UKRI Innovate UK

Reimagining Materials and Manufacturing Together

Celebrating innovation in UK manufacturing

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Innovate UK has a vision for the UK's materials and manufacturing sectors

In our Materials and Manufacturing Vision 2050 we describe how the UK can become a leading, world-class destination for advanced low carbon manufacturing.

It is a complete reimagining of the role that UK materials and manufacturing should have within our economy and society in a net zero focused world.

The Innovate UK Materials and Manufacturing Vision 2050 sets out some thought-provoking considerations for the future of the industry. It is aimed at stimulating interest, focus and action to achieve its image of the future UK industry.

The Innovate UK Materials and Manufacturing team is supporting this vision through two programmes: **Resource Efficiency for Materials and Manufacturing**, and **Sustainable Bio-based Materials and Manufacture**. Both are described in more detail below, including stories about businesses funded by the programmes and the impact they are having.

Strategic imperatives for 2050

Our vision is driven by three strategic imperatives that are mutually supportive.

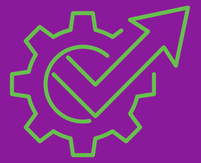
The UK will be globally competitive and an increasingly attractive place to manufacture goods with organisations in materials and manufacturing embracing innovation to be:

Net zero and resource-efficient

By understanding our environmental resources and the impact of every stage in the supply chain and manufacturing process, and widely adopting sustainable practices.

Resilient and responsive

With the agility to mitigate risks arising from the changing global economy, interruptions to supply of critical minerals and materials, national and global disruptions, and climate change.



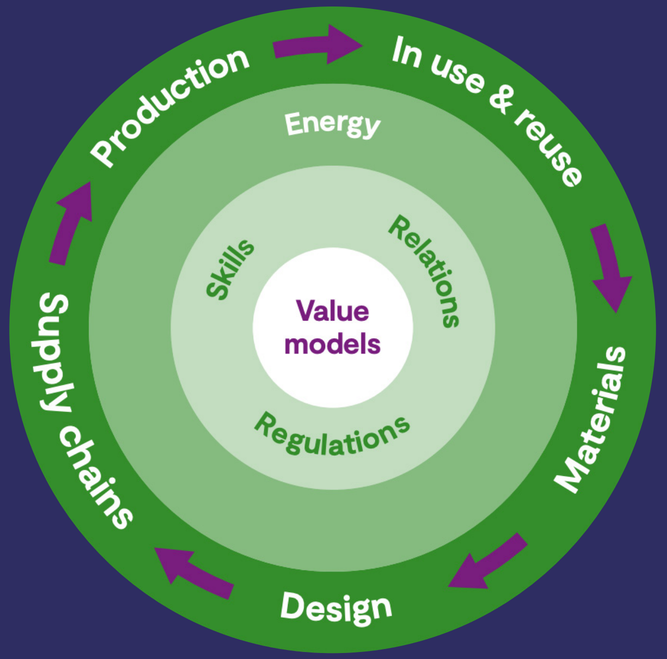
Technologically advanced and digital

To improve efficiency across supply chains, enable novel business models, support whole-system design and deliver highly customised products.

Areas of focus

The Innovate UK Materials and Manufacturing Vision 2050 provides key insights and innovation strands for 10 areas of focus – five core areas and five enabling areas – where we expect major change and where the UK has the strengths to take advantage.

The core and enabling areas should be viewed as a system where the interactions and symbiosis between the areas are as important as developments within the areas themselves.



The core areas

Materials for the future economy
Materials, associated processing and new material applications will be the basis for cutting-edge products that reduce emissions, energy consumption and costs for UK manufacturing.

Smart design
Effective design methods, design for resource efficiency, and design for maximum through-life value, with a digital thread over the lifecycle of products, will be at the heart of UK manufacturing.

Resilient supply chains
Sustainable feedstocks, supply chain visibility, and co-location of waste and emission streams will support UK manufacturing.

World-class production
Flexible production capacity, minimal material waste, high-quality products, streamlined productivity, and agile and adaptable operations will allow manufacturing to thrive.

Longer in use and reuse
UK manufacturing will minimise materials use and waste, practise complete traceability, and use new remanufacturing services.

The enabling areas

Clean energy
A decarbonised, affordable and secure energy system will power UK manufacturing.

Proactive regulations and policy
A trusted regulatory framework, coordinated policies, and agile and forward-looking standards will accelerate assurance within UK manufacturing.

Future skills
Courageous leadership, critical skills foresight, upskilling and diverse talent will drive manufacturing.

Networked relations
Collaborative networks, open knowledge sharing platforms, and aligned investment will energise manufacturing.

Evolving value models
Innovative business models, agility to meet demand, green financing, and balanced trade will drive manufacturing.

Resource Efficiency for Materials and Manufacturing

Resource Efficiency for Materials and Manufacturing aims to put in place the key building blocks to help businesses transform to a resource efficient future.

The programme aims for UK organisations to understand the impact of the full product lifecycle and to thrive from the development and adoption of resource efficient solutions.

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Resource Efficiency for Materials and Manufacturing facts and figures

Feasibility study projects

24 projects

40 partners

£2.2m total cost

Collaborative research and development projects

18 projects

52 partners

£13.5m total cost

2 Investor Partnership projects

With £2.4m total cost

6 funded innovation exchanges

International missions

To countries including Canada, India, Japan, Singapore, South Korea, Turkey and USA

14 workshops

Face-to-face and online, reaching a total 650+ attendees

Showcases

Providing dissemination and networking opportunities

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Weffan

Reducing waste in fashion manufacturing

A Resource Efficiency for Materials and Manufacturing feasibility study enabled sustainable fashion startup Weffan to investigate the optimisation of machinery, forge crucial UK partnerships and develop a business case for 3D woven garments.

The UK fashion industry, which supports 1.3 million jobs and generates £23 billion a year in tax revenue, faces significant sustainability challenges. 15-20% of material is wasted on the manufacturing floor alone due to outdated methods. Globalisation has led to offshoring, diminishing UK manufacturing capabilities.

Redefining garment manufacture

As a startup tackling this multifaceted problem, Weffan faced a daunting task. The company's founder and COO, Graysha Audren, said: "We're essentially redesigning how clothes are made. It requires a holistic approach to the entire supply chain, which is deeply complex and entrenched in outdated, globalised practices."

Weffan's innovative approach combines textile and garment manufacturing into a single step using existing Jacquard machines. To achieve its objectives, Weffan partnered with the University of Leeds' 3D Weaving Innovation Centre to explore immediate commercial goals and long-term technological solutions.

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Accessing existing supply chains

The company also engaged with industrial partners in the UK and EU to understand how its technology could integrate into existing supply chains.

The key outcome for Graysha and her team was the development of a waste savings evaluation system. This data-driven approach strengthens Weffan's position when engaging with investors and potential clients, providing concrete evidence of the benefits of its technology.

Calculating environmental and economic benefits

Graysha said: "Now, for every prototype and garment design we make, we can compare waste savings to conventional methods."

Other key outcomes included:

- creation of a product roadmap and pricing strategy
- establishment of crucial partnerships with UK manufacturers and researchers
- enhanced communications to explain 3D woven garment methodology to fashion brands
- identification of the UK manufacturing market
- development of a business model based on market research and commercial viability testing
- improved understanding of how to integrate 3D weaving technology into existing supply chains.

15–20%

material waste caused by using outdated methods

Overall, the study has accelerated Weffan's journey towards revolutionising garment production in the UK fashion industry, providing crucial insights, partnerships and systems.

A critical step towards commercialisation

Graysha said: "This feasibility study was critical for our journey towards commercialisation. It allowed us to take the time to thoroughly research and develop our ideas and provided a safe space to explore different directions before committing to full execution."

Read the full version of this impact story **here**.

Automatic weaving machine

Concretene

Cutting the carbon footprint of concrete

A Resource Efficiency for Materials and Manufacturing-funded collaborative research and development project is developing domestic supply chains for graphene-enhanced concrete that could help the construction industry reduce its carbon footprint as well as the cost of building.

Concrete is the backbone of modern construction. It is widely available, and can be used to quickly and **cost-effectively build affordable housing**. But concrete does come with a cost to the environment. Direct emissions from cement production (the main ingredient in concrete), combined with energy-intensive processes and transport, account for as much **as 8% of global CO_2 emissions**.

Concretene, a Manchester-based nanotechnology company, is leading a project that uses graphene to reduce the carbon footprint of concrete.

15–20%

reduction in concrete costs by using Concretene

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Reducing carbon by a third

Concretene's patented technology harnesses the remarkable properties of graphene, a material **said to be 200 times stronger than steel**. By enhancing the dispersion of graphene nanoplatelets (GNPs) within concrete, Concretene achieves structural performance equivalent to traditional concrete while using less material. This results in up to a 30% reduction in the carbon footprint compared to the widely-used Ordinary Portland Cement.

Concretene's breakthrough lies in stabilising the dispersion of GNPs using graphene oxide (GO). This prevents aggregation, enables high concentrations of graphene, and, crucially, boosts the material's strength and durability.

Defining the journey to scale

However, scaling up production is hindered by supply-chain issues, particularly the availability of GO and GNP. The GRAPHenhance project is addressing the challenges of quality, price volatility and specialised requirements by developing UK-based supply chains for GO and GNP production. William Blythe, a leading chemical manufacturer, will produce GO tailored to Concretene, while Thomas Swan will optimise GNP production to meet future demand.

Concretene's head of project management and communications, Alan Beck, said: "A pilot test, using Concretene on a farm in Cheshire, was successful and provided us with valuable insights into the scaling process as well as the challenges of integrating a new material into existing systems in the construction industry."

Making Concretene in the Formulations Lab in the GEIC

Fitting all the pieces together

The potential impact could be transformative. By using Concretene, construction projects could see a 15-20% reduction in concrete costs, 10% less cement use and significantly enhanced durability, according to the company. Wider benefits include boosting the UK chemicals sector, creating economic growth and positioning the UK as a global leader in graphene technology.

For businesses thinking about applying for funding themselves, Alan said: "It's been a real benefit to us in moving from lab to market. It's helped in understanding how to interface with the raw material supply chain, with the concrete suppliers, engineers, clients… the people who make it happen. This project has enabled us to get a much better understanding of how all those pieces fit into place, and the funding enabled us to actually do those activities."

Organisations and partners supported in Resource Efficiency for Materials and Manufacturing

- 3x6
- Additive Manufacturing Solutions
- Aeramine
- Aggregate Industries
- Aibuild
- The Alliance for Sustainable Building Products
- Almac Sciences
- Amphibio
- Authentise
- BAE
- Batch.Works
- Batri
- Biophilica
- Brunel University London
- Building Research Establishment
- Cardiff University
- Catnic
- Centre For Process Innovation
- Chip[S] Board Ltd
- Concretene
- Cranfield University
- Customem (Puraffinity)
- Dynatics Solutions
- DZP Technologies
- European Metal Recycling
- European Thermodynamics Limited
- FlexSea
- Gen 2 Carbon
- Green Lithium
- Greenleaf Surgical
- Hardide Coatings
- Holdson
- Hybrid Manufacturing Technologies
- iCOMAT
- Incredible Husk International
- Innovative Materials Ltd
- Lancaster University
- Leeds Beckett University
- Lightweight Structural Composite Panels Technologies
- Manufacturing Technology Centre
- Materials Nexus
- Materials Processing Institute
- Matsuura Machinery
- NanoLayr UK Ltd
- Nationwide Engineering Research & Development
- NCC Operations Ltd
- NS85
- Nueton Tech Ltd
- Oakdale (Contracts)
- Opovate
- Paintbox Banbury
- Peak To Peak Measurement Solutions
- Phoenix Scientific Industries Ltd
- Pilkington Glass
- Plastecowood
- The Plastic Economy Ltd
- Polestar Automotive UK
- PRA World
- Procter & Gamble Technical Centres Limited
- PyrOptik
- Quantum Science
- R53 Engineering
- Rare Earth International
- Re-Mine Ltd
- Scott Bader
- SHD Composite Materials
- Sigma Lithium
- Snowflow AI
- Sol Environment
- Sonichem
- Swansea University
- Tattva
- TauProbes
- Teer Coatings
- Teesside University
- Thermulon
- Thomas Swan
- TISICS
- Ultima Forma
- Ultromex
- University of Bath
- University of Birmingham
- University of Hertfordshire Higher Education Corporation
- University of Leeds
- University of Surrey
- University of Warwick
- Valuechain
- Vector Homes
- WASE
- WCM
- We Are Nium
- Weffan
- Weir Minerals Europe Limited
- William Blythe
- Wool Insulation Wales

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UK participants

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Sustainable Bio-based Materials and Manufacture

Sustainable Bio-based Materials and Manufacture (SusBioMM) addresses the challenge of developing innovations in sustainable and scalable biomanufacturing processes.

Its aim is to enable the UK to be more globally competitive by supporting development across different industries and sectors. SusBioMM is co-funded by the Engineering and Physical Sciences Research Council and the Biotechnology and Biological Sciences Research Council.

Innovate UK, BBSRC and EPSRC

Sustainable Bio-based Materials and Manufacture facts and figures

Feasibility study projects

39 projects

89 partners

£3.6m total cost

Collaborative research and development projects

21 projects

65 partners

£15.1m total cost

Innovate UK, BBSRC and EPSRC

1 innovation exchange

With Victrex Plc to produce a sustainable precursor in the PEEK manufacturing process, resulting in two innovative solutions

1 Global Business Innovation Programme

Engineering Biology and Industrial Biotechnology, San Jose, California, USA

12 webinars

4 covering the power of biotechnology to transform the UK chemicals industry, novel packaging materials, integrated biorefineries, and the role of biotechnology in developing a circular textiles industry

8 showcasing innovators involved in developing bio-based materials and innovations in sustainable and scalable biomanufacturing processes

3 showcases

Providing dissemination and networking opportunities

Pulpex at Materials Research Exchange 2024

BioMara

Repurposing seaweed byproducts as petrochemical alternatives

BioMara manufactures products from ocean-farmed seaweed for sale into functional foods, nutraceuticals and cosmetics. A Sustainable Bio-based Materials and Manufacture-funded feasibility study enabled the company to investigate the development of a sustainable biorefinery to manufacture products from residual streams.

BioMara's main focus is to extract and purify the high-value parts that make up a small proportion (5-30%) of seaweed biomass. The company saw there were environmental and economic opportunities in unlocking the value of the whole biomass and moving towards a zero-waste process. For instance, many of the components derived from the biorefinery residual streams are sustainable alternatives to petrochemical-based products.

70–95%

of seaweed currently wasted

Innovate UK, BBSRC and EPSRC

The benefits of seaweed production
Ocean farming of seaweed feedstock has many benefits, including providing fish habitats, protection against coastal erosion, removing nitrogen and phosphorus from the ocean, and as a carbon sink.

Creating co-products from residual seaweed biomass makes economic sense too, potentially increasing profits for processors like BioMara and their suppliers.

While this is exciting for sustainability and product development, it can be a difficult business proposition for a start-up because of the challenge of scale and competition from cheaper, non-sustainable sources.

Building the business case
Investigating the feasibility of new products from residual streams would have been difficult for BioMara without funding, because the company couldn't risk diverting resources from its main products.

BioMara's founder Jay Dignan said: "In manufacturing you have a chicken and egg problem: as a startup you can't produce at the price point for a client because you haven't got the investment, but you can't get the investment until you get clients and sales. These grants help solve that by moving us along the road towards a product that's ready for market."

For Jay, a key outcome of the feasibility study was building knowledge of the residual streams and their market potential. Through data collection, testing and new product development – even putting products in the hands of potential customers – the company gained confidence in the route to market.

The power of partnership
The funding enabled BioMara to build a closer relationship with its collaboration partner, seaweed supplier Kelp Crofters Ltd. By visiting Kelp Crofters' farm operations, BioMara gained a deeper understanding of harvesting and primary processing in the supply chain.

Taking part in events and conferences helped BioMara consolidate learning, disseminate information and connect with potential customers who could help them develop and valorise co-products from the biorefinery residual biomass streams.

Read the full version of this impact story **here**.

Biomara founder, Jay Dignan, gained a deeper understanding of seaweed harvesting

Arda Biomaterials

A leather alternative made from beer waste

A Sustainable Bio-based Materials and Manufacture-funded collaborative research and development project enabled Arda Biomaterials to accelerate the material development process.

Arda Biomaterials has developed a sustainable leather alternative derived from the proteins extracted from brewer's spent grain — the waste grain from the beer brewing process. By transforming this abundant waste into a biodegradable, animal- and plastic-free leather substitute, the company is addressing the environmental challenges of traditional leather production while contributing to the UK's circular economy.

The market for sustainable leather alternatives is vast and growing rapidly. **Valued at $73.3 billion in 2023, the sector is projected to exceed $130 billion by 2030**, driven by increasing consumer and industry demand for eco-conscious materials.

Lowering the footprint of a fashion favourite
Traditional leather production relies on carbon-intensive animal agriculture, which contributes to **over 14% of global CO_2 emissions**. Arda Biomaterial's alternative bypasses this resource-heavy process entirely, using spent grain to create a material the company says has just 2% of the carbon footprint of conventional leather.

The material avoids the toxic chemicals used in tanneries, uses less water to produce and is fully biodegradable, breaking down without contributing to microplastic pollution.

Replicating the characteristics of leather
Through a collaborative research and development project that includes Queen Mary University of London and King's College London, Arda Biomaterials is developing a process to introduce sustainable protein fibres into its material, enhancing its strength and usability while retaining its low environmental impact.

Establishing industry partnerships
Economically, Arda Biomaterials supports UK breweries by providing an additional revenue stream for spent grain, while creating opportunities to onshore modern manufacturing processes and generate new jobs.

The company's initial focus is on the luxury leather goods market. With smaller production volumes and higher price points, this sector is well-suited to Arda Biomaterial's early-stage capabilities. The company has engaged key players in the industry, who are expected to be announced soon, and it has already produced a showpiece bag with the sustainable fashion brand BEEN London as well as cardholder wallets with the craft beer company Beavertown Brewery.

A bag made from Arda Biomaterials' sustainable leather alternative

Harnessing Innovate UK funding
The company's co-founder and CTO, Edward TJ Mitchell, said: "Innovate UK's support accelerated our R&D efforts by enabling us to hire two additional scientists. It allowed us to collaborate with Queen Mary University of London and King's College London, providing access to expertise and resources we otherwise wouldn't have been able to afford."

And for startups who might be thinking about applying for Innovate UK funding themselves, he said: "Don't do it last minute. The key thing is to sit down and really plan the whole project funding application; that will give you dividends in your business development, because you need to make structured plans for your company anyway."

2%

of the carbon footprint of conventional leather

Innovate UK, BBSRC and EPSRC

Organisations and partners supported in Sustainable Bio-based Materials and Manufacture

- 2M Manufacturing
- Acheson & Acheson
- Activatec
- Advanced Bacterial Sciences
- Agricycle Innovation
- Agri-EPI Centre
- AgriFoodX
- Albumedix
- AlGreen
- Arda Biomaterials
- Ashe Morris Ltd
- Atritor
- Bangor University
- Bioataraxis
- BioMara
- Biome Technologies
- Biorenewables Development Centre
- Biozeroc
- British Geological Survey
- Brunel University London
- Bryn Power
- C3 Biotech
- Cambridge Smart Plastics
- Cardiff Metropolitan University
- Cassels Farm
- CelluComp
- Centre for Process Innovation
- Chip[S] Board Ltd
- CO2CO
- CP Cases
- Cranfield University
- Cresco Biotech
- Crown Paints
- C-Source Renewables
- CuanTec
- CyanoCapture
- Deakin Bio
- Deep Blue BioTech
- Diageo Great Britain
- Eco Cascade
- Eden Bio
- Efficiency Technologies Ltd
- Elemis
- Evolutor
- Faber Futures
- Fibe
- FlexSea
- Future Humanity Ventures
- Green Square Agro Consulting
- HydRegen
- iBiotech
- Iceni Glycoscience
- Imerys
- Impact Laboratories
- Imperial College London
- The James Hutton Institute
- James Hutton Limited
- JJ Power
- KelpCrofters
- King’s College London
- KoFibres
- Kymira
- LOHAS Recycling
- Manufacturing Technology Centre
- Maplex Technology
- Marine Biopolymers
- Material Research
- Matrix Polymers
- Mednet
- Mykor
- Nanolayr UK Ltd
- Nanolyse Technologies
- National Institute of Agricultural Botany
- Northumbria University
- Notpla
- Nova Biochem
- Osmose Studio
- PEEQUAL
- PhycoWorks
- Pilio
- Planet Smart
- Plastic Engineering Solutions
- Procter & Gamble Technical Centres Limited
- Pulpex
- PuriFire Labs
- Queen Mary University of London
- Queen’s University of Belfast
- Royal Agricultural University
- SAGES
- Scitech Adhesive Systems
- Sevenoaks Modular
- SPG Innovation
- Sterling Bio Machines
- Sun Bear Biofuture
- Tata Steel UK
- Teesside University
- Natural History Museum
- Three Brothers Brewing Company
- Transformational Energy
- University College London
- University of Cambridge
- University of East London
- University of Edinburgh
- University of Glasgow
- University of Hertfordshire
- University of Leeds
- The University of Manchester
- University of Nottingham
- University of Oxford
- University of Sheffield
- University of South Wales
- University of Surrey
- University of the West of England
- University of York
- Vandenberghuk
- Xampla
- Zentraxa

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UK participants

Innovate UK, BBSRC and EPSRC

For more information

Resources

Materials and manufacturing vision 2050

Resource Efficiency for Materials and Manufacturing

Sustainable bio-based Materials and Manufacture

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