



Innovate
UK

Manufacturing and Materials Review

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Facts and figures

Total project grant funding

£178m

Total match funding

£154m

Grant funding to SMEs

£92m



Unique SMEs supported

517



Unique organisations supported

755

The statistics shown on this page represent the grant funding provided directly to projects only, from 2016-17 to December 2020. In addition to these figures Innovate UK invests in the Catapult network, KTN and Innovate EDGE, all of which provide extensive support to a vast number of organisations in the sector, as detailed throughout this review.

Welcome

Manufacturing in the UK accounts for approximately 8% of jobs and 10% of economic output, yielding an impressive 42% of UK exports and 65% of UK research and development spending¹. A successful advanced manufacturing and materials sector is fundamental to the prosperity of the UK. It will be crucial in the post-pandemic recovery, and is essential for long-term economic growth and resilience.

The industry has been deeply impacted by the COVID-19 pandemic and vulnerabilities in supply have been exposed. Yet it has shown resilience and the capability to adapt, and continues to identify opportunities to innovate and grow. During the crisis, companies dynamically repurposed production to meet changing demand, for products such as personal protective equipment, and built new collaborations to develop highly complex products, with the Ventilator Challenge being one example.

This adaptability will become ever more critical. There is an acute need to embrace emerging and digital technologies, develop skills, embed resilience in operations and the supply chain, overcome the challenges of EU exit, and build sustainability. These require flexibility, collaboration and innovative thinking.

It is necessary to address these challenges in a coordinated way, aiming for integration across the full supply chain. This will require transformative collaboration and an inclusive approach to knowledge-sharing, best practice and behavioural change.

We will need to design, manufacture, sell and use products that deliver ever more value during their lifetime, with minimal environmental impact. The manufacturing process alone contributes at least 12% of UK total emissions², and these exclude the broader manufacturing system and the embedded carbon in the materials, components and products we import. We will need to enable re-manufacturing and high-quality recycling, minimising pollutants. Waste will be reduced but not eliminated, and we will need to increase efforts to transform this waste into valuable product.

These transformative challenges are difficult. Innovate UK, together with our partners KTN, Innovate UK EDGE and the Catapult network, endeavours to build the innovation ecosystem to help organisations thrive while taking the necessary steps towards a better and cleaner future.

This brochure highlights the support we have made available and illustrates a selection of the companies we work with. It is a call for increased engagement as we develop strategic priorities for the coming years.

- 1 It explains how we aim to inspire innovative businesses to work collaboratively to solve key societal challenges.
- 2 It details how we aim to involve people by building networks and communities, linking businesses with support, and providing platforms for companies to demonstrate their expertise and innovations.
- 3 It describes how we invest to help progress innovations through open grants and loans.

Our vision is for UK manufacturing and materials organisations to be:

- net zero and resource efficient, understanding the environmental impact of every stage in the supply chain and manufacturing system, and widely adopting circular economy principles
- competitive and thriving so the UK becomes an increasingly attractive place to manufacture goods, and a leader in the development and export of industrial technologies
- resilient and responsive to mitigate the risk from supply of critical materials, national/global disruptions, and adaptation to climate change.

We believe it is more important than ever for all of us to work together to innovate and grow a thriving UK manufacturing base, increase exports, create higher value jobs, and meet the challenge and opportunity of Net Zero 2050.

David Elson

Head of Manufacturing and Materials Sector Team
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Inspire

We aim to inspire innovative businesses to work collaboratively to solve key societal challenges. The programmes in this section have been developed and delivered in partnership with industry and are based on a shared vision of these challenges. Importantly, we support world-leading institutions, such as the High Value Manufacturing Catapult, which are key in helping the UK design, develop and deliver innovation.



Grant funding success

Manufacturing and Materials funding is leading to success in driving UK innovation and productivity.



In 2016, the Manufacturing and Materials sector area brought together the High Value Manufacturing team and the Advanced Materials team to launch a series of funding competitions covering the scope of the combined sector area.

Each round offered £15 million in grant funding. The competitions included a combination of feasibility studies and collaborative R&D projects, which leveraged typically a further £10 million of private investment from business per round.

These sector competitions provided a more predictable drumbeat to help businesses plan their R&D projects. Competitions were launched every six months, with a total of four held through to early 2018. They represented a combined investment in R&D of around £100 million in manufacturing and materials innovation projects.

The response to the competitions was very positive concluding that they had, in line with the recommendations from the Dowling³ and Nurse⁴ Reviews, contributed to making it easier for customers to engage with research

CASE STUDY

REALITY

The collaborative REALITY project reduces carbon footprint and material waste in car manufacturing.

Jaguar Land Rover joined forces with aluminium recyclers, materials technology disruptors and academic partners Brunel University London and the University of Warwick to deliver the REALITY project.

The project is pioneering the separation and use of recycled scrap aluminium waste in new car production. The innovative recycling process that was developed in this project helps to reduce carbon emissions, facilitate closed-loop manufacturing and accelerate decarbonisation in the automotive industry. It enables the creation of a completely new aluminium alloy to be used in cars, incorporating both end-of-life and post-industrial scrap.

This innovative project, which is funded by Innovate UK, will help the UK meet its 2050 net zero target.



Jaguar Land Rover's recycling initiative transforms aluminium from end-of-life vehicles into a new high-grade material

and innovation funding in general and the team's funding stream in particular.

A new sector grouping approach to the Manufacturing and Materials programmes further simplified the funding competition participation and demonstrated a good success rate for applicants. Technology and market areas included design for manufacture and reuse, application of digital (Industry 4.0) technologies, chemical and industrial biotech process industries, plus metallic, non-metallic and composite material innovations. The competitions also covered a wide range of other manufacturing technologies across general industrial sectors as well as automotive, aerospace, med-tech, construction and electronics markets.

Specially selected Manufacturing and Materials team innovation leads provided technical input and guidance to the projects. The majority of the projects are now complete and we are seeing some excellent outcomes with some examples highlighted in the following case studies.

CASE STUDY

Signal Biometrics

This company is using physiological data to protect lives, from Formula 1 drivers to first responders.

A core grant-funded business has developed the first low-cost, fire- and water-resistant clinical-grade biometric sensors, creating heat-resistant fabrics and protective clothing.

An idea initially directed at Formula 1 drivers, Signal Biometrics' adaptable technology is designed with motorsport, military and, crucially, first responder, rescue and extreme sports industries in mind. The multi-use technology enables quicker, safer, informed safety and healthcare interventions after an accident occurs.

The company is now actively exploring other markets, including the development of helmet-worn real-time technology to detect and measure concussion.



CASE STUDY

Keronite

A business supported by Innovate UK has designed a low-cost water purification system without the need for chemicals.

Clean water is essential for health, the environment and industry. People need uncontaminated drinking water, wildlife needs pollution-free streams, rivers and seas, and purified water plays a crucial role in the manufacturing of many products.

Traditional water-purification methods can be costly, inefficient and, in the case of certain chemical treatments, cause pollution themselves. But now a team at **Keronite**, a company based near Cambridge, has devised a low-impact, chemical-free solution.

Keronite specialises in protective coatings for metal parts. Its Pristine project utilises the reactive nature of certain materials, known as photocatalysts, to create a coating that removes pollutants from water.

Dr Robin Francis, Chief Technology Officer at Keronite (pictured), said: "When light of a particular wavelength, usually ultraviolet (UV) light, shines on a photocatalyst it stimulates a reaction on the surface, which can cause the destruction of bacteria or viruses.

"A well-known example of this is Pilkington self-cleaning glass, which has a thin layer of the photocatalyst titanium dioxide. As sunlight hits the glass, the coating reacts to break down dirt on the surface."

In 2018, Keronite used a £190,000 Innovate UK grant to help develop its concept of photocatalyst technology for water treatment. The company teamed up with UV water treatment specialists ATG UV (subsequently acquired by Evoqua Water Technologies).

Together they created a reactor that runs contaminated water through a tube filled with plates coated in the photocatalyst titanium dioxide. A high-power UV light through the centre of the tube stimulates a cleaning reaction as the water passes over the surfaces of the cones. Dr Francis said: "Unlike chemical treatments, which continually need to be replenished, a photocatalyst never runs out because it is activated by light.

"It's immobile, so doesn't introduce any pollutants to the water and, because it's highly active, it has the potential to tackle hard-to-remove micro-organisms."

By successfully creating a 10-fold reduction in energy consumption from initial prototypes, the Pristine reactor now offers a commercially viable proposition the company is keen to explore.

Dr Francis explained: "Our initial focus is on industries that require ultra-pure water for manufacturing, such as pharmaceuticals and electronics.

"But the technology has potential in many areas, from cleaning contamination from farming or mining, through to large-scale municipal drinking water and sewage treatment, and even treating polluted water sources in developing world countries."

Keronite has recently been awarded an additional Innovate UK grant of £47,634 under the business-led response to COVID-19 competition. The focus is to develop photocatalytic surface coatings with antiviral qualities that can actively destroy airborne pathogens, such as SARS-CoV-2, the virus that causes the disease COVID-19.

Dr Francis said: "This technology – with its ability to produce clean water cheaply, efficiently and with no side-effects and now the possibility of helping fight against COVID-19 – offers the potential of significant revenue and, more importantly, huge societal benefits."

"The technology has potential in many areas, from cleaning contamination from farming or mining, through to large-scale municipal drinking water and sewage treatment."

Dr Robin Francis, Chief Technology Officer, Keronite



IB is developing and supporting a move to renewable and biological compounds

CASE STUDY

Biome Technologies

A bioplastic company is developing naturally derived substitutes for plastics, helping reduce the chemical industry's dependence on fossil resources.

The environmental and social concerns surrounding the use of fossil fuels and food crops make lignin a compelling target as a source of organic compounds.

A consortium led by **Biome Technologies Ltd** investigated a bio-based alternative for the oil-derived organic chemicals used in the manufacture of bioplastics¹.

The consortium will continue to research the useful lignin intermediate aromatic building blocks for platform chemicals in plastics to help bring the technology closer to commercial scale.

The IB Catalyst industrial research Round 1 awarded £596,000 to the consortium, which comprises Biome Bioplastics, the University of Warwick, the University of Leeds and the Centre for Process Innovation.

The project built on an earlier IB Catalyst technical feasibility project undertaken by Biome and the University of Warwick. This demonstrated significantly improved understanding and considerable bioprocess development, as well as securing exploitable intellectual property.

Industrial Biotechnology Catalyst

The IB Catalyst invested over **£75 million towards research and development to support transformative and game-changing technologies.**

Industrial biotechnology (IB) can be defined as the exploitation of enzymes, microorganisms and plants to produce energy, industrial chemicals and consumer goods. The IB Catalyst programme, delivered as a partnership between Innovate UK and key UK research councils, supported early-stage feasibility studies, industrial stage research and experimental development grants.

IB Catalyst impact

The IB Catalyst supported research and development into the processing and production of materials, chemicals (including pharmaceutical precursors and biopharmaceuticals) and biofuels.

It also helped the development and commercialisation of innovative IB processes to manufacture a wide range of existing and new products through collaborative and non-collaborative research grants.

With five funding streams, the IB Catalyst committed over £75 million across 82 projects spanning the five challenge areas:

- production of fine and speciality chemicals and natural products (such as fragrances, flavours, pharmaceutical intermediates)
- production of commodity, platform and intermediate chemicals and materials (such as plastics, resins, silks)
- production of liquid and gaseous biofuels
- production of peptides and proteins (such as enzymes, antibiotics, recombinant biologics)
- novel or improved upstream or downstream processes to reduce costs or improve efficiency in industrial biotechnology applications.

The IB Catalyst had a balanced portfolio of projects, which included potentially transformative and game-changing technologies.



Industrial Strategy Challenge Fund

The Industrial Strategy Challenge Fund is a major innovation programme led by UK Research and Innovation (UKRI). An investment of around £2.6 billion of public money and £3 billion in matched funding from the private sector has been focused on projects that bring together researchers and businesses to tackle today's big societal and industrial challenges.

The ISCF brings together industry and researchers to address societal challenges

Manufacturing Made Smarter Challenge

This programme focuses on innovations in digital technology and will help the UK boost productivity by up to 30%⁶ by 2030.

The **Manufacturing Made Smarter (MMS) Challenge** is a £147 million government investment. Its aim is to transform UK manufacturing by delivering world-leading products at pace and on price, thanks to digital innovation.

As the innovation arm for the overall UK Made Smarter approach, the MMS programme is a fundamental part of the UK government's modern Industrial Strategy. The programme gives UK manufacturers access to digital innovation ecosystems that will help prove ideas and

concepts, develop them quickly with the support of industry experts and support scale-up.

The impact forecast for the MMS programme is significant. As well as creating a radical, cost-effective set of innovative solutions, funding takes the risks out of innovation so the UK's most visionary manufacturers can embrace digital technologies. The programme is predicted to generate thousands of new jobs and boost productivity by up to 30%⁶ by 2030.

Chris Courtney, Challenge Director of Manufacturing Made Smarter at UKRI, said: "Digital technologies have the power to radically transform how we manufacture and deliver the products and services of today and the future.

"Our ambition is for the UK to become a leader in the manufacturing industry and the development of the next generation of technology solutions that will shape how the world works.

"There are enormous opportunities to innovate in this area. We have world-leading industries, a powerful scientific and research community, and a vibrant technology sector. I'm excited to see this powerful coalition transform the future of manufacturing."

In September 2020, the challenge announced winners from its first round of funding from the initial competition. Fourteen cutting-edge projects are now underway, totalling over £50 million investment in digital innovations. The projects cover a wide range of technologies, such as the internet of things, artificial intelligence, and digital twin and additive manufacturing.

Prior to this, in July 2020, a £20 million funding call was launched, focusing on digital opportunities within UK manufacturing supply chains. Its aim was to provide manufacturing companies, technology developers and academic experts with the opportunity to work together on collaborative research and development projects.

Then in August 2020 came a £20 million investment for Manufacturing Made Smarter Research Centres. This essential funding supports many centres, taking a multidisciplinary approach to transforming factories, supply chains and the nature of work within them. Further investment will be made to underpin this work, exploring the economic, social, regulatory and policy changes needed to accelerate the digital transformation.

In 2021, the activity surges on. The challenge will fund a national network of Innovation Hubs and Test Beds.

CASE STUDY

GKN Aerospace

Cross-sector leadership is enabling cost-effective supply-chain decisions.

GKN Aerospace is leading a cross-sector team, involving organisations from the aerospace, automotive and pharmaceutical industries, to trial a combination of digital technologies in live manufacturing environments.

These include artificial intelligence and machine learning technologies, intelligent robots, and smart devices that can exchange information between old and modern computer systems, allowing a greater understanding of data.

The project will create a more seamless flow of real-time information, enabling cost-effective manufacturing decisions across the supply chain.

CASE STUDY

Frog Bikes

A children's bike company is reducing costs and its carbon footprint.

Frog Bikes is a British SME leading a project innovating the design of children's bikes. The company uses the latest digital technologies and manufacturing techniques to create a lighter, better-performing bike.

The system streamlines production, reduces cost, and, by allowing suppliers to use recycled materials, creates less waste.

The project will bring these manufacturing techniques to the UK, securing control of the company's supply chain, helping to reduce its carbon footprint.

These will help industry to accelerate the development and deployment of innovative solutions for smart factories and connected supply chains. Several accelerator activities will also run focused on technology developers with cutting-edge ideas. Other opportunities will follow such as a further round of Collaborative Research & Development funding plus activities focused on international innovation collaborations.

Transforming Foundation Industries Challenge

With sustainability and international competitiveness both vital to the UK economy, the Transforming Foundation Industries Challenge is supporting innovation and jobs.

As the UK moves ever more rapidly towards both a net zero carbon and sustainable future, it is imperative that materials such as glass, cement, metals, paper, ceramics and bulk chemicals are produced in a more environmentally sound but commercially viable manner. The **Transforming Foundation Industries (TFI) Challenge** is designed to both stimulate and pull through the multi-sector innovations that are required to make this happen.

As part of the Clean Growth Grand Challenge within the government's Industrial Strategy, the TFI Challenge aims to help businesses across the foundation industries share expertise and develop innovation solutions to increase their sustainability and remain internationally competitive.

Key aims for the challenge include:

- supporting research on new ways to reduce waste and energy use
- supporting university-led research into new technologies
- developing foundation industries' common identity to better meet challenges for the sector
- partnering with the financial sector to encourage more investment in technology companies that can reduce the environmental impact of the sector.



This challenge helps foundation industries to share expertise and develop innovations

Channelling investment

The TFI Challenge will invest £149 million through the Industrial Strategy Challenge Fund (ISCF) to ensure these sectors make improvements to their energy and resource efficiency, helping meet the government commitment of net zero carbon emissions by 2050. The challenge has up to £66 million to invest in direct projects, which is match-funded by £83 million from the private sector.

The two key economic benefits of this investment are:

- securing jobs for the future across the UK; the sector provides almost 500,000 skilled jobs in 31,400 firms, mainly in areas outside of London and the South East
- anchoring high-value manufacturing in the UK; these sectors underpin high-value manufacturing. Without them, the UK will become less competitive.

Since starting in 2020, the TFI Challenge has already committed over £25 million of grant funding to innovation projects to help achieve economic benefits.

CASE STUDY

Glass Futures pilot facility

A new pilot facility in St Helens will provide a centre of excellence for the sustainable manufacture of glass.

The TFI Challenge has contributed £15 million of the £54 million total cost of the construction of a new **Glass Futures pilot facility**. Due to open in 2023, the facility will be set up in St Helens to accelerate the development of promising clean technologies. Other contributing partners are Liverpool City Region Combined Authority and St Helens District Council, with an additional £20 million industry contribution.

The 30 tonnes per day furnace and associated processing equipment will enable members from the glass and other high-temperature sectors to undertake process improvement experiments at a highly instrumented pilot facility.

The facility in St Helens is on a former glassworks site historically occupied by United Glass.

Business Secretary Kwasi Kwarteng said: "This new funding will build on our commitment to cut emissions across heavy industry, create green-collar jobs on Merseyside and help us to build back greener."



Smart Sustainable Plastic Packaging Challenge

£60 million funding will set the UK at the forefront of next-generation sustainable plastic packaging systems, helping the environment and creating jobs.

From keeping medicines safe to being integral in computers, phones, clothes and shoes, plastic has become part of modern life. Yet an estimated eight million tonnes of plastic waste enters the world's oceans each year⁷ and discarded plastics contaminate vital ecosystems and threaten our food chains.

The **Smart Sustainable Plastic Packaging (SSPP) Challenge** aims to establish the UK as a leading innovator in smart and sustainable plastic packaging for consumer products. The challenge will deliver cleaner growth across the supply chain, with a dramatic reduction in plastic waste entering the environment by 2025. Part of this funding will develop and demonstrate at-scale new business models for reuse and refill as well as behavioural change.

£60 million in funding comes from the ISCF, complemented by £149 million from industry, and work is already underway. Over the past 12 months, the SSPP Challenge has supported collaboration and networking through the **UK Circular Plastics Network**. It has run two competitions for early-stage business-led projects, worked jointly with multiple research councils to fund an Enabling Research Programme, and completed the first round of demonstrator funding.

Enabling research

Enabling academic research has been vital. The SSPP Challenge awarded 10 university-led research projects a total of £8 million in funding. The aim is to find solutions to existing issues with plastic packaging, reduce plastic pollution and unlock barriers to create fundamental changes in the industry.

Universities are working with partners from across the plastics sector to ensure solutions are directly in line with industry needs. The impact has been strong, with funding winners designing innovative research projects. These have included increasing the use of compostable plastic, utilising smart technology to change the way food-to-go is packaged, and creating new circular approaches to plastic waste management.

Demonstrator funding

Demonstrator funding leads to impact and growth. £20 million was awarded to four business-led projects to invest in cutting-edge recycling technology and to reduce landfill and incineration. These projects represent the biggest investment in chemical recycling technologies to date. From hydrothermal liquefaction and a depolymerising facility that extracts colour from waste allowing easier reuse, these technologies have the potential to create hundreds of new jobs in the North of England.

Further activity includes an £8 million competition for late-stage business-led research and development projects and a second round of demonstrator funding. Key focus areas for these competitions will be supporting solutions for developing refillable-packaging systems and sustainable solutions for film and flexible plastic packaging.

Plastics Research and Innovation Fund

A new investment partnership is supporting UK companies to stop the flow of plastics into the world's oceans, reducing waste and pollution.

Each year eight million tonnes of plastic enters the ocean⁷, the equivalent of dumping one rubbish truck of plastic into the sea every minute. Up to one million sea birds and 100,000 mammals, turtles and fish are killed as a result⁷. Sadly, this figure is expected to quadruple by 2050 if we do not act now.

Innovate UK and **Sky Ocean Ventures** have joined forces to support UK companies working on original ways to stop this devastating flow of plastics into oceans around the world.

Innovate UK has provided £3 million in grants to support UK start-ups leading the fight against plastic waste. Sky Ocean Ventures has matched this with private investment for the same companies.

This is a project that will forge vital change. Set up by Sky UK, Sky Ocean Ventures invests to support young companies and create meaningful change by highlighting the potential environmental disaster caused by plastic pollution in the oceans.

Through this investment partnership, the programme has directly funded innovations for new sustainable plastic alternatives, and alternative business models and supply chains. These innovations all use less plastic, create new product designs and are developing new ways to deal with plastic waste.

CASE STUDY

Flexi-Hex

A rapidly growing company is offering an alternative to plastic packaging.

Flexi-Hex creates adaptable plastic-free packaging for many industry sectors. Its goal is to remove plastic from the global packaging industry and raise awareness of the environmental threats currently facing the world.

Of all the plastic produced globally, 42% is for the packaging industry⁸. This is a number Flexi-Hex wants to reduce. To achieve this, the company has created a robust and patented protective sleeve made from an expandable honeycomb material. Made from over 85% recycled paper pulp, the innovative hexagonal cell structure is strong and provides protection for fragile products. It also creates a sleeve that is extremely flexible and forms to the shape of products placed within it.

This carbon-negative company is already creating an impact. Favoured by Grolsch, Diageo and more, Flexi-Hex now supplies over 25% of UK distilleries with plastic-free bottle packaging, removing over 800km of plastic from the packaging industry⁹. Company growth is averaging 400% year-on-year.



Flexi-Hex's sustainable plastic-free packaging is used across a range of industries

Compound Semiconductor Applications Catapult

This Innovate UK funded Catapult is developing compound semiconductor applications technology that outperforms silicon chips in speed, power and light, saving energy and reducing emissions.

Compound semiconductors are integral to achieving the UK government's 2050 net zero targets and ensuring secure and resilient communications in the digital world.

Traditionally, semiconductors in the form of silicon chips have been used in modern electronics. Yet compound semiconductors outperform silicon chips in three important ways: speed, power and light.

Based in Newport, Wales, the **Compound Semiconductor Applications (CSA) Catapult** is part of Innovate UK's capability-building Catapult Network. The CSA Catapult plays a key role in the world's first compound semiconductor cluster, which, as a whole, has a cumulative strategic investment of more than £600 million. The CSA Catapult collaborates with large companies, start-ups and universities to develop and commercialise new compound semiconductor applications. Its technology expertise covers photonics, power electronics, radio frequency and microwave, and advanced packaging.

Dr Ingo Lütcke, Head of Power Electronics at the CSA Catapult, said: "Compound semiconductors not only enable us to save energy in existing markets, but their adoption also opens a range of new markets and products. Saving energy in additional markets further reduces the environmental impact of an ever-growing human population."

The CSA Catapult's key markets cover transportation, clean energy, digital communications, defence and security, and space. The compound semiconductor market is expanding at a 10-15% compound annual growth rate, compared with 6% for silicon¹¹, and the impact of the CSA Catapult's work is already significant.

Direct leveraged investment accounts for £140 million of the cumulative project value across all collaborative research and development projects. 68% of partners are in academia¹², strengthening knowledge collaboration, opportunities and jobs.

The impact from the jobs generated is growing. The CSA Catapult's 30,002sq ft Innovation Centre of Excellence employs 75 researchers, engineers and support staff. Due to the accelerating adoption of compound semiconductor applications, the CSA Catapult forecasts it will create and safeguard 4,770 jobs. Supporting this are 33 new projects, nine international partners to date and a further £177 million of collaborative projects in the pipeline.

CASE STUDY

ESCAPE

A £20 million project is building a secure UK end-to-end supply chain capability for innovative silicon carbide (SiC) power electronics.

One impact project is **ESCAPE** (End-To-End Supply Chain Development for Automotive Power Electronics). Its end-to-end supply chain capability will produce game-changing technology, supporting the push for electrification in the UK and worldwide, and working towards net zero.

ESCAPE is partnership collaboration at its best. McLaren Applied Technologies, ClasSiC, Lyra Electronics, MaxPower, MicroSemi, Tribus-D and TPS are just some of the 13 partners that will help ESCAPE to compete globally.

The project forecasts to safeguard or create 203 jobs in engineering and manufacturing. With the CSA Catapult providing market intelligence, SiC evaluation modules and more, the successful exploitation of ESCAPE will result in over £66 million of further UK investment in SiC R&D and capital expenditure.

Dr Lütcke said: "The rapid electrification of transport provides a unique opportunity to accelerate the innovation in power electronics.

"The driving force behind electric vehicles and alternative energy generation is the reduction of greenhouse gas emissions and improved air quality, ultimately saving our planet and impacting everyone's lives."

High Value Manufacturing Catapult

Working through seven world-class centres of industrial innovation, the HVM Catapult helps accelerate new concepts to commercial reality.

The **High Value Manufacturing (HVM) Catapult** is government and industry's go-to place for advanced manufacturing technologies in the UK.

Established and sponsored by Innovate UK, the HVM Catapult bridges the gap between business and academia. It does this by providing access to world-class research and development facilities and expertise that would otherwise be out of reach for many businesses in the UK.

With 3,130 staff in seven centres across 18 sites, the HVM Catapult's activity is having a big impact on technology and markets, enabling economic growth and societal and environmental progress.

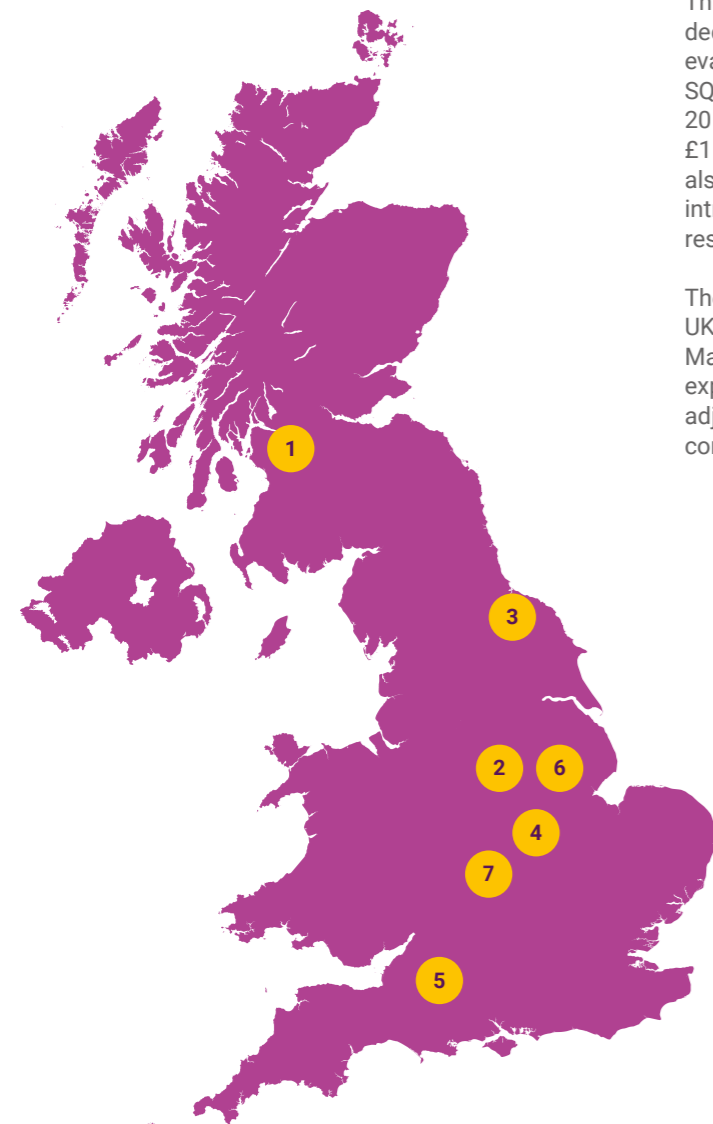
Examples include:

- 6,500 jobs through Fit For Nuclear and Nuclear Sharing programmes, plus £50 million private investment
- HVM Catapult training over 600 manufacturing apprentices, with 200 on the HE/graduate training programme
- up to 2,500 jobs in Coventry from a clustered regional investment of £800 million.

The HVM Catapult's areas of expertise cover all advanced manufacturing technologies from basic raw materials through to automation, biologics, biotechnology, casting, composites, virtual reality and visualisation.

This all means a big asset base of £791 million that is dedicated to driving growth. Indeed, an independent evaluation, conducted in 2017 by economics consultancy SQW¹⁰, assessed the potential economic impact of the 20 most substantial HVM Catapult interventions alone as £15.7 billion of GVA over the next 10 years. The evaluation also assessed that over 60% of smaller businesses would introduce a new or improved manufacturing process as a result of the support provided by the HVM Catapult.

The HVM Catapult works in partnership with Innovate UK teams and is directly sponsored through the Manufacturing and Materials team. This sharing of expertise helps guide strategic priorities and supports any adjustments needed to reflect technology trends, market conditions and business priorities.



- 1 Advanced Forming Research Centre
- 2 Advanced Manufacturing Research Centre
- 3 CPI
- 4 Manufacturing Technology Centre
- 5 National Composites Centre
- 6 Nuclear Advanced Manufacturing Research Centre
- 7 WMG

CASE STUDY

Seismic Consortium

This consortium is working to transform the design and construction of primary schools.

The Seismic Consortium is a collective of leading UK construction consultants, which includes the HVM Catapult's **Manufacturing Technology Centre (MTC)**.

Around 100 new and replacement primary schools are needed every year in the UK, costing £5 billion. One of the consortium's aims is to change the way primary school projects are designed, procured and constructed, creating efficiencies and saving money.

MTC has carried out extensive R&D into standardisation to drive down costs, reduce lead times and radically improve productivity in the delivery of outstanding primary schools.

CASE STUDY

WMG and Arriba Technologies

New heat pump technology is contributing to the government's 2050 net zero target.

The **HVM Catapult Centre at WMG**, the University of Warwick's innovation arm, supported Arriba Technologies Ltd with the development of a solar-powered heat pump product for large buildings including hospitals, factories, schools and supermarkets.

The technology is designed to help meet the government's 2050 net zero target. Early readings from the heat pump's first large-scale installation suggest energy efficiency savings of up to 80% are achievable.

With a planned UK facility, commercial scaling is in progress and is attracting interest from significant public sector organisations, including the Department of Health.

The AMRC is a world-class centre for industry-focused research and development



CASE STUDY

Advanced Manufacturing Research Centre, Rotherham

An HVM Catapult Centre is playing a crucial role in reviving the area's manufacturing sector.

The **Advanced Manufacturing Research Centre** in Rotherham, one of the HVM Catapult Centres, has attracted over £218 million of inward investment from global companies into the area. This has spurred regeneration, transforming a deprived area into a prosperous innovation hub with up to 3,500 new jobs.

The centre has also enabled Rolls-Royce to transform its productivity in disc machining, reducing the time taken to manufacture each disc by 50%. This has helped secure a £100 million investment in a new Rolls-Royce advanced aerospace disc manufacturing facility in Washington, Tyne & Wear, as well as inward investment from Boeing.

Responding to COVID-19

Discover how the Innovate UK family has responded and helped to support the manufacturing and materials community as we work together through challenging times.

Innovate UK has delivered support during the pandemic to drive innovation

Innovate UK

In April 2020, the government placed Innovate UK in a lead position to deliver support to UK businesses to drive innovation during the COVID-19 pandemic. To enable this, funding competitions were used to deliver support to all sectors of the UK economy, including the manufacturing and materials community.

Sustainable Innovation Fund

A £191 million Innovate UK COVID-19 recovery programme encourages cutting-edge research and development across all sectors of the UK, particularly in environmental sustainability challenges.

Key statistics:

- support for over 1,100 projects and approaching 1,200 businesses
- support for 168 manufacturing and materials projects
- total funding for these 168 projects is over £23 million.

Innovation Continuity Grants

These grants provide funding to allow businesses to crucially continue delivering world-class innovation, ensuring the UK continues to be at the forefront of R&D.

Key statistics:

- support for over 630 businesses undertaking existing Innovate UK-funded R&D projects that are experiencing financial liquidity challenges due to COVID-19
- over £10 million provided in support for 91 manufacturing, materials and mobility businesses.

Innovation Continuity Loans

Innovation Continuity Loans give SMEs and third sector organisations access to £210 million, helping them continue their innovation activity despite the COVID-19 pandemic.

These continuity loans are for organisations that find themselves facing a sudden shortage or even unavailability of funds resulting directly from the COVID-19 pandemic. The demand for this support has increased as the impact of COVID-19 continues to hit businesses.

Additional projects

Further Innovate UK initiatives include:

- Fast Start Competition, a £40 million Innovate UK programme established to support UK businesses to focus on emerging or increasing needs of society and industries during and following the COVID-19 pandemic
- £39 million of additional funding to Innovate UK EDGE to expand its bespoke specialist-led growth support to 6,000 innovative businesses over two years. This will help to build the foundations to succeed and scale.

High Value Manufacturing Catapult

The High Value Manufacturing (HVM) Catapult has been at the forefront of efforts to equip the healthcare front line with the tools it has needed to treat patients suffering from COVID-19 and to save lives.

On 16 March 2020, the Prime Minister spoke to over 60 of the UK's leading manufacturing businesses and organisations, calling on them to help the UK step up production of vital medical equipment, such as ventilators.

Using the HVM Catapult's strong relationships across industry, by 19 March HVM Catapult CEO, Dick Elsy, was able to pull together a consortium of outstanding UK industrial talent. Many of these companies would traditionally be competitors, either in the marketplace or the Formula 1 racetrack, but they put this aside in the national interest. At unprecedented speed, the consortium built a plan to deliver what the country would need.

The HVM Catapult's centres were closely involved throughout the effort, with the Advanced Manufacturing Research Centre's new Welsh facility at Broughton transformed into a full-scale production line. The latest digital manufacturing technologies were deployed to optimise production in a safe environment, with

simulations used to model logistic and operator movements, and operator training delivered using augmented reality headsets.

The consortium ultimately produced 20 years' worth of ventilators in just 12 weeks, delivering over 13,000 ventilators to the NHS.



CASE STUDIES

Aerosol Generating Procedure Shield

The team at the Manufacturing Technology Centre (MTC) developed an innovative new **Aerosol Generating Procedure (AGP) Shield** to protect NHS staff while carrying out vital procedures. The shield can be rapidly deployed for front line use, providing an additional layer of protection to the UK's medical staff.

The MTC distributed the first 200 shields to NHS trusts across the country free of charge. It continues to develop a final lightweight moulded version, which could be made available commercially through a third-party manufacturer under licence.

The shield's design was accessible online, enabling it to be produced anywhere in the world where such protection was needed.

Vaccines

Experts from the HVM Catapult's **CPI** joined the national task force to develop, trial and manufacture an effective vaccine. CPI has focused its efforts on evaluating the process of scale-up and development of the mRNA vaccine platform technology, and on building the capability to manufacture millions of doses of the vaccine. The research into mRNA vaccines is potentially game-changing far beyond COVID-19.

Personal protective equipment

The HVM Catapult Centres have been active in ensuring that as much personal protective equipment (PPE) as possible made it to the NHS front line and social care services. They donated over 100,000 items of PPE and manufactured key items, such as face visors, using 3D-printing and batch cutting techniques to produce them as quickly as possible.



Involve

We aim to involve people and organisations from every part of the UK to ensure all can share in the benefits of innovation. We build networks and communities, link businesses with support, strongly encourage equality and diversity, and provide platforms for companies to showcase their expertise and innovations.

KTN

KTN connects ideas, people and communities to drive innovation that shapes the future and creates lasting economic impact.

KTN works closely with Innovate UK to support innovation across multiple sectors

KTN accelerates the realisation of ambitious research and ideas into real-world solutions by connecting sectors, disciplines, geographical areas and supply chains.

With 200 staff across the UK, and reaching nearly 40,000 organisations, KTN's expertise is wide and significant. Dedicated teams serve specific sectors such as food, health, transport and infrastructure, with technology-focused teams in areas of digital, enabling technologies, emerging technologies and complex systems.

Working with Innovate UK's Manufacturing and Materials team

KTN teams in chemistry, industrial biotechnology (IB), and materials and manufacturing work directly in partnership with Innovate UK's Manufacturing and Materials team.

By exploiting the reach of KTN's experts across all technologies and sectors, diverse connections are made that would not otherwise happen. KTN works in close partnership with the broad Innovate UK family to scope new competitions and create new communities. It does this by:

- linking a manufacturer to a technology it didn't know existed to solve an issue or to improve its productivity
- unlocking the value of a new cutting-edge piece of research or product concept by linking to industry partners and market understanding
- facilitating the embedding of new knowledge into a business
- identifying new and emerging opportunities, challenges or gaps and building communities to exploit them.

KTN's work continues with a renewed purpose since the launch of its strategy in summer 2020, which highlighted its mission to drive positive change. Project examples include:

- supporting strategy development with Innovate UK's Manufacturing and Materials team
- informing policy on the circular economy with the Department for Environment, Food & Rural Affairs, Department for Business, Energy and Industrial Strategy, and Innovate UK
- developing strategic opportunities for manufacturing chemicals from alternative feedstocks as part of the transition to net zero
- fostering diversity in the sector through a celebration of women in manufacturing¹³ and young people in manufacturing¹⁴
- the publication of a guide¹⁵ on how to take a product from concept to manufacturing fruition
- development of a new high-profile global event on sustainable plastics¹⁶
- KTN SME Accelerator – accelerating innovative chemistry and IB solutions for a net zero world.



KTN is exploring strategies to enable net zero chemical manufacturing

In numbers

In 2019-20 KTN's Chemistry, Materials and Manufacturing teams delivered:

- 22,000 newsletter subscribers
- 2,206 business engagements
- 776 introductions
- 133 collaborations
- 152 recorded outcomes, with an estimated £27 million of value returned to the UK economy, equivalent to approximately £14 for every £1 spent on KTN.



International

Internationally, KTN leads the **Global Expert Missions** (GEM). The programme plays an important role in building strategic partnerships, providing deep insight into the opportunities for UK innovation and shaping future bilateral collaboration programmes. GEM in recent years covered advanced materials to South Korea and Israel, advanced composites to the USA, remanufacturing to China, and artificial intelligence and manufacturing to Canada.

The Canada missions led directly to a funding competition in partnership with the Canadian equivalent of Innovate UK (NRC IRAP). The investment came to £5 million and 5 million Canadian dollars in 10 collaborative projects featuring partners from the two countries. The Composites mission to the USA also led to a £1.7 million joint grant funding competition.

Catalysis

Catalysis is the increase in the rate of a chemical reaction by the addition of a reagent that is not itself consumed. It is a key enabling technology to produce chemicals. It is estimated that 85% of all products manufactured include catalysis in their production chain.¹⁷

Catalysis can be used in carbon capture and utilisation. This involves capturing carbon emissions from existing processes and turning the gas back into chemical-starting materials.

KTN has successfully demonstrated how catalytic production can enable the conversion of various types of waste to basic chemicals. These can be used as building blocks for new materials, creating cleaner and more efficient processing.



KTN's wide-ranging expertise includes support for foundation industries

Digital manufacturing

Several years ago, KTN recognised the need to help manufacturing SMEs with digital manufacturing (Industry 4.0). In response, it developed an adoption tool called 4Manufacturing®, which it is deploying with regional partners across the UK and in partnership with the Made Smarter movement.

In parallel, KTN conceived and delivered special interest groups in the following: flexible manufacturing, additive manufacturing, robotics and artificial intelligence, and immersive technology.

This has all played a major role in feeding into the scoping and now delivery of the £147 million Manufacturing Made Smarter Challenge.

Sustainable plastics and support for the foundation industries

In sustainable plastics, the KTN materials team built a circular plastics network and is working to inform and deliver the £60 million Smart Sustainable Plastic Packaging Challenge. The team's work on plastics also includes a project looking at the global problem of marine litter.

In addition, the team provides support to the Transforming Foundation Industries Challenge, creating an engaged cross-sector network of over 1,000 members from business and research organisations.

Additional case studies

- <https://ktn-uk.org/casestudy/autocraft/>
- <https://ktn-uk.org/news/support-from-the-innovate-uk-family-has-helped-trakrap-develop-an-excellent-circular-business-model/>
- <https://ktn-uk.org/casestudy/mdf-recovery/>
- <https://ktn-uk.org/casestudy/playdale/>
- <https://ktn-uk.org/casestudy/c-tech-innovation/>

Innovate UK EDGE

Innovate UK EDGE provides bespoke support for innovative manufacturing and materials companies, helping them to develop growth-orientated commercial strategies.

Innovate UK EDGE (previously delivering its services as Enterprise Europe Network) is a key part of Innovate UK's investment in businesses that drive economic growth. It complements Innovate UK's project funding with intensive, specialist-led support for ambitious companies.

Each high-potential, innovative business in the EDGE portfolio benefits from the objective perspective of a dedicated innovation and growth specialist local to them. An EDGE specialist considers a business in the round and, working closely with its leadership, identifies the most productive ways to accelerate its growth.

EDGE specialists can draw on resources such as EDGE programmes, events, innovation and international networks, and their domain expert colleagues. For some businesses, EDGE resources, such as investment readiness programme Pitchfest and the Global Business Innovation Programme, will also be a gateway to its bespoke, specialist-led support.

The EDGE team establishes strong relationships based on trust that support each business through its growth journey to scale. The most outstanding scaling businesses that are disrupting their industries, are capable of internationalisation and are achieving over 50% growth per annum are invited to join the Scaleup Programme for enhanced support.

A first engagement with EDGE, which starts with a thorough audit of challenges and opportunities, typically results in targeted action in one of the following areas:

- exploiting innovation – EDGE expertise and networks help businesses protect and harness IP, improve innovation management and access the innovation ecosystem globally
- sourcing funding and finance – with EDGE help, businesses can find the best option and get investment ready to propel their growth
- entering new markets – EDGE provides connections and guidance for ambitious businesses to expand into vertical and international markets and achieve scale.



CASE STUDY

Cubi-Tech Pharmaceuticals

EDGE helped this business hone its strategy and publish a number of patents.

In 2020, **Cubi-Tech Pharmaceuticals** protected its intellectual property around a novel hot-melt extrusion (HME) manufacturing process with help from Innovate UK EDGE.

Its technology enables continuous production of 3D-printed tablets and formulations in varying dosages, combining active pharmaceutical ingredients with polymers that mask any unpleasant taste.

Using HME for medicinal products cuts manufacturing time in half and achieves a 50% reduction in the cost of production, giving the company a significant advantage in the market.

Innovate UK EDGE has been helping Cubi-Tech for more than three years. Initially, this assistance began with help in reclaiming more than £200,000 in R&D tax credits, followed by assistance to develop the strategy to transform the business into an HME pharmaceutical manufacturer, as well as advice to protect its intellectual property.

The company has now successfully registered and has published three patents in Drug Delivery Systems with the UK Intellectual Property Office which include ibuprofen manufacturing using HME.

CEO and founder Saumil Bhatt said: "Our Innovate UK EDGE specialist, Valerie Pondaven, introduced me to the IP audit just at the right time. We reviewed our patents and then we filed for another three in May, so that's six patents in all."

Employee numbers have risen from nine to 12, with two more to be added over the next few weeks. Saumil Bhatt said: "Turnover is now at £1.5 million. In five years, I expect it to rise to £10 million or more."

Knowledge Transfer Partnerships

The Knowledge Transfer Partnerships scheme helps businesses in the UK to innovate and grow by linking them with academic or research organisations and graduates.

Funded by UKRI through Innovate UK with the support of co-funders, **Knowledge Transfer Partnerships (KTP)** is a vital network. Funders include the Scottish Funding Council, Welsh Government, Invest Northern Ireland, Department for Environment Food & Rural Affairs and Department for Business, Energy and Industrial Strategy.

Innovate UK manages the KTP and management KTP (mKTP) programmes – which focus on improving productivity through better management practices –

facilitating delivery through key partners. Each partner plays a specific role in the support and delivery of the programme.

KTP matches a business and its new skills with the latest academic thinking. The result is the delivery of a specific, strategic innovation project through a knowledge-based partnership. Projects last between 12 and 36 months depending on the subject context and the needs of the business. With over 800 live projects, KTP is a truly national programme with projects in almost every sector.

CASE STUDY

Dmitry Bogachov, Sandon Global

KTP award winner uses science expertise to maximise commercial opportunities.

More than 100 knowledge bases are engaged in KTP. Providing access to world-class academic knowledge and resources, KTP enables fresh thinking and deep expertise to find expression through positive impacts.

Dmitry Bogachov is an example of the kind of impact the network offers. A KTP Associate working with **Sandon Global Engraving Technology Ltd** and the University of Manchester, Dmitry was one of the winners of the Future Innovator category at the 2020 KTP Best of The Best Awards. The accolade is given to KTP Associates who have shown exceptional skills in driving and delivering innovation strategy.

Sandon Global is a leading manufacturer of anilox rolls and cylinders for the flexographic, lithographic and metal decoration print industries. In 2019, Sandon Global was awarded an Innovate UK grant to develop laser technology capable of engraving the new coatings developed during this KTP phase. Dmitry's overall objective in the project was to develop, embed and exploit expertise in materials science and surface engineering. This would enable Sandon Global to become the commercial centre of excellence for anilox technology.

The impact achievements are numerous. Dmitry introduced changes to manufacturing methodologies and powder composition. This led to substantial increases in products

Dmitry Bogachov,
2020 Future Innovator
award winner



passing through quality assurance and a reduction in non-compliance rejects due to coating failures. Dmitry's work also resulted in a new thermal spraying technique, which significantly improved the tribological properties of Sandon Global's products. The proactive approaches Dmitry adopted also led to the modification of the project plan, maximising commercial and in-depth research opportunities.

Stephen Ellis, Site Director at Sandon Global, said: "Dmitry has become the driving force for innovation within the company and the conduit between the academic and industry teams – balancing the possible with the practical. We believe he will go on to be a very successful innovation leader of the future, hopefully within Sandon Global."

Thanks to KTN for material provided for this case study.



Thought leadership

Innovate UK's teams support industry to commercialise and exploit state-of-the-art advanced manufacturing and materials research.

Innovate UK teams provide expert guidance on cross-sector capabilities, strategic priorities, challenges and opportunities, as well as guidance on UK and international funding calls.

Examples include:

- **Industrial Biotechnology Leadership Forum (IBLF)** – an industry-led initiative to progress an industrial biotech economy in the UK
- **Department for Business, Energy & Industrial Strategy-led Bioeconomy governance group for delivery of the government's policy paper Bioeconomy strategy: 2018 to 2030¹⁸** – looks at the approach government, industry and the research community will take to harness the power of bioscience and biotechnology
- **Future Biomanufacturing Research Hub** – tasked with accelerating the translation of scalable biomanufacturing processes for value-added chemicals, engineering materials, fuels and pharmaceuticals
- **Chemistry Council Innovation Committee** – helps address tools and guidance needed to allow customers and supply chain stakeholders to make informed decisions regarding the sustainability of products
- **Henry Royce Institute** – develops fundamental materials research to commercialisation and is primarily funded by Engineering and Physical Sciences Research Council. Innovate UK's Manufacturing and Materials team works closely with the Institute and key contacts in industry.

CASE STUDY

A National Industrial Biotechnology Strategy to 2030

This report sets out the plan to enable IB to become a mainstream part of UK industry.

The IBLF commissioned a National Industrial Biotechnology Strategy to 2030. Published in 2018, the report sets out a range of strategic targets, with seven recommendations. A key recommendation is to foster a more supportive regulatory environment and create a long-term policy landscape to support IB innovation.

In response, Innovate UK commissioned the BSI Group in late 2019 to develop a strategic IB regulations and standards roadmap, aligning it to the UK government's net zero 2050 strategy. It is due for publication in 2021.



Diversity and inclusion

Supporting people from a variety of backgrounds and walks of life to innovate and succeed in business will improve the UK economy.

Innovate UK is committed to encouraging diversity and inclusion in business innovation. Diversity is proven to lead to economic growth. Ethically and economically, it is important to find the best and most talented innovators from a diverse range of backgrounds and provide them with support and resources to succeed.

In July 2020, a report was commissioned outlining barriers, challenges, opportunities and support needed for minority ethnic groups and disabled people to participate in business innovation.

To tackle under-representation in business innovation we need to look closely at our structures, processes and the way we operate.

Here, we look at two diversity and inclusion campaigns already having a significant impact.

Women in Innovation

Women in Innovation is our first diversity and inclusion campaign, which aims to get more women innovating in business in a variety of areas.

The campaign began in 2016, aiming to understand the challenges of being a female entrepreneur. A women-only competition with awards offering innovation grant funding and a tailored programme of mentoring and business support was set up. The support helped the award holders grow their businesses while creating new role models for the next generation.

A second Women in Innovation funding competition was launched in 2018, followed by a third wave in 2020.



Laura Niehorster,
founder of social
enterprise Proud Pads

Young Innovators

Innovate UK is investing £2.2 million to support young people aged between 18 and 30 years old to develop their innovative business ideas. Part of this is the **Young Innovators** programme, a partnership between Innovate UK and the Prince's Trust.

The programme includes annual awards for young people with creative and ground-breaking business ideas, plus a high-profile #IdeasMeanBusiness campaign.

By 2023, the Young Innovators programme will award up to 100 young people from diverse backgrounds with a £5,000 grant, one-on-one business coaching and an allowance to cover living costs.

CASE STUDY

Dr Fanya Ismail, SGMA

SGMA is delivering innovative solutions to protect the environment from plastic pollution.

Dr Fanya Ismail is the founder and CEO of **SGMA, Sol-Gel Materials and Applications Ltd**. Founded in February 2017, SGMA has successfully developed a barrier coating for fibre-based food packaging that replaces single-use plastics and is biodegradable, compostable and recyclable. The company is committed to eliminating plastic in multiple sectors by providing practical and green solutions.

Certification in Europe and America is underway, and Dr Ismail aims to complete the commercialisation process and successfully deliver the barrier coating product to the packaging market.

Dr Fanya Ismail,
founder and
CEO of SGMA



CASE STUDY

Laura Niehorster, Proud Pads

This social enterprise plans to reduce tonnes of sanitary waste.

Proud Pads are sustainable sanitary pads that can be washed and reused for up to five years. This innovation could help to reduce the 200,000 tonnes of sanitary products that the UK throws away each year²⁰.

Laura Niehorster founded Proud Pads as a company with a conscience that aims to break the taboo around periods while championing her environmental goals. Fleece impregnated with charcoal and bamboo is used to make the products, which are antibacterial, anti-odour and easy to wash.

The future aim is that, for those without access to sanitary products, Proud Pads can help end period poverty.



Events

Whether it is demonstrating ground-breaking new processes, showcasing clean technologies or holding online digital conferences, Innovate UK teams run key events to help grow UK innovation.

Materials Research Exchange

This exhibition and investor showcase demonstrates the wealth of UK materials research and innovation, providing an ideal opportunity to absorb current trends and glimpse future innovations.

The **Materials Research Exchange** (MRE) is a bi-annual event, showcasing ground-breaking new materials and their manufacturing processes. The ultimate goal is to accelerate the process of bringing these innovations to the commercialisation stage.



MRE 2020, run by Innovate UK and KTN, was the flagship materials event. A two-day exhibition and conference, the event showcased the wealth of UK materials research and investment opportunities.

The event was a strong success. In attendance were 90 speakers, more than 80 exhibitors and over 800 delegates. The diversity of exhibitors at the event was evident. There was a well-represented mix of academia and industry showcasing their position in the materials landscape, bringing together a wealth of expertise and opportunities. Attendees could meet and network with novel materials innovators and research groups. Delegates could also hear and debate about the scope of current developments in advanced materials across key supply chains and sectors, including the impact of emerging digital technologies.

The reach was wide and knowledge-generating, and pivotal to that were the seminar sessions. These covered the full spectrum of the materials world, focusing on everything from materials in health to aerospace, 2D materials, the electrification of transport, batteries, metamaterials and beyond, with sustainability remaining a core theme throughout.

Innovate UK will be sponsoring the next MRE event, and the date will be announced once confirmed.

Digital Manufacturing Week

The Innovate UK net zero arena showcased trailblazing manufacturers and innovation leaders at the Digital Manufacturing Week conference and exhibition.

The **Digital Manufacturing Week** conference and exhibition is one of the largest annual gatherings for the sector.

With 2020 requiring a shift to a virtual online event, the Manufacturing and Materials sector team was supported by sister organisations, arranging and facilitating a day of presentations. These were combined with lively discussion covering the challenges, opportunities and support needs of the manufacturing sector on the journey to a net zero future.

Speakers from larger organisations such as Innocent Drinks and Rolls-Royce were joined by SMEs such as Whitecroft Lighting, Raynor Foods and Crystal Doors. Each described how they have embraced sustainability, integrating it into their business strategy and operation.



Their inspiring vision showcased how product manufacture that is better targeted towards the near- and long-term societal needs can lead to economic success. It also highlighted how an approach targeted on societal needs can minimise negative environmental impacts, conserving energy and natural resources.

Going forward, the aim of the team is to foster a robust innovation ecosystem to support the sector transition to net zero.

Rushlight Showcase

Rushlight Showcases promote the development and deployment of clean technologies, innovations and sustainable solutions, raising awareness and opportunities.

Rushlight showcases typically bring together over 250 delegates including cleantech developers and sustainable supply chain solution providers, investors, corporate venturers and government departments. The events promote clean technology, knowledge and cooperation within the sector.



Rushlight receives backing from leading national and international supporters. Innovate UK has sponsored the exhibition headline of the event, with other sponsors including the Department for Business, Energy & Industrial Strategy, Department for Transport, Flanders Investment & Trade, Granted Consultancy and Venner Shipley.

The showcases facilitate an exhibition of multiple clean technology solutions, many of which are Innovate UK funded projects from the Manufacturing and Materials, Clean Growth, Innovation Loans, Faraday Battery and Transport programmes.

The events include a conference with companies presenting their cutting-edge technologies. Investors are also given a tour of the exhibition, providing them with an opportunity to meet the companies.

The impact of the events is immediate: feedback shows they successfully showcase the impact of funding technology developments. They also raise awareness of further funding opportunities to create low-carbon and sustainable solutions.

Claire Perry, then Minister of State for Energy and Clean Growth, said: "The Summer Showcase aligns well with the government's Clean Growth Strategy, and we want to ensure that UK business is reaping the benefits of the ever-growing demand for low-carbon technologies... The showcase continues to highlight how the UK can lead on, and benefit from, clean growth for years to come."

Invest

We aim to invest by providing the right finance and connections at the right time to support the commercialisation of innovation. We help progress the best innovations through open grants and loans, and build international partnerships to increase UK presence in global value chains.



Smart Grants

This cross-sector funding programme is delivering disruptive and commercially viable innovation that aims to have a significant impact on the UK economy.

Innovative ideas, such as using geopolymer-stabilised soil as a sustainable construction material, have game-changing potential

The world is rapidly changing. Industrial and technological developments must advance to keep up with global developments and customer demands. This means a continuous stream of new ideas is needed to help meet emerging challenges, allowing businesses to grow and adapt to the changing times.

The Innovate UK **Smart Grants** programme searches for the very best ideas from businesses that display the potential to generate significant impact. The programme supports highly innovative and disruptive research and development projects with strong commercial potential from any part of the UK.

Ambition is the word. This national funding programme invests in products, processes or services that are game-changing in their given industry. Guided by market innovation, the programme listens to businesses about what can revolutionise the market as we know it.

UK businesses of any size and industry can apply for grants of up to £2 million up to four times a year.

Importantly, this allows flexibility of scope, timeline, stage of technological maturity and choice of collaboration with either business, university or third sector entities.

One of the programme's targets is to help de-risk disruptive and innovative projects and help them reach market. This means supporting projects after their initial and fundamental research stage before they take their next commercial investment steps to be fully commercialised.

The funding is already being widely allocated. During the 2019-20 period, the Smart Grants funding programme approved investment for 84 projects, worth approximately £31 million within the sectors of manufacturing, materials and mobility. On average, 26% of the Smart grant funding is awarded to manufacturing, materials and mobility projects.

The funded projects range from the creation of novel materials such as plastic alternatives, new durable material coatings for the aerospace sector, vehicle armour for increased security of passengers, and new wearable technologies focused on energy generation.



“Floreon is made from plants, a renewable resource. It’s 100% recyclable and compostable.”

Shaun Chatterton, Chief Executive, Floreon

CASE STUDY

Floreon

A business formed out of Smart Grant-funded research has developed stronger bioplastics that offer new opportunities for greener products.

Plastics made from plant material make up 6% of global production of plastics, according to the Institute for Bioplastics and Biocomposites²¹. They have a lower carbon footprint than traditional oil-based plastics but lack toughness and versatility. Concern about plastic in the oceans means there is greater regulation on materials being reused or recycled rather than disposed of or composted.

Hessle-based technology company **Floreon-Transforming Packaging Limited** has developed a new compound, Floreon, that radically improves the product when added to a bioplastic made from polylactic acid. This formula is opening new markets in consumer electronics and the automotive industry.

Chief Executive Shaun Chatterton said: “Floreon is made from plants, a renewable resource. It uses less energy to manufacture. It’s stronger, so packaging can be lighter, creating less waste. It’s 100% recyclable and compostable.”

Floreon is working with commercial vehicle-body builder JC Payne on lightweight vehicle parts to replace ones made of metal. The company’s success has so far attracted £1 million from individual private investors. It has also signed a manufacturing partnership with Silvergate Plastics and a collaboration agreement with global plastics additive business Clariant.

The global market for ABS (acrylonitrile butadiene styrene), a common engineering plastic, is valued at over \$22.3 billion²². Floreon’s technology provides a renewable, low-carbon alternative to this material with comparable performance, and Floreon is now licensing its technology into this market.

Floreon was formed after a successful 2008 Innovate UK funded Knowledge Transfer Partnership between cleaning and hygiene business CPD and the University of Sheffield.

Shaun Chatterton, CPD founder and then Chief Executive, wanted a green replacement for the large plastic water bottles he was supplying for water coolers and turned to materials scientists for help.

He was so impressed with the results of the Knowledge Transfer Partnership, he sold CPD and formed Floreon. Floreon and the University of Sheffield formed a second Innovate UK funded Knowledge Transfer Partnership to look at applications for the compound.

Partnerships employ a recent graduate, known as an associate. That associate was Dr Andrew Gill, who is now the company’s Technical Director and has since led two feasibility studies (funded from the Smart Grants programme) into further improving Floreon and investigating applications.

Dr Gill said: “Floreon is based on research funded by Innovate UK. The support has allowed us to undertake the development needed to get this product to the market.

“I’ve been able to undertake manufacturing trials and see things through to an actual product, which is really exciting.”

International priorities

Innovate UK's Manufacturing and Materials team is facilitating far-reaching, impactful collaborative endeavours through bespoke funding instruments, helping the UK to remain at the global forefront of cutting-edge research and investment.

The UK Research and Development Roadmap²³ highlights the importance of international collaboration. The Roadmap sets out the UK's ambition to be a world leader in science and innovation.

Key aims from the Roadmap include:

- collaborate globally if we are to remain at the forefront of cutting-edge research and innovation
- remain a partner of choice for other world-leading and emerging research and innovation nations, drawing global talent and supporting our leading researchers to collaborate with the best in the world
- ensure the UK's science and innovation community, people, institutions and infrastructure are outward facing, attracting global collaboration and investment.

Together with government departments, cross-council affiliates and our B2B networking partners (KTN, Innovate UK EDGE), Innovate UK's Manufacturing and Materials sector team has facilitated far reaching and impactful collaborative endeavours through bespoke funding instruments, including:

- Horizon 2020
- EUREKA
- Newton Fund
- Global Challenges Research Fund
- Funding for International Collaboration
- Global Missions Programme.

Horizon 2020

Horizon 2020 has been the largest ever European funding programme for research and innovation, with a grant budget of €79 billion distributed over seven years. Through the work of our National Contact Points, Innovate UK supported UK entities, including businesses, to engage in this programme.

Over 190 UK SMEs have secured Horizon 2020 funding across the four sub-themes of Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing. Many of the 190 businesses secured grants of more than €1 million each.

The Horizon 2020 aims were to:

- ensure that Europe produces world-class science
- remove barriers to innovation
- make it easier for public and private sectors to innovate together.

The Horizon 2020 programme was established by the European Union (EU) as a collaborative financial instrument that would help secure Europe's global competitiveness.

The programme, running from 2014 to 2020, is seen as a means of putting Europe at the heart of world-class science and innovation, making it more competitive, creating economic growth and new jobs.

Funding calls were based on three areas: excellent science, industrial leadership and societal challenges. The UK Manufacturing and Materials sector has been highly successful in securing Horizon 2020 grant funding.

Horizon Europe

Horizon Europe, the next EU flagship research and innovation programme, began in 2021 and will run until 2027, with a total budget of €95.5 billion. Following the EU-UK Trade Cooperation Agreement, UK scientists, researchers and businesses will continue to have access to research funding on equivalent terms as organisations in EU member states.

We will continue to help and support UK stakeholders to take full advantage of the opportunities afforded by Horizon Europe, enabling them to take forward their research and innovation objectives through the knowledge and expertise of the UK National Contact Points network.

CASE STUDY

Promethean Particles

A Nottingham-based nanomaterials business is launching products into full-scale production.

Promethean Particles Ltd, spun out from the University of Nottingham in 2008 and supported by EU innovation funding, is targeting specialist markets with its proprietary inks, paints and coatings.

They include printed electronics, adsorbent materials and other applications where nanoparticles can be used to modify conductivity, hardness, optical, mechanical or fire-retardant properties, even in plastic or composite systems.

The company succeeded in developing a low-cost, continuous flow process for producing nanoparticle materials after joining a consortium that was awarded €10 million under the EU Seventh Framework Programme for a project called SHYMAN (sustainable hydrothermal manufacturing of nanomaterials).

There were four employees at the start of the project in 2010 and that number has grown to 10, with further expansion planned.

SHYMAN helped to take Promethean's proprietary technology from pilot-scale to a plant capable of producing more than 1,000 tonnes annually.

Further Horizon 2020 case studies <https://www.gov.uk/government/collections/horizon-2020-the-eu-research-and-innovation-funding-programme#success-stories>



EUREKA

EUREKA is one of the world's largest networks for international cooperation in R&D and Innovation, operating in around 45 countries (both EU and non-EU). It is a trusted framework facilitating bilateral and multilateral collaboration and supports the globalisation of businesses with innovative ideas.

Innovate UK has supported a range of activity in support of materials and manufacturing R&D through the Eureka framework. These were:

- **Network projects** – bottom-up collaborations between EUREKA countries
- **Eurostars** – collaborative projects led by SMEs
- **Clusters** – industry-driven public-private partnership projects between SMEs and large industry in specific technology and market areas
- **Globalstars** – projects between a EUREKA country and a country outside the network.

CASE STUDY

HYLASE (Eurostars)

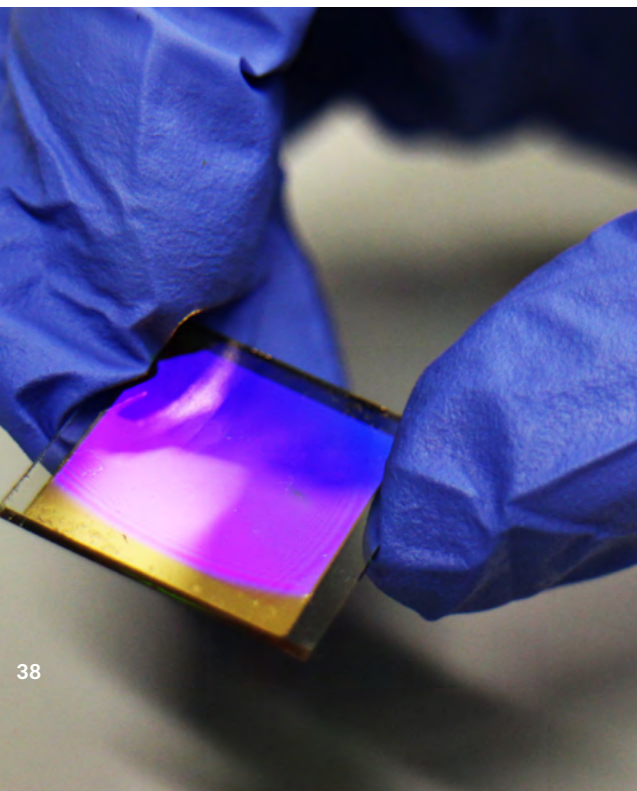
British and German specialists teamed up to develop a new standard in laser systems.

HYLASE is a cutting-edge laser technology. It is ideal for printing, etching and cutting complex surfaces such as glass, plastic and thin films used in semiconductors, optics and diverse sectors as insulation protection and decoration and other coatings.

Funded by Bundesministerium für Bildung und Forschung BMBF (Germany) and Innovate UK through the Eurostars programme, HYLASE represents a new standard in ultra-compact, high-energy laser systems capable of producing complex materials essential to modern manufacturing.

HYLASE technology has excellent processing speed, accuracy and beam quality, boosting output and minimising heat build-up. The lasers also proved very reliable and easy to integrate and maintain within new and existing industrial and scientific applications.

HYLASE laser amplifiers were installed in the European X-Ray Free-Electron Laser. This cutting-edge research facility produces intense x-ray flashes (a billion times higher than commercial sources) that can uncover the atomic detail of cells and chemical reactions.



Official Development Assistance

Innovate UK is proud to be a delivery partner for two UK **Official Development Assistance** (ODA) funds, the Newton Fund and Global Challenges Research Fund, which invest in delivering global development impact.

The main objective is to support cutting-edge research and innovation that addresses global issues affecting developing countries as identified by the United Nations Sustainable Development Goals (SDGs).

UK organisations eligible for funding under this programme will be working in partnership with other ODA-eligible countries to address development challenges that are relevant to developing countries around the world, while also delivering benefits to the UK.

Newton funding

The **Newton Fund** builds research and innovation partnerships with countries in Africa, Asia and Latin America to support economic development and social welfare, tackle global challenges and develop talent and careers.

It does this through:

- equitable partnerships with middle-income countries
- multidisciplinary research that is based on agreed national strategies
- nurturing talent and careers with capacity development.

Each Newton Fund partnership is unique. UK and international partners work together to devise and deliver Newton Fund programmes. Resources provided by the UK are matched by partners, building in collaboration from the very beginning.

Global Challenges Research Fund

The **Global Challenges Research Fund** (GCRF) supports UK and international researchers and innovators to take on key issues affecting developing countries through:

- challenge-led multidisciplinary research
- strengthening capability for research, innovation and knowledge exchange
- providing an agile response to emergencies.

Six strategic challenges provide a framework through which the GCRF targets work to achieve lasting change. These cover:

- security, protracted conflict, refugee crises and forced displacement
- cities and sustainable infrastructure
- education
- food systems
- global health
- resilience to environmental shocks and change.

The challenges align closely with the UN SDGs and acknowledge the interconnected nature of global sustainable development challenges.

Fund for International Collaboration

The **Fund for International Collaboration** (FIC) enhances the UK's ability to build new and strengthen existing partnerships with global research and innovation leaders.

The fund has already supported more than 30 international collaborative programmes of research, innovation and infrastructure across UKRI's remit, and the UK/USA CR&D competition on advanced composites materials and manufacturing technologies.

Manufacturing and materials programmes that have been launched from the fund include:

- UK-China partnerships in sustainable manufacturing, covering renewable buildings, energy and materials recovery in steel making
- UK-Canada CR&D Competition, covering innovative projects on robotics, AI application, composites, food processing and process efficiency.

Global missions

The Global Missions Programme comprises two distinct but closely related elements: **Global Expert Missions** (GEM) and **Global Business Innovation Programme** (GBIP).

The GEMs, led by KTN on behalf of Innovate UK, play an important role in building strategic partnerships, providing deep insight into the opportunities for UK innovation and shaping future programmes.

Each GEM visits priority countries for a short mission in an identified priority sector/technology area. The aim is to develop our understanding of specific opportunities, building the evidence base and roadmaps for future collaboration.

Key insights and recommendations from this mission are then published as a report²⁴ and made available for UK businesses free of charge, to help make informed decisions on research collaborations.

Fully funded by Innovate UK and delivered by Innovate UK EDGE, the GBIP supports high-growth innovative businesses to develop, explore and exploit opportunities in specific markets, technology and innovation areas.

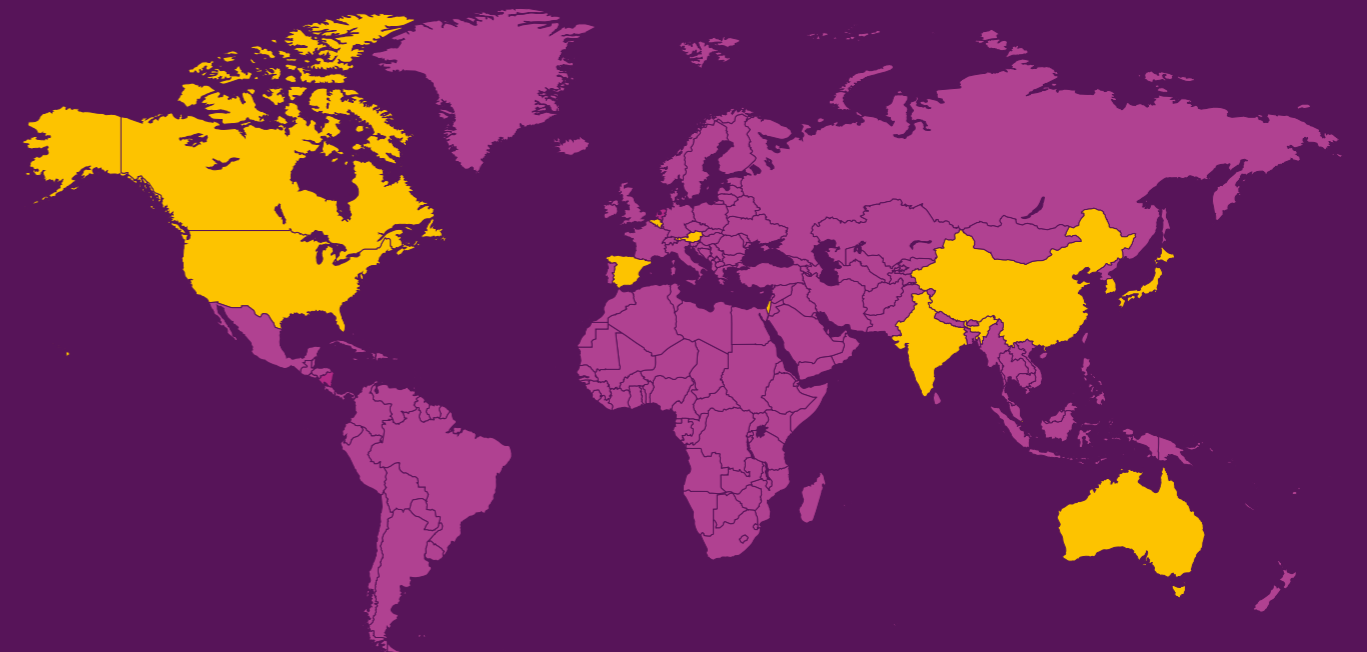
GBIPs provide the sort of detailed market knowledge, introductions and cultural insight that SMEs would find difficult to generate themselves. The programme is designed to help innovative companies find R&D partners, build collaborations and explore R&D and innovation opportunities internationally.

GBIP case studies

- <https://www.innovateukedge.ukri.org/success-story/Recycling-electric-vehicle-battery-South-Koreans>
- <https://www.innovateukedge.ukri.org/blog/Advanced-materials-innovators-head-South-Korea>

Connections to countries

Our projects have connected us with expertise worldwide.



North America

United States of America
Canada

Europe

Spain
Belgium
Austria

Asia

Israel
India
China
Singapore
South Korea
Japan

Oceania

Australia

Innovation Loans

Ground-breaking Innovation Loans have helped UK businesses increase R&D investment and create high-value research jobs, boosting the UK economy.

In the 2015 Spending Review²⁵, the UK government announced it would introduce new financial products to support innovation. In direct response, Innovate UK, working with government and other partners, developed Innovation Loans. Their objective was to bridge the funding gap for innovative businesses while providing value for money for the taxpayer.

Initially, £50 million was available for two financial years between 2018-19 and 2019-20. The loans were so successful that the pilot was further extended, with £25 million of additional funding. Innovate UK ran seven competitions, with loans of between £100,000 and £1 million for SME business innovation projects.

The scope and objectives of the programme are very specific. The loans are for UK businesses wanting to scale up and grow through innovation, developing new or improved products, processes or services. The businesses supported are typically quite young and small – seven

years old on average, with net assets of about £500,000. In most cases, they have been developing their technology (often with grants and usually with equity investment) for some time before reaching the point of seeking scale.

One competition in the pilot was specifically focused on Innovation Loans to support scaling up manufacturing processes. Throughout the pilot, these Innovation Loans were found to be particularly suitable for businesses with this challenge and the resulting growth opportunities.

To date, Innovate UK has committed over £75 million to around 100 successful applicants, and the growth, as a result, has been significant.

A review by SQW in 2019²⁶ confirmed that the Innovation Loans pilot had been very successful. Indeed, following discussions with businesses, it was clear the programme provided much-needed finance for innovation, filling a gap in the funding landscape.

Not only did the Innovation Loans provide businesses with the funding they would not have otherwise received, the loans also subsequently accelerated and/or scaled up business projects in a way that would not have otherwise been possible.

The loans have also been important in helping businesses secure a significant amount of follow-on funding, increasing R&D investment and creating high-value research jobs.



CASE STUDY

KwickScreen

Patented screens are delivering improved NHS infection control.

Korn Wall Ltd has designed a revolutionary product that provides a physical protective barrier to prevent the spread of infection via droplet transmission in healthcare environments.

KwickScreen is designed to create a safe space for every patient and ultimately replace traditional and outmoded hospital curtains. Its proprietary, bistable composite technology has allowed the company to make retractable and portable screens at scale. Not only do they reduce the spread of infection, but they are more sustainable and cost-effective than alternatives.



KwickScreens are now used in most UK hospitals and the company forecasts demand to continue to increase in the UK and beyond with the enduring impact of COVID-19 on attitudes and behaviours.

Alan Murrell, CEO of Korn Wall Ltd, said: "The loan meant we were able to invest in new machinery, semi-automate manual processes and dedicate resource to innovations that further support the NHS.

"Our staff numbers have increased from 15 to 67, and this includes the recruitment of six bright and talented graduates.

"We would never have been able to scale and grow in this way without the support from Innovate UK."

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Innovate UK drives productivity and economic growth by supporting businesses to develop and realise the potential of new ideas.

We connect businesses to the partners, customers and investors that can help them turn ideas into commercially successful products and services and business growth.

We fund business and research collaborations to accelerate innovation and drive business investment into R&D. Our support is available to businesses across all economic sectors, value chains and UK regions.

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