data and smart services. Data has to be managed as a strategic resource, and its value grows if it is exchanged, linked and integrated. All it needs is a secure infrastructure that protects sovereignty and trust. Now is the time to act!
“The digitisation of industry is fundamental to its success”

Laura Smith said the CBI recognised the need for linkages between industry, academia and government. In the UK economy, manufacturing accounts for 44 per cent of all exports and 19 per cent of GDP. The digitisation of industry is fundamental to its success to ensure that the UK is competitive on a global stage. Business is recognising the importance of technology and 2015 was the third consecutive year of growth in research and development in the UK.

“Confidence in data sharing is important”

Paul O’Donnell said the market for manufacturing technology in the UK was at relatively high levels as firms realised the importance of investing in such technology. However, the UK had a poor historical record for investment.

Much of this was due to difficulties in access to finance for technology, with lenders often reluctant to fund high-tech equipment, especially the intangible elements of it – a problem which the technical direction of Industry 4.0 had the potential to exacerbate.

Legal and security implications were also a barrier to progress, with concerns about cyber security, the management of data relationships and confidence in data sharing. The Government has a role to play in addressing some of these areas.
Session Two
Mechanisms for Industry to Engage
“Smart machines will work hand in hand with employees”

Steffen Wischmann questioned if Industry 4.0 - the fourth industrial revolution - was really a revolution? Well, it is when you consider that the biggest taxi company has no cars (Uber), the most popular media proprietor creates no content (Facebook), the most valuable retailer has no goods (Alibaba) and the biggest accommodation provider has no real estate (Airbnb).

Digital change throws up several challenges:

• Strong international competition (USA, Asia)
• Value chain networks that cross borders between companies and countries.
• New disruptive technologies
• Reclaiming and extending the strength and controllability of digital technology.

But the aim must be to strengthen European companies to develop innovative solutions.

Production is the backbone of German prosperity. To continue that, it is vital to address the trends that will dictate how products are produced tomorrow:

• Acceleration of product cycles
• Increasing demand for individualised products
• Penetration of new technologies and innovation
• Production that considers the shortage of resources (materials and skills)
• Production in a global world and control of global production networks.
• We need adaptive, self-configuring and self-organising production systems.

National Key Project: Industry 4.0

• Production is the **backbone of German prosperity**
  – Direct jobs: 7.7 m.
  – Indirect jobs: 7.1 m.

• The **mega trend CPS** is of vital importance to answer the question how we are going to produce tomorrow:
  – Acceleration of production cycles
  – Increasing demand for individualized products
  – Penetration of new technologies (innovation at all interfaces)
  – Production that considers the shortage of resources (recycling, substitutional materials, personnel)
  – Production in a global world (control of global production networks with ICT)

• We need **adaptive, self-configuring and self-organising** production systems

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Steffen Wischmann - Autonomous systems in the context of Industry 4.0
contact: wischmann@iit-berlin.de
A research map of German industry shows that there are a number of collaborative projects and research studies addressing the issue of Industry 4.0. One of these is Autonomics for Industry 4.0 which has 19 live collaborative projects in operation.

Autonomics for Industry 4.0 is a 110 million euro project supported by 55 million euros of central funding. It has organised conferences, workshops, trade fair appearances and research on cross-sectoral issues. In addition, it identifies new business models with the objective of fostering highly-flexible production infrastructures. The focal points are working conditions, human-machine interaction, engineering models, logistics and robotics.

Examples of projects in operation include re-usable, flexible robotic applications (ReApp), identifying potential for automation in SMEs (ManuServ), connected logistics for construction sites (SmartSite) custom manufacture of sports shoes and textiles (SpeedFactory), automated stock-taking with drones (InventAIRy), semi-autonomous forklifts with intuitive control (FTF out of the box), context-aware safety systems (INSA), distributed control of production for automotive (SmartFace), bionic control of production systems (InnoCyFer), 3D-supported engineering platforms for production planning (OPAK) and assistance in production processes for cognitive-impaired employees (motionEAP).

Task forces have been established for cross-sectoral issues, including legal challenges, standardisation, IT security and the future of employment. On the issue of employment, the future means that smart machinery will work hand in hand with humans. Research and experience shows that automation does not cause unemployment; it simply changes the nature of employment. Technology won’t destroy our jobs, but it will change the way we work.

Through the use of digital technologies, companies can organise working conditions simultaneously to foster economic growth as well as employee development and well-being.
“Government, industry and institutions must show leadership”

The Dutch version of Industry 4.0 is named Smart Industry. It recognises the need to digitise industry in the Netherlands to safeguard its future for wealth creation, and that the main source of value creation is information.

Field labs are active case studies where knowledge can be spread by those actually developing their business along smart lines with breakthrough technologies.

The skills programme involves courses to promote sustainable employability, a regional approach in connecting schools and industry, combined with employee pools, task rotation and social innovation.

The ICT action is developing technical solutions, business models and forms of co-operation to simplify the use and exchange of data, as well as a robust and secure infrastructure and development of software tools. A cyber security campaign launch is planned for 2016.

Ten regional field labs have begun, with more planned for 2016. Their aim is to achieve innovations, drive innovation systems, develop new technology and integrate their advances on a regional basis, identifying obstacles along the way.

Active field labs include a ‘Zero Surprises in Maintenance’ group working with Cargill, Fujifilm and Sitech to digitise maintenance processes, and a ‘Smart Dairy Farming’ field lab aiming to increase the sustainability of dairy farming by real-time monitoring of dairy cattle and sharing information throughout the chain.

Smart Industry's agenda is made up of four actions: awareness, field labs, skills, and ICT, with targets for each.

The target for awareness is that by 2018, 80 per cent of the country’s industry will be aware of the programme, and 40 per cent will be actively doing something about it.
Fabbrica Intelligente - An Italian mechanism

Prof Tullio Tolio, President of the Scientific Technical Committee Cluster Intelligent Factories

“The aim is to create a long-lasting Italian manufacturing community”

Manufacturing is very important to Italy. It is the biggest non-financial sector of the economy in terms of value and employment, it is the biggest exporting sector, and the biggest for private investment, innovation and productivity growth. Italy is in the top six countries in the world in terms of added value in manufacturing, and employs four million people in around 417,000 companies.

Italy has established eight national clusters to accelerate its economic growth. The cluster to take industry forward is Fabbrica Intelligente - Intelligent Factories.

The mission of Fabbrica Intelligente is to create and organise a long-lasting Italian manufacturing community to initiate research and evaluate research outcomes. The cluster directly interacts with the Ministries (in particular MIUR- and MISE) contributing to the definition of national research agendas and calls. The cluster also aims to connect national and regional research policies with international policies, to facilitate Italian participation in European initiatives, and to direct the Italian manufacturing sector towards new products and services, new processes and technologies.

The cluster has 223 industrial members, as well as university and research organisations. These members are working at regional, national and EU level to connect research initiatives and policies. Regional clusters mirror national clusters and interact with regional governments.

Fabbrica Intelligente identifies trends in markets, technology, resources and demographics, and creates a structure for sharing best practice. Top-down manufacturing challenges are combined with bottom-up research projects to create research priorities and identify enabling technologies.

As a result of this process, research priorities have been established in:

- Systems for personalised production
- Strategies, methods and tools for industrial sustainability
- Factories for humans
- Innovative production processes
- High efficiency production systems
- Evolving and adaptive production systems
- Strategies and management for next generation production systems

Four cluster projects have been established at a cost of 40 million euro, 30 million of which comes from funding. These projects are:

- Sustainable manufacturing
- Adaptive and modular approaches for the digital factory
- Smart manufacturing
- High performance manufacturing
The Industrial Internet Consortium (IIC) is focusing on the “Industrial Internet of Things” (IIoT) and how products, processes and people connect to each other across traditional domains. As things become intelligent, this will change everything. Examples of this happening already are smart parking processes, where a car is guided to the nearest available parking via wi-fi with real-time updates, and lawn-mowing robots with remote configuration through mobile phones.

Being able to deliver connected products with value-added services requires two key capabilities: cross-domain system integration, and efficient product manufacturing. The IIC is focusing on the former, while Industry 4.0 is focusing on the latter. For a large manufacturer like Bosch, both sides of the equation are important. Industry 4.0 is helping us to be more flexible and efficient on the manufacturing side. IIC is helping us to build the next generation of connected Industrial Internet Solutions.

Validating new IIoT solutions is very important, and the testbed approach of the IIC is a great way of doing this. Our next focus area will be on joint IIC/I4.0 testbeds, to bring these two important worlds even closer together.

**Standardization**

I believe that developing standards, if you don’t know what standards you need, is a waste of time. So how do you find out what you need? It’s not just developing the use cases. It’s building it, testing it, and seeing what works.

I call it the Nike effect: just do it!

Dr. Richard Soley, Executive Director, Industrial Internet Consortium (IIC)
“This is an opportunity which already has companies buzzing”

Lynne McGregor said the UK is built on innovation and its genius for invention and creativity has shaped the world. From television to the world wide web, from penicillin to in-vitro fertilisation, from the jet engine to graphene, the UK’s global economic footprint is testament to those who have innovated before.

But strategic innovation doesn’t just happen. It is a consequence of co-ordinated collaboration between business, government and research, which is where Innovate UK comes in. Innovate UK has a five point plan for future growth:

1) **Accelerating UK economic growth** nurturing small, high growth potential firms in key market sectors, helping them to become high-growth mid-size companies with strong productivity and export success.

2) **Building on innovation excellence throughout the UK** investing locally in areas of strength.

3) **Developing catapults within a national innovation network** to provide access to cutting edge technologies, encourage inward investment and enable technical advances in existing businesses.

4) **Working with the research community and across government** to turn scientific excellence into economic impact and deliver results through innovation.

5) **Evolving our funding models** by exploring ways to help public funding go further and work harder, while continuing to deliver impact from innovation.

The backdrop to applying this to manufacturing comes from the global market opportunities offered by the strengthening domestic supply for offshore wind, automotive, off-site construction, smart processes and passenger aircraft. The growth in emerging economies and the legacy of UK research and development now ripe for development, this along with the network of support availability, combine to make this a good time for progress.

<table>
<thead>
<tr>
<th>Backdrop</th>
<th>Timeliness</th>
<th>Additionality</th>
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<tbody>
<tr>
<td><strong>Global Market Opportunity</strong></td>
<td><strong>Growth in emerging economies</strong></td>
<td><strong>Funding models and connectivity to de-risk pull-through of high-value, cross-sector manufacturing technology and the broadening of innovation</strong></td>
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<td>£30bn boost to UK economy by 2025 by strengthening domestic supply</td>
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<td>Offshore wind → £18bn</td>
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<td>Automotive → £48bn</td>
<td><strong>Scale: large (to serve industrial sector needs) and small (mass customisation)</strong></td>
<td><strong>Facilitation events and workshops to enable manufacturing companies to discuss issues and challenges with digital solution providers</strong></td>
</tr>
<tr>
<td>Off-site construction → £6bn</td>
<td><strong>Circular economy</strong></td>
<td><strong>To develop and disseminate these mechanisms, Innovate UK will need to work with a variety of partners including Catapult centres, EPSRC centres, trade bodies, the EU and European organisations.</strong></td>
</tr>
<tr>
<td>Smart IB processes → £4-12bn</td>
<td><strong>Additionality</strong></td>
<td><strong>The good news is that this is a huge opportunity for UK manufacturing. While UK manufacturers have historically been bad at investing in automation, this is an opportunity that has companies buzzing.</strong></td>
</tr>
<tr>
<td>Passenger aircraft → £629bn by 2030</td>
<td><strong>Place:</strong> reshoring, (re)distributed/local manufacturing</td>
<td><strong>Industry 4.0 isn’t just about automation. It is about using all information that can be gathered about customer requirements, suppliers and factory operation in order to be smart, flexible and adaptive. And that is something the UK is good at.</strong></td>
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| UK Capability | 9.5% of UK GVA, Global 11th, EU 4th | 8% workforce (2.6m), 50% of exports |
| 69% of business R&D | 88% VA from large firms |
| 17% turnover from medium firms | Overseas control of top tiers |
| Good support in the landscape: HVMC, CIMs, MAS, RCs, ... | **Legacy of R&D ripe for pull through** |

Opportunities over the next five years include the development of digital for manufacturing to improve competitiveness and flexibility, preparing manufacturing readiness at scale, and developing early stage manufacturing concepts for future-proofing industry and enabling new sources of revenue.

Innovation will be required for digital manufacturing. This will include the development of new technologies such as smart sensors, self-organising wireless networks and methods of cyber security, as well as innovative design and integration of systems to achieve the design principles.

To inspire and encourage innovation, Innovate UK would consider:

- Production and communication of use cases, best practice guides and diagnostic tools
- Demonstrators and innovation hubs

**Backdrop**

- **Global Market Opportunity**
  - £30bn boost to UK economy by 2025 by strengthening domestic supply
  - Offshore wind → £18bn
  - Automotive → £48bn
  - Off-site construction → £6bn
  - Smart IB processes → £4-12bn
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- **Timeliness**
  - Growth in emerging economies
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  - Funding models and connectivity to de-risk pull-through of high-value, cross-sector manufacturing technology and the broadening of innovation
  - Network of HVMC, KTN and CIMs for pre-competitive and competitive R&D
  - Can link HVM with Digital

**UK Capability**

- 9.5% of UK GVA, Global 11th, EU 4th
- 8% workforce (2.6m), 50% of exports
- 69% of business R&D
- 88% VA from large firms
- 17% turnover from medium firms
- Overseas control of top tiers
- Good support in the landscape: HVMC, CIMs, MAS, RCs, ...
Discussion and Questions

The major issue raised in this discussion was the balance of power between big companies and their supply chain. Often it was the case that major companies leveraged their supply chains on cost and delivery, making ever more difficult demands.

The conclusion was that as a supplier innovates, their position becomes much stronger, particularly if they become a leader in their field. The supplier may also be able to develop skills which put it in a powerful competitive position.

Summary: Sessions One and Two

- While the agenda and vision is similar throughout Europe, each country appears to be creating their own Industry 4.0 platform, and the ideas and timescales differ, with the current level of coordination very low.
- Most companies want to start doing something now.
- Large companies are progressing with the transition, whereas many SMEs are still waiting for infrastructure to be established.
- EU rules or guidance for security standards look like a powerful new area.
- Industry 4.0 is not just about the traditional manufacturing world; it can involve the whole of the value addition industry.
- Germany already has a website with online maps of use cases showing what can be achieved with Industry 4.0. A Copenhagen study said the improvement in efficiency/GDP would be 22 per cent. One of the presentations was from a spin off company from Fraunhofer, aiming to make a business in the training sector, which focuses on the requirements for competence and business transformation in Industry 4.0.
- Almost every EU country likes the idea of Digital Innovation Hubs to help with the very large numbers (Italy in particular) of SMEs, who are key to manufacturing in most countries.
- It is very important, especially for SMEs, that open standards are developed.
- Among the German views of things, key aspects are standards, legislation, workers, security and platforms. The German view seems to be dominated by the political imperative to ensure that the future labour force is positively connected to the changes and advantages resulting from Industry 4.0. i.e. it is being done with their involvement, almost for their benefit. This would be a clear and simple contrast to a US view, with UK maybe somewhere similar. There is likely to be significant polarisation in workforce roles between the skilled and unskilled elements of Industry 4.0.
- Egbert-Jan Sol from the Netherlands talked about sensor data from the internet of things, and commented that this does not pose copyright protection issues. We need “compliance at the touch of a button”, the idea that all of the legal issues associated with sharing data could be dealt with systematically.
Interactive Communication and Data Management on the Shop Floor -  
An overview of the complete line and process

Denis Barrier, Bosch Rexroth, Germany

“...more reactive, less time, less space.”

As a supplier of systems, controls, technology solutions and machinery to industry, Bosch - with 250 plants worldwide - is both a provider and an operator of manufacturing technology.

Operating in an environment of challenges and opportunities, the company is committed to Industry 4.0 and sees it as a route to greater prosperity and higher employment.

One example of Industry 4.0 in action is the multi product line at its factory in Homburg. The line manufactures a hydraulic distributor with on-board electronics. The product is supplied to the tractor industry and has six products types with 250 variants and 2,000 single parts.

The project to bring Industry 4.0 principles to the production of the product began in July 2013 and went live in October 2014. The project involved the development of digital connections between the operator, the work station and the product itself. Order planning and production control are integrated in a virtual world.

The work station uses autonomous, intelligent connected systems with virtual imaging, online checking and a context-based intuitive user interface with the operator. The advantages include the quick adoption of new or changed requirements, a transparent overview of capability for the production planner and easy-to-handle changes of interface for the operator. An active cockpit acts as a communication platform with “touch and send” capability that allows all operators and planners to see real-time information at any time.

Customer advantages include connectivity throughout the system, reduced manual effort, consistent and real-time information, transparent information enabling efficient decision-making and a better informed workforce.

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**MTC - Rexroth@4.0**

Industry 4.0 – connected assembly line

- Digital connection between operator, product and work station
- Integration in virtual world of order planning and production control systems

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**MTC- Rexroth@4.0**

Customer Benefits

- Connectivity to any back end system (date bases, documents, …)
- every time actual and consistent information available
- reduced manual effort for updating the information boards in the shop floor
- transparent information presentation enables efficient decisions direct in front of the board
- quick start of decision process by using online documentation of meetings and e-mail direct from the board
- associates are better and actual informed
- environmentally friendly - paperless
“People will always be important in an M4 factory”

Meggitt, a major supplier of extreme environment components and sub-systems for aerospace, is responding to Industry 4.0 with its M4 – Meggitt Modular Modifiable Manufacturing – programme. M4 was devised to conquer the challenge of improving the quality and production speed of low-volume, hand-assembled, complex, high-value components. The programme addresses traceability in products manufactured over a nominal 30-year lifespan and the requirement to continually feed information back to operators on potential assembly efficiencies and to engineers enabling them to improve design for manufacture.

Today, the M4 factory virtual simulation is rapidly moving to a fusion of simulated and real factory data – what controls engineers would call a “factory in the loop”. The goal is a hybrid where M4 technologies can be used with legacy factory infrastructures, recognising that no one is likely to embrace tearing down current factories to move them all, big-bang style, to the M4 model.

People will always be important in an M4 factory – the complexity of Meggitt components means that robotics can only aid humans. This calls for a highly-skilled workforce, supported by the M4 system and smart communication involving data-gathering via wearables, screens and gesture-receptive controls. The information gathered from multiple sources allows for dynamic rescheduling, adaptation to abrupt changes, predictive analytics and swift identification of areas for improvement. Simulation can aid what-if scenarios to improve the robustness of scheduling and systems.

M4 provides the digital framework for a factory into which technologies, analytics and other data-mining methods can be introduced to continually improve performance. An initial investigation using projection, video recording and data collection for back-office analytics has delivered promising results. Exploiting additional emerging technologies, including wearables, mobility computing and local autonomy in process flow decision-making is expected to create more value and optimisation opportunities.

The Meggitt programme involves a partnership with the University of Sheffield Advanced Manufacturing Research Centre, the Manufacturing Technology Centre in Coventry, and IBM.
UK End-User Experience - Challenges, barriers to overcome and the economic benefits

David Thomas, Siemens Congleton

“We will understand and anticipate customer needs....”

Siemens factory in Congleton was established in 1971 and designated an electronics manufacturing location in 1991. With 450 staff it is the biggest employer in Congleton and is a high volume manufacturer of variable speed electronic drives within the Siemens Digital Factory division. Customer requirements are individual, rather than for standard products, so production can be complex.

To respond to increasingly complex customer requirements, Siemens Congleton has embraced the ultimate goal of Industry 4.0 – to meet future customer demand we must create smarter factories, which are more resource efficient, more productive and more competitive in a globalised economy.

The factory is now working to digitise the whole process, using virtual reality to understand complex factory simulation and ergonomics, and employing emerging technology and robotics. The whole plant has a vision of becoming an integrated digital enterprise, with business planning, logistics, manufacturing operations and customer and supplier interfaces managed through technology. People issues such as the cascade of information and the development of hybrid skills run in tandem to meet the challenge of a return on innovation.

The Congleton 2020 programme combines advanced manufacturing with integrated digital systems and processes. As an integrated and agile location the factory aims to understand and anticipate customer needs, to drive an optimised end-to-end value chain that delivers sustainable growth.

The factory is tackling the complexity of producing a customised product by sharing information with the supply chain, by digitising production streams to visualise complexity and experiment, and by exploiting emerging technologies and flexible automation.
German Study on SME Readiness for Industry 4.0
Christian Prasse, Fraunhofer IML

“SMEs may miss out on business opportunities...”

The Fraunhofer Institute for Material Flow and Logistics (IML) consists of 250 scientists and 250 student assistants working on material flow systems, logistics traffic and environment, and enterprise logistics. As part of a consortium, IML applied to become one of five Competence Centres funded by the German Federal Ministry for Economic Affairs and Energy (BMWi), targeting small and medium size enterprises.

SMEs, of a wide variety of sizes, have the advantages of being largely owner-managed with quick decision-making processes, having short communication lines, flexibility and a drive for workable solutions. On the other hand, they have less money to invest and limited research and development capability. They have varied starting positions ranging from high-tech spin-offs to traditional craft businesses.

SMEs may be negatively affected by Industry 4.0 and changeovers to digital production in networked factories. There is a risk that they could miss business opportunities if they are not able to participate in new technological solutions.

Why Competence Centres?

- Regional consolidation of information and competence matching to support SME
- Broad impact by regional networks (organisations, associations etc.) national cross-linking of all Centres
- Existing labs and testbeds adapt to SME needs
- Technological „deep dive“ and matching with competent partners
- Demand-driven dynamic project adjustment
- Mutual responsibility: SME does not pay for support but will not be funded

The project to establish Competence Centres will support SMEs on a regional basis, establishing regional networks as well as cross-linking all centres. Existing research centres and laboratories can be adapted to the needs of SMEs, and companies will be matched with appropriate competent partners. The aim is to allow the greatest possible number of SMEs to take advantage of the technology platforms and gain access to methods, tools, software and prototype solutions.
Discussion and Questions

The main point reinforced by the discussion panel was the need to take a long term view. Company boards who lack long term vision may be reluctant to invest. It is important that they understand the potential for new business and the advantage of future-proofing their enterprises.

Often, return on investment is not the right measure. It is the learning and the new skills, which will equip the business for technological change that provide the real short term benefit.

Summary: Session Three

- The end-user presentations from Bosch, Meggitt, and Siemens were particularly useful insights.
- Changing businesses and business models e.g. Meggitt (adapt to the new world, start doing things in a new way, changing current working practices, flexible manufacturing, producing different parts on the same line) demonstrated the smart workbench.
- While SMEs are not fully involved in the initiatives, large companies are capable of running demonstration projects.
- Bosch is doing an internal demonstration project, partially to promote their own equipment. Meggitt demonstrated a smart workbench, is collaborating with others and has funding available, and Siemens is aware they have pressure on them to demonstrate something.
- Very little is known about the economic viability. None of the end-users predicted a defined return on investment, or described a clear end-goal.
- It is clear businesses must change business models, adapt to the new world, start doing things in a new way, changing current working practices towards flexible manufacturing and producing different parts on the same line. Businesses must change to survive.
Session Four
Enablers And Support
Introductions and Scene Setting to Skills, Data
Security and Standards
Skills for Industry 4.0, New Ways of Learning for Industry 4.0
Thorsten Hülsmann, Fraunhofer IML and GlobalGate

“People are the key”

Industry 4.0 presents a range of human resource issues. These include new processes, know-how transfer, communication of new strategies, talent management, knowledge management and certification, and standardisation.

In Germany, it is recognised that as companies become more interconnected, digital and flexible, the future world of work is unclear as demand for products and services changes and new values emerge from cultural and social changes. The factory of the future may produce better jobs enriched by information technology, but also the erosion of middle levels of qualification with the rise in very high levels of qualification.

The challenge for the digital revolution is that more and more data is available and this has to be contextualised. GlobalGate is looking at people developments from technology and innovation, knowledge-intense services, leadership soft skills, and production and logistics needs, and is working with companies to develop learning programmes. These programmes can be delivered at the strategic level, the process level, the system level and the cultural level.

The company is working with Hartmann on the development of communication and corporate learning, with NDT Global on standards of certification, with AEB on online tutorials for customer information, and with Fraunhofer to develop online learning for experts in battery technology.
Secure Cloud - Data security in MoD relevant environments
Susan Reiblein, Hewlett Packard Enterprise

“Build a plan for your cloud journey”

Traditional IT systems have served business well for many years, but as the need for data storage and rapid data access grew, traditional IT was seen as inflexible, inefficient and capital intensive. The Cloud, on the other hand, is dynamic, virtual and available on-demand. However, public cloud was more expensive, less secure and less reliable, so a managed virtual private cloud is available as a pay-up-front or pay-as-you-go secure option. So there is now a range of infrastructure solutions available based on needs, payment preferences, location and security requirements.

It is now for businesses to define their cloud requirements based on use, need for control, privacy and security, storage needs, payment, physical location etc. A plan should be developed for the cloud journey, with careful needs-scoping, assessment, information gathering, analysis and recommendations before the final decision.

Standards have been developed for cloud providers, meaning security compliance can be checked against accreditation, the highest levels of which allow government organisations and those working with government to ensure secure cloud services.

The technology and security exists to allow the cloud to suit any needs.

Right Solution Depends on What Your Security needs and Workload is…

Defining Your Cloud Requirements
The critical questions

– What do you want to use it for?
– Who will you use it and how will access be controlled?
– How important is privacy and security of the data?
– Do you need same level of privacy and security for all your data?
– How will they access it and how often?
– Is it mission critical?
– How much will you use (storage and server numbers)?
– For how long will you run at these volumes?
– How dynamic does the workload need to be?
– Do you care where it’s physically located?
– Do you need to pay as you go?
“Assess the business benefit, not just the latest technological solution”

Digitising manufacturing is all about extracting value from data, be it isolated or hierarchical. An ICT technology strategy should be developed which takes account of data, structure, intelligence, innovation, technologies, infrastructure, architectures and processes.

The first step in the process is to understand your starting position in the digital manufacturing landscape. The Manufacturing Technology Centre can support this process with digital diagnostic tools. A digital transformation journey needs to be traced from there, taking into account an organisation’s strategy.

This journey may involve dismantling existing structures, particularly if they are intrinsically inflexible. It is important to assess the business benefit of the changes made, not just the latest technological solution available.

At the MTC, it is possible to demonstrate the value of digital technologies and the business benefits associated in a real manufacturing context. Often, the end destination is not pre-defined, the digital transformation journey is not straightforward, and the benefits are not apparent. Also, there may be a need to take a step backwards and rethink the way digital technologies are used in order to reach a robust solution. For these reasons, it is important to get as much support as possible from funding bodies and technology experts.
“Delivering standards will require international partnerships”

The BSI is looking at standards for Industry 4.0 in a project to identify how best to accelerate innovation in manufacturing. This work involves examining:

• Inter-operability between machines and data
• Manufacturing system resilience
• Business capability, particularly new models and best practice
• The international dimension, including the need for co-operation and universal deployment of standards
• Design for a digital environment, including for manufacturing, for service and for verification

The BSI, working with its German counterparts, is carrying out research to identify existing standards. The next steps will be to develop an implementation plan and take the lead where it will be in the interests of UK industry to do so. International partnerships will be required to deliver widely adopted standards.
Discussion and Questions

The pressing need for defining standards in implementing Industry 4.0 was emphasised in this session. A national strategy, backed by government, is needed to establish national standards and, ultimately, global standards. There is also a need to standardise terminology, to make the conversation more accessible, and this conversation should be end-user led and not dominated by proprietary interests.

Industry 4.0 is a process being developed by all industrialised nations. In the United States the discussion is wider, looking at the impact of technology on society.

In China, the Government is investing heavily in its 2025 industrial strategy, and is working with German companies. In Japan there is a similar industrial initiative.

Summary: Session Four

- The German view of Industry 4.0 is all about training the workforce to use extra information to manufacture a wider range of products. It is not about substituting people for robots, it is more about getting the workforce into different, more highly skilled jobs, which are less repetitive. The skills to be learned are not yet clear, but it is important to prepare people for the changing market.

- The Hewlett Packard Enterprise presentation demonstrated how data can become a product which changes business models completely.

- European and global standards are needed to unite the currently fragmented Industry 4.0 initiative, and few such standards exist. New standards are likely to take a number of years to produce and the underlying technologies will need to mature and become clearer.
Conclusions, Outcomes And Feedback
What Next?

Ken Young, Technology Director, MTC

“It’s all about people”

Education and skills are massive issues. We must have people with the skills to use the new technologies, and we must have the right people to deliver the advances and understand why they are doing it.

There must be demonstrators so that small and medium sized companies can see the technology in action and understand what it can do for their business. The Catapult centres can provide enormous help with this process.

Government must be committed to help with skills and skills development. Trained people should be seen as a national asset.

Access to funding for Industry 4.0 is important, and this may require a change in attitude from funders and lenders. Banks have been willing to lend if they can see a machine that has a residual value, but the value is less obvious when the investment involves a piece of data or a way of transmitting it.

At the MTC we are working to provide digital infrastructure that enables us to deliver innovation in advanced manufacturing technologies and new products, and to accelerate manufacturing capability development with the concepts of Digital Factories and Supply Chain Readiness Levels.

All of these things are important, but in the end - it’s all about people.
The next phase of globalisation and the fourth industrial revolution offers the opportunity to re-boot manufacturing in the UK. We need more of our companies to be at the heart of the global manufacturing value chain - driven by technology - to ensure the UK is the number one place to manufacture.

Our foundations are strong. The manufacturing sector is already more than three times more productive than the rest of the economy and it has an impressive R&D track record - accounting for £13 billion investment each year. The UK’s strengths in innovation, design and services position us to take advantage of fast moving technological changes and exploit them for competitive advantage in manufacturing.

This will only be achieved by maintaining a strong partnership between government and industry - and across all sectors - including services and the new and emerging disruptor businesses that have customer demand at the heart of their business model.

UK business must be in the driving seat, leading and embracing technological change and investing for the future. There needs to be an accelerated push towards commercialisation of the vast wealth of creative ideas, technologies and embryonic products that have earned the UK its reputation as a hot bed of innovation.

The role of government is to get out of the way of business; enabling them to maximise growth and productivity through minimising bureaucracy, creating the right environment for innovation and supporting modern industrial skills development. It will continue to invest in science and innovation, supporting our world class Catapults and universities that are essential in showcasing technology and cultivating collaboration to help manufacturers turn innovation into real world success.

The Productivity Plan sets out cross government measures in support of a dynamic and competitive business environment. It details how the tax system, the removal of barriers to new market entrants and obstructive regulation will support investment in innovation and cutting edge technology. It promotes a skills system that will equip the current and future workforce with the skills required by future focused employers.

The UK Digital Strategy will further support the framework conditions to support UK manufacturers to adopt digital technology. It will set out actions designed to promote digitalisation, across the whole economy and for the benefit of citizens. It will detail how the UK can revolutionise the way it works with digital markets, gain digital skills, support appropriate cyber security and deliver world class digital infrastructure.

The Government will also publish a new Innovation Plan, bringing together the whole of government to support and drive forward innovation. This will provide a framework for the UK approach to ensure we are leading the fourth industrial revolution.

The UK will continue to work alongside partners at an EU level on the Digitising Industry agenda. We support an effective digital single market that makes it easier for UK business to operate and help harness the opportunities of digitisation. We will encourage actions that recognise and support the global footprint of our UK companies.
The Manufacturing Technology Centre (MTC), working in partnership with industry, academia and R&D institutions, develops and proves innovative manufacturing processes and technologies in an agile, low risk environment.

The MTC has been at the forefront of leading the UK’s processes for Industry 4.0, or what is fast becoming known as the Fourth Industrial Revolution. It is running a wide research portfolio aimed at helping companies access digital factory technology involving Government and European Commission funds, totalling over £15 million alongside MTC’s own core research funds.

For more information, or to discuss how you can get involved, please visit www.the-mtc.org or contact us on the details below:
Tel: +44 (0)2476 701 600
Email: marketing@the-mtc.org
The Manufacturing Technology Centre
Ansty Park
Coventry
CV7 9JU

All the presentations from the conference are available online: www.the-mtc.org/industry4-0

About the Science and Innovation Network (SIN)

The UK SIN is jointly funded by the Department for Business, Innovation and Skills and the Foreign & Commonwealth Office. SIN has 93 staff, based at diplomatic missions in 28 countries and 47 cities around the world. SIN teams work closely with UK stakeholders and partners to achieve the following global objectives:

- Influence science and innovation policies of governments, industry and academia to benefit the UK
- Improve UK policy based on international experience and emerging opportunities and issues
- Encourage high level science co-operation to benefit the UK and achieve wider policy objectives
- Make best use of international technology co-operation and investment to grow UK innovation potential

About UK Trade & Investment (UKTI)

UK Trade & Investment (UKTI) works with UK based businesses to ensure their success in international markets through exports. We encourage and support overseas companies to look at the UK as the best place to set up or expand their business. We have professional advisers around the UK and staff across more than 100 countries. Our priorities are to:

- Inspire and support 100,000 additional UK exporters to sell their goods and services abroad by 2020
- Strengthen our efforts in high growth markets
- Maximise the UK’s export potential where we have a free trade agreement
- Secure export-oriented foreign direct investment
- Help to put in place the government’s long-term strategy for economic growth
- Increase our reach by working closely with more partners