1. Introduction

The Manufacturing the Future Theme at EPSRC ran four workshops between December 2018 and March 2019 to engage with a broad cross-section of the UK Manufacturing community.

The primary motivation of the workshops was to share the outputs of the 2018 Manufacturing Futures Retreat and to gather input into developing these outputs further. The workshop presented an opportunity to discuss changes affecting the UK research landscape and build and improve on EPSRC’s relationships with the Manufacturing community, especially with those who had little or no experience of engaging with EPSRC. The workshop also provided the community the opportunity to reflect on and discuss topics of importance to EPSRC such as equality, diversity and inclusion, and Peer Review.

There were expectations that the attendees would disseminate information and key messages to the wider community following the workshop.

A summary of the outputs of the workshops are captured in this report.

1.1 On the day

The workshops were held from 10.00 – 16.00 on:

- 5th December 2018, Bristol  
- 22nd January 2019, Glasgow  
- 19th February 2019, Sheffield  
- 12th March 2019, London

The format and agenda was consistent across all workshops to ensure a breadth of views could be gained across similar topics. The agenda is annex 1.

1.2 Attendance

A call for expressions of interest to attend the workshops was publicised on EPSRC’s website in September 2018. All eligible applicants were offered a place at one of the four workshops.
2. Workshop Sessions

2.1 EPSRC Update

Katie Daniel, Head of Manufacturing at EPSRC presented on the following topics:

- **UKRI**
  - UKRI Structure
  - UKRI Mission and Values

- **EPSRC strategy and activities**
  - Prosperity outcomes
  - EPSRC current activities
  - Big Ideas

- **Manufacturing the Future theme**
  - The Manufacturing Team
  - Strategic Advisory Team
  - The Manufacturing Portfolio
  - Manufacturing Visions
  - The Manufacturing Priorities: getting the most from our critical mass portfolio; investing in new ideas; supporting excellent people; Equality, Diversity and Inclusion, and working with partners.

The slides are available in annex 2

2.2 2018 Manufacturing Futures Retreat

The EPSRC Manufacturing the Future Theme held a 3-day Retreat in May 2018 to provide evidence for future strategic EPSRC decisions in supporting manufacturing research in the mid and long term.

Following advice from our Strategic Advisory Team (SAT), the theme sought input from the wider manufacturing community on scoping some of the topics that emerged from the Retreat.

The Retreat identified nine research and innovation themes, three of which were discussed in detail with the workshop attendees:

- Invisible Manufacturing
- Perpetual Transformable Products
- Zero Loss Systems

Full details of the retreat process, the themes and the actions the Manufacturing theme is taking can be found in the report of the retreat [https://epsrc.ukri.org/files/newsevents/manufacturing-futures-retreat-2018-report/](https://epsrc.ukri.org/files/newsevents/manufacturing-futures-retreat-2018-report/).

The attendees were provided with the output of the retreat for each area (Annex 3). For each area the attendees were asked:

- What are the key challenges in this area?
- What is the manufacturing specific focus?
The outputs of the sessions are shown below in a series of mind maps.

The outputs have been used along with guidance from the SAT to develop a call which will be launched later in 2019.
Perpetual Transformable Products:

- Dynamic value proposition
  - Assessing recyclability vs perpetuating
  - Long-life products vs adapting/transformable/healable products
  - More than a fashion change?
  - Requirement for change
  - Use in hazardous environments
  - Adapt to situations for safety

- Business model
  - Change from owning to rented
  - Servitisation
  - Who are the customers?
  - Would they accept & ‘buy in’ to the idea?
    - Accepting ‘old’ products
    - Viewing products differently
  - Where is the value?
  - Where is the profitability?
    - Lots of widgets vs one
    - What would the supply chain look like?
    - Initial price outlay
    - Consumer products or industrial products?
    - How many products like this are there really?
    - Useful for software, physical product is more of an issue

- Global standards
  - NASA 2040 vision
    - Protocols that ensure future compatibility
    - If it keeps changing how do you qualify it every time?
    - Assessing in service
  - Materials
    - How degrade during use?
    - Need to be able to tune material properties post-manufacture
      - Energy
    - Where is it going to come from?

- Design
  - Supra-modularity
    - Use evolution
    - Building in mutability
    - Adapting to as yet unpredicted needs
    - Too complex to be recycled?
    - Would it stop us having step changes?
  - Reliability
    - Validation
    - Self healing
    - Predictive maintenance
    - During the change you relinquish control over it
Zero Loss Systems

Material
- Smart responsive chemicals & materials
- Recycling materials (learn from Ali)
- Biodegradable products
- Chemical remanufacturing
- Feature size vs recycling
- New concrete
- Do we recycle to the molecular level?
- Homocomposites with hetero-properties
- Super integrating database
- Effect of being recycled
- Knowing enough about the materials

Consumer want/need
- Not just a tech problem
- Social science
  - Influencing consumer behaviour
  - Social acceptance
  - ”Not as good if it has been recycled”
  - How do consumers decide on a material?
  - How do demand-side waste?
  - Basic financial education needed?

Design
- Is it better to design something to last longer?
  - Design process so there is zero waste, for recycling & end of life
- Intelligent autonomous design systems
- Design new materials for recycling & end of life
- Design for disassembly
- Common language needed

Modelling
- LOA & modelling
  - What’s the biggest waste
- Predict disassemble-ability
- Building blocks
- Multiscale
- Interface problem

Supply chains
- Using waste as a feedstock
  - New supply chains
  - New resources
- Local resource streams
- Manufacturing closer to consumer
  - Material sourcing
    - Automation
    - Sourcing & purity
  - Join up across sectors
    - Cross sector learning
  - Data flow - no waste?
    - Infrastructure
      - E.g. recycle Li batteries
      - Lights out factories
    - Legislation to force industry to change
  - Getting economics right
    - Value of assembled product is much higher than the sum of its parts
  - Enables a service model

Technologies
- Towards full utilisation of ALM powder feedstocks
- Metrology & control
- Sensors for intelligent assembly
- Moon dust sintering
- Responsible innovation
- New processes to process recycle materials
- Remanufacture of composites

Thermodynamics
- Takes more energy to recycle
- Speed of manufacturing vs energy input
- Energy harvesting solutions
- Loss vs waste
- Zero L energy

As a system
- Should be ‘closing the loop’, not just ‘zero loss’
- Dealing with legacy infrastructure/processing
  - ‘Good stewardship’
  - How are scales connected?
    - CE conflicting with decarbonisation agenda
  - Multidisciplinary approach
    - 1. Zero loss
    - 2. Lower cost

How to quantify waste?
- Better understanding to benchmark difference processes
- Optimise the system?
  - Decay/growth
  - Link to nature’s approach
  - Certification/regulation

Zero Defect Systems
2.3 Considering Equality, Diversity and Inclusion

As UKRI, we are committed to equality, diversity and inclusion (E,D&I) for its own sake, and to continue to attract and nurture talented people from the widest pool to maintain a global lead in research and innovation and remain internationally competitive. This is supported through two equality, diversity and inclusion specific strategic objectives:

1. Champion equality, diversity and inclusion across the research and innovation sector, and support a healthy and high integrity culture
2. Be a great place to work, which inspires, engages and learns from its people.

UKRI is undertaking the following actions to achieve these objectives:

- Leading by Example, within UKRI
- Leading and supporting change in our research community
- Challenging bias and ensuring fair and inclusive funding processes

More information about UKRI’s commitment to equality, diversity and inclusion can be found here: https://www.ukri.org/about-us/policies-and-standards/equality-diversity-and-inclusion/

As EPSRC, our objective is to embed ED&I in all that we do, ensuring that the activities we support and the research that we fund drives change in our community, and supports a system that is inclusive for everyone. We are working towards achieving an equal, diverse and inclusive environment where all individuals are able to thrive by adapting and monitoring our current processes and trialling new and innovative approaches.

Actions that EPSRC have taken include:

- Improving the gender diversity in our advisory boards and peer review panels
- Providing unconscious bias training for staff members, advisory boards and the EPSRC college
- Required an ED&I strategy from applicants for some of our major investments
- Carry out Equality Impact assessments of all policies, practices, decision-making processes and events to ensure they are fair and do not present barriers to participation
- Publish diversity data on applications, awards and success rates along with UKRI partner organisations. In addition EPSRC publishes diversity data on our peer review process including the Peer Review College, reviewers and panel members
- Support projects that accelerate the pace of culture change and challenge current thinking, via the Inclusion Matters call

The full range of actions being undertaken by EPSRC to promote and support E,D&I can be found here: https://epsrc.ukri.org/funding/edi-at-epsrc/

This information was presented to the delegates and then they were posed the following questions:

1. What aspects of academic life are experienced differently by different people?
2. And what actions can you take to address this?

The delegates were asked to think as broadly as possible, beyond the protected characteristics and into all aspects of academic life. The aspects of academic life that were identified were:
When considering what actions could be taken, the delegates were asked to think about actions that they are aware of occurring and those that they could think of but are not aware of occurring.
Throughout the discussions it became clear that not all of ESPRC’s policies were well known. Some things that were raised as actions that EPSRC could take, were ones that we already have in place.
Full details of EPSRC’s policies can be found on our website: https://epsrc.ukri.org and we have recently written a blog about how we support flexible research careers to explain the range of options https://epsrc.ukri.org/blog/supportingflexibleresearchcareers/

Did you know that?

- You can claim the cost of additional care requirements to allow you to attend visits, meetings and conference as part of your research grant https://epsrc.ukri.org/funding/applicationprocess/basics/caringresponsibilities/
- When selecting panels, EPSRC is looking not just at the gender balance, we also want to make sure there is the correct mix of expertise, institution, career level and panel experience
- Extensions to grants are available if staff change from full time to part time working.
- It is possible to pay for a technician to carry out practical work on behalf of an investigator or researcher that is unable to do the work themselves. https://epsrc.ukri.org/funding/applicationprocess/fundingguide/
- Parental leave will be covered by the research councils and the grant funds can also be used to pay for appointing a substitute or extending the grant.

The intention for this session was to begin the conversation regarding E,D&I with the manufacturing community and EPSRC. The manufacturing theme wanted the opportunity to talk about what actions are already being taken by the community and how EPSRC can support academics to be inclusive in all aspects of research. The conversation was a positive opportunity to discuss a challenging topic and provided all parties with plenty to consider.

The outcomes of this session are being combined with other activities occurring across EPSRC and utilised by the Equality, Diversity and Inclusion team within EPSRC to develop future guidance, policies and actions.

2.4 Translating Research

At each workshop, two members of the manufacturing community were invited to talk about their experiences of translating research into impact. Each person spoke for 5 minutes on

- Their experience of translating research into impact
- Advice for others on the process of translating research and forming links with Industry.

There was then a question and answer section.

The people who presented were:

- Dr Laura Baker, Tata Steel
- Dr James Kratz, University of Bristol
- Jon Wilmott, University of Sheffield
- Professor Alastair Florence, University of Strathclyde
- Professor Adam Clare, University of Nottingham
- Professor Kenny Dalgarno, Newcastle University
2.5 Peer Review

The Peer Review session was an opportunity for the delegates to provide each other with tips and guidance on the peer review process. The delegates were in mixed career stage groupings.

The peer review process was broken down into three stages: Preparation of the proposal; Peer Review and Panel. At each stage a member of the community spent a minute providing their top tips on that aspect of peer review process. The delegates then had the opportunity to ask each other and the EPSRC staff their questions and share their top tips for the peer review process for clarity the tips have been separated out into distinct sections.

The top tips are summarised below:
Writing a Proposal:

- Get Feedback on the Proposal: Carry out some form of peer review on your proposal before submitting, whether a formal internal peer review at your institution or asking a critical friend to review it. EPSRC’s reviewer forms are available at: https://epsrc.ukri.org/funding/assessmentprocess/review/formsandguidancenotes/

- Consider the Audience when writing the proposal. It has to be understood by:
  1) EPSRC Staff
  2) Expert Peer Reviewers
  3) Generalist Panel members

- Writing a proposal takes times

- Get involved in Peer Review - Both postal peer review and panels - to see other proposals and how other people respond to proposals. Join EPSRC’s Peer review college here: https://epsrc.ukri.org/funding/assessmentprocess/college/memberselection/

- Have a portfolio of ideas in development and accept that they will progress at different rates

- Write an Elevator Pitch. Have a short version of your idea in words or slides that you can use to introduce others to the idea

- Keep the assessment criteria in mind at all times

- Be open to new ideas

- Start conversations with partners early on and keep their expectations realistic;

- Keep things in the relevant sections. Be aware that some reviewers might not read the proposal in order

- Ideas should be adventurous but not too risky

- Cost the proposal sensibly:
  Define the staff time properly
  Request a project manager if appropriate
  Budget for impact activities

- Work Backwards: focus on the objectives of the idea and the challenge it is addressing, then build the most appropriate research methodology

- When writing the pathways to impact, think about it early on and break it down by work package

- Collaborations should be authentic and only involve the relevant expertise. It may be necessary to uninvolve people as the idea progresses

- Keep the proposal clear and simple:
  Both the idea - don’t try and do too much
  And the text – keep it understandable
Writing a useful review:

- Allow enough time for the review
- Respond to EPSRC. Ask for an extension if needed or decline if you aren’t able to provide the review
- Provide constructive, specific feedback. For the majority of proposals, peer review comments are the only feedback a proposal receives
- Evidence all comments, both the positive and negative ones. An evidenced review holds more weight with the panel
- Be honest with the confidence rating; it is ok to say you are only an expert in a specific area of a proposal as long as this is clear to the PI and Panel
- Use the scoring scale. A definition is provided and the score should match your comments
- Read the guidance and call document. Familiarise yourself with the call scope and assessment criteria
- Be detailed when providing your area of expertise but don’t include any identifying details
- Be clear and concise with your comments. Try to address all points. If that isn’t possible, include them in order of seriousness
- Provide evidence for your comments
- It is ok to explain if you think a reviewer has misunderstood something, but do it politely and provide more evidence.

Writing a PI Response:

- Be objective and don’t take it personally.
- This is used by the panel to consider how much weight to give the reviewers. It can often be a deciding factor in how to score the proposal.
- Respond to the comments and not the score.
- Be clear and concise with your comments. Try to address all points. If that isn’t possible, include them in order of seriousness
- Provide evidence for your comments
- It is ok to explain if you think a reviewer has misunderstood something, but do it politely and provide more evidence.
Being Interviewed:

- Be excited about your idea
- Practice before the interview
- Respond to the question being asked
- Include all participants in the interview and make sure everyone knows their role/what they are speaking on
- Don’t speak for too long on each question; get your information across concisely

Being on a Panel:

- It is a considerable time commitment
- Need to be able to summarise the proposals and the points raised by reviewers concisely
- Panel members are not allowed to re-review. The decisions are only made based on the reviewers comments and PI response. Expertise is used in understanding the reviewers comments and PI response not the proposal.
- All assessment criteria need to be considered when scoring the overall proposal
- Be open about conflicts of interests
- Don’t be wedded to the pre-panel scores you assign a proposal if the panel conversation or interview brings new evidence to light.
EPSRC publishes all of its guidance regarding peer review on our website. We have also recently published a series of blogs that provide advice from a portfolio manager’s perspective that provide a helpful guide to the different stages of peer review. There are five blogs, covering:

- Getting Started: https://epsrc.ukri.org/blog/pmperspectives/
- Writing the Case for support: https://epsrc.ukri.org/blog/pmperspectives2/
- Writing and responding to reviews: https://epsrc.ukri.org/blog/pmperspectives3/
- The panel process: https://epsrc.ukri.org/blog/pmperspectives4/
- After peer review: https://epsrc.ukri.org/blog/pmperspectives5/

The outcomes of this session is being considered by the manufacturing theme and the peer review policy theme to develop future guidance.
Annex 1: Agenda

9.30     Refreshments and Networking
10.00    Welcome
10.15    EPSRC Update
          o EPSRC strategy and activities
          o UKRI
          o Manufacturing the Future strategy and activities
11.15    Refreshments
11.35    2018 Manufacturing Retreat
          o Presentation of the Outputs and Outcomes of the 2018 Manufacturing Retreat
          o Facilitated Session on a selection of the outputs of the retreat
12.35    Lunch
13.35    Considering Equality, Diversity and Inclusion in a research grant
14.20    Translating Research
          o Two examples of people’s experience of translating research into Industry
14.45    Refreshments
15.05    Indiana Great-Research-Idea and the Temple of peer review
15.50    Closing Remarks
16.00    End of Day
Annex 2: EPSRC Update

UKRI - Structure

UKRI & INDUSTRIAL STRATEGY

UKRI – Our Mission

UKRI – Our Values

Delivering UKRI’s vision and the Government target of 2.4% of GDP spend

Collaboration: We will work in partnership with the UK’s diverse research and innovation community

Create social and national impact

Innovation: We will build on international best practice, learn from what doesn’t work, innovate and take risks.

Push frontiers of human knowledge and understanding

Integrity: We will be independent and objective, using rigorous analysis and robust monitoring and evaluation.

Foundations for Research and Innovation

Excellence: We will ensure quality, value for money and sustainability are embedded in everything we do.

Foundations to the Industrial Strategy

To achieve our vision, we need to get the foundations right.

We will focus on four key areas:

1. Leading talent
2. Openness and transparency
3. A trusted and diverse system
4. Research culture

Impact of UKRI

The UK’s role in the global economy

People

Generating appropriate workforce for all

Institutions

Creating a world-class research and innovation infrastructure

Business environment

Creating a world-class research and innovation environment

International

Embedding the excellence of UK research in national and global strategies

Infrastructure

Creating a world-class research and innovation infrastructure

Sustainable Development

Embedding the excellence of UK research in national and global strategies

Sustainability

Embedding the excellence of UK research in national and global strategies

Sustainable Development

Embedding the excellence of UK research in national and global strategies
Industrial Strategy Challenge Fund

- Builds on the UK’s world-class research base and delivers the science that business needs to transform existing industries and create new ones.
- Accelerates commercial exploitation of the most exciting technologies the UK has to offer the world to ensure that scientific investment truly delivers economic impact, jobs and growth right across the country.
- Programmes delivered by the fund will be industry-led and powered by multi-disciplinary research and business-academic collaboration.

https://www.ukri.org/innovation/industrial-strategy-challenge-fund/

Wave 1 Challenges (c. £1b)

- Leading-Edge Healthcare Challenge (including Medicines) up to £189m
- Faraday Battery Challenge up to £125m
- Robotics and AI in adverse environments Challenge up to £89m
- Next Gen. Affordability Lightweight Engineering (Al/Transp.) up to £26m
- National Satellite Test Facility up to £27m

Underpinning UKRI investments (Wave 1a) up to £383m

Wave 2 Challenges (up to £729.5m)

- Audiences of the future (up to £10m)
- Data in early diagnosis (up to £15m)
- Preparing from the 100 years of COVID (up to £13m)
- Healthy ageing (up to £10m)
- Transforming construction (up to £17m)
- Transforming food production (up to £16m)

Wave 3 Challenges

- 252 Expressions of interest submitted - £12.5bn requested from the ISCF, £10.2bn industry co-funding
- Number of areas selected for deep dives
- Shortlist (https://innovateuk.blog.gov.uk/2019/02/05/industrial-strategy-challenge-fund-wave-3-shortlist/)
- Accelerating detection of disease
- Commercialising quantum technologies
- Digital security by design
- Driving the electric revolution
- Future fight
- Industrial decarbonisation
- Manufacturing blade Smarter
- Smart sustainable plastic packaging
- Transforming foundation industries

Strategic Priorities Fund

- Builds on Nurse Review vision of a ‘common fund’ - aims to:
  - Drive an increase in high-quality inter-disciplinary collaborations across councils;
  - Link UKRI investment with cross-government priorities and opportunities;
  - Ensure the system is able to respond to strategic priorities and opportunities.
- Example:
  - £35m for AI and Data Science for Engineering, Health, Science and Government – led by EPSRC in collaboration with The Alan Turing Institute, BBSRC, MRC, NERC and STFC.

Supporting research and talent

- Future Leaders Fellowship Scheme - £900m over 11 years, 6 funding competitions and ~550 fellowships over next 3 years.
- New cohorts of PhDs and Knowledge Transfer Partnership positions
- Over 5 years, £50m for additional PhDs, including 100 PhDs to support research into AI.

Future Leaders Fellowships

Objectives:
- Foster new career paths e.g. academic/business, across disciplines
- Provide long-term, flexible funding
- Support applicants from diverse career paths

Detail:
- Early career researchers and innovators
- UK and international applicants
- 7 years support on a 4+3 model, review every four years

How to apply:
- 6 calls, 2 year until 2020/21, ~100 fellows per call (~50 in round 1)
  - No ring-fenced budgets, no remit boundaries
  - Round 3 deadline 30th May (outlines - 2nd May)

https://www.ukri.org/funding/funding-opportunities/future-leaders-fellowships/

Regional innovation and growth

- £115m Strength in Places Fund bringing together UKRI councils in partnership with devolved funders and the Office for Students
- ESI call closed in July with Assessment Panel in September
- Strong demand through this call
- Successful projects will commence in 2019/20

Innovate UK funding intensity per capita in different areas of the UK
EPSRC Strategy and activities

EPSRC activities

Strategic Delivery Plan and Spending Review
- SCP published early summer 2019
- FIR planning during 2019

CDT call
- 75 CDTs announced, £446m investment with £366m from industry partners
- 16 URG AI CDTs, £100m investment with £78m from industry

Prosperity partnerships
- To support existing partnerships between business & universities
- Opportunity to co-invest in large-scale, long-term, user-inspired research at TRL 1-3
- Calls launched in the summer

Big Ideas

What is a big idea?
- An adventurous, exciting idea that will enthuse the public and Government
- If successful it will be transformative and have ground-breaking impacts
- It is hard to achieve and requires significant support (financial, people, skills)

Three perspectives/insights:
- Industrial Strategy
- Fundamental science
- Multidisciplinary research

Not a call for proposals, no funding associated
https://epsrc.ukri.org/research/ourportfolio/mfgcbigideas/

Manufacturing the Future Theme

Katie Daniel
Head of Manufacturing

Nick Cooper
Critical Mass, Circular Economy, Plastics

Richard Bailey
Theme Strategy, Impact, Industrial biotech

Becky Cheesbrough
Additive Production, Fellowships

Vacancy
Design, Operations, Digital

Tracy Hanlon
Materials, Leaders

Stryeni Paul
Circular Economy, Resource Efficiency

Stephanie Williams
Process, Medicines

MANUFACTURING THE FUTURE
Strategy and activities

Strategic Advisory Team

Dr Katy Milne, Manufacturing Technology Centre (MTC)
Professor Andy Neely, University of Cambridge
Professor Linda Newnes, University of Bath
Amy Peace, Britest
Professor Mark Price, Queen’s University Belfast
Susan Readman, Independent
Professor Robert Tooma, Drochaid Research Service Ltd
Robert Walker, Nissan

MtF Portfolio

- £425m investment
- 292 grants
- 50 organisations
- 8.86% of EPSRC portfolio
Manufacturing Theme by Research Area

Our Visions for Manufacturing

21st Century Products
Manufacturing research integrated into the discovery, design and development of new products

Digital Manufacturing
Use of advanced ICT to improve the integration of design, manufacturing and services

Sustainable Industries
Resource efficiency, energy resilience, circular economy

New Industrial Systems
New approaches to manufacturing, interface of other priorities

Focus for 2019

Future Manufacturing Research Hubs

Hubs £10m, 7 years

Drive national research & innovation agendas

Build on engineering & physical science foundations

Address major challenges

Examples

Lonza

Multi-disciplinary

Current Hub Portfolio

Hub and Spoke university locations

Critical Mass: Programme Grants

New Ideas: Standard Research Proposals

- Supports our ambition to increase % of community-led research:
  - Standard, new investigator awards, networks, workshops, overseas travel grants

- Should address key research challenges facing manufacturing

- Batching dates:
  - 21 April 2019
  - 23 July 2019 (TBC)

- Assessment criteria:
  - Separate list at Engineering panel
  - Manufacturing-focused prioritisation panel (if sufficient demand)

- Up to £3.5m available per panel

https://epsrc.ukri.org/funding/calls/manufacturing-the-future-standard-research-proposals/
New ideas: retreat, adventure and networking

- Manufacturing Futures retreat
  - Chaired by Prof Andy Neely (Cambridge/MIF SAT)
  - Public outputs by end March 2019
  - Plan (subject to budget/staff resource) for 1-2 calls and scoping/workshops

- Adventurous Manufacturing call
  - Adventurous – high risk, high reward research
  - Panels held in February – approx. £3m of projects to be supported
  - High demand – pilot activity, will evaluate with SAT

- NetworkPlus highlight notice
  - Community building, roadmapping and supporting feasibility studies
  - Up to £5m available (incl. possible extension)
  - Decisions May/June

Early & Established Career Fellowships

- Priorities aligned to 4 manufacturing visions
- Contact: Becky Cheesbrough
  (Rebecca.cheesbrough@epsrc.ac.uk)
- https://epsrc.ukri.org/skills/fellows/

Supporting Excellent People

Manufacturing Fellowships

- Support transition from industry to academia
- Plan to launch 7th call in early 2019 (subject to budget)

Networking

- Regular Critical Mass & Fellows workshops

Equality, diversity and inclusion

Implementing UKRI / EPSRC strategy

- Sessions during regional workshops & with critical mass directors

Encouraging development of EDI strategies for research grants e.g. Programme Grants

Q&A on EDI strategy during interview panels

Incorporated into assessment criteria for hub mid-term reviews

We also welcome other ideas

Researchers submit a single collaborative proposal with eligible applicants from both countries.

- The lead agency follows their usual procedures to process the application and involve peer review;

- Each country’s researchers are supported by their respective funding agency;

- The funding agencies align decision-making points where possible.

https://epsrc.ukri.org/about/partner/international/agreements/nsf

Working with Partners: EPSRC – NSF(ENG)

Lead Agency Agreement

At least 90 days in advance of the date the application is expected to be approved, the lead agency must respond to the proposal.

- Contact: Judith McCall
  (Judith.mcCall@epsrc.ukri.org)

Working with Partners: Catapult Researchers in Residence

Aim:

- To increase the connections between the UK research base and the Catapults

What:

- Development of new collaborations through research visits/residencies for university (and other eligible ROCs) academics to spend time embedded within Catapult teams.

- Co-funding will build connections, support pathways to impact and knowledge exchange between academia and the Catapult centres

How to engage:

- Catapults awarded vouchers by EPSRC, AHRC, ESRC and NERC to support a range of activities to accelerate the impact of RC-funded research and/or expand the capabilities of their centre.


Working with Partners: Other Activities

- Joint team meetings with Innovate UK

- Developing thinking with innovative and innovative about catapult / university engagement

- Collaborating on development and delivery of SSEN/SPT activities - within UKRI, business, government, academia

- Maintaining good relationship with BES manufacturing team

- Improving engagement with other Catapults e.g. co-funding BESRC call networks in Industrial Biotechnology and Bioenergy

- Exploring opportunities for international activities
Annex 3: Retreat Outputs

Zero Loss System

What is this theme all about?
What if our manufacturing system was able to produce with no waste?
The whole system, as well as all materials, products and processes, would be designed to make maximum use of resources. Feedstocks would be turned into products from the atom up. The system would also include processes for recycling/rework after the “death” of any resources – using intelligent assembly & disassembly, molecular level de-manufacture.

Manufacturing processes would be linked across locations, scales and sectors to make use of local resource streams, logistics and energy. This approach would require a systems approach/multi-layer thinking, leading to acceptable (even positive) environmental impacts from the manufacturing system.

Why do we think it is important?
Living within our global resources limits is arguably the most important challenge we face today.

However planetary protection & stewardship is not just about saving the world for the next generation, it can also provide economic benefits in providing resilience against resource depletion as well as lower resource usage & costs.

What are the research challenges to be explored?

- Drawing the boundaries for systems level thinking, e.g. scale up & boundaries in cross-sector supply chains
- Design of new materials, composites, products & packaging for deconstruction & reuse
  - E.g. concrete, textiles, paper, electronics
- Recycling technology
  - Design of energy efficient materials processing techniques
  - How to deal with current day products & materials
- Social acceptance of constraint, especially around cost of products → generational change
- Business models
- Do you start with ‘dirty’ or clean sectors?
Invisible Manufacturing

What is this theme all about?
What if our manufacturing system could self-optimise to provide the product a consumer wanted, to their specifications, whilst the system remained to all intents and purposes invisible to the consumer?

The system would be:

- Sentient, able to predict, plan for and respond to product demand
- Automatically able to design personalised products, potentially designing something never previously imagined
- Autonomous, self-optimising for different input materials, minimising waste reduction & low carbon
- A federated, pervasive system e.g. hive/ant-like manufacturing

Why do we think it is important?

- This would provide an highly optimised manufacturing system, delivering the right products at the right time, place, cost, & quality
- The system would be optimised for waste reduction & low carbon, leading to a lower environmental impact, as well as a reduction in costs
- The system could deliver a democratised/accessible manufacturing capability – anyone could design, or cause to be manufactured, their desired products, enabling entrepreneurs and creativity and providing a distributed/franchisable system (factory in a box).

What are the research challenges to be explored?

- Development of intelligent hybrid processing platforms that enable new product design & functionality
- How to ensure the system supports (not hinders) sustainability
- A control system for the autonomic nervous system of the factory
- Fusion of engineering modelling, human knowledge, creativity & AI
- Predictive design – design (product, manufacturing system) evolution informed by data from being designed, being manufactured, and being in service
- Architecture & sensors for self-sensing systems, multimode sensors e.g. hyper spectral imaging, imprinting sensors, automation of measurements and actuation
- Standards, both for the hardware and the software elements - how would this work in heavily regulated production industries (e.g. biopharma)
- Human intervention & creativity – how to capture this to the best effect
- Ethics? Should the system inform user about material/requirements ‘swaps’? What does trust look like and how might it evolve?
- What constraints/rules do you give the systems? How do you make sure it is optimising towards the ‘right’ point?
- Regulation – how do we control this ‘monster’?
Perpetual Transformable Products

What is this theme all about?
What if our products could renew, improve and transform themselves throughout their lives, e.g. self-strengthening wind turbines, clothes that use air pollution to evolve their aesthetic?
Such products would:

- Be self-healing and self-renewing
- Act as their own factory, sourcing and extracting their own resources
- Personalise themselves to you and your needs as a consumer
- Grow with you, evolve to your changing needs with time
- Improve themselves to always best in class, but yet could also age purposely
- Change their aesthetics according to your aspirations (emotional durability)
- Reconfigure themselves for new consumers

Such products would challenge existing ownership models, opening up a more sharing economy.

Why do we think it is important?

- Products that could adapt to changing needs of their consumer could lead to a better quality of life, e.g. enabling independence for aging population
- Self-reconfiguring products could encourage a greater utilisation of assets, through a shift from a disposable economy to a sharing economy (with associated social benefits of sharing), reducing obsolescence
- Better resource efficiency as fewer new products are needed – save materials, energy, water etc.
- New models of owning, with positive costs implications of the new way of consuming

What are the research challenges to be explored?

- Materials science - Self-healing materials, sacrificial coatings, material degradation modelling
- Reprogramming materials performance & properties for different performance: Impact/strain rate, electrical & magnetic fields, light, chemical absorption
- Digital twin/modelling – Predicting degradation & self diagnosis → prognosis, evolving through data & testing upgrades
- Embedded measurements – the product is the sensor (it has a nervous system)
- Business model challenge relating to sharing economy/services
  - How to monetise the changes
  - Could be very challenging outside expensive capital goods
  - Extended producer responsibility?
- Redefine repair & model manufacture requirements - what happens to redundant parts?
- Does adaptability prevent/discourage step changes? What use would a perpetual diesel engine be? Do people want things that last forever?
Looking at the issue across scales from the molecular → product → system → to the global. Interface research between various layers could be considered, big integration challenge.