

## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
OPPOSABLE GAMES LIMITED	Augmented Berry Vision (ABV) - Real-time Augmented Display of Spectral Ripeness Cues in Berry Farms	£119,640	£83,748
BERRY GARDENS GROWERS LIMITED		£14,000	£7,000
National Inst of Agricultural Botany		£56,754	£56,754
University of the West of England		£59,205	£59,205

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## Project description - provided by applicants

Demand for healthy products including fresh fruit continues to increase. In the UK soft fruit purchases now account for 22 percent of all consumer fruit purchases. According to Defra's agricultural report, volumes have continued to climb, with the market value of soft fruit grown in the UK worth an estimated at £670 million in 2018\.

There is increasing consumer and retailer demand for high-quality UK-grown soft fruits, and this will increase further post-BREXIT as retailers favour British produce. Great efforts have been made in the past decades to breed varieties with better taste and appearance, whilst investments in improving growing practices has led to production and quality gains. However, achieving consistently ripeness and quality across variable and challenging growing seasons is difficult, and there is a large variability of fruit ripeness after picking due to the invisible changes in colour during ripening. Despite the industry's best efforts in picking, punnets often still contain under or over ripe fruit, leading to negative impact on the perception of fruit quality by consumers.

We will develop a low-cost, spectral imaging based Augmented Reality (AR) prototype glasses device for pickers that can determine and label the fruit ripeness in real-time and assist growers to produce high quality berries with consistent ripeness in every punnet, leading to reduced waste throughout the value-chain. As a proof of concept, blackberry will be used as an exemplar.

The blackberry market in the UK is growing by around 20% year-on-year currently reaching £37.4m in annual retail sales, but determination of ripeness by pickers can be extremely difficult due to the very subtle colour differences between almost-ripe, ripe, and over-ripe fruit. In this project, lab-based fruit quality assessments will be conducted to understand their relationship with ripeness, and hyperspectral imaging will be applied to identify a simple spectral index determining the ripeness.

A lightweight AR frame and LED display will be custom-built to satisfy the application and cost requirement. By integrating a spectral filter or fast tuning narrow-band LED light source, spectral imaging will be processed in real time, and the ripeness of individual berries labelled on the LED display.

The AR technology based picking glasses can be extended to other soft fruits and will have a large impact on the UK soft fruit industry, which as a project partner will have first access to the technology, making a step-change in consistent fruit quality, competitiveness and so economic impact.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
JGHC LIMITED	Development of a decision support tool to reduce asparagus tip breakdown in the UK	£124,850	£87,395
Cardiff University		£48,424	£48,424
Cranfield University		£63,088	£63,088

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Maintaining asparagus quality using cold storage alone is currently limited to one week. Thus, UK asparagus production is unable to provide year round supply necessitating the import of large quantities of spears from overseas. This practise has a significant environmental impact and burden as much of the product is transported by air freight. A previous Innovate UK and BBSRC funded project established the optimum dynamically controlled atmosphere (DCA) conditions to preserve the quality of UK-grown spears for 3 weeks plus one week of shelf-life. However, the major limiting factor to implementing DCA commercially was the development of the physiological disorder known as tip breakdown (up to 10% of asparagus production is affected). High levels of tip breakdown were observed in 2018 across the UK and this was attributed to the warm temperatures during the harvest season.

This project aims to identify the factors that cause tip breakdown; and thus the opportunity to reduce its incidence and understand when fresh harvested spears may be successfully stored in DCA and/or actions that may be taken. This will be achieved by developing a decision support tool using classification models in order to identify and predict tip breakdown at their early stages.

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CAMBRIDGE ANIMAL TECHNOLOGIES LTD	Healthy Heifer: precision solution to improve heifer rearing for increased productivity across the dairy sector	£158,211	£110,748
AGRI-EPI CENTRE LIMITED		£87,798	£87,798

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## Project description - provided by applicants

The proposed project will create a precision technology solution for dairy farmers, focused on optimising the rearing of heifer replacements. The project will focus on the following areas:

1. Integration of information from various sources including advanced sensing technology and farm records to obtain the full picture of individual animal condition.
2. A data analysis platform which will continuously analyse the data sources and provide appropriate real-time and automated health and performance flags to optimise intervention strategies.
3. A decision support system to optimise health and management protocols and quantify impact. This will be developed using expert advice from across the supply chain, including veterinary and animal science expertise.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CCM TECHNOLOGIES LIMITED	Evaluating efficacy of novel green fertilisers using carbon capture technology	£117,633	£82,343
Cranfield University		£114,740	£114,740

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## Project description - provided by applicants

Carbon dioxide is one of the greenhouse gases in addition to nitrous oxide and methane, which is contributing towards climate change. One way to mitigate the high levels of carbon dioxide in the atmosphere is to capture it into the terrestrial environment. This technology (known as carbon capture) will be deployed in this project, provided by a company known as CCm Technologies. Carbon dioxide present in the atmosphere will be captured into organic waste material such as food waste, agriculture residues and water treatment. The reactions between the captured carbon dioxide into the organic waste converts it into a renewable source of fertiliser.

CCm will build on existing analytical methods used to trace carbon at its capture point, in an emissions exhaust point, to its final storage destinations within the soil by attempting to automate the storage of this data within its control system. The carbon data will build on existing traceability categories for fertiliser feedstocks to consistently log carbon within supply chains.

The aim of this project is to evaluate how effective is the CCm fertiliser in terms of providing nutrients to crops. This can be achieved through a series of activities. There will be field scale trials to determine how effective is the fertiliser to provide nutrients to meet crop demands. In the field scale trials, root scanners will also be used to determine root network and density as a measure of below ground carbon stock. Soil samples will also be collected in the field experiments to determine nutrient content and yield of crops. Earthworm counts will be carried out to as an indication of soil health. Pot studies will inform how effective are new formulations of fertilisers and its impact on soil nutrient and crop yield to complement the field scale studies. There will also be erosion studies using trays packed with soil and mixed in with fertiliser formulations to determine effect of rainfall intensity on runoff and leachate. The runoff and leachate will be measured for dissolved nutrients and carbon which will provide information on impact of these fertilisers to the environment. Since the fertilisers can be considered a greener option, the nutrients are expected to be slowly available in the soil to crops with minimal impact to the environment. The outcome of this work will not only tackle in terms of capturing atmospheric carbon dioxide into the soil but also improve soil health and crop productivity.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
3D BIO-TISSUES LIMITED	Using macromolecular crowding to increase cellular meat production and feed a low-emission bioeconomy	£127,756	£89,429
CENTRE FOR PROCESS INNOVATION LIMITED		£121,655	£121,655

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## Project description - provided by applicants

3D Bio-Tissues Ltd (3DBT) is a Newcastle University spin-out company that is translating recent developments in cell biology and tissue engineering into medical and food-related products. The company has developed a process that produces highly organised collagenous tissue. The similarity in structure between these engineered tissues and their natural counterparts is remarkable and allows for significantly improved function of the resulting tissue. For example 3DBT is currently creating organised collagenous tissues for skin and corneal replacements, but has recently shown that this process is also relevant to cellular meat. A challenge remains in driving down the costs of producing these tissues, especially if intended as food alternatives (cellular meat will necessarily have to be affordable for mass consumers), while eliminating at the same time the use of animal-derived ingredients from the process. Thus, this project explores the development of simple, inexpensive, and readily-available media supplements to feed cells in culture and enable the production of tissues recreating the texture and composition of meat whilst meeting central market demands i.e. low price and absence of serum.

Several research groups and companies in Europe, the US, and elsewhere are developing serum-free media alternatives for enhanced production of cellular meat. However, most of these strategies focus on finding natural and synthetic substitutes for the relevant serum factors. We propose to take a different approach that focuses on the use of novel supplements derived from existing agro-industrial by-products. Use of these in the culture medium will represent a new animal/xenobiotic-free method to increase the efficiency of cellular meat production, a strategy that aims to reduce (or even eliminate) the need for serum supplementation - making the product truly animal-free. Ultimately, the results from this feasibility study used in conjunction with our tissue production methods will deliver a new \_in vitro\_ system to produce highly-organised, multi-stratified equivalents to bovine, ovine, and porcine meat with a texture and taste that consumers know and love. We therefore expect these innovations to directly address some of the main 'pains' of the cellular meat market, namely by providing natural-looking products with similar characteristics, at a lower production price, and grown without the need of animal slaughter nor use of antibiotics. Ultimately, we expect that a greater adoption of cellular meat by general consumers will eliminate the need for intensive animal farming, thus contributing to lower greenhouse gas emissions worldwide.

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Moredun Research Institute	Smart sheep: precision livestock farming and sustainable sheep production	£74,387	£74,387
5 AGRI LLP		£25,448	£17,814
DATAMARS AGRI UK LTD		£7,000	£0
NIGHTHAWK SOFTWARE LIMITED		£72,440	£50,708
SRUC		£44,197	£44,197
SYNERGY FARM HEALTH LIMITED		£24,454	£14,672

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## Project description - provided by applicants

This project addresses the adoption of precision livestock farming (PLF) technologies in sheep farming. PLF has been widely adopted in the management of high-value animals e.g. dairy cattle, but is not currently applied to those with lower economic value, e.g. sheep, despite the potential to increase production efficiency. In the UK, there are around 23.3 million sheep, including 14.7 million breeding ewes worth approximately £690 million to the economy. Since 2010, all individual sheep in the UK are equipped with EID (Electronic Identification) tags, further paving the way for use of PLF technologies. However, uptake is a major issue. A recent survey of European sheep farmers showed that only 38% of farmers have any EID equipment, which are rarely used for sheep management. Likewise, in the UK, a survey of PLF technology adoption showed that 55% of farmers did not have and did not intend to adopt EID technology for management purposes.

The project consortium will engage with end-users (members of the farming community and farming advisors) early in the project, to co-design tools to increase the uptake of PLF on-farm. We will use one proven PLF tool; an existing pen-side tool to optimise lamb worming, using an algorithm for the early identification of under-performing lambs. This Targeted Selective Treatment (TST) has been developed at MRI and validated at MRI, SRUC and on commercial farms, including one facilitated by 5Agri. The adoption of TST reduces wormer use and labour, and the costs required. Importantly, it slows the development of wormer resistance. Farmers have described a clear need for this type of approach on farm. However availability to the farming community is currently hampered by the lack of a user-friendly method for farmers to access the algorithm. This project will facilitate the integration of the algorithm into a cloud-based platform, thereby making it easily accessible to farmers.

Validation of the improved technology will be performed on 10 'innovative' and 2 research sheep farms across the UK, covering a range of geographical locations and using commercially appropriate sheep breeds to ensure evidence that is relevant to a wide range of sheep farms. Cost-benefit analysis and carbon foot-printing of implementing the new approach will be conducted.

The results of this project will be disseminated through on-farm knowledge exchange events at strategic locations across the UK to demonstrate the ease, accessibility, cost-benefit and environmental benefit of using this integrated pen-side TST approach.

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ENTECH NUTRITION LIMITED	Feasibility Study: Designing a highly efficient production facility for insect-based products	£174,790	£122,353
CAMPDEN BRI (CHIPPING CAMPDEN) LIMITED		£29,912	£29,912
University of Exeter		£45,293	£45,293

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## Project description - provided by applicants

Entec Nutrition is a UK-based SME that is pioneering the development and adoption of farmed insects as a sustainable food source.

As population levels rise, it is expected that fish and poultry consumption will increase, generating a greater demand for animal feedstocks, and therefore animal-feed ingredients (feed costs constitute 50-60% of aquaculture production costs; 60-80% of poultry) [Government Office for Science, 2017].

The global feed industry is energy-intensive, reliant on international imports, at risk of commodity price hikes, and associated with deforestation. The UK needs to increase feed production resilience to mitigate these issues and to move the UK's fish and poultry production towards a sustainable and productive future. This project will significantly support the UK goal to reach net-zero carbon target by 2050.

Entec Nutrition and its uniquely positioned consortia (Campden BRI, The University of Exeter) and specialised subcontractors to design a fit for purpose, highly energy-efficient and cost effective insect rearing facility design. This includes exploring the intrinsic science behind insect nutrition applied to animal feed, investigating efficient food production methodologies and integrating technology to propose a high-tech, bespoke insect rearing facility that is completely aligned to the market needs.

The project will enable significant investment on the construction of this cutting-edge production facility, bringing immediate economic benefits to the country. Additionally, the project has the potential to position the UK as a leader in using insect feed to lower the cost of production and environmental impact of the poultry and aquaculture industries.

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CHERRY VALLEY FARMS LIMITED	Towards improving efficiency through leg health and reproductive performance in commercial duck breeding flocks	£121,811	£73,087
HUDSON & SANDERS LIMITED		£24,164	£16,915
University of Edinburgh		£124,837	£124,837

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## Project description - provided by applicants

Our motivation is to improve efficiency through increases in productivity through improved reproductive performance and reduction in wastage via leg health culls. We will achieve this by bringing together innovations in data capture, sensors, image recognition, genomics and novel analytical techniques to develop an integrated data driven solution for the whole duck production chain. Our tripartite collaborative project brings together world leading duck breeding company, Cherry Valley Farms (CVF), The Roslin Institute (RI) and Hudson & Sanders (H&S). The collaborative team brings end-to-end research, innovation and exploitation potential through the entire duck production chain.

At the end of the ISCF-TFP feasibility study we aim to have developed and evaluated a range of complementary tools to manage duck flocks and capture data associated with reproductive performance and leg health/gait analysis. These tools can be exploited both by duck breeding companies to more accurately capture relevant data on an individual basis to improve genetic progress. In addition, flock based predictors of performance and perturbations of performance, including welfare and behaviour, linked to flock output will be assessed. The outputs from our project will be passed down the breeding pyramid, not only as improved genetic stock, but in the form of management strategies as technical support offered to customers. This will enable companies like H&S to develop disruptive technologies and deliver integrated solutions that have the potential to improve productivity and sustainability of duck production.

The proposed innovation is in combination of technologies (sensors, image recognition, genomic pedigree) being combined to improve reproduction and welfare at both the genetic level (requiring individual birds data) and commercial population level. Together, exploitation of the innovations at both individual and flock level will enable us to improve productivity, reduce wastage, reducing the competition of crops for animal feed and decreasing the environmental footprint of production and thus contribute to delivering the target of net zero emissions from agriculture.

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CROP HEALTH AND PROTECTION LIMITED	Feasibility Study: Developing a biopesticide for Cabbage Stem Flea Beetle	£55,783	£55,783
CAB International		£69,066	£69,066
H & T BIOSEED LIMITED		£62,556	£43,789
RUSSELL BIO SOLUTIONS LTD		£62,467	£43,727

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## Project description - provided by applicants

The proposed project is a feasibility study to develop an innovative biopesticide technology for the control of Cabbage Stem Flea Beetle (CSFB) in Oilseed Rape (OSR). The project is driven by demand from farmers and the OSR market which has decreased by 12.9% from 2018 to 2019, due, in part, to CSFB damage. This is a result of recent restrictions on neonicotinoid-treated seed and the development of Pyrethroid resistance.

Preliminary work has been conducted by CAB International (CABI) using a fungal isolate which has shown 100% kill rate against CSFB after 4 days.

Project outputs will be the development of biopesticide application methods that can target the CSFB at different stages of development.

This project will also focus on end-user engagement through two knowledge transfer workshops. The first workshop will focus on the aim and objectives of the project, and the second will cover dissemination of results and technology adoption. In addition, end-user feedback will be gathered using a market survey to ensure the project is aligned to end-user needs. The business model, economic analysis and route to target will be assessed as part of the market development work package.

The project will be led by CHAP, a UK-based research organisation aiming to increase crop productivity through the uptake of new technologies. CHAP will deliver the knowledge exchange workshops and project management. CABI will lead on the formulation development, with inputs from H&T Bioseeds Ltd and Russell Bio Solutions Ltd. The aforementioned industry partners will also lead on market development.

The outputs of the project have the potential to have a significantly impact on the UK economy, by helping farms achieve increased yields through enhanced CSFB control. This project will also work towards achieving net zero emissions by 2040 through development of targeted biopesticides application systems, thus decreasing the number of machinery passes, reducing excess packaging due to reduced inputs and ultimately reducing toxic chemical inputs. The wider environmental/societal benefits of this project include less damage to the environment and human/animal health due to reduction of chemical inputs.

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NETAFIM UK LIMITED	Integrating nutrient demand models and AI-based sensors with precision-dosing rigs to improve resource use and productivity, and reduce waste and emissions in commercial raspberry production.	£105,100	£73,570
BERRY GARDENS GROWERS LIMITED		£10,000	£5,000
ENVIRONMENTAL MONITORING SOLUTIONS LIMITED		£50,397	£30,238
National Inst of Agricultural Botany		£84,498	£84,498

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## Project description - provided by applicants

Soft fruit is an exciting product area with excellent growth potential. Although UK soft production is growing by ca. 8%/year, \*\*demand for\*\* berries by UK consumers still exceeds supply. Continued growth is needed to displace often inferior imports, but this must be achieved on a sustainable basis through efficient utilisation of valuable resources (primarily water and inorganic fertilisers) and minimal environmental impact.

Soft fruit growers know that a sub-optimal supply of macro- and micro-nutrients will limit marketable yields and berry quality, but most guidelines on fertiliser inputs are hopelessly outdated. These formulations are often adjusted based on anecdotal observations by growers and agronomists, but there is little scientific basis to these amendments and many unneeded macro- and micro-nutrients accumulate in the substrate. Growers then apply irrigation flushing events to remove these harmful so-called "ballast ions" which wastes water, can result in lowered berry firmness, flavour and shelf-life, and poses a risk to local groundwater quality.

Excessive N inputs often result in elevated emissions of N<sub>2</sub>O as a result of denitrification, and N<sub>2</sub>O emissions account for ca.44% (global warming potential \[GWP\] basis) of the total agriculture-related GHG emissions. CO<sub>2</sub> has a GWP value of 1 while N<sub>2</sub>O has a value of 298, making the latter a more potent GHG. Reducing N inputs in agriculture and horticulture by more closely matching demand with supply should help to reduce N<sub>2</sub>O emissions, but this is a risky strategy if guidelines and monitoring sensors are not available.

Our nutrient demand modelling work in IUK 102124 showed that N input to substrate-grown raspberry could be reduced by 32% without affecting marketable yields and berry quality, and overall water and fertiliser demand was lowered by 20% due to a reduction in plant biomass (less luxuriant growth). In a follow-up project IUK 102640, we have developed a prototype AI-based nitrogen / phosphorous / potassium (NPK) real-time sensor that growers can use to determine NPK availabilities in coir to inform their fertigation decision making, and this will be tested under commercial conditions in 2020\.

Here, we propose to combine new variety-specific N demand models with a prototype AI-based sensor that estimates NPK coir availabilities in real time, and embed the outputs into the NetBeat(tm) platform. The SmartNutrigration system will maintain coir NPK availabilities within a narrow optimum range during each developmental stage using outputs from nutrient demand models and real-time feedback from AI-based NPK sensors thereby maximising sustainability.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MOY PARK LIMITED	Ideal Home: the net zero poultry house for the future	£81,036	£40,518
J.F. MCKENNA LIMITED		£44,206	£26,524
Queen's University Belfast		£124,297	£124,297

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## Project description - provided by applicants

The annual value of UK agriculture to the national economy is in the region of £122 billion (2018, DEFRA). The value of the UK poultry meat production sector alone, the second largest in Europe, to the UK economy increased by ~ 9% to £2.6billion (2018) with 1.24 billion birds producing in the region of 1.8 million tonnes of meat. This is a sector seeing continued expansion to meet retail demand where production was boosted by ~6% in 2018, the highest rate of any meat production sector (DEFRA, 2020). Such intensification has however to be balanced against the need for high levels of animal welfare and environmental protection, particularly when considered against national and international climate change targets. Globally the poultry meat production sector is responsible for 8% of agriculture emissions at ~ 100 CO<sub>2</sub>-eq/kg of protein produced. Against this backdrop mitigation methods such as animal health interventions and farm infrastructure/management improvements will be key for sustainable productivity increase (FAO, 2018).

Moy Park is one of the largest poultry integrators in the UK, with over 45 million birds housed at any one time. This equates to 2,396 houses across England and Northern Ireland.

A poultry house, with a life span of over 30 years, presents a significant capital investment for any farmer. Additionally, due to the nature of poultry production these houses have a significant demand for energy to control and provide heating, ventilation, lighting and operate feeding systems. The cost of building these houses, along with their running costs accounts for 33% of growing a chicken.

Therefore, from an industry perspective, to help achieve the net zero emission by 2040 in a sustainable manner that assures high animal welfare practices, work must start now. The \_Ideal Home\_ partnership, led by Moy Park Ltd., has developed a feasibility project that introduces a detailed baseline assessment identifying the current situation within "traditional" housing. Ideates and evaluates precision solutions for alternative housing systems to produce feasible, sustainable new approaches to poultry housing and management for improved well-being and performance, energy efficiency and improved resource efficiency.

\_Ideal Home\_ is an exciting project with high reward potential as it seeks to spur transformational change to sustainability and productivity across the UK's poultry production system. Net zero emission agriculture, tuned to feed the growing global population, can only succeed if improved production and sustainability are fully integrated into the food production process.

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DAVLEC LIMITED	Assessment of commercial and technical feasibility of installing an automated milk sampling and reproduction testing system in a traditional milking parlour	£112,195	£78,536
CLARITY BIOSOLUTIONS LIMITED		£137,696	£96,387

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### Project description - provided by applicants

This project addresses the overall ISCF aim of Transforming Food Production by aiming to demonstrate the technical and commercial feasibility of Davlec's Automated Milk Sampling Device (AMSD) and Clarity's Lateral Flow (LF)Reader and test for progesterone in cow's milk. Providing an easy to use and cost-effective progesterone tests to work alongside the farmer's usual heat detection method aims to give him/her more precise information on the optimal timing for insemination, thereby increasing the likelihood of successful inseminations and reducing the number of days between calves; the calving interval (CI). Reducing the CI also addresses the specific competition aim of driving productivity in ruminant production systems by enhanced decision support with a technology solution and system.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results



## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
RAFT SOLUTIONS LIMITED	Development and Optimisation of the FECPAKg2 System to Speciate Protozoan Infections in Livestock and Improve Productivity and Sustainability	£80,362	£56,253
TECHION (UK) LTD		£87,350	£61,145

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

Coccidiosis in cattle and sheep is caused by infection of the alimentary tract with protozoan parasites called *Eimeria* spp. There are many species of *Eimeria* but only a small proportion of these are commonly associated with clinical disease; other *Eimeria* species may be present but are not considered important pathogens. Coccidiosis can affect animals at any stage in their lifetime, however young animals are most vulnerable due to their low immunity. Disease can be seen all year round; it is most common that outbreaks will occur during the wet seasons of the year. The UK continues to get warmer and wetter each year as a result of global warming.

Infection causes a loss of absorptive capacity of the gut with consequent diarrhoea which can be severe. Affected animals usually suffer weight loss, pain and protracted convalescence resulting in welfare considerations, lengthy delays to finishing, susceptibility to secondary bacterial infections and extra feeding costs, alongside cost of treatment (including labour and medicines). It is one of the most economically significant diseases in cattle and sheep due to the considerable impact on production at herd/flock level.

Current diagnosis involves faecal testing for presence of oocysts. Interpretation of faecal samples is challenging because there may be low numbers of oocysts present in the faeces of normal calves, and not all *Eimeria* spp. are considered to be pathogenic. Demonstration of large numbers of oocysts in faecal samples is helpful but speciation is essential to determine whether coccidia are pathogenic. Current practice for speciation requires sporulation of the oocyst (which currently takes between 3 and 5 days) and then microscopic examination of the sporulated oocyst by a highly skilled technician. However, this is rarely undertaken in field outbreaks due to cost and time taken to get results from external laboratories to the veterinary practice. With these limitations and the pressures for prompt treatment regarding welfare and productivity, farmers would usually blanket treat animals with a non-targeted treatment.

The existing FECPAKg2 system developed by project partner Techion is a rapid on-farm diagnostic platform for faecal egg count testing currently used to detect parasitic nematode infections in ruminants and equids. This project will assess the feasibility of adapting the existing FECPAKg2 system to detect protozoan parasites, alongside development and integration with automated image recognition software to objectively speciate using digital images of unsporulated oocysts (e.g. immediate diagnosis using fresh faecal samples).

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
AGRI-EPI CENTRE LIMITED	SmARtview: An AI-powered Augmented Reality Tool for Animal Health and Productivity	£49,430	£49,430
Abertay University		£74,968	£74,968
FARMVETS SOUTHWEST LIMITED		£62,406	£31,203
POCKET SIZED HANDS LIMITED		£62,082	£43,457

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

Imagine being able to walk through a herd of cows, instantly recognising each one -- distilling key individual productivity and health data in real-time, so that you can make the best decisions in order to provide her with the optimal care to enhance her production and welfare. Whether a stockperson, vet, nutritionist, breeding technician, farm assurance auditor or supply chain rep -- you can instantly view a dashboard to understand how each cow is performing and her health status, at the cowside.

The emergence of precision agri-tech in the dairy sector has given rise to a multitude of data collection platforms in, around and on dairy cows, such as animal mounted sensors (smart collars, pedometers, tags and boluses), smart milking machines and camera technologies, as well as individual cow records and observations. Farm staff, vets and other advisors are required to access and interpret these multiple data-streams in order to make data-driven decisions on cow health and production management. Yet, accessing multiple data-streams, let alone analysing and interpreting them, is extremely challenging. In practice, the value of much of this data is lost because it cannot be used in a timely and insightful fashion.

We have combined technology from the gaming and agri-tech sectors to solve this deficiency. SmARtview integrates multiple data-streams from any technology platform that is deployed on the farm, using AI to identify an individual cow and access her data, together with AR to visualise the integrated analysis to support data-driven decision-making. This will enable livestock keepers and vets to readily access and interpret -- at the time and place of examining an animal - the data tools at their disposal, in an integrated form that magnifies the value of any single data source -- enabling it to be used to inform point-of-care decisions.

This will advance herd health and productivity, elevating the overall performance of the farm through achieving efficiencies and resulting in improved financial, animal health and environmental performance.

This project takes a radical cross-sector approach by combining expertise in dairy production with the up-to-the-minute technological knowledge, creativity and user experience expertise of the UK gaming industry.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
AGSENZE LTD	MothNet: Novel Approaches to Enable Fully-automated Smart Monitoring of Codling Moth	£121,147	£84,803
INTERNATIONAL PHEROMONE SYSTEMS LIMITED		£128,283	£89,798

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

The MothNet project will assess the early stage technical feasibility of a fully automated codling moth monitoring system. The innovative project will gather and analyse data on codling moth features based on a wide range of parameters in order to identify previously unexploited features that can be used to distinguish the species. In addition new long-life pheromone lure designs will be trialled. In this way, the project will enable partners to assess whether the system concept is feasible and should be developed further.

This project was conceived in response to feedback from within the fruit growers industry that precision trapping and monitoring systems are urgently needed. Industry requirements are for highly accurate real-time data collection without the need for skilled labour for moth identification and replacement of trap parts - such a system is not currently on the market. Alongside technical feasibility, dedicated work packages explore different business models for the product and routes to adoption in a range of geographical contexts. End-users are engaged from the outset to define target price points and technical requirements.

Successful completion of the MothNet project will lead to the development of a precision pest monitoring system that helps to reduce emissions and improve resource use efficiency by enabling rapid targeted response to pest outbreaks that in turn reduces pesticide usage and increases yields from existing agricultural land. Specifically our potential solution to the challenge of pest-predation in the fruit industry is data-driven, using widespread occurrence counts combined with environmental data to define action thresholds. By developing a fully automated system designed around reducing labour for fruit growers, our approach will increase adoption of precision approaches to bridge the productivity gap. Once the initial feasibility of species distinction has been proven, our ambition is to further refine the system to characterise sex and age of codling moth, enabling yet greater precision of control through models based on lifecycle stage of the insects. Following this, adaptation of the system to distinguish and record a range of insect species (both beneficial and harmful) creates an entirely novel device bring about a step-change in agricultural and environmental monitoring.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
LIGHT SCIENCE TECHNOLOGIES LTD	Assessing the feasibility of all-in-one growing sensor and innovative transmission node for vertical farms - driving energy efficiency, productivity and commercial viability	£137,466	£96,226
Nottingham Trent University		£112,499	£112,499

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

Vertical Farming(VF) has been branded as the future of Food Production due to the environmental benefits and food security benefits (small geographical footprint, pesticide-free, water reuse, all year round growing) of the growing process. However, the industry is in its infancy and littered with inefficiencies(high energy/labour costs, limited crop choice, high levels of contamination), resulting in poor ROI.

The global [vertical farming market][0] size is anticipated to reach \$9.96bn by 2025, according to a new report by Grand\ View\\_Research, (expanding@ 21.3%-CAGR) over the forecast period. Increased use of Internet of Things(IoT) sensors for producing crops is likely to spur the market demand over the forecast period.

Precision, integrated real time data solutions that are robust to the VF environment are critical to elevating the productivity of VF to a level where industrial-scale farms become commercially-viable and attractive to external investment. Ultimately our aim is to develop technology to generate high-value data to be shared (commercially but also via academic publication) with the global VF industry.

LST and the project consortium are focused on delivering an IoT precision data solution, comprising of an IP-protected all-in-one floating sensor, robust wireless data network, monitoring interface and BigData platform. The delivery of this solution will have significant impact to the VF industry:

\* \*\*Cheaper/Smarter Technology\*\*

\* \*\*Reduction in labour costs:\*\* significant reduction in human intervention

\* \*\*Improved Productivity/Efficiency:\*\* Data to maximise yields(and prevent disease) whilst ensuring only the precise materials/ingredients/energy are utilised.

\* \*\*Improved IRR/Profitability:\*\* leading to global adoption of VF.

The wider long term benefits to the UK and the ROW include;

\* \*\*Reduction in imports and associated emissions\*\* \*(Economic/Environmental/Social)\*\*

\* 85% of the UK's Salads&Prepared Veg is imported(£978m market ITC-Trade; 2018). The project will address the urgent need to reduce our reliance on imports, boost UK internal growing capacity(to meet supermarket demand) and \*\*improve food security\*\*

\* Offer traditional farmers the option to grow all-year-round, preventing sales being lost over winter to overseas

\* \*\*Reduction in unsustainable global demand on land and water for arable use(Environmental)\*\*

\* Agriculture currently uses 70% of all water consumed globally, vertical farming can help prevent water scarcity.

\* \*\*Improve UK resilience to environmental shocks(Economic/Environmental/Social)\*\* Drought or a lack of water result in 10% crop loss pa in the UK alone, equivalent to £400m(DEFRA;2016).

\* \*\*Improved Nutritional Offering:\*\* By improving VF's operations/outputs will enable VF research to focus on the growing of new, nutrient rich or dense crops(potatoes, stevia etc), helping move away from just leafy salad/micro-green's

[0]: <https://www.grandviewresearch.com/industry-analysis/vertical-farming-market>

Note: you can see all Innovate UK-funded projects here:

<https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results



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Use the Competition Code given above to search for this competition's results

## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
The James Hutton Institute	Raspberry Auxin Soil/Substrate Protectant (RASP)	£98,569	£98,569
JAMES HUTTON LIMITED		£98,848	£49,424
THOMAS THOMSON (BLAIRGOWRIE) LIMITED		£12,449	£8,714
WESTLAND HORTICULTURE LIMITED		£17,646	£8,823

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

*Phytophthora infestans* is the pathogen that caused the Great Irish Potato Famine and today over 170 described species of *Phytophthora* cause crop disease on a global scale, costing commercial crop industries billions of dollars. The UK fruit industry and raspberry particularly has been decimated by *Phytophthora* root rot (PRR) with an 80% reduction in field production leading to a smaller pot based short term industry supported by extensive fruit imports. Methods to control infection and spread are limited by current legislation that limit the use of prophylactic fungicides and increase the importance of novel control methods based on host resistance, growing media and watering. *Phytophthora rubi* and *P. fragariae* are PRRs which spread through plant propagation, growth media and water flow in plantations. Manipulating the physical, chemical and biological properties of the growth medium has the potential to play a key role in inhibiting PRR. Commercial plant growth substrates can be designed specifically to meet a crop's individual needs with regards to nutrient requirement, water management and grower preferences. Manipulating the growing media's physical, chemical and biological properties can lead to a stronger healthier root and plant system, while also limiting and actively suppressing the growth and spread of harmful root pathogens, such as PRR. Specific additives have previously been incorporated into growing media to control and prevent other root pathogens and pests such as Vine Weevil, *Fusarium* spp. and *Pythium* spp. A recent JHI study identified multiple responses triggered in a PRR resistant raspberry plant upon challenge with *P. rubi*, including a mechanism, which has the potential to improve a plant's resistance to PRR. The growth medium can be improved by the manipulation of these plant-derived chemical signals that are normally induced upon pathogen challenge in resistant cultivars, to boost the immune capabilities of susceptible cultivars. Using molecular methods such as gene expression, genetic markers and fluorescent pathogen cultures we can track disease development in the root-zone environment in different growing media substrate formulations. The innovative range of growth substrate additives developed in this project will stimulate raspberry root growth signal to improve the root system under a controlled irrigation regime and secondly actively inhibit the growth and spread of root pathogens. Establishment of optimal raspberry growing conditions integrated with early pathogen detection and control of PRR spread will transform raspberry agronomy, maximising yield and securing the UK soft fruit industry with application to other crops worldwide.

[0]: #\_msocom\_1

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## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
CROVER LTD	Feasibility study of a Crover robot for the autonomous sampling of grain bulks	£203,600	£142,520
AGRI-EPI CENTRE LIMITED		£46,249	£46,249
East of Scotland Farmers Ltd		£0	£0

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

Cereal grains are the basis of staple food, yet post-harvest losses during long-term storage are exceptionally high, above 20% in the UK and worldwide. Pests are to blame, with grain moisture content and temperature being the most significant factors. Cereal storage sites such as farms, grain merchants, millers and breweries, experience these challenges, which have high cost implications in terms of lost revenue and cost to rectify.

The objective of this project, a partnership between Crover Ltd, Agri-EPI Centre and East of Scotland Farmers, is to create the first robotic device able to safely sample grain bulks at various depths and while still hidle in storage, where existing methods cannot. Unlike current grain solutions that can only reach near the surface pose a safety hazard to operators collecting the samples, Crover's remote probing device will be able to collect samples throughout the whole silo/shed. This gives early detection of potential spoilage allowing proactive management to reduce losses and maintain quality.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
Manchester Metropolitan University	A robot-enabled, data-driven machine vision tool for nitrogen diagnosis of arable soils	£104,877	£104,877
GMV INNOVATING SOLUTIONS LIMITED		£124,820	£62,410
Royal Botanic Gardens Kew		£19,941	£19,941

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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## Project description - provided by applicants

Increasing crop productivity with reduced inputs and lower impacts on the environment is a major challenge for global food production. Among all farmer-controlled input factors, Nitrogen (N) has the second-largest impact on crop growth after water and arable soils are a predominant source of N in many cropping systems. Optimal N fertilisation can increase crop production and enhance soil fertility. On the other hand, high N inputs are costly for farmers and result in reductions in plant biodiversity, pollution of natural ecosystems and increases in emissions of the potent greenhouse gas, nitrous oxide. Current spend on fertilisers by UK farmers is £1.345bn. At present excessively high N fertiliser rates are used by farmers because they are not aware of the areas of land where N is excessive, optimal or deficient. Accurate detection of soil N is crucial for the economic and environmental sustainability of cropping systems. The current practices in determining soil N is costly, labour intensive and time consuming and so high N inputs are common.

For the first time, driven by the end user needs, this innovative interdisciplinary project between academia, industry and farmers will co-develop a cost-effective, non-destructive, robot enabled, data driven, machine vision solution by harnessing disruptive technologies (Robotics, AI/Computer Vision/Big Data Analytics), agricultural science to automatically detect nitrogen levels of arable soils, capable of 1) automated data collection using a mobile robot with 3D imaging sensing; 2) automated intelligent diagnosis of both crop N and soil N based on AI/Computer Vision/big data analytics which derives N using the crop and/or cover crop(s) as a quantitative bioindicator of soil N values. This utilises known plant responses to N enrichment with models parameterised by precise relationships derived in this study. The integration of sensor systems and machine vision/data analytics with autonomous robotic platforms offer significant opportunities for new measurements and machine vision-based tasks in food production that would otherwise be unobtainable and unachievable. This precision agriculture solution will transform food production by reducing N inputs, increasing farm profitability and contribute to net-zero emission by reducing emissions of nitrous oxide through offering early detection of both crop N and soil N, providing accurate information on nitrogen N use efficiency and soil quality assessment. It will position UK precision agriculture technologies at the forefront of new industries and drive economic growth in UK.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
LIBERTY PRODUCE LIMITED	Hydrobubbles to Boost Plant Growth Through Captured Carbon Utilisation	£135,852	£95,096
ICENI LABS LIMITED		£59,503	£41,652
The James Hutton Institute		£34,803	£34,803
VERTICAL FUTURE LIMITED		£18,162	£12,713

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results



## Project description - provided by applicants

Protected structures such as greenhouses, polytunnels and indoor farms are used in the production of high-value fruit and vegetable crops. They facilitate increased crop yields and quality by altering and maintaining environmental factors such as light, temperature, humidity and pest pressure. For countries based in northern latitudes these production systems are critical to maintaining longer growing seasons and for local production of many high-value and commercially significant crops including strawberries, tomatoes, peppers and cucumbers. Despite their benefits, considerable risks remain for growers in this industry with high operational costs and economic returns that are sensitive to changes in price and yield.

Technological solutions are required to overcome the challenges of productivity and sustainable production. This project is designed to address these obstacles through a collaborative multi-disciplinary approach. By bringing together farmers, technologists and researchers, we can develop a 'hydrobubble' generation technology that will deliver significant benefits across the sector. This technology promotes plant growth in hydroponic systems by up to 30%, through the injection of oxygen-rich micro and nano-sized bubbles into the irrigation water. The physical properties of these bubbles means they are negatively charged and electrostatically attracted to plant roots, where they cluster to constantly supply oxygen to the plant. This has proven benefits to plant yield and studies have reported marked improvement in both root development, fresh weight and the synthesis of specific plant biocompounds in a number of crop varieties.

This project will evaluate the feasibility of this new technology in three protected crop systems (glasshouse, polytunnel and vertical farming). It will establish whether the application of micro-nanobubbles can:

- \* Increase plant yield;
- \* Improve crop quality;
- \* Boost nutritional content;
- \* Reduce pathogen load;
- \* Contribute to the target of net-zero emissions from agriculture through the utilisation of captured CO<sub>2</sub> in the bubbling process.

This project will focus on delivering user-driven, effective and low-cost solutions. It will build on previously published work in the area, capabilities in technology development, crop knowledge and data analysis. This technology will enable increased productivity and profitability from protected crop production systems and enable an economic shift, facilitating indoor production from vertical farms to enter mainstream consumer markets. These benefits are highly exportable, with the potential to strengthen the UK agri-technology proposition and move food production towards a sustainable and productive net-zero emissions future.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
Harper Adams University	PRUEX	£100,108	£100,108
HUDSON & SANDERS LIMITED		£31,268	£21,888
PRUEX LTD		£34,974	£24,482
ROSS ROBOTICS LIMITED		£59,923	£41,946

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

This project will reduce greenhouse gas emissions whilst improving flock health and profitability in deep litter broiler houses. Microbial cleansing, using food grade *Bacillus*, has been in use in hospitals for the past five years. Using *Bacillus* to clean surfaces has proven more effective and sustainable than alternate chemical disinfectants. PRUEX are adapting *Bacillus* cleaning for a range of agricultural applications including cleansing broiler houses by converting bird excrement to compost. Early trials have shown significant reductions in ammonia, an environmentally damaging gas, and pathogens. This creates a healthier environment for the birds, considerably reducing the quantity of antibiotics required to keep them thriving. It also reduces the need for expensive ammonia scrubbers. When combined, *Bacillus* treatment dramatically improves growth, laying, welfare, and overall profitability. Trials suggested that using *Bacillus* treatment in UK broiler houses could reduce ammonia emissions by 1000s tonnes/year as well as other greenhouse gases. Trials will investigate the reductions in ammonia, carbon dioxide, methane, and nitrous oxide produced by *Bacillus* treatment.

Previous trials also identified daily applications of *Bacillus* being more effective than applying it every four or five days. Unfortunately, manually applying the product every day is labour intensive and prohibitively expensive and ceiling mounted applicators are inefficient and less effective. This project therefore proposes to use a robot to apply the microbial cleanser daily. Ross Robotics, working with Harper Adams University and Hudson and Sanders (one of the UK's largest poultry producers), developed a scouting robot for use in poultry houses as part of the RoboChick project. This robot can carry a range of sensors for monitoring environment conditions and activity in poultry houses. Adding a vaporiser will allow it to apply the *Bacillus* treatment whilst surveying the building. When combined with the robot's sensor system, it will be possible to vary applications rates based on environmental conditions, thereby optimising product use and cost.

Ross Robotics, working with HAU and PRUEX, will develop an on-board vaporiser system for the RoboChick robot vehicle. HAU will coordinate trials with H&S in two heavily instrumented poultry houses, one of which will act as a control, and produce academic papers detailing results. HAU's Agri-Tech Economics Group will evaluate the commercial viability of the system and work with the commercial partners to appraise purchaser, hire, contractor, and other business models. All of the partners will disseminate results, recommendations, and best practice to the wider industry at subsequent trade events.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
CLARITY BIOSOLUTIONS LIMITED	Development of advanced breeding and metabolic indicator technology for the dairy and beef industries	£135,660	£94,962
RAFT SOLUTIONS LIMITED		£67,964	£47,575

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

This project will drive productivity in ruminant production systems by enhancing decision support with a precision livestock farming technology solution and system for the measurement of key biological indicators of herd nutritional and reproductive health. The project brings together Clarity Biosolutions' innovative lateral flow reader and test technology together with RAFT Solutions' deep understanding of the needs of the beef and dairy industries. The project will deliver information about the feasibility, both technical and commercial, of a series of tests which if brought to market successfully would deliver, environmental and economic benefits to the agricultural industry in the UK and worldwide. It would help to bring about improvements in herd health and reduce the carbon emissions associated with beef and dairy production.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
QUANT FOUNDRY LIMITED	Enhanced Animal Behavioural Analytics For Improved Cattle Welfare, Health, Productivity and Sustainability	£124,550	£87,185
AGRI-EPI CENTRE LIMITED		£34,660	£34,660
University of Bristol		£89,748	£89,748

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Project description - provided by applicants

The Quant Foundry Artificial Intelligence (AI) Livestock Surveillance Solution in collaboration with Bristol Veterinary School at the University of Bristol aims to provide a world-class solution for the identification of anomalous cattle behaviour to aid in the rapid identification of different ailments. The solution combines AI-driven video analytics of animals within an automated farm framework to increase health and welfare and lower production costs and emissions.

While there are a number of existing solutions for remote monitoring of animals, many require an active involvement of people with little potential cost savings. Other solutions require the use of physical hardware that must be worn by the animal, requiring significant per-animal setup and maintenance costs. Internationally there are a number of ongoing research trials for image recognition, however there is little mention of their use identifying specific illnesses. Many video systems applied to livestock do not scale well with the number of animals, whereas the Quant Foundry system can identify and track multiple animals with little computational overhead. The unique innovation is our general computing model with standard off-the-shelf hardware that will be able to identify many different conditions for each animal. This considerably reduces the time and cost of development, deployment and upkeep.

This research and feasibility study will be performed across two areas: (i) classification and identification of key animal behaviour features to be applied to our deep learning algorithm, and (ii) a commercial feasibility study to assess the commercial effectiveness of the hardware and identification algorithm for identifying anomalous behaviours such as lameness and other abnormal motions. The validation study will involve an installation of the system at Agri-EPI Centre's South West Dairy Development Centre to record continuous video of every cow after milking over a 9-month period. Through an existing AI system developed by the University of Bristol, individual cows will be identified and linked to production/veterinary data and behavioural annotations from Bristol Vet School experts, verified by external assessors. This data will be used to validate and refine the Quant Foundry AI solution, and will also be curated for public dissemination as a resource for the field.

The final stage will be to assess the overall effectiveness of the primary lameness, mastitis and Johne's disease solution and determine its benefits for commercialisation and research. This would lead to further studies to advance fundamental animal welfare, behaviour and sustainability research.

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

Use the Competition Code given above to search for this competition's results

## Results of Competition: ISCF TFP Science and Technology into Practice: Feasibility Studies

Competition Code: 1911\_ISCF\_TFP\_FS

Total available funding is £15m across 2 strands: demonstration and feasibility

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
MAGGROW U.K. LIMITED	Radical and Environmentally-friendly Agricultural Sprayer Technology using Ultra-Fine Bubbles	£124,996	£87,497
AGRI-EPI CENTRE LIMITED		£45,501	£45,501
CROP HEALTH AND PROTECTION LIMITED		£79,242	£79,242

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Use the Competition Code given above to search for this competition's results



## Project description - provided by applicants

From time-to-time a technology comes along that offers potential for significant change and disruptive economic benefit, CDs and smart-phones being cases in point. More modest, but never-the-less significant is the emergent technology based on ultra-fine bubbles (UFBs), also known as nanobubbles. These UFBs are less than a millionth or so of a centimetre in diameter (1000 times smaller than the width of a human hair), which in their stabilised form exhibit a range of remarkable properties, notably their longevity (the period of time they remain as bubbles), and importantly their capability for carrying, in aqueous media, gases of various kinds and bubble surface adherents. As a consequence, they are already realising ground-breaking applications in many aligned industries, including, cleansing-sterilisation, oil, gas, and mineral extraction processes, pharmaceutical, food-flavouring and cosmetic industry, with in-roads into medicine and cancer treatment; each with, or the potential for, £multi-million market values.

That versatility in UFB properties, together with advances in UFB research are pointing to significant potential for purposely incorporating appropriately characterised bubbles into agricultural aqueous media, for spraying and irrigation purposes, and with a view to achieving more effective reductions in inputs (water, chemicals, etc.) more effective coverage, water usage, delivery of crop nutrients, pest-control agents and agents for control of plant diseases. The aim of this project is to establish the feasibility of integrating UFB and proven magnetic-assist technology in a generic platform that can be used to specify a wide-ranging modalities and applications, and the basis for new, economically viable and environmentally-friendly products and services. A successful outcome can also mean a significant step towards new UK enterprise and new employment opportunities. Appropriately managed the outcome can turn the £0.25million investment into a rolling agenda for enterprise, conceivably capable of achieving a 100-fold return-on-the investment within five years.

The need for greater productivity in agriculture to meet food security challenge is without question, as is the need to do so with regard to environmental protection and climate change. UFB technology has the potential as a technological platform to contribute significantly to meeting these demands. But the benefits do not end there, effective land use and land reclamation are significant considerations in meeting the challenge, as are other planetary boundaries, including, emissions and climate change impact, land and water usage, bio-geo chemical flows and biodiversity. The risk in the investment is modest, the potential for substantive returns for the UK is enormous.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SRUC	Identifying best sensor technologies to deliver verifiable health & welfare, environment and processing quality benefits for dairy production.	£84,000	£84,000
FIRST MILK LIMITED		£113,001	£67,801
MCQUEENS DAIRIES LTD		£6,000	£3,000
NESTLE UK LTD.		£6,000	£3,000
University of Strathclyde		£16,000	£16,000

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## Project description - provided by applicants

Dairy production and processing are key industries for many rural areas in western Britain, converting human inedible feeds into valuable components of healthy varied diets and contributing to the sustainability of rural communities. Dairy production has the lowest carbon footprint of all of the ruminant production systems that can utilise the UK's grasslands for food production and so we focus on improving technical efficiency in dairy production and processing. The project addresses some of the key concerns of consumers and retailers of milk and dairy products, who need to be reassured about the environmental footprint and animal welfare standards of dairy production systems. It will develop new tools to provide consumers, retailers and processors with verifiable information about the environmental footprint and animal welfare standards in dairy production systems. We will use monitoring technologies, including environmental sensors, animal-mounted sensors and camera technologies that are already being used by farmers to manage technical aspects of their systems, such as feeding and fertility. We will avoid prejudging the potential of different technologies and start out by working with any equipment that is already being used commercially, or is about to be commercialised. By relating this information to manually recorded information, using advanced machine learning techniques, we will be able to develop new algorithms to provide indexes of environmental emissions and cow welfare in ways that are both easier, cheaper and more reliable. Our objective is to identify predictors of a few key common indicators for both environment and welfare aspects that can contribute to accepted farm assurance standards and reassure consumers. We will work with progressive dairy farms across the main UK dairying regions to ensure that relationships are robust and to provide a platform for demonstration and extension to other farmers. After BREXIT, the UK may have new opportunities to export or replace imports of high-value dairy products; development of such products is built on a solid foundation of verifiable quality in aspects such as environmental footprint and cow welfare.

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