The future of manufacturing: creating a vision for UK manufacturing 2040

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UK Manufacturing 2040
An IET Initiative

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6th Industrial Revolution by 2040!

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<tr>
<td>Mechanization, water power, steam power</td>
<td>Mass production, assembly line, electricity</td>
<td>Computer and automation</td>
<td>Cyber Physical Systems</td>
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- **The Use of Water and Steam To mechanise production**
- **The Use of electric Power To Create Mass production**
- **The Use of Electronics and IT to Automate Production**
- **Fusion of technologies into physical, digital and biological Spheres**

- **1760 - 1840**
- **1870 - 1914**
- **1980’s to Date**
- **2010 to date**

2040
Balanced Net Zero Pathway – 2050: The sixth Carbon Budget
**Zero-energy Bio Fridge – new materials**

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**Principle of the gel**

Bio Nano robots absorb heat (infrared radiation) and emit it in the visible spectrum - luminesce. In addition, they protect from ultraviolet radiation that can damage the products.
UK Manufacturing in a global context

Green and smart

Creating employment and workplaces

Increasing share of employment in industry

Strengthening activities in design, R&D

Increasing competitiveness

Addressing ageing society challenges

Developing a more socially sensitive and territorially balanced economy

Source: Strategies of the countries; NMD 2018, Cranfield University
Pre COVID-19 drivers

- Strong Pound
- Asian Crisis
- Employment Decline
- Raw Materials & Oil Price
- Inflation Pressures
- Euro Debt Crisis
- Raw Materials & Oil & Energy Price
- Economic Uncertainties
- Low Overseas Demand
- Export Demand
- Domestic Demand
- FDI & Investment
- Weak Pound
- Employment Growth
- Brexit
- Low Interest Rate
- Demand

1993 > 1998
- Export Demand

1999 > 2003
- Domestic Demand
- FDI & Investment

2004 > 2008
- Low Interest Rate
- Demand
- Strong Pound
- Employment Decline

2009 > 2013
- Weak Pound
- Employment Growth

2014 > 2018
- Employment Growth
- Brexit

Source: NMD 2018, Cranfield University
UK Manufacturing Drivers 2040: Post COVID-19

- Man-made uncertainties – supply risk, geo-political conflicts.
- State influence and frameworks – a more uncertain world
- Demand environment – a major driver from pre-covid

- Delivering wellbeing through the manufacturing – new driver.
- Sustainability – environmental, economic and social

- Digital adoption and manufacturing technologies – pre and post COVID
- Innovation – pre-covid driver
- Human capital – pre-covid driver
An IET initiative:

**What 2040 might hold for UK Manufacturing?**

- we need your view (online debate)

- sector specific view through round tables

- please join the debate: sep@theiet.org
Sam Turner

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FUTURE MANUFACTURING ENGINEER

What does the future manufacturing engineer look like? What are the key skills that engineers will need to survive and thrive?

Five global challenges – where engineers can make things happen …

Transport  How do we move people and goods?
Energy     How do we generate and distribute enough energy to sustain cities?
Food       How do we feed 10 billion people?
Health     How do we meet peoples’ health and well-being needs?
Circular Economy  How do we ensure that we make best use of resources?
Many respondents most interested in working in the energy and circular economy sectors in the future.

Over 66% of respondents (232/334) feel that the anticipated rate of major change will occur in the next 5-10 years, with almost 75% (257/302) anticipating continuity of major change in 10-20 years’ time.
Communication skills, creativity and design thinking ranked as the top three non-engineering competencies of ‘highest importance’ for future manufacturing engineers.

‘Future engineers will be part of a cohesive team where interpersonal skills will be paramount to ensure an efficient outcome’

‘Soft skills keep coming up. The thought is that anyone can do anything with the correct technical attitude, but so often we are rejected because of irrelevant technical skills’.
Energy, transport and the circular economy are the top challenge areas where manufacturing engineers can make the most significant contribution.
RECOMMENDATIONS

4.1 For those seeking to start or continue a career in manufacturing engineering: Ensure you have the non-engineering training and support as well as your technical skills to develop your career and secure the success you seek.

4.2 For those seeking to recruit, train and retain manufacturing talent at all levels: Recruit flexibly and then invest in your people to bring out their ideas, agility, and contributions.

4.3 For those providing education and training to the next generation of manufacturing engineers: seek to develop a pipeline of versatile and digitally literate problem solvers who are prepared to be lifelong learners in a rapidly changing environment. Multi-disciplinary skills and knowledge, including in sustainability, energy systems, and behavioural science – alongside traditional engineering and science disciplines – should be a central part of the skills pathway for next generation manufacturing engineers.

4.4 For the IMechE, the IET and other relevant professional engineering institutions: Collaborate widely with others, especially non-engineers, to detect change coming more quickly than you expect. Support the UK sector embracing and exchanging new ideas with others across the world to ensure productive manufacturing for all.
Nicole Ballantyne

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The Made Smarter Innovation Network is a vibrant cohesive growing community of industrial digital technology providers, developers and users - enjoying increased investment in R&D and global collaboration opportunities across sectors.

2017 Made Smarter UK review goals

- Faster Innovation and Adoption of IDTs for the UK
- Increase manufacturing sector growth between 1.5 & 3% p.a.
- Increase in jobs of 175,000

Made Smarter Innovation, as one of the Government’s Industrial Strategy Fund (ISCF) programmes, is investing £1.47m into creating a fully connected, dynamic manufacturing ecosystem inspiring innovation across academia, technology providers and manufacturers.

Made Smarter Innovation Targets by 2034

- £2.3bn increase in GVA
- 4000 skilled jobs created
- 30% productivity improvement
- 4.5% decrease in carbon emissions
- 25% decrease in waste

Delivered by:

- KTN
- UK Research and Innovation
Virtual product and process design - making new drugs, foods and products faster.

Machine Learning and Predictive Maintenance for zero defect digital welding.

Smart Connected Factories - transforming production in live manufacturing environments.

15% per year growth through 3D design and manufacture of blast furnace castings.

Intelligent biopharma manufacturing to meet the demand for vaccines.
Towards 2040....the key aspirations

- Connected Supply Chain
- Smart Factories
- Adaptable, Flexible Manufacturing
Thank you
Innovation Alley at Smart Factory Expo 2021

Sign up to be considered as an exhibitor on Innovation Alley at Smart Factory Expo.

10 - 11 Nov 21, Liverpool

https://info.ktn-uk.org/p/2VFU-8GQ/made-smarter-innovation-alley
Carl Perrin

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Creating a vision for UK manufacturing 2040

8th July 2021

Carl Perrin
Director – Institute for Clean Growth & Future Mobility
Clean Growth; Future Mobility

10 Key Solutions Needed to Reduce Greenhouse Gas Emissions

1. Phase out coal plants
2. Invest in clean energy & efficiency
3. Retrofit buildings
4. Decarbonize cement, steel & plastics
5. Shift to electric vehicles
6. Increase public transport
7. Decarbonize aviation and shipping
8. Halve deforestation & restore degraded lands
9. Reduce food loss and waste
10. Eat more plants & less meat

Source: WWF

The Global Challenges Research Fund explained.

The Ten Point Plan for a Green Industrial Revolution

- **Point 1**: Advancing Offshore Wind
- **Point 2**: Driving the Growth of Low Carbon Hydrogen
- **Point 3**: Delivering New and Advanced Nuclear Power
- **Point 4**: Accelerating the Shift to Zero Emission Vehicles
- **Point 5**: Green Public Transport, Cycling and Walking
- **Point 6**: Jet Zero and Green Ships
- **Point 7**: Greener Buildings
- **Point 8**: Investing in Carbon Capture, Usage and Storage
- **Point 9**: Protecting Our Natural Environment
- **Point 10**: Green Finance and Innovation
Electric car battery plant plan for Coventry Airport

16 February

An outline planning application for the gigafactory could be submitted later this year.

Coventry Airport could be the site for a 'gigafactory' - a plant to manufacture electric car batteries.

Blyth Power Station to be turned into UK's first 'gigafactory'

12 April

Construction of the "gigafactory" on the site of the former Blyth Power Station is due to start in the summer.

The UK's first "gigafactory" has moved a step closer after the firm behind it revealed it had purchased a former power station.
Sources of GHGs
Measuring Performance, Setting Targets

SCOPE 1
DIRECT

SCOPE 2
INDIRECT

SCOPE 3
INDIRECT

HFCs
CO₂
PFCs
CH₄
N₂O

Purchased Electricity for Own Use

Production of Purchased Materials
Summary – Triple Bottom Line

People

Planet

Profit
Thank You
Jill MacBryde

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Future Scenarios
Manufacturing in Scotland
2036

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Peter McKeirnan, Tim Reckordt, Carolina Marin Cadavid, Aylin Ates, Harry Sminia, Steve Paton
Remi Zante, Benoit Fernandez
The stages of future scenarios

1. Data collection-workbook
2. Driving forces identification – Ideas generation
3. Teams develop clusters from the initial driving forces (Workshop)
4. Ranking drivers of Clusters to Build Impact /uncertainty Matrix
5. Designing the scenarios matrix
6. Populating the scenarios matrix
7. Creating scenarios narrative
8. Testing scenarios
The impact predictability matrix

Using the ranking process to arrive at the highest impact/most uncertain clusters

- Workforce & capabilities
- Technological infrastructure
- Supply base
- Sustainability & Climate Change
- Supply chain governance
- New ways of work in manufacturing
- Financial environment & Government intervention
- Availability of finances
- International trade & relationships
- Political Environment
- Innovation & diffusion
- New ways of work in manufacturing
- Life-long learning
International Trade and Relationships

Working like a donkey
- Technological advancements imported
- National technology exported and development
- International trade deals and under-minds domestic production
- Low levels of capital vs labour in the manufacturing process
- Use of international low cost labour
- Productivity levels below the UK average
- Uncompetitive supply base is unattractive to international supply chains
- Scottish branded products thrive
- Race to the bottom culture
- Limited access to investment finance, mainly only available through international companies
- Buying in carbon neutral tech technology

Hidden like a turtle in a shell
- Mixed messaging over manufacturing
- Instability around Brexit and referendum
- Lack of access to global skills and knowledge base
- Limited pool of national talent
- Limited connection to international networks
- Suppliers struggling to be properly connected
- Installed equipment not fit of purpose
- Few major decisions made in Scotland
- Disconnected and uncoordinated supply base
- Gaps in the supply base
- Restrictive and reduced levels of funding
- Scotland imports all carbon neutral technology
- Strategic skills development fragmented

Gliding like a dolphin
- Highly skilled international workforce
- High levels of training and learning
- Digital manufacturing attracts young people
- World leading technological infrastructure
- Digitally connected supply base
- Expanded transport infrastructure
- High levels of decision making authority
- Capable and diverse supply base
- Rich and extensive sources of funding
- Relatively stable political environment
- Sustained political support
- Scotland is not exporter of carbon neutral technology

Hibernating like a polar bear
- Strong public investment and innovation programmes
- Limited international collaboration to innovate and trade
- High level and continuous training programmes
- Restrictive immigration rules affecting access to international skilled workforce
- High levels of cutting-edge technology
- Limited exports and capitalisation of domestically developed innovation
- High level of use of manufacturing service platforms locally
- Limited access to investment finance, mainly only available through the government
- Narrowed access to international supply base
- Reduced use of available manufacturing capacity
- Barriers to export carbon neutral technology
- Strong decision making authority locally

Innovation and diffusion

Active

Flexible

Constrained

Passive
Special thanks to UKRI, ESRC. Work carried out as part of grant ES/V015621/1 “Understanding the impact of the Covid-19 crisis on UK manufacturing and identifying priorities for renewal through innovation”
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Meet the Panel

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Dean, University of London and member of the IET Manufacturing Policy Panel

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CEO, Institute for Future Transport and Cities

Sam Turner
Chief Technology Officer, High Value Manufacturing (HVM) Catapult

Professor Jill MacBryde
Professor of Innovation and Operations Management, Strathclyde University

Nicole Ballantyne
Knowledge Transfer Manager, KTN

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Your views are important to us

We welcome your views and collaboration both today and beyond to help us achieve this. This ensures that we can keep professionals and wider society reliably informed about the key issues of today, while horizon-scanning to understand the trends and developments that will impact the engineers of the future.

To get involved contact us sep@theiet.org