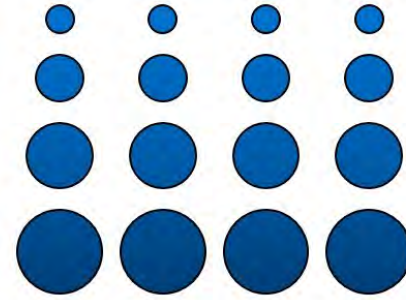


EP SRC Network Plus

Digitalised

Surface



Manufacturing

Network

RSC INTEREST GROUP VIRTUAL MEETING 8 DECEMBER 2021

EPSRC NetworkPlus In Digitalised Surface Manufacturing Allan Matthews University of Manchester and The Henry Royce Institute

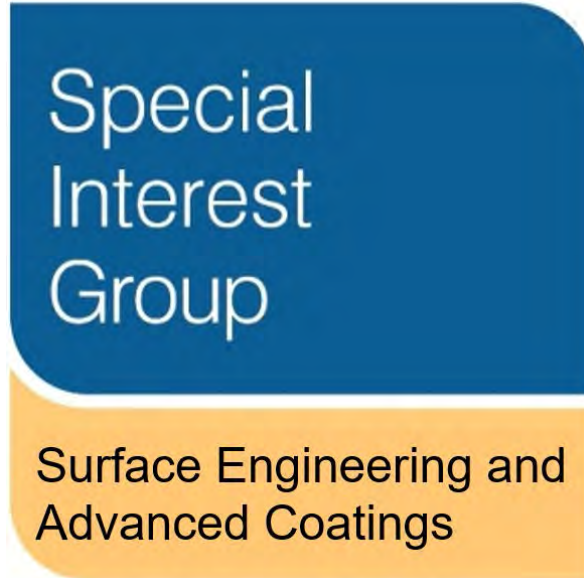


What do we mean by
Digitalised Surface Manufacturing?

Put simply, this means being able to represent in digital form all coatings and the processes by which they are produced.

Digitalisation has been found to be particularly vital for the
Surface Manufacturing sector.

Report from KTN on SEAC



In June 2014 a Special Interest Group established by the KTN to examine the **Surface Engineering and Advanced Coatings (SEAC)** sector produced a Report which has achieved buy-in from across the sector (Industry and Academia) and this is leading to major changes.

TIME FOR STRATEGIC CHANGE: UK SURFACE ENGINEERING AND ADVANCED COATINGS INDUSTRY

A REPORT BY THE SEAC SPECIAL INTEREST GROUP



The report can be downloaded by following the link below.

https://connect.innovateuk.org/web/material/sktn/article-view/-/blogs/surface-engineering-and-advanced-coatings-report?p_p_auth=M1BcARlz

Also Important: UK Government Policy

Forging our future: Industrial Strategy - the story so far.

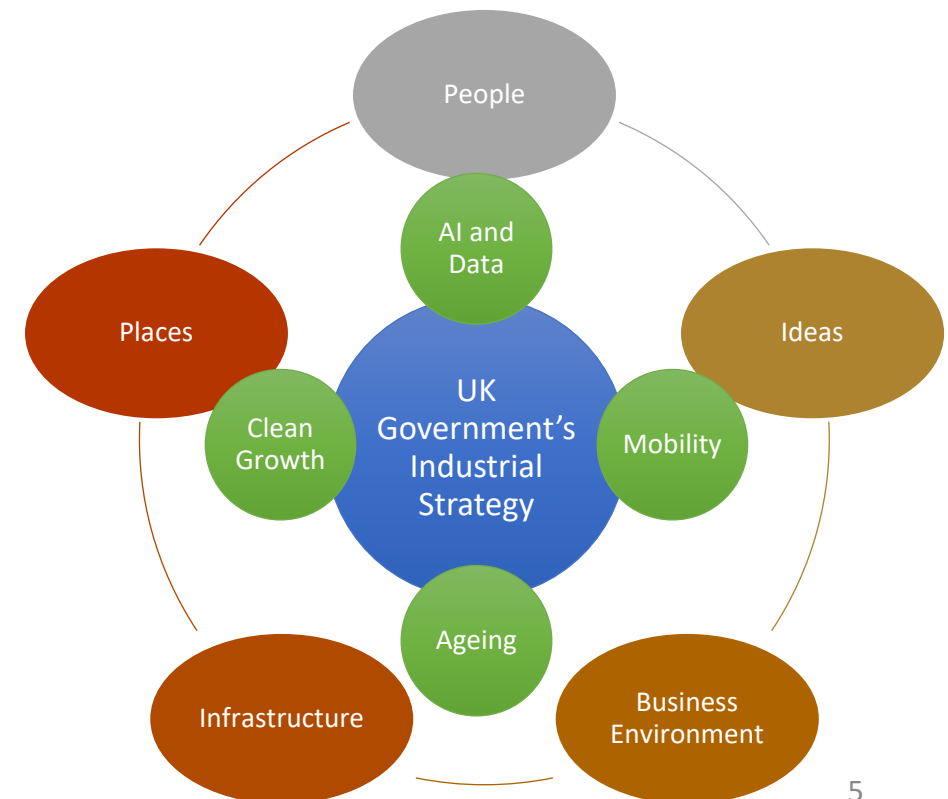
A Government policy paper (published December 2018)

The aim is to build on the strengths in the UK and lead the industries of the future via 4 pillars (grand challenges) and 5 drivers of productivity.

The Made Smarter report estimated **benefits of adopting Industrial Digital Technologies** to be upto **£455bn in next decade** for UK manufacturing sector.

The UK coating manufacturing industry is worth £11bn and the related products/applications £140bn.

Currently, **no UK university has all the required interdisciplinary expertise** and there is lack of connected knowledge in the area of digitalisation in surface engineering.

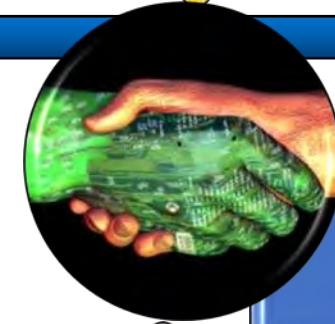


UK Government's Made Smarter Review, 2017:

“The UK is behind other advanced nations in overall productivity (output per worker), which is in part due to lower levels of adoption of digital and automation technology. This is particularly acute among SMEs”

Why Digitalise? (Manufacturing is going digital)

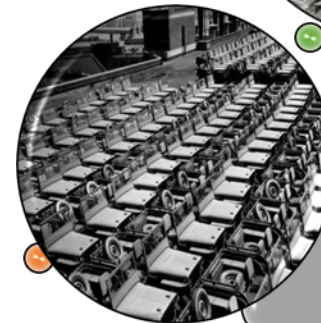
- **Industry 4.0** – current trend in manufacturing technology based on the *Smart Factory* concept including AI
- **Smart Factory** - modular *Cyber-Physical Systems* monitor and control manufacturing processes
- Manufacturing is **Digitalised** and carried out **On-Demand** and often to **Near-Net Shape**



4.0
Smart factory



3.0
PC & Automation



2.0
Mass production

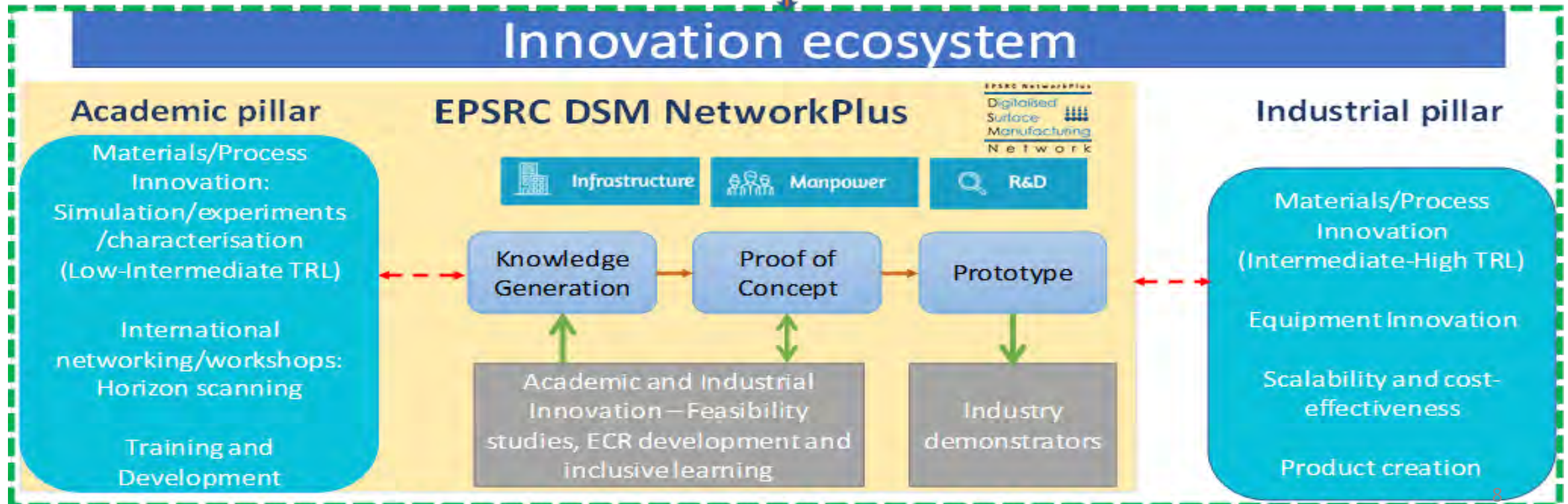


1.0
Mechanisation

Positioning of DSM



Innovation ecosystem



THE 7 WASTES

How can Digital Manufacturing improve productivity?

VALUE ADDED

OVERPRODUCTION

Creating too much material or information

OVERPROCESSING

Processing more than necessary to produce the desired output

INVENTORY

Having more material or information than you need

DEFECTS

Errors or mistakes causing the effort to be redone to correct the problem

TRANSPORTATION

Moving material or information

WAITING

Waiting for material or information, or material or information waiting to be processed

MOTION

Moving people to access or process material or information



Over production

Defects

Over processing

Removing waste adds value and improves productivity, particularly for the Coatings sector.

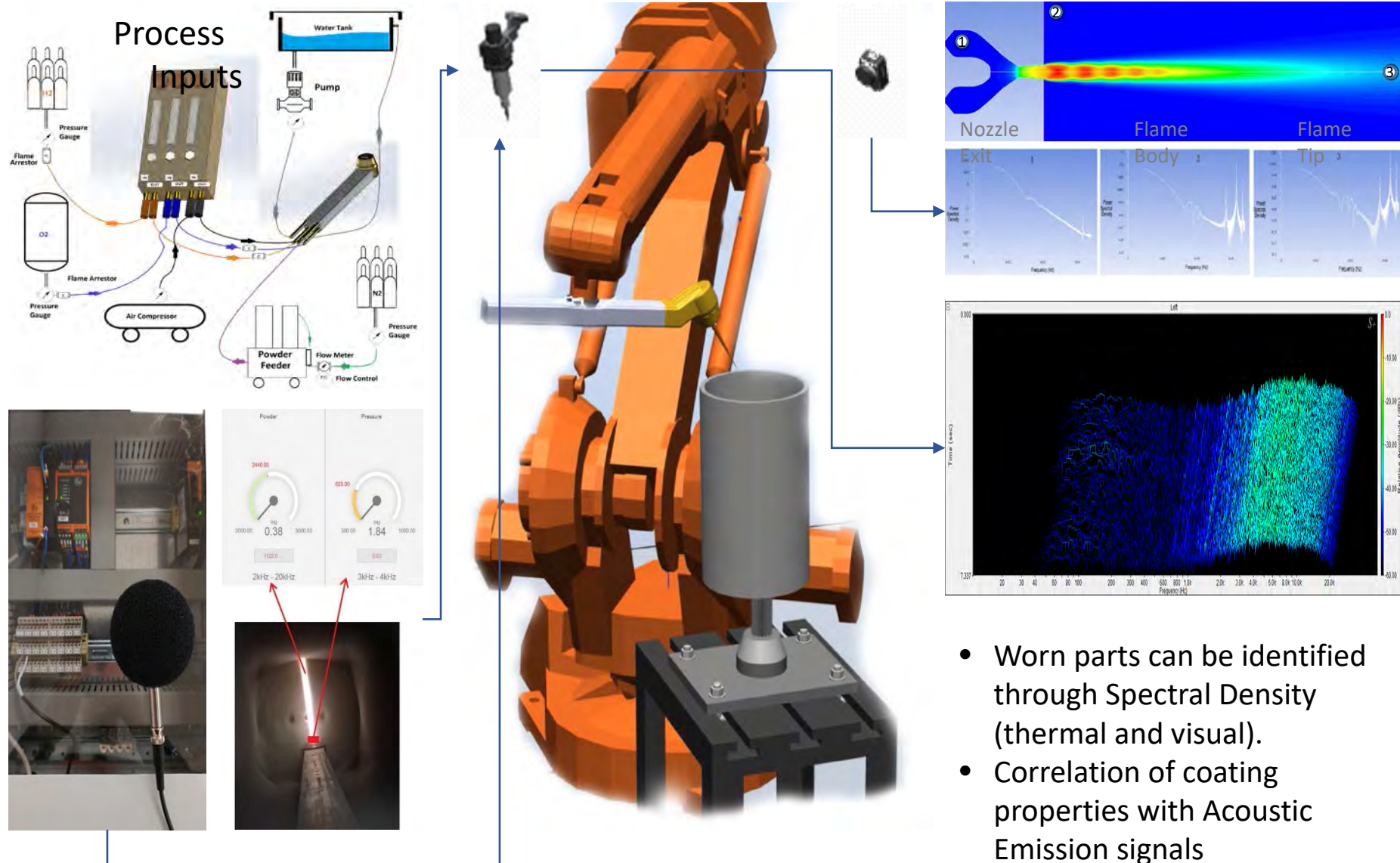


Extended from:
<http://quotesgram.com/quotes-on-waste-lean/>

The overall benefits for closing the “Digital Gap” can be summarised as follows:

- Better utilisation of assets
- Reduce dependency on tacit knowledge
- Reduce the time and cost linked to product verification
- Improves and gives visibility to all business performance metrics – Yield, Right First Time, Cost, Delivery, Quality and Equipment Effectiveness
- Enables and improves Design for Manufacture
- Opens up new business opportunities
- Provides a framework for developing a resilient business

To achieve IoT Integration, coating processes must be fully digitally monitored using cyber physical devices. Example: HVOF Thermal Spray Coatings (Courtesy Bryan Allcock)



- Worn parts can be identified through Spectral Density (thermal and visual).
- Correlation of coating properties with Acoustic Emission signals
- Noise peaks can be identified from process issues.

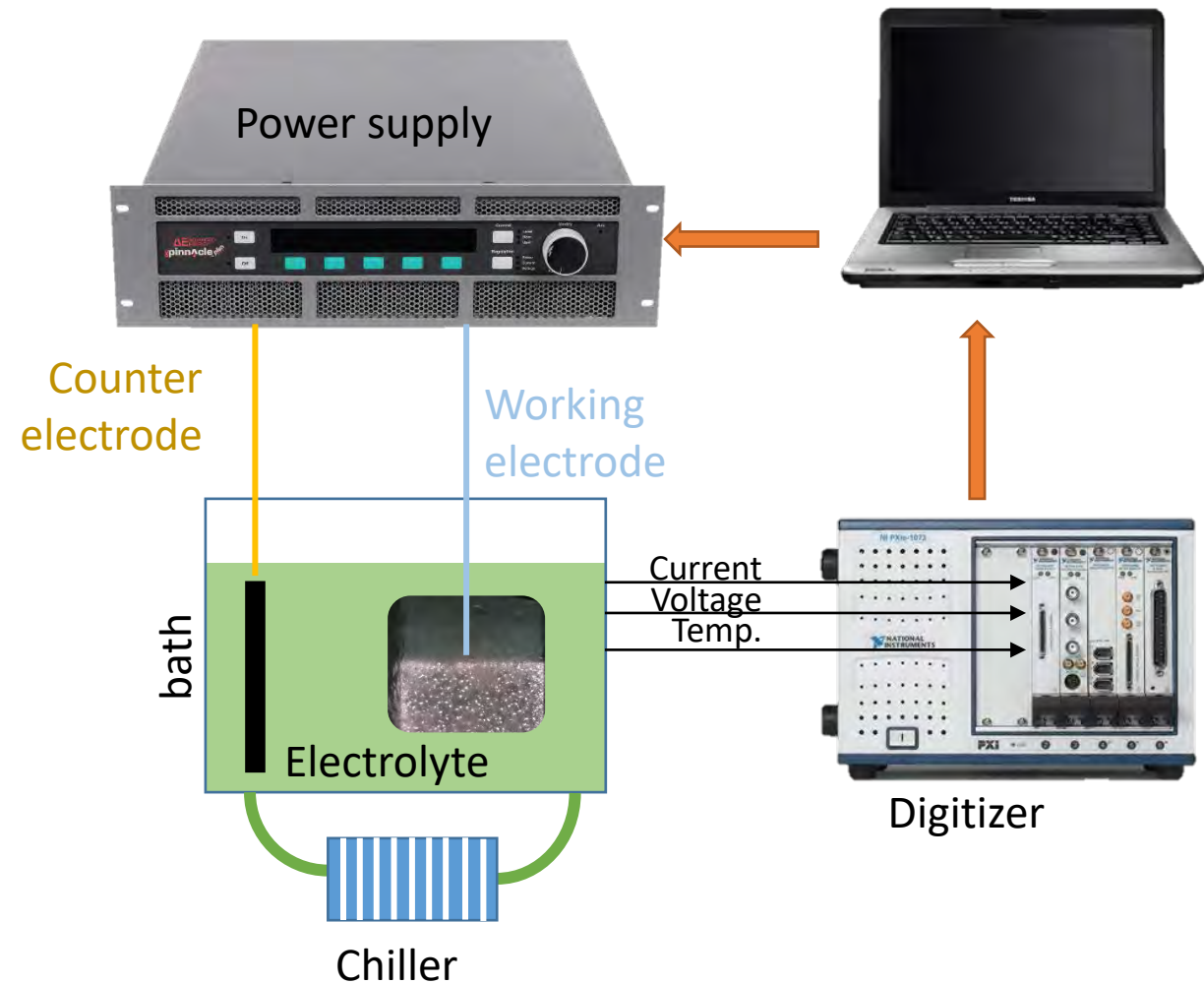
Plasma assisted electrolysis

Advantages

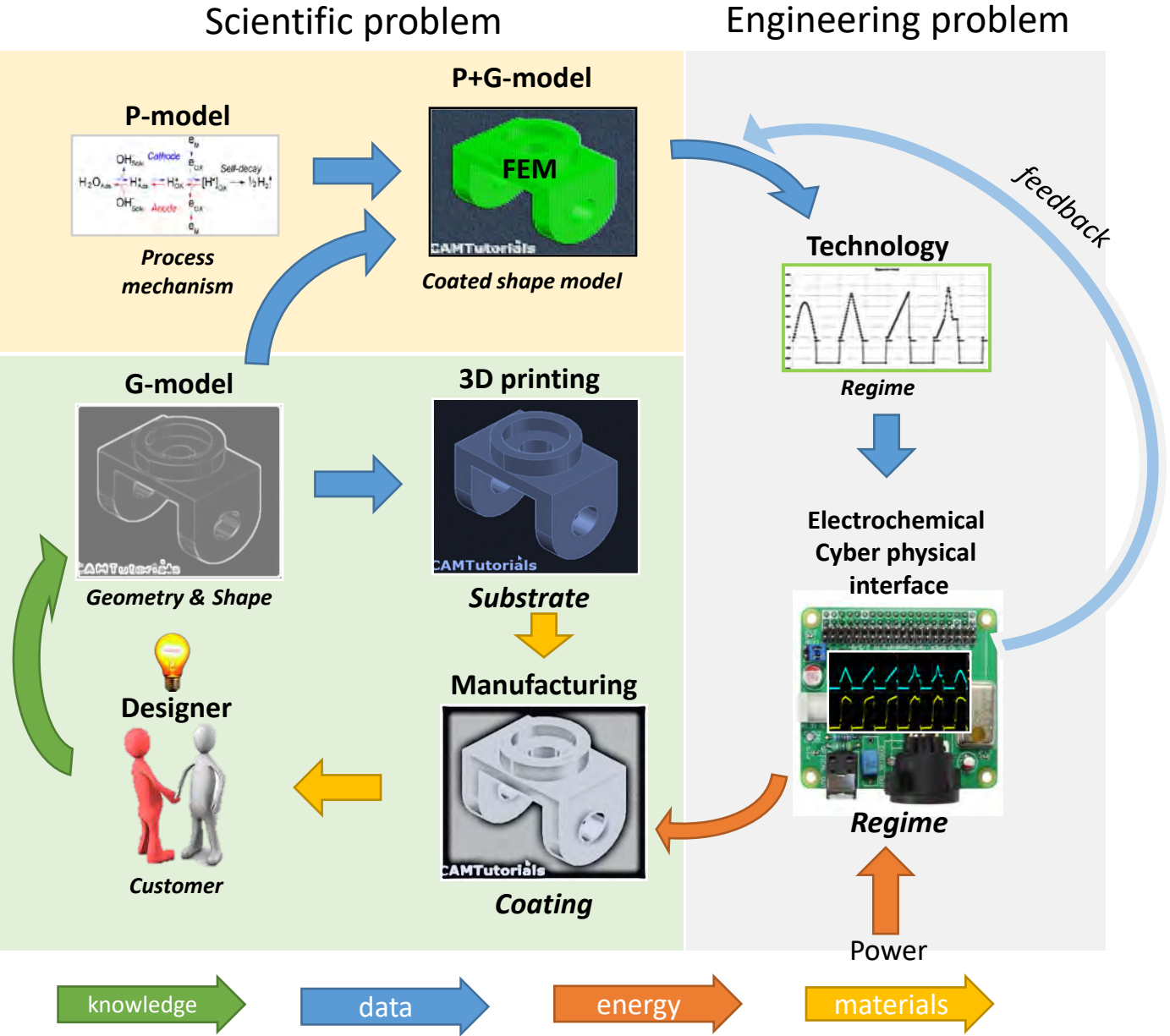
- Faster deposition
- No pre-treatment
- Better protection
- Non toxic reagents
- Compatible with complex shapes
- Wide range of surface properties

Basic equipment

- Power supply
- Cell
- Specimens
- Sensors/digitizer
- Data logger
- Cooling, extracting gas etc.

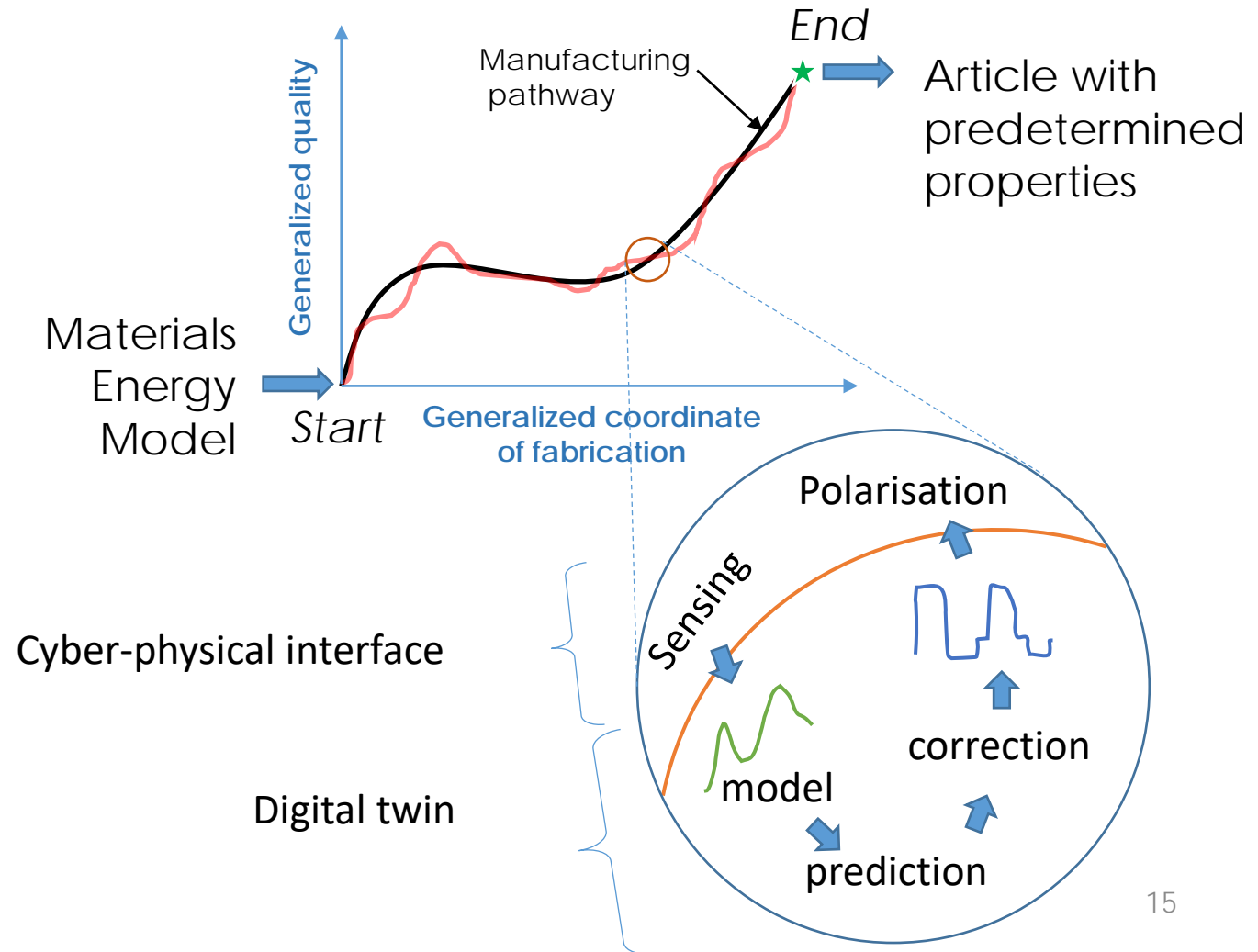


Intelligent plasma assisted electrochemistry



Intelligent manufacturing pathway

- Starting conditions
- In-situ quality criteria
- Final characteristics



Digital twin

- **Software** based model of the manufacturing process
- System **behaviour** through all steps of fabrication
- **Optimization** in digital form
- Reference manufacturing **pathway**
- Quality **criteria**

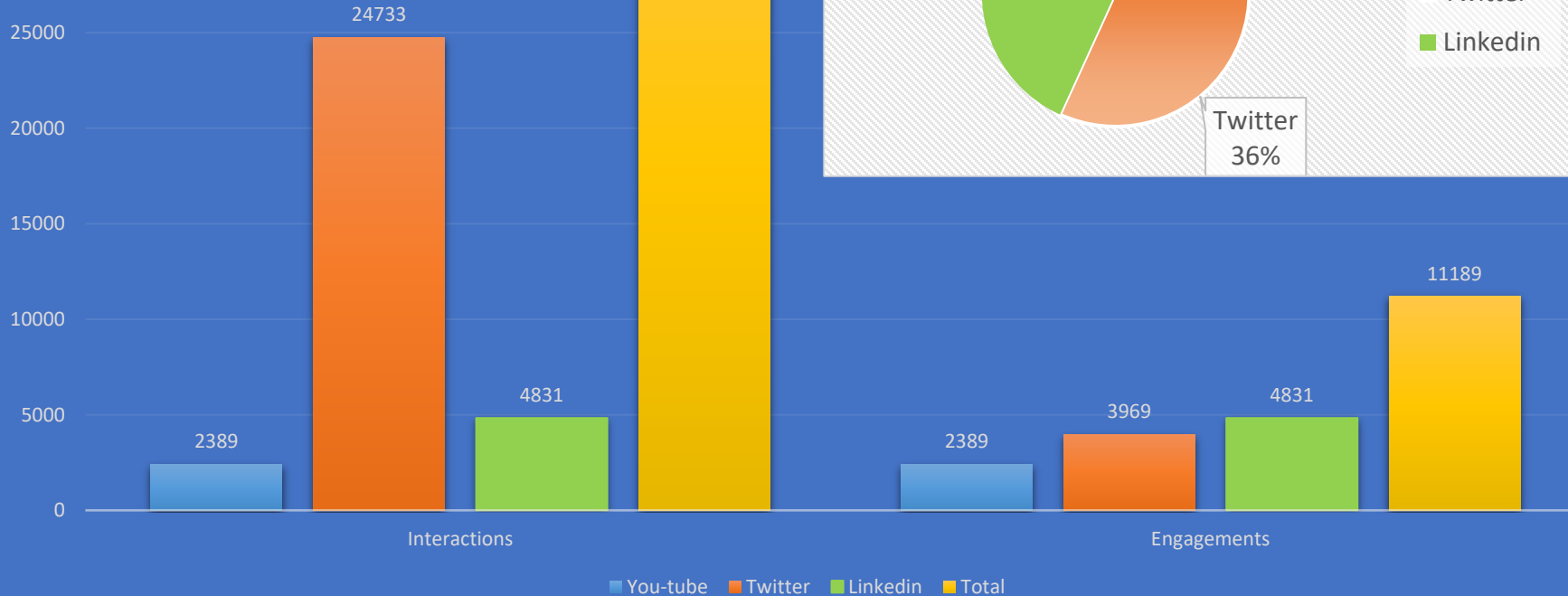


Source: 1991 J.Cameron "Terminator 2"

DSMN+ Social Media Statistics (Indicator)

DSMN+ Social Media Stats

	Interactions	Engagements
You-tube	2389	2389
Twitter	24733	3969
Linkedin	4831	4831
Total	35922	11189



You-tube- The figure means that that many times people watched our content on the you-tube and total watch hour is nearly 4,500 hours

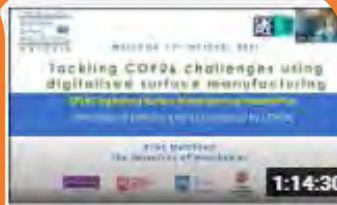
Twitter- The figure means that that many times people engaged with our content including, profile visits, registration, comments, likes, retweets- People are aware of our presence

LinkedIn- The figure means that that many times people engaged with our content including, likes, profile visits, registration, comments, etc

Webinars, Training courses and Other Engagements



Part-2: Tackling COP26 challenges using digitalised...
172 views · Streamed 1 month ago



Part-1: Tackling COP26 challenges using digitalised...
139 views · Streamed 1 month ago



Bioinspired hierarchical materials and composites
39 views · 2 months ago



Part-2: Online event to highlight opportunities to...
67 views · Streamed 2 months ago



Part-1: Online event to highlight opportunities to...
166 views · Streamed 2 months ago



Through life-engineering to self-engineering
68 views · Streamed 4 months ago



Digitalisation for Sustainable Manufacturing- Joint Event...
111 views · Streamed 4 months ago



Progress in corrosion modelling for prediction...
134 views · Streamed 4 months ago



Untangling the Requirements of a Digital Twin
38 views · Streamed 6 months ago



What can digitalisation do for me?
30 views · Streamed 5 months ago



Part 2- Short course on Digitalisation and Industry 4.0
27 views · 4 months ago



Part 3- Short course on Digitalisation and Industry 4.0
25 views · 4 months ago



Re-Imagining Engineering Design: Growing Radical...
23 views · Streamed 5 months ago



Machine vision techniques for composite part inspection
28 views · Streamed 7 months ago



Recent advances and industrial implementation o...
141 views · 8 months ago



Residual stress analysis of thermal spray coatings
208 views · Streamed 9 months ago



Materials engineering for affordable energy conversio...
27 views · 10 months ago



Part 1- Short course on Digitalisation and Industry 4.0
133 views · 10 months ago

DSMN+ Webinars- The Network has recorded more than 20 webinars you-tube channel and these webinars have been watched more than 2389 times (in total) by the community

Events, Training courses and Other Engagements



11 Oct 2021

Tackling COP26 challenges using digitalised surface manufacturing

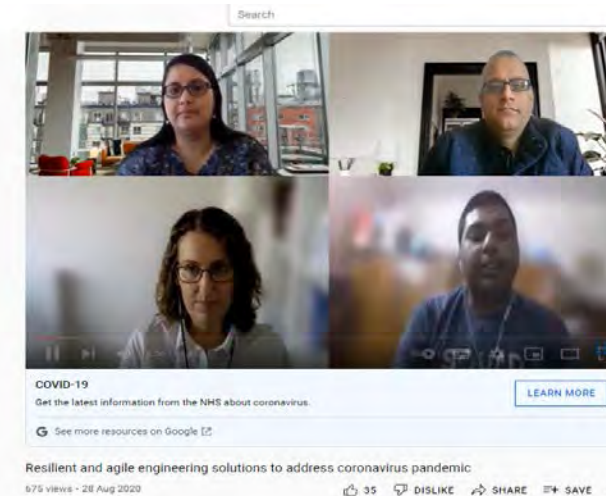
62 people registered
55 people attended
173 times the recording was watched on YouTube

- 50% of speakers were female
- 36% of speakers were ECRs
- 45% of speakers were BAME
- 100% of female ECR speakers were BAME



Short course on Digitalisation and Industry4.0

- Delivered in 4 parts
- No registration required
- Watched 215 times on YouTube by the community



Resilient and agile engineering solutions to address coronavirus pandemic

- COVID-19 related discussion
- Watched 667 times on YouTube

11 October 2021

9:30 am - 12:30 pm, UK BST

Register Here

Joining information will be available upon registration.

For further query or concern, please contact Pamila.Sharma@manchester.ac.uk

Tackling COP26 challenges using digitalised surface manufacturing

Introducing DSM and COP

09:30 am **Prof Allan Matthews**, Director, DSM Network and The University of Manchester, UK
Welcome and Overview of DSM and its relevance to COP26

09:40 am **Ms Caaisha Warsame (1st year PhD Student)**, London South Bank University, UK
COP26 introduction

Speakers

Energy systems

09:45 am **Ms Laura Sandys CBE**, Non-Executive Director, SGN Limited and Energy System Catapult, UK
The Energy System of The Future- Digitalised, Decarbonised and Decentralised

Tribology and transport

10:05 am **Prof Barbara Shollock**, Kings College London, UK
Decarbonised Transport- The role of surfaces

Nature inspired engineering

10:25 am **Prof Claus Helix-Neilsen**, DTU, Denmark
Biomimetic Membranes - surface engineering inspired by nature

10:45 am Short Coffee Break, 10 min

Coatings for sustainable energy

10:55 am **Prof Margaret Stack**, University of Strathclyde, UK
A Weather-map, a Globe, a Wind-turbine and a Tidal-turbine: Some perspectives on coatings selection for renewable energy systems

Thin films for sustainable energy

11:15 am **Dr Neil McSparran**, NSG Group, UK
Future of Glass and Thin-film coatings

Scalable low-carbon manufacturing

11:35 am **Mr Nicholas Butcher**, Emerson and Renwick, UK
Industrial perspective on COP26

Student Presentations

11:55 am **Mr Nestor Sanchez Arriaga**, University of Sheffield, UK
Role of Instrumented Digital Platforms (Digitalisation) in Decarbonisation

12:00 noon **Ms Sara Hawi**, Cranfield University, UK
Engineering Biology: Addressing one of the most threatening impacts of climate change

12:05 pm **Mr Syed Mehade Hussain**, London South Bank University, UK
Machine Learning: Future Developments for Sustainability and Tackling Climate Change

Expert Panel

12:10 pm Q&A and Expert Panel Session
12:30 pm Close



Events, Training courses and Other Engagements



11 Oct 2021

Tackling COP26 challenges using digitalised surface manufacturing

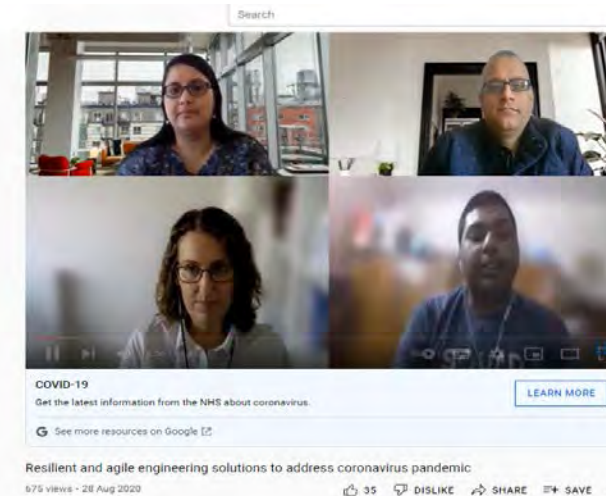
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Feasibility Awards- 2020 (Total 24 applications, 9 applications were funded for a total of £205,000)



University	PI Awarded/Title of the project (£25K)
 	<p>Anil Prathuru, Andrei Petrovski, Nadimul Haque Faisal, Federico Venturi, Tanvir Hussain A machine learning based predictive tool for high velocity oxyfuel (HVOF) thermal spray coating performance and digitalisation</p>
	<p>Seán McLoone, Dan Sun, Emi Garcia-Palacios, Blesson Varghese, Pantekis Sopasakis, John McLoughlin Anodising, improve product and process</p>
	<p>Manuela Pacella, Vadim Silberschmidt Innovative self-adapting materials for future coatings</p>
	<p>David Hall, Beatriz Mingo, Nicholas Bojdo Taking control of the aerosol deposition process for ceramic coatings</p>
	<p>Tanvir Hussain, Federico Venturi, Acacio Rincon Romero A Machine learning tool for predicting sprayability and coating properties in Cold spray deposition (MaCSpray)</p>

Feasibility Awards- 2021 (Total 24 applications, 9 applications were funded for a total of £205,000)



University	PI Awarded/Title of the project (Used IAA Funding Model for these)
	<p>Prashant Agrawal, Matthew Unthank, Hamdi Torun, Richard Fu Modelling of integration of passive hydrophobic coating and active thin film Surface acoustic wave platform for effective bio-film removal</p>
	<p>Esther Karunakaran, Siddharth Patwardhan, Annette Taylor, Mahendra Raut Tailoring silica surfaces for antibacterial applications by application of surface interaction modelling: towards digitalising economical and scalable bio-safe surfaces</p>
	<p>Nan Gao, Stefan Dimov, Navdeep Singh, Hassan Latif, Jitao Zhang Evaluating anti-biofouling properties of textured liquid-repellent surfaces using an experimental and Surface Evolver approach</p>
	<p>Hari Upadhyaya, Gaurav Goel, Jonathan Bean AI designed Anti-Viral Surface Materials (ADAVSM)</p>

Some examples of active support/Mentorship of ECR's

20 September 2021 ECR led COP26 Event

ECR led online event highlighting opportunities to tackle COP26 challenges

- 13 ECR speakers
- 6 UK Universities
- 30% PDRAs
- 70% PhD students
- 35% speakers female
- 85% speakers BAME
- 100% female speakers are BAME

1. DSMN+ organised a dedicated COP26 ECR event, which is a highly trending Youtube video. Through this event, ECRs from all around the UK showcase their viewpoints about the COP26 issue.
2. DSMN+ Co-Director Dr Goel became an ECF Manufacturing Research member due to the active mentorship by the DSM team
3. DSMN+ supported Prof Hussain's EPSRC Fellowship on developing next generation spray coatings (Nottingham)
4. Of the 9 funded feasibility studies so far, 5 were led by ECRs
5. There is now a new plan in place just discussed with EPSRC where DSMN+ and ECF forum will come together to do a joint event to seamlessly integrate the two vibrant communities
6. DSMN+ supported Dr Giusca's (Cranfield) Feasibility study bid awarded by the Metrology Hub

Collaboration with other organisations

HENRY
ROYCE
INSTITUTE



AMRC
ADVANCED MANUFACTURING
RESEARCH CENTRE

AMPI
THE ADVANCED MACHINERY
& PRODUCTIVITY INSTITUTE



ER | GROUP

oerlikon



Innovations in Surface Engineering to achieve net zero by 2050

Collaboration with other Networks



Organised a joint event titled-
**Digitalisation for Sustainable
Manufacturing**

Registration- 145 people
Attended- 111



Outputs created by the Network of Networks

Learning from Early Career Researcher survey in Spring 2021

A survey developed by the SPRITE+ network and includes responses from Early Career Researchers (ECRs) in the SPRITE+, eFutures and Connected Everything networks has helped shape our activities for ECRs. Please read the findings from the survey [here](#).

Learning from the Network of Networks Community Equality, Diversity and Inclusion Survey 2021

The Networks came together over the summer of 2021 and over 260 people completed our survey so we can understand more about our community and how we can be more supportive, particularly as Covid restrictions ease. This is the [summary and findings](#) presented at the Network of Networks meeting in October 2021.

Network Impact

A discussion of the Network of Networks led to this [summary document](#) being created in November 2021. We hope this will help other networks consider their impact more widely than the typical outputs often measured.

Guide for Network Managers

For over 12 months a small group of network managers came together to share their learning and co-create a guide for managing networks based on their experience. The online guide was created by Dr Samantha Kanza and is hosted at Southampton University. Use this link to access the guide: network-mgmt.ai3sd.org/



The Security, Privacy, Identity and Trust Engagement NetworkPlus

SPRITE+ HUB

Security, Privacy, Identity, Trust in the Digital Economy

Dr Kieran McLaughlin (QUB), SPRITE+ Link



Transforming Foundation Industries
Research and Innovation Hub



TRANSFORMING THE FOUNDATION INDUSTRIES

AI 4 Scientific Discovery



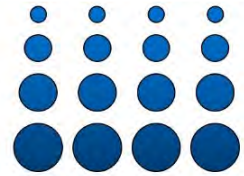
Network Year 2 summary

- **Followers/Members** - from 202 to 1396 (427+824+53+92)
- **Partner organisations** - from 61 to 74 (In addition 5 EPSRC Networks)
- **Enhanced digital interactions** - Network website / Twitter / LinkedIn / YouTube channel - a total of 36,000 interactions and 12,000 engagements, including about 4500 hours watched content on YouTube (**viewed 2389 times**)
- **DSM Featured Webinar:** Every Month, Increased flexibility
- **9 feasibility awards funded** with a total of £205,000. Next ones will be in early 2022
- **79 one-to-one interactions with teams/PIs** (including a range of technical topics and a range of national, international, industrial, academic, ECR participants)
- **Industry meetings** to identify challenges for demonstrator projects

Thank you!

EPSRC NetworkPlus

Digitalised
Surface



Manufacturing

Network

UKRI Engineering and Physical Sciences Research Council

EPSRC NetworkPlus Digitalised Surface Manufacturing Network

MANCHESTER 1824 The University of Manchester

QUEEN'S UNIVERSITY BELFAST

The University Of Sheffield.

London South Bank University

Cranfield University HENRY ROYCE INSTITUTE

AMRC ADVANCED MANUFACTURING RESEARCH CENTRE

mtc Manufacturing Technology Centre

MAPP Manufacturing Process

SEA SURFACE ENGINEERING ASSOCIATION

TR L9 SURFACE ENGINEERING & ADVANCED COATING

SELF Surface Engineering Leadership Forum

POETON EST. 1999

MONITOR COATINGS

wallwork Heat Treatment | Vacuum Brazing Ultra Hard Coatings

Micro Materials Excellence in Nanomechanics

thinmetalfilms Ltd. Precision Optical Coating Engineers



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