Results of Competition: ISCF Future Food Production Systems

Competition Code: 1909_ISCF_TFP_FFPS_CRD_RD2

Total available funding is £20M

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
DEEP BRANCH BIOTECHNOLOGY LTD	REACT-FIRST: Reduced Emission Aquaculture & Chicken Trial For Integrated, Responsible and Sustainable Transformation of CO2 into animal feed	£1,894,789	£1,301,352
AB AGRI LIMITED		£55,198	£27,599
BIOMAR LIMITED		£84,454	£42,227
DRAX CORPORATE LIMITED		£170,355	£0
Nottingham Trent University		£147,056	£147,056
SAINSBURY'S SUPERMARKETS LTD		£10,859	£0
University of Edinburgh		£119,867	£119,867
University of Nottingham		£158,068	£158,068

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University of Stirling		£385,133	£385,133

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Project description - provided by applicants
The world's population will reach 10 billion people by 2050\. By this point, the demand for animal-based products will have doubled, yet we currently struggle to feed the animals we eat in a sustainable fashion today. Based on Deep Branch Biotechnology's proprietary CO2-to-protein process, the REACT-FIRST consortium will develop feeds with 65-75% smaller carbon footprints, with no requirements for arable land and minimal water usage. By utilising carbon dioxide from Drax Power's Selby (Yorkshire) biomass power station, Deep Branch generate Proton, a protein powder optimised for aquaculture and poultry diets. By working with BioMar and AB Agri, leading in feed production in these respective markets, the consortium will develop Proton-based feeds that will be validated by world-class research facilities at the University of Sterling's Institute of Aquaculture and Nottingham Trent University's Poultry Research Unit. The project will be guided by the Scottish Aquaculture Innovation Centre and Sainsbury's, offering a full value chain network for aquaculture and poultry, ensuring outcomes are aligned with industry needs. The University of Nottingham's Synthetic Biology Research Centre will enable Deep Branch's process to be further optimised in a non-GMO fashion, whilst the University of Edinburgh's Innogen Institute will assess the full sustainability impact of the project and whilst ensuring responsible innovation.

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ENTOCYCLE LTD	The Insectrial Revolution: Stimulating the establishment of a world-leading sustainable insect industry in the UK	£6,308,576	£3,406,631
AB AGRI LIMITED		£82,312	£41,156
BETA BUGS LIMITED		£586,381	£410,467
COOKE AQUACULTURE SCOTLAND LIMITED		£69,130	£34,565
Durham University		£491,051	£491,051
ENTOMICS BIOSYSTEMS LIMITED		£1,098,418	£768,893
FERA SCIENCE LIMITED		£221,364	£221,364
INSECT TECHNOLOGY GROUP HOLDINGS UK LIMITED		£170,094	£102,056

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University of Stirling		£532,021	£159,606
University of Warwick		£284,716	£284,716

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Project description - provided by applicants
Black Soldier Fly (BSF) farming is now widely accepted as a key solution to tackling some of the world's biggest challenges in agriculture. BSF can simultaneously recycle food waste into insect-based animal feed (a sustainable alternative to fishmeal) and biofertiliser (a sustainable alternative to chemical fertilisers). This highly complex farming system requires input from experts across research, governmental and commercial sectors. No single organisation is currently in possession of all the required expertise. Whilst hundreds of scientific papers and millions of pounds have been invested globally into validating the transformative potential of BSF farming techniques, the race is still on to demonstrate large-scale, profitable BSF farming operations. The UK is home to leading BSF specialists with expertise covering the entire value chain. In 2017, partners in this application formed the UK Insect Biomass Conversion Working Group (IBCWG) to combine their expertise with the shared idea that together our combined knowledge is greater than the sum of its parts. In isolation, we are leading specialists in entomology, engineering, data analytics, machine vision, food safety and food supply chains but, together, we can deploy highly profitable and sustainable BSF farming systems. This project provides an exciting opportunity to combine our expertise and collective ambition to establish the UK as the global industry leader by demonstrating a complete BSF farming system that is **profitable**, **sustainable** and **scalable** to leapfrog global competition. This project will realise the transformative nature of BSF farming by: * Delivering a complete system demonstrator that converts industrial quantities of food waste into insect-based animal feed and biofertilizer using our groundbreaking, highly automated technology; * Generating the data to prove that BSF farming is **profitable**, **low carbon** and **scalable** in the UK; * Validating the **safety** and **efficacy** of **insect-based animal feed** and **biofertiliser**; and * Prove product safety and address the final legislative bottlenecks By proving the above, we **unlock access to growth finance** which will enable us to **rapidly scale** the BSF farming industry in the UK and overseas. The partners intend to establish the UK as an international centre of excellence for BSF farming and technology. By 2040, we aim to have delivered over 100 sites internationally, create 3300 UK based jobs, generated combined annual revenues of £400m for UK tax paying businesses and delivered savings of **50m tonnes CO2** equivalent \[IBCWG\] - driving us towards the Government's targets for **net zero emissions**.

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CALYSTA (UK) LTD	F4 : Future Food From Fermentation	£2,714,145	£1,899,902
CARBON TRUST ADVISORY LIMITED		£88,900	£62,230
NEW-FOOD INNOVATION LTD		£141,959	£99,371
PERLEMAX LIMITED		£450,103	£315,072

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Project description - provided by applicants
There is increasing demand for nutrient rich foods, with more of the world adopting meat and grain rich diets, and the world population expected to grow 25% by 2050\. The ability of traditional agriculture to meet the growing demands for meat and grain is uncertain in a world expected to face significant climate change. Microbial food products have the potential to transform the global food industry, producing highly nutritious food in scalable fermentation processes. This project will seek to both improve the process efficiency and sustainability of microbial food production and expand the market opportunity by developing new product streams. The project brings together Calysta, producers of FeedKind single cell protein (SCP) animal feed, produced by fermentation of methane utilising bacteria, New Food Innovation, Perlemax, The Carbon Trust, Leeds University, and Pontus Research, who will collaborate to develop more sustainable processes, new products, and assess these as feed and food products The project will develop novel processes for the sustainable production of microbial biomass, including; microbubble technology for improved mass transfer; the use of novel microbial consortia and; the simultaneous fixing of emitted CO2 in a linked microbial process. The processes currently used for the production of the animal-feed approved FeedKind will be fully evaluated, producing a roadmap for the rapid development of high-quality food-grade processes for the production of nutrient rich foods. FeedKind microbial SCP is naturally high in protein and to increase its value as a food ingredient processes will be developed to generate a soluble protein isolate fraction for use as a food ingredient and the insoluble fraction for use as an animal feed ingredient. The soluble protein isolate fraction will be assessed for valuable properties such as gelling, foaming and binding, for replacement of animal-derived proteins in meat-free products. The insoluble fraction will be assessed as an animal feed ingredient for fish and piglets, where it will also be assessed for improvement of animal gut health. The outcomes of this project will be the development of new processes and technologies for the production of novel nutrient rich microbial food and animal feed products. The processes developed will be resource efficient, reducing CO2 emissions, with low water and land usage compared to traditional agriculture. The processes will be highly scalable and non-seasonal using technology that can be deployed anywhere.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
EVOGRO LTD	Production at the point of consumption: a distributed network of intelligent growing systems for foodservice operators and consumers	£510,754	£326,883
National Inst of Agricultural Botany		£148,290	£148,290
THEREFORE LIMITED		£576,396	£374,657

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Project description - provided by applicants
The originators of this project are leaders in the indoor growing system field and have successfully commercialised the technologies and associated services for on-site growing of high value produce (specialty salad leaves, herbs and microgreens) by foodservice operators. The lead business provides clients with a complete integrated system including hardware, consumables, remote monitoring and support services, which enables them to grow-their-own high quality crops with minimal effort and without needing horticultural expertise. The system is technologically innovative because it combines flexible, multi-zonal hardware with a sophisticated cloud-based software platform that combines image processing, machine learning and artificial intelligence to enable monitoring of every crop and automatic programming of the cabinets. This distributed network approach is transformative because it moves the means of production to the point of consumption. Leafy salad crops are inherently perishable and are wasted in huge quantities. This solution eliminates this wastage and the associated negative environmental impacts of the conventional supply chain. The existing Evogro system is highly adaptable and can produce a wide range of crops, but the purchase and operating costs of these systems is still too high for all but the most committed consumer and it is only economic to grow specialty produce. This project will address these issues by researching and developing the next generation of value engineered and autonomous growing system that will dramatically reduce the cost of ownership.This will greatly expand the addressable market by making it affordable for new consumer segments and make it economic to produce mainstream crops. The project will also apply the next generation system to the growing of these mainstream crops, optimising the growing models to maximise their nutrient density. The consortium will run pilot trials of the next generation growing system in volunteer groups of foodservice operators (including some sectors like education and care homes with potential to deliver additional social benefits) and household consumers. This project has the potential to be transformative because it radically disrupts the conventional supply chain and delivers improved nutrition and sustainability benefits to consumers. With widespread adoption, distributed plant growing systems could save tens of thousands of tonnes of food waste annually in the UK. This is a nascent market but activity is accelerating around the world. The company has already begun exporting and sees strong potential in overseas markets. This project will position UK technology at the forefront of this new global industry.

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INFARM - INDOOR URBAN FARMING UK LIMITED	InFarm2.x: Data enabled vertical farming with minimal waste and emissions and maximum efficiency and crop nutrition	£3,743,114	£1,871,557
MARKS AND SPENCER P.L.C.		£82,975	£41,488
Newcastle University		£990,573	£990,573
ROBOSCIENTIFIC LIMITED		£606,224	£424,357

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Project description - provided by applicants
Global population is expected to grow to 9.8Bn by 2050 with 7Bn of these people living in urban areas. Providing nutritious food for all in a resource and energy efficient manner is becoming increasingly challenging. Arable land to grow crops is becoming more scarce with a third of usable land lost in the last 40 years due to soil degradation (Grantham Centre for Sustainable Futures, 2015). Vertical farming whereby crops are grown indoors in stacked trays under controlled environments can provide a viable large scale alternative to traditional agriculture. Vertical farming gives growers the ability to fully control all the things needed to produce healthy plants including heat, light and water. As such, the systems can be tailored for year round growth and use significantly less water and energy than traditional farming. Additionally, no insecticides or pesticides need to be used. Another significant advantage is location; vertical farms can be located in both rural and urban environments to ensure the produce is a close to the consumer as possible, reducing food miles and therefore contributing to net zero emissions targets. Our project will be led by Infarm, a highly successful vertical farming business who have commercialised vertical farming systems to produce nutritious and healthy leafy salads and herbs. Retailers and consumers want more fresh produce grown in this way including peas, beans, tomatoes, strawberries, chillies and carrots. However, these products often have more complex growth cycles and needs requiring more condition control and monitoring. We aim to develop and optimise systems to grow a wider variety of fruit and vegetables than at present. We will optimise our growing spaces to include additional gas sensors and monitoring cameras to allow us to monitor the growth cycles and changes to varying crops to work out the perfect growing conditions. Once we have developed the Infarm2.x system and processes, we will trial the project outputs in our small scale in-store systems where produce goes straight from growing to the consumer, cutting out the need for expensive, energy intensive transport. We will work with key partners to provide the technology and scientific research expertise needed to enhance our growing spaces (RoboScientific and, Newcastle University) and key UK food retailer Marks and Spencer to facilitate trials and advise on end user needs.

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SUSEWI LTD	AGRI-SATT - Agricultural Growth using Remote-sensing, IoT, Satellite and Autonomous Telecommand Technology	£4,840,857	£3,388,600
Scottish Association For Marine Science		£368,495	£294,796
University of Southampton		£472,094	£377,675

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Project description - provided by applicants
The AGRI-SATT programme combines newly available, high-resolution spatial and temporal satellite data with key environmental and algal productivity data to create an effective, scalable, protein and food production method on desert land. The objective of this growth methodology is to produce food and aquaculture feed with widely available natural nutrients, in locations where nothing grew before. By extracting CO2 from seawater and underutilized nutrients from the deep ocean, this highly sustainable project 'deacidifies' enormous quantities of seawater, returning 99.98% of the seawater used during the process. This is very beneficial to the local ecosystem and aids coastal primary producers to sequester more carbon from the environment further amplifying the benefits of this growth methodology. What distinguishes the AGRI-SATT programme is that it exploits abundantly available natural seawater to produce food in non-arable deserts using wind-energy. The tested, scaled and patented growth methodology will be applied globally. With ground-based operational data, production operations will be forecast and automatically adjusted to dramatically increase the impact of this highly sustainable food production method. The AGRI-SATT programme, for the first time, combines daily, high-resolution, hyperspectral satellite data with detailed in-pond photo-physiological data to determine the quality and productivity of natural algae for the production of high value food and feed ingredients. Marine microalgae create the plant-based Omega-3 fatty acids, protein, and even the colour and taste of seafood that accumulate in high-value mollusks, crustaceans and fish or alternatively could be used for vegetarian food. Combining these data in an AI-enabled computational 'Digital Twin', automates and increases production and the nutritional quality (protein, pigments) of food. Furthermore, with IoT-enabled, SCADA-controlled pond machinery, sustainable food and feed production will be maximised. By controlling the production ponds with IoT-informed operational equipment and 'weather-responsive nutrient supply', this growth methodology recreates the ideal growth conditions for microalgae. Also, reproducing ideal growth conditions year-round means our highly sustainable and scalable production method is cost-competitive with less sustainable commodities like fishmeal or soy protein concentrate. UK PLC benefits directly by receiving large volumes of critical feed as well as highly valuable organic food. This sustainable food fundamentally and significantly increases the competitiveness of UK food production. The data integration software is applicable globally to all agricultural schemes that aim to increase Net Primary Productivity. The cloud-based AI applies to any agricultural production system.

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