The Institution of Engineering and Technology

Institution of MECHANICAL ENGINEERS

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

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#Manufacturing2040

Rajkumar Roy
Sam Turner
Nicole Ballantyne
Carl Perrin
Jill MacBryde

Ask questions at sli.do #Manufacturing2040

Rajkumar Roy

Ask questions at sli.do #Manufacturing2040

UK Manufacturing 2040

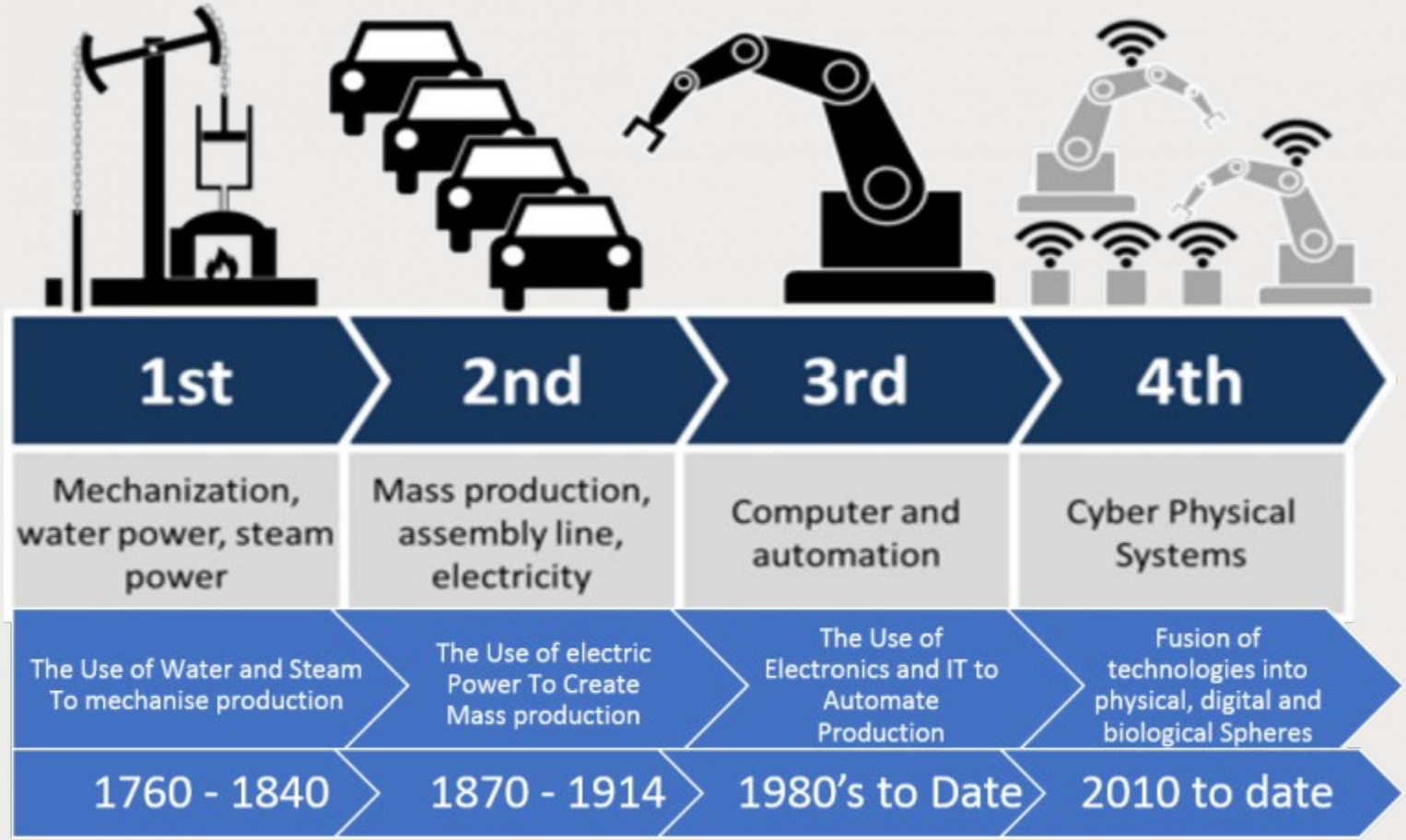
An IET Initiative

Professor Rajkumar Roy, Dean

School of Mathematics, Computer Science and Engineering

Email: r.roy@city.ac.uk

6th Industrial Revolution by 2040!

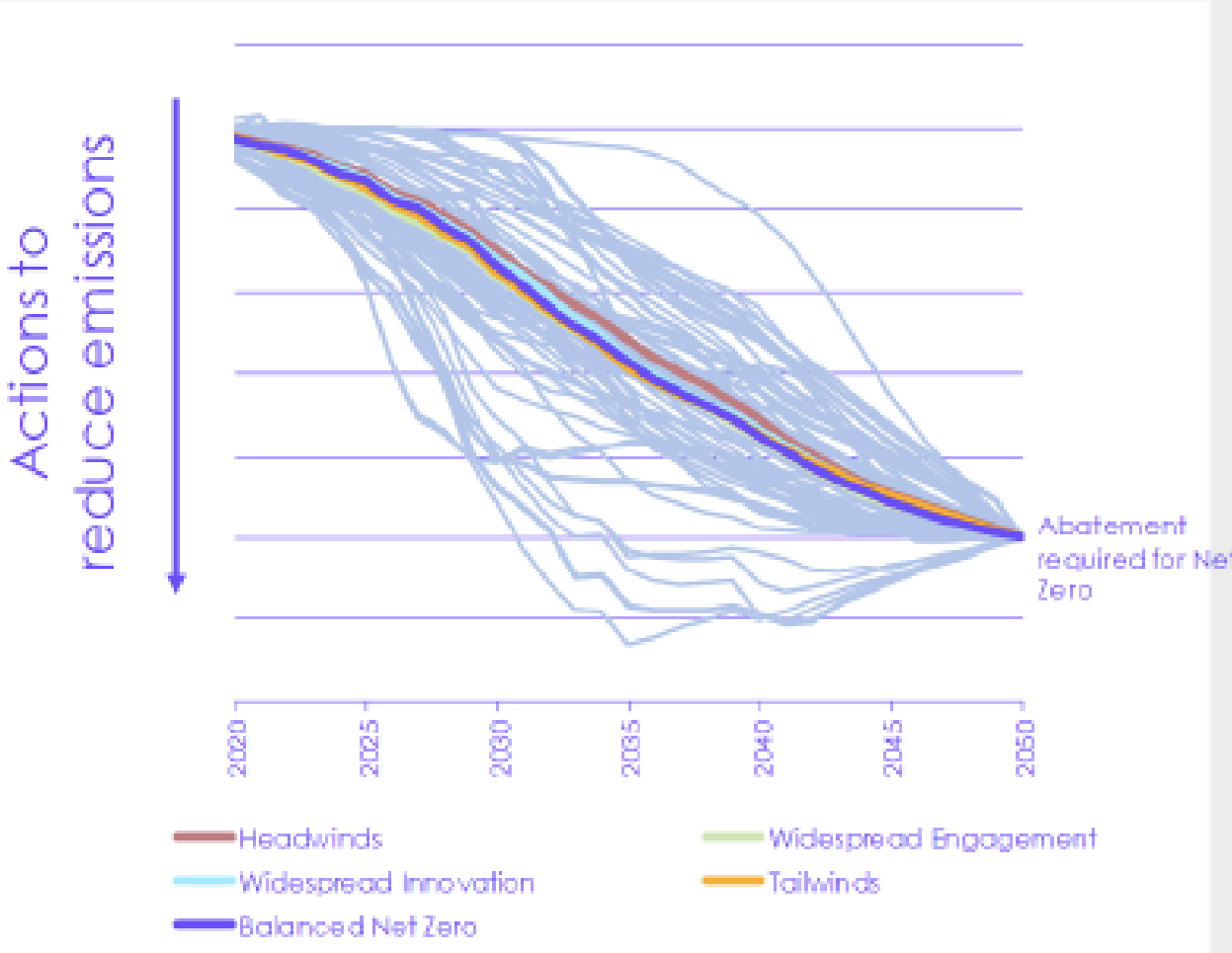


?

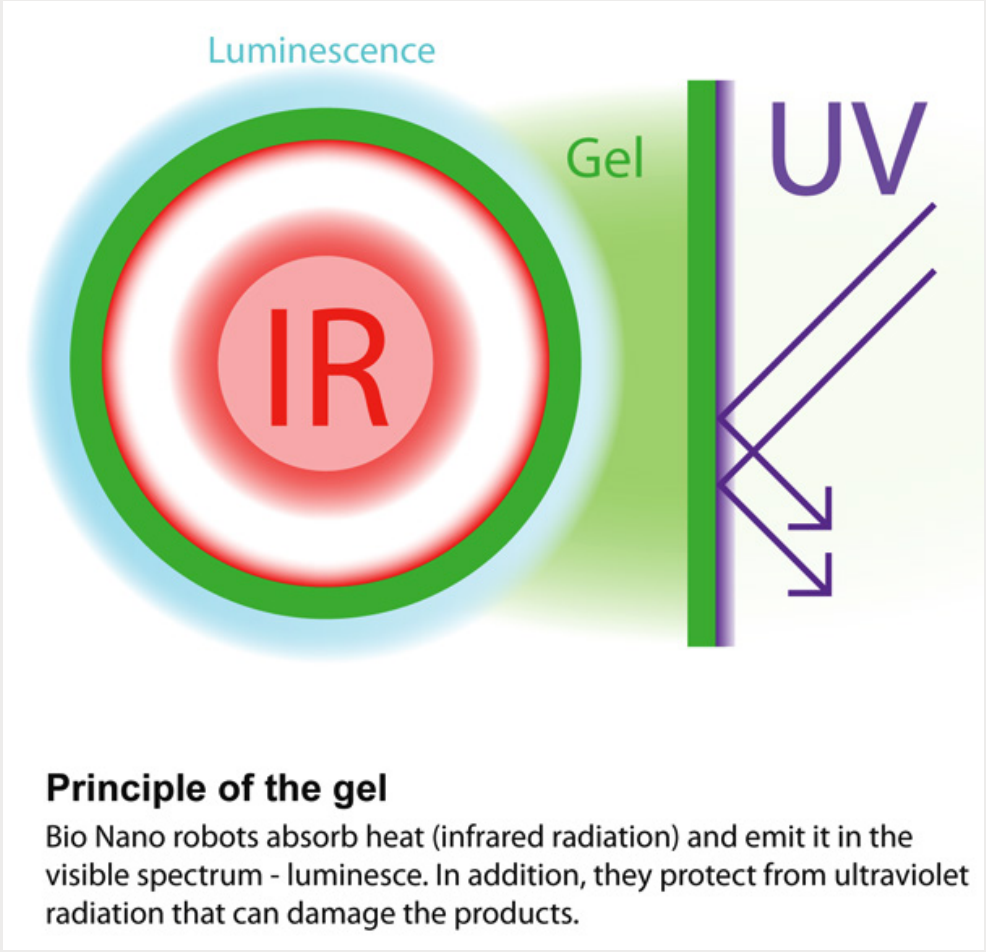
6th

2040

Balanced Net Zero Pathway – 2050: The sixth Carbon Budget



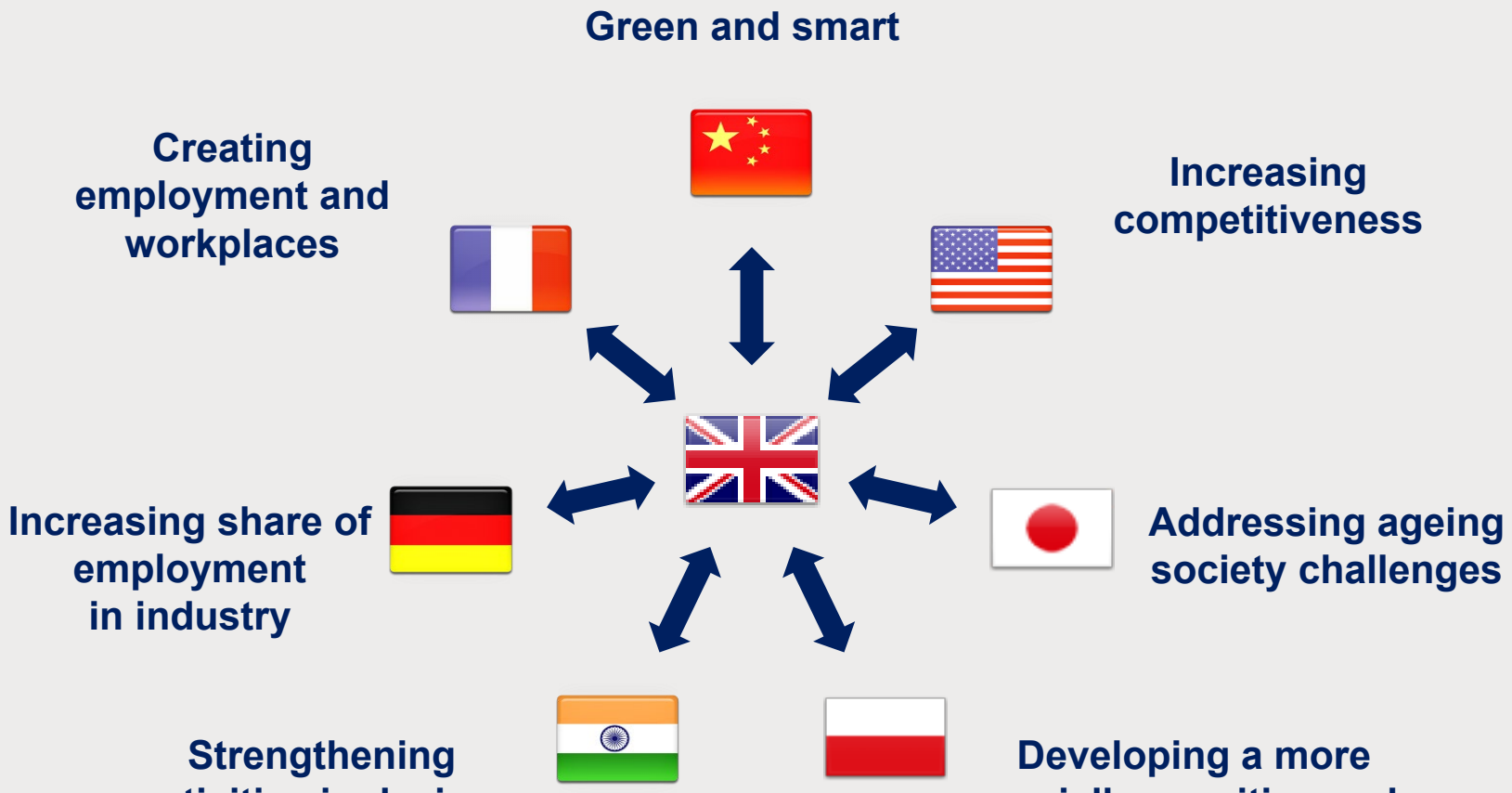
Zero-energy Bio Fridge – new materials



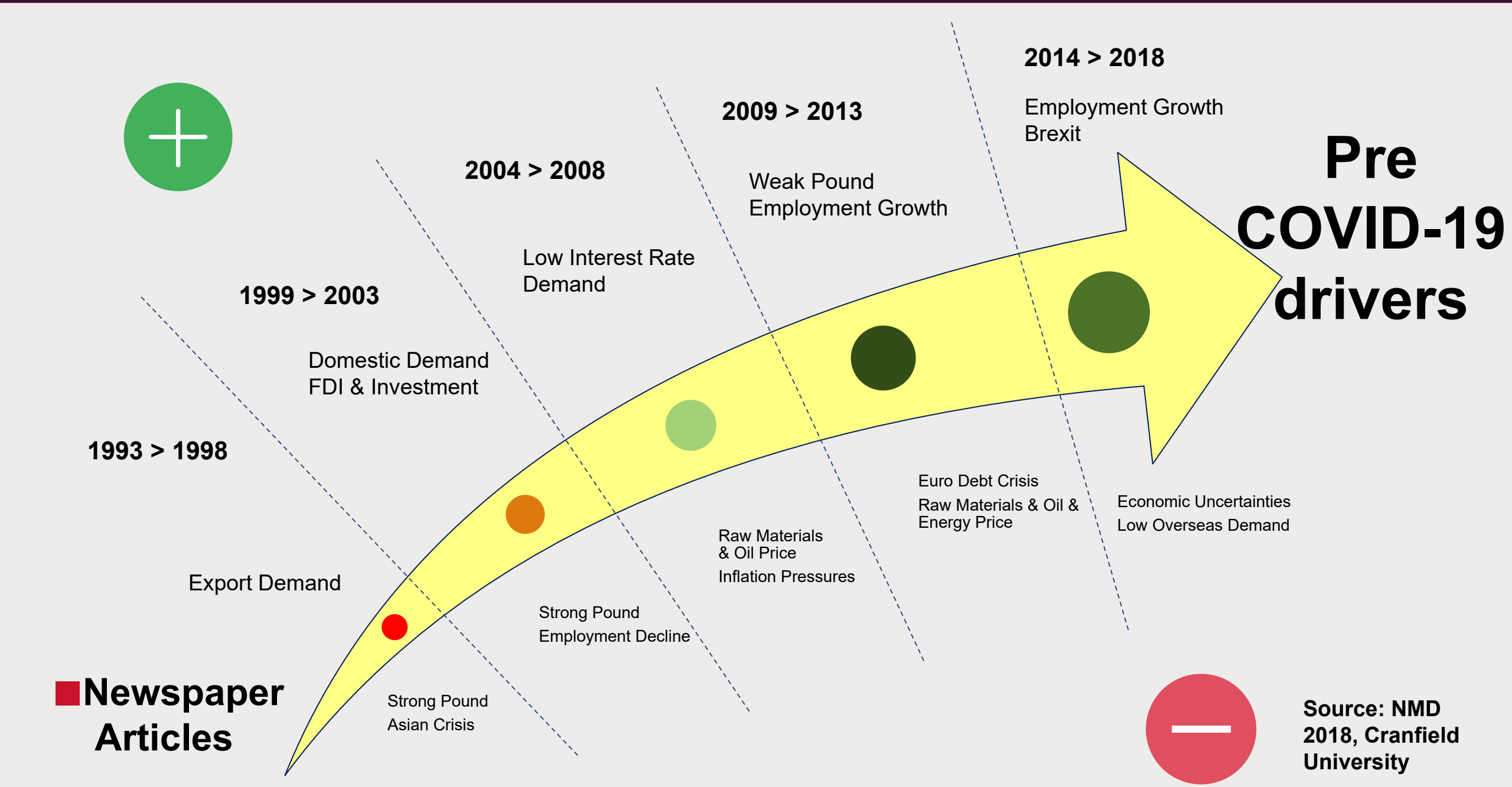
Principle of the gel

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



Source: Strategies of the countries;
NMD 2018, Cranfield University

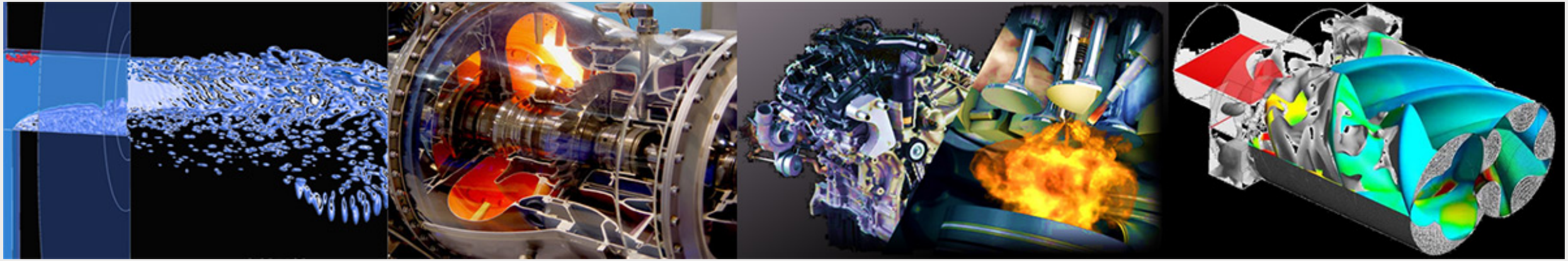

2014 > 2018
Employment Growth
Brexit
2009 > 2013
Weak Pound
Employment Growth
2004 > 2008
Low Interest Rate
Demand
1999 > 2003
Domestic Demand
FDI & Investment
1993 > 1998
Export Demand
Strong Pound
Asian Crisis
Strong Pound
Employment Decline
Raw Materials
& Oil Price
Inflation Pressures
Euro Debt Crisis
Raw Materials & Oil &
Energy Price
Economic Uncertainties
Low Overseas Demand
Pre COVID-19 drivers
Newspaper Articles
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

Ask questions at sli.do #Manufacturing2040

FUTURE MANUFACTURING ENGINEER

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

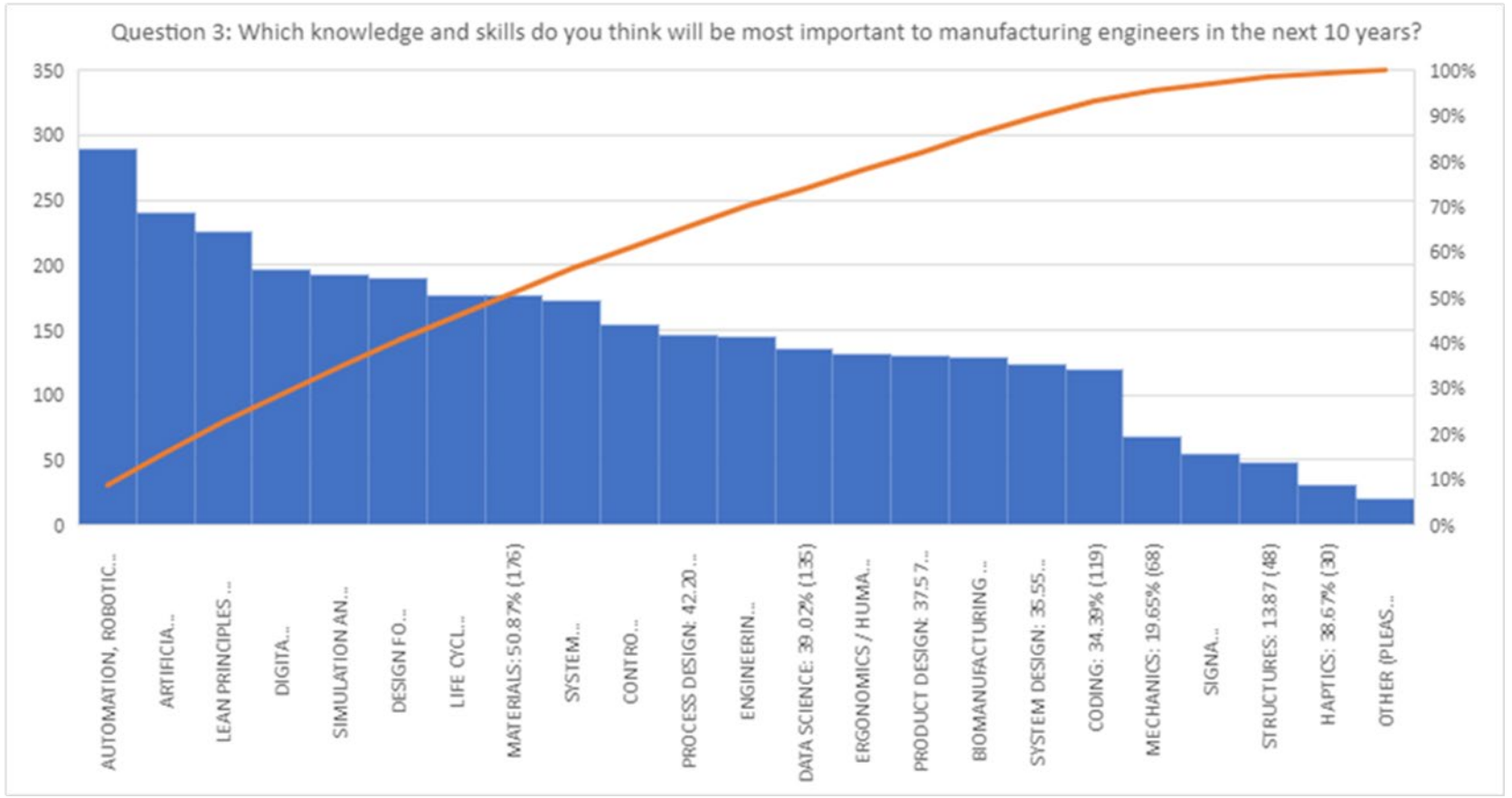
Institution of MECHANICAL ENGINEERS

IET The Institution of Engineering and Technology

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?

WHAT WILL BE THE MOST IMPORTANT KNOWLEDGE AND SKILLS IN THE NEXT 10 YEARS?

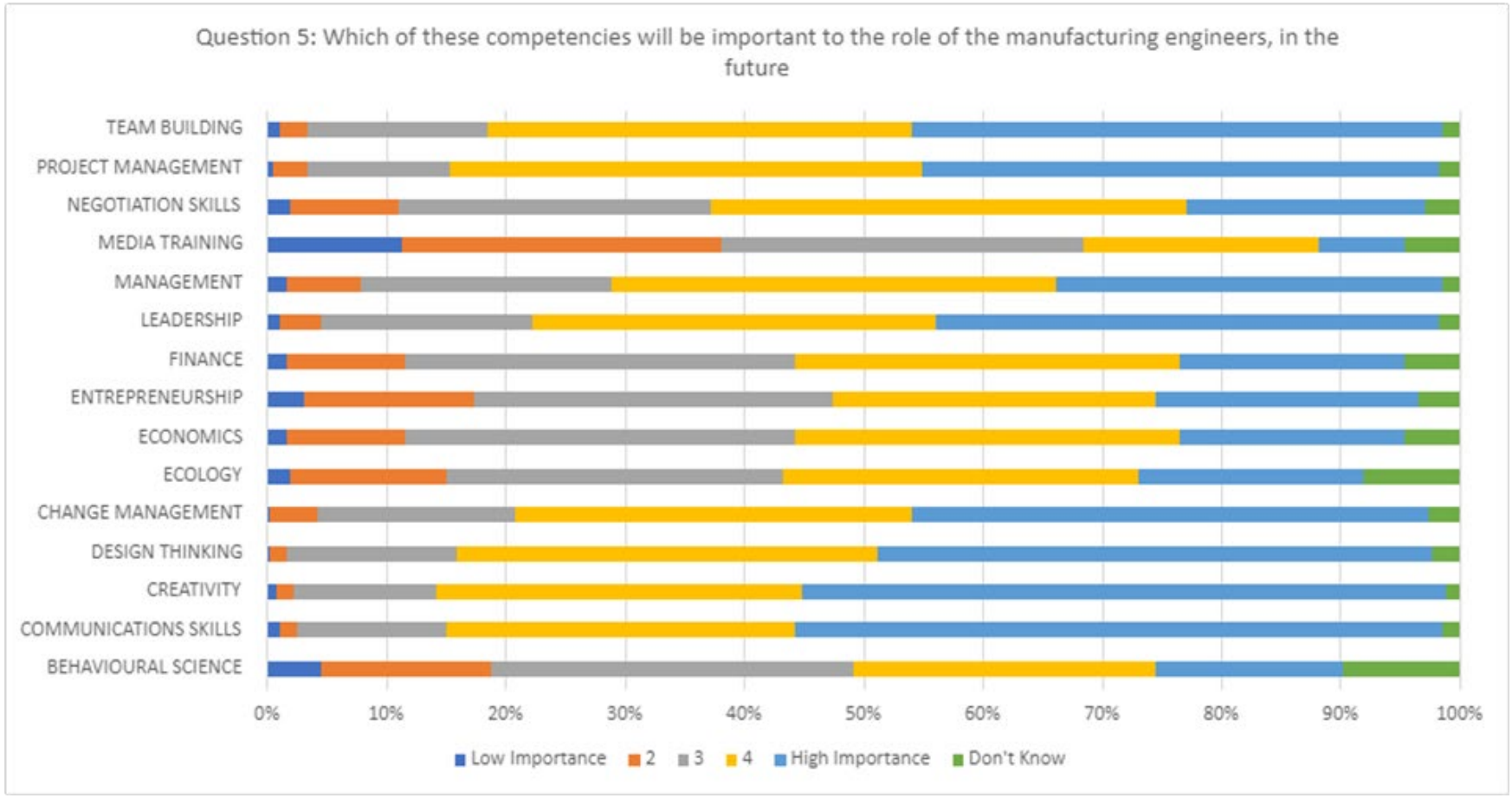


- Many respondents **most interested in working in the energy and circular economy sectors in the future**.

- 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

MULTI DISCIPLINARY

Communication skills, creativity and design thinking ranked as the top three non-engineering competencies of 'highest importance' for future manufacturing engineers.

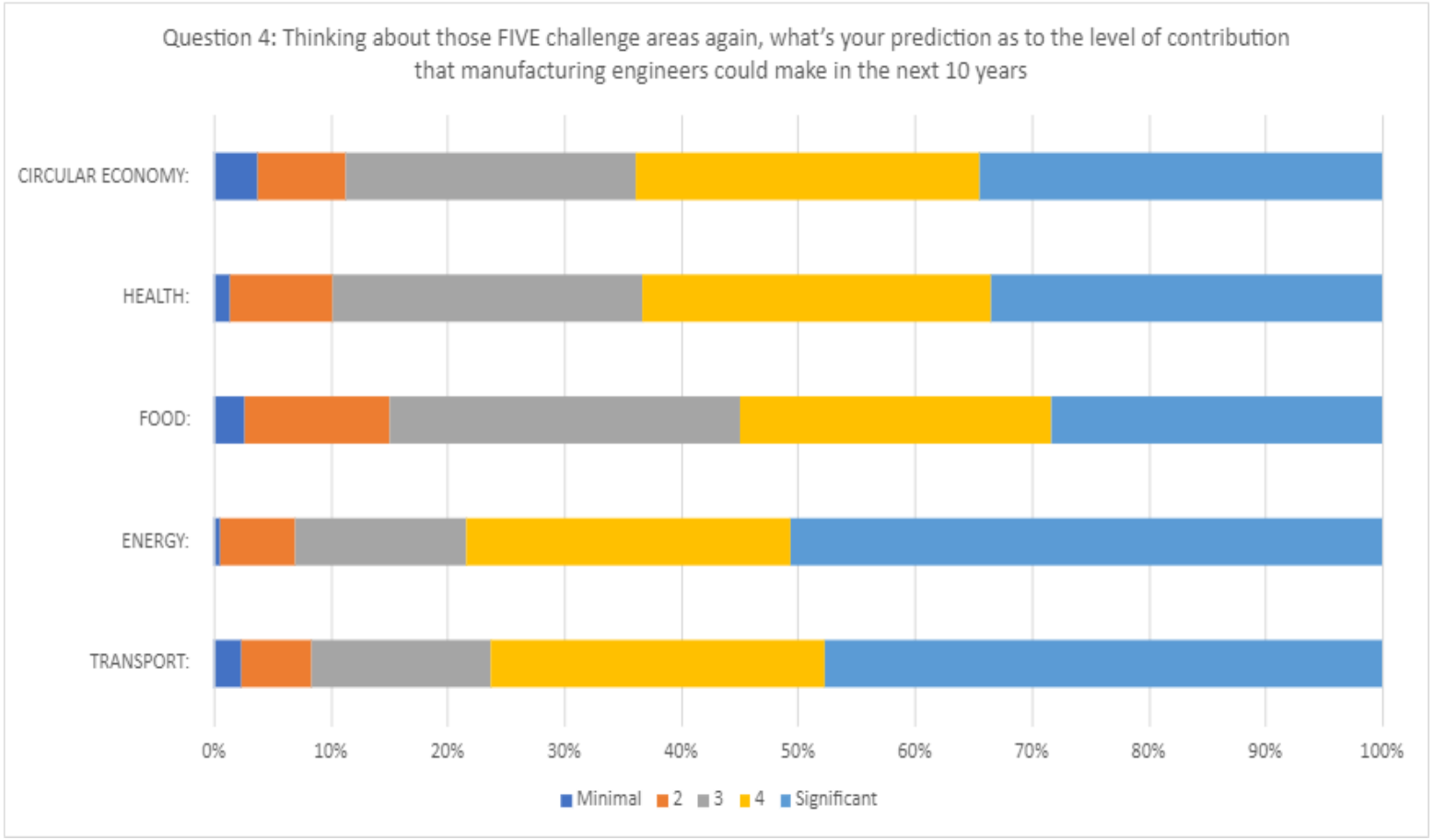


'Future engineers will be part of a cohesive team where interpersonal skills will be paramount to ensure an efficient outcome'

'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'.

FUTURE CHALLENGE AREAS

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

Ask questions at sli.do #Manufacturing2040

8th July 2021

Manufacturing 2040

Nicole Ballantyne :
Knowledge Transfer Manager - Manufacturing

ktn

UKRI UK Research and Innovation

MADE SMARTER INNOVATION NETWORK

MADE SMARTER | INNOVATION NETWORK

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.

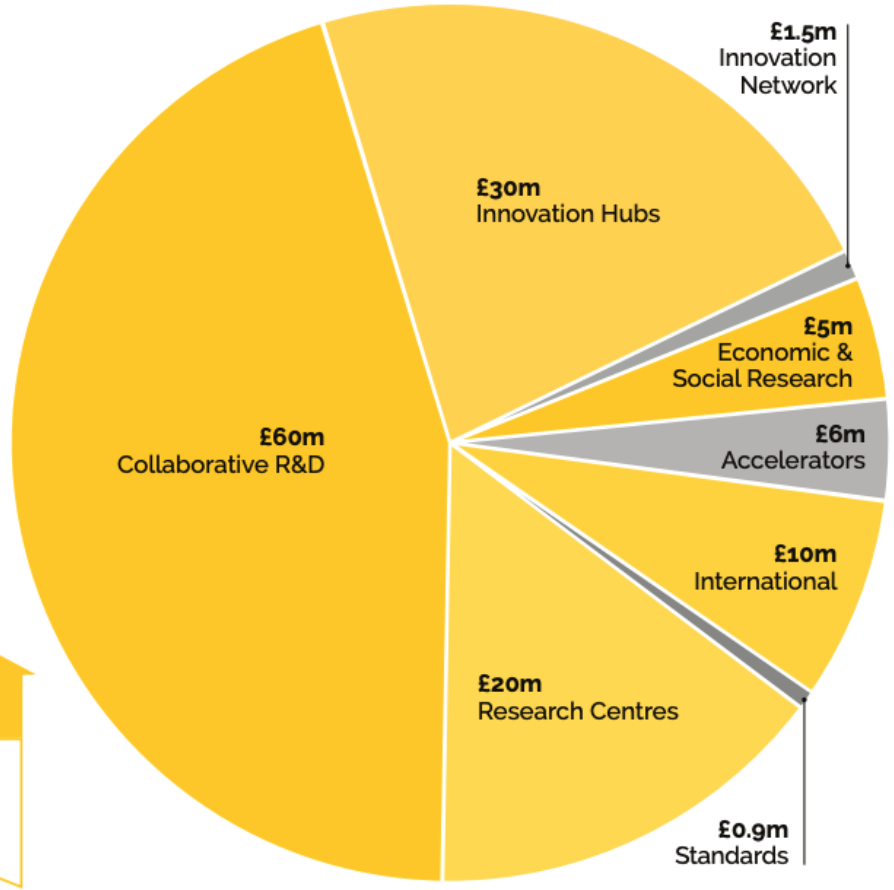
2017 Made Smarter **UK review goals**

Faster Innovation and Adoption of IDTs for the UK
£455bm

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 £147m into creating a fully connected, dynamic manufacturing ecosystem inspiring innovation across academia, technology providers and manufacturers.



Made Smarter **Innovation Targets by 2034**

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

DELIVERED BY ktn | UK Research and Innovation

Virtual product and process design - making new drugs, foods and products faster.

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

Machine Learning and Predictive Maintenance for zero defect digital welding.

Smart Connected Factories - transforming production in live manufacturing environments.

Intelligent biopharma manufacturing to meet the demand for vaccines.

Connected Supply Chain

Smart Factories

Adaptable, Flexible Manufacturing

Towards 2040….the key aspirations

nicole.ballantyne@ktn-uk.org

Thank you

MADE SMARTER | INNOVATION NETWORK

DELIVERED BY ktn | UKRI UK Research and Innovation

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

Ask questions at sli.do #Manufacturing2040

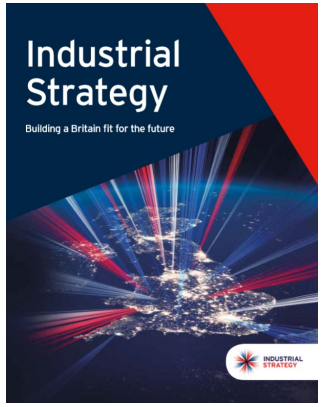
Creating a vision for UK manufacturing 2040

8th July 2021

Carl Perrin

Director – Institute for Clean Growth & Future Mobility

Clean Growth; Future Mobility



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

Clean Growth; Future Mobility

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Electric car battery plant plan for Coventry Airport

16 February

COVENTRY CITY COUNCIL

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.

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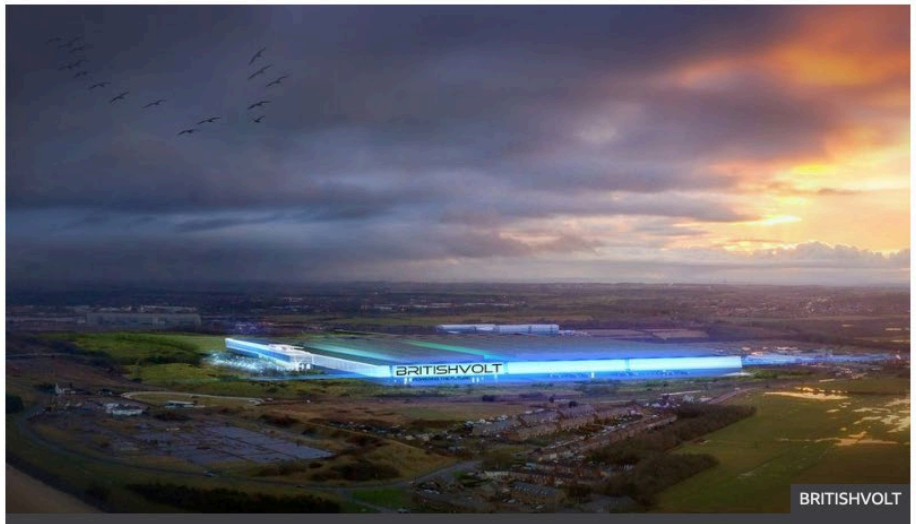
Blyth Power Station to be turned into UK's first 'gigafactory'

12 April

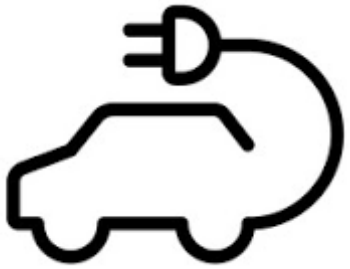


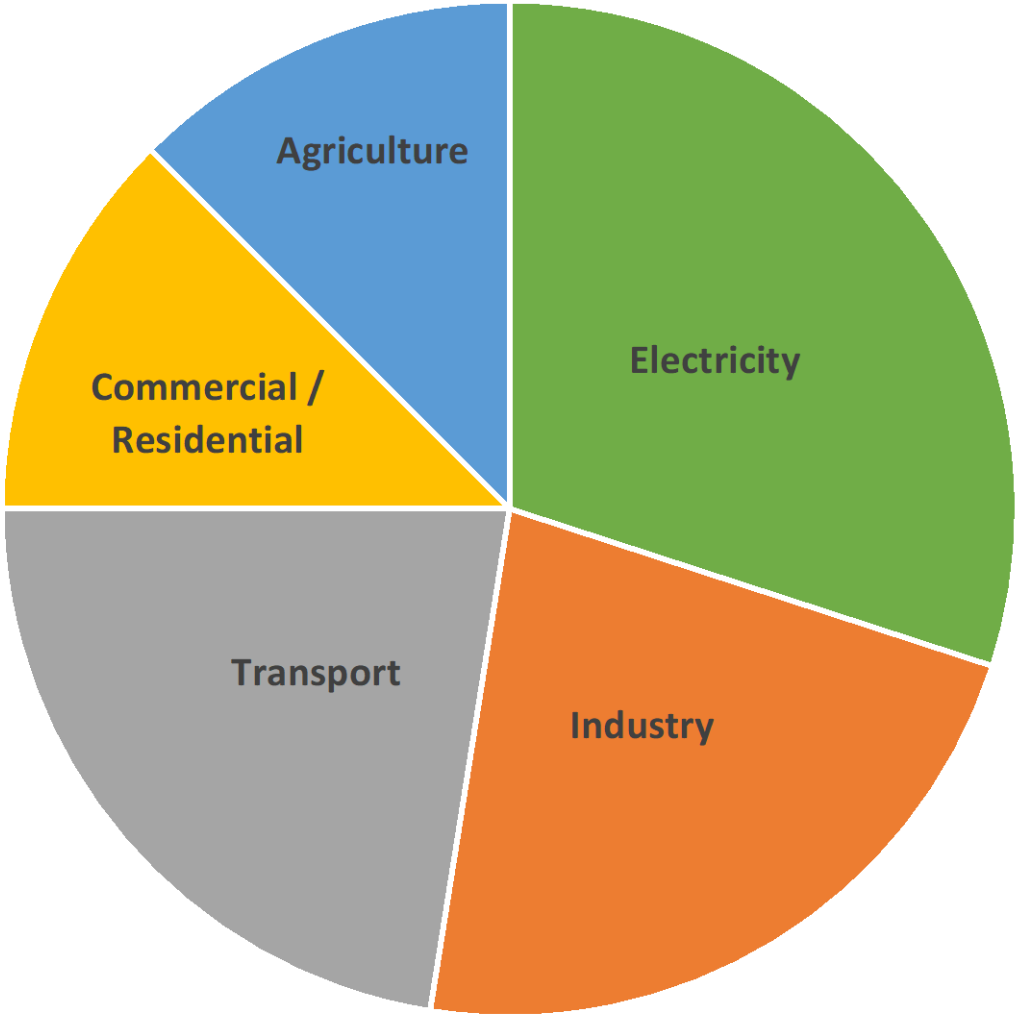
BRITISHVOLT

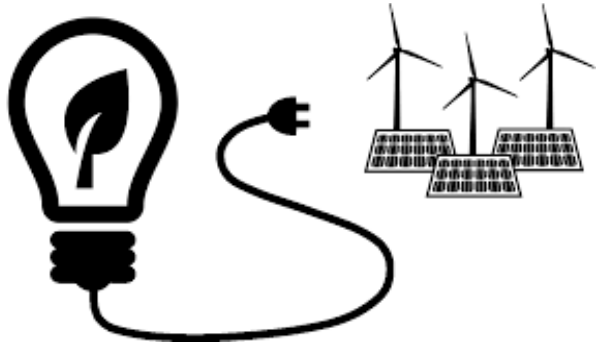
Construction of the "gigafactory" on the site of the former Blyth Power Station is due to start in the summer

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



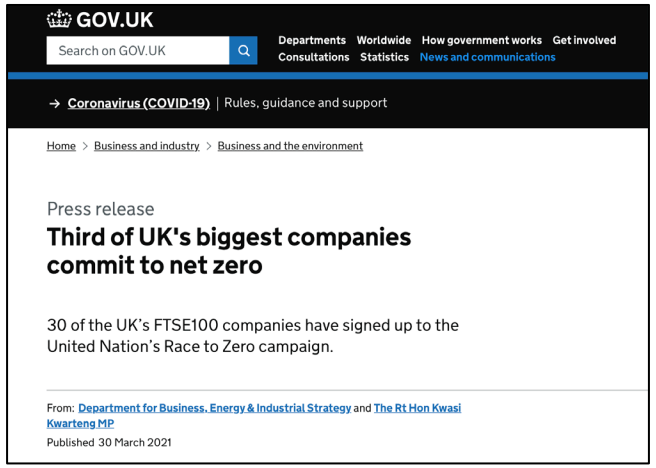




Taking Action; Addressing Climate Change

Research Institute
Clean Growth & Future Mobility

Coventry University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Press release

Third of UK's biggest companies commit to net zero

30 of the UK's FTSE100 companies have signed up to the United Nation's Race to Zero campaign.

From: Department for Business, Energy & Industrial Strategy and The Rt Hon Kwasi Kwarteng MP

Published 30 March 2021

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gsk GlaxoSmithKline

Unilever

Berkeley Group

TESCO

AVIVA

PHOENIX GROUP

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vodafone

Entain

BARRATT DEVELOPMENTS PLC

BT

IAG INTERNATIONAL AIRLINES GROUP

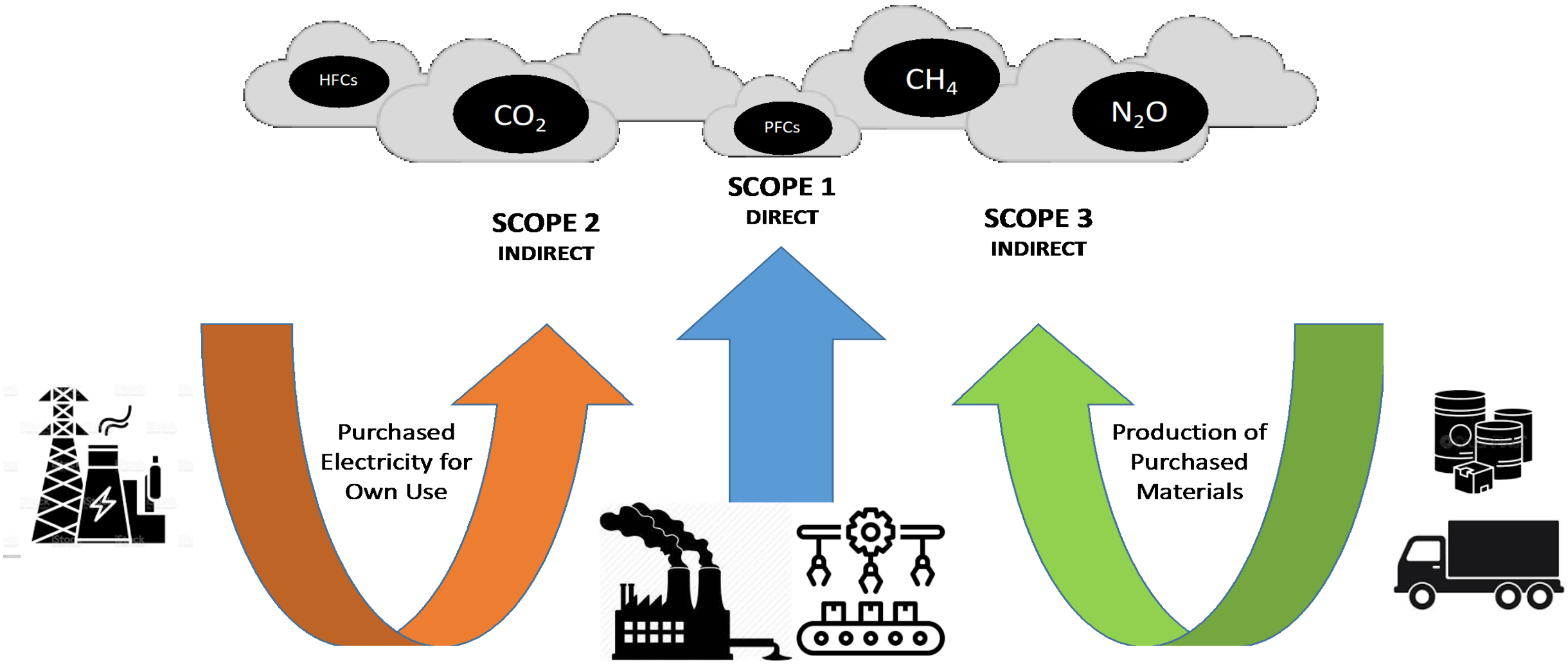
WPP

Rolls-Royce

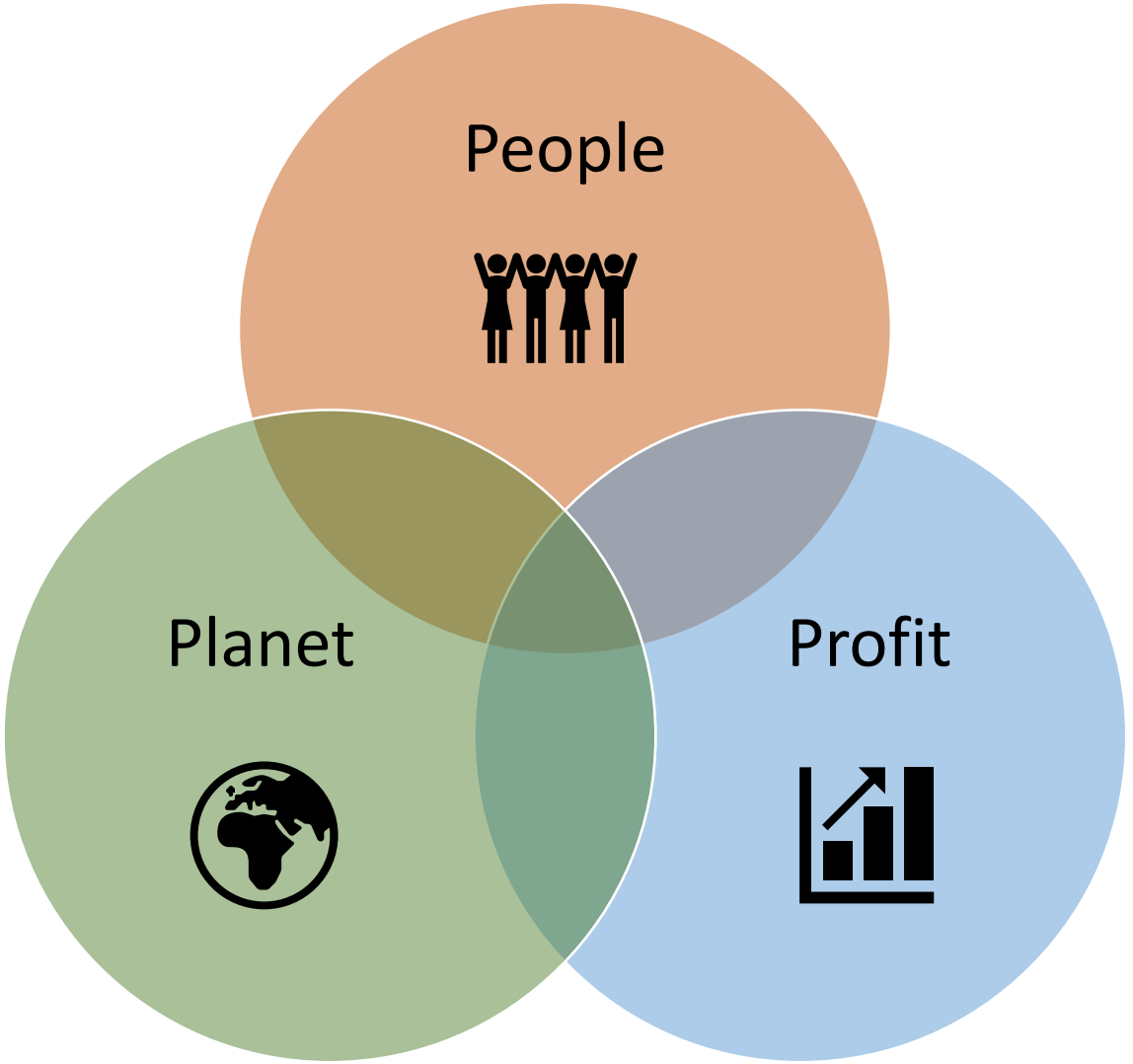
Sainsbury's

2020 2025 2030 2035 2040 2045 2050

Measuring Performance, Setting Targets



Summary – Triple Bottom Line




Coventry
University
Thank You

Jill MacBryde

Ask questions at sli.do #Manufacturing2040

Future Scenarios Manufacturing in Scotland 2036

Professor Jillian MacBryde

University of Strathclyde

jillian.macbryde@strath.ac.uk

Peter McKeirnan, Tim Reckordt, Carolina Marin Cadavid, Aylin Ates, Harry Sminia, Steve Paton

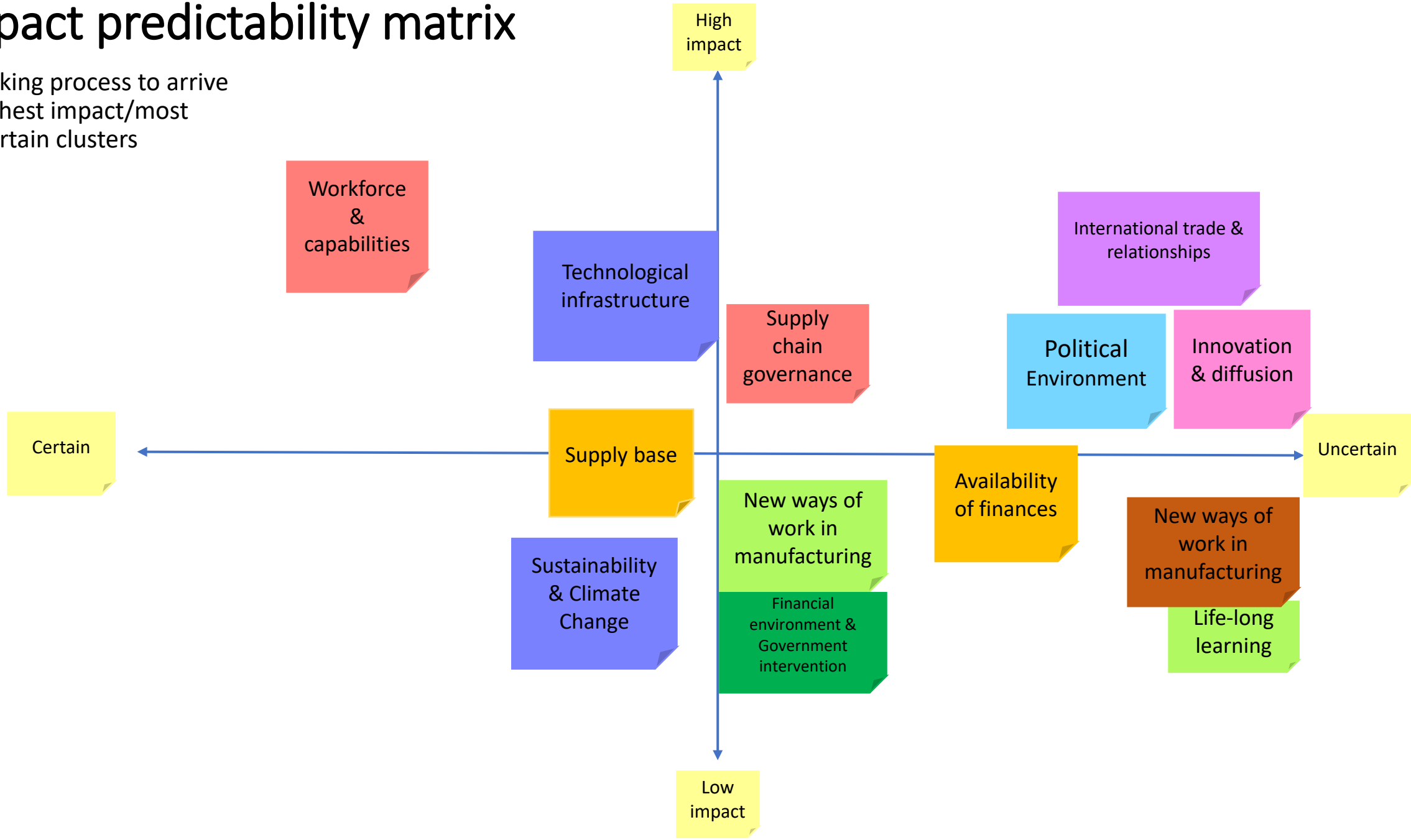
Remi Zante, Benoit Fernandez

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



International Trade and Relationships

Flexible

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

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 net exporter of carbon neutral technology

Innovation and diffusion

Passive

Active

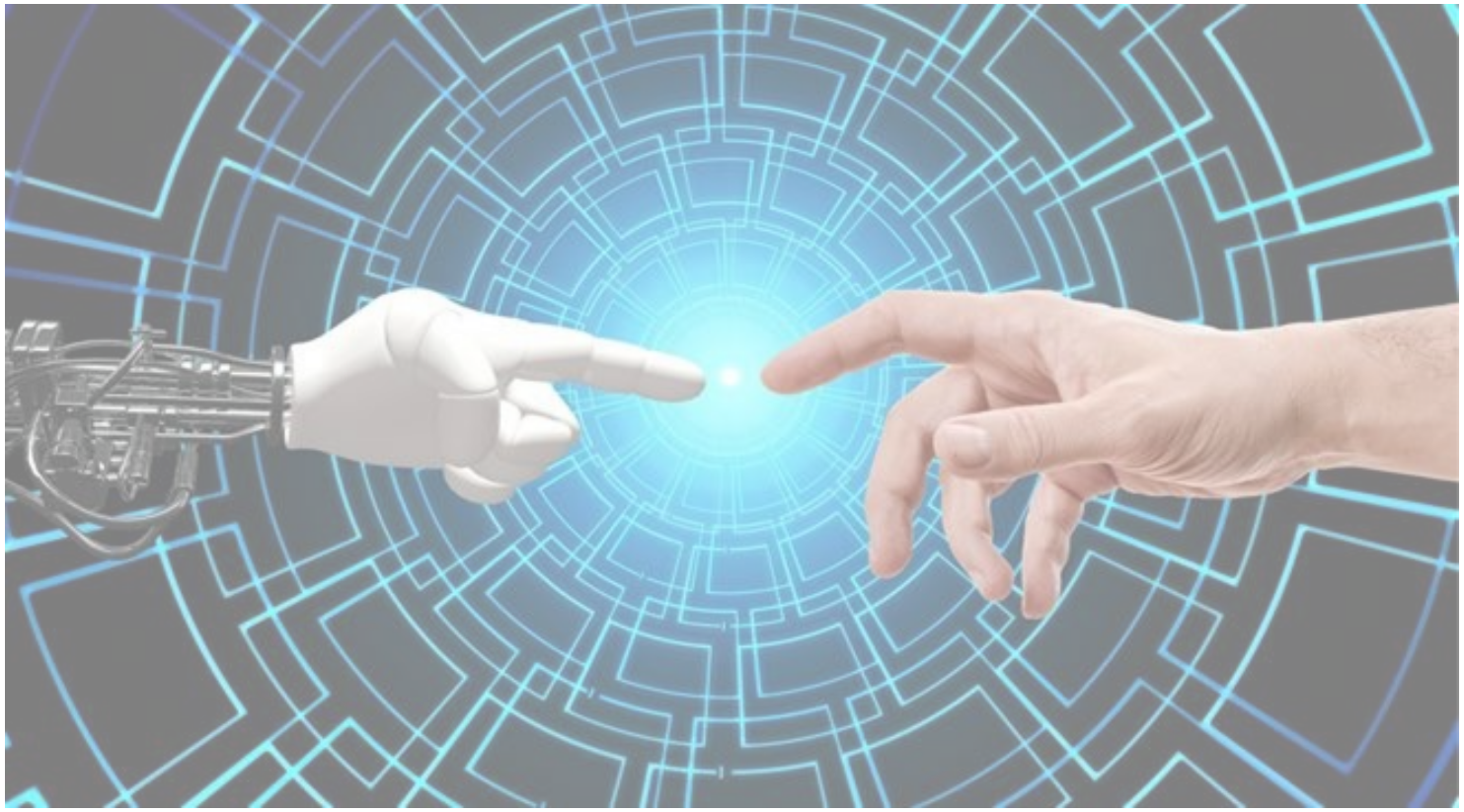
- Mixed messaging over manufacturing
- Instability around Brexit and referendum
- Lack of access to global skills and knowledge base
- Limited pool of national talent
- Limited connection to international networks
- Suppliers struggling to be properly connected
- Installed equipment not fit of purpose
- 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

- 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

Constrained

Hidden like a turtle in a shell

Hibernating like a polar bear



University of Strathclyde Glasgow

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”

Questions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Meet the Panel

Prof Rajkumar Roy

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

Carl Perrin

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

Ask questions at sli.do #Manufacturing2040

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