Results of Competition: ISCF TFP Science and Technology into Practice: Demonstration

Competition Code: 1911_ISCF_TFP_DEMO

Total available funding is £15 million split between Demonstration and Feasibility strands

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
SAGA ROBOTICS LIMITED	Robot Highways	£1,699,455	£1,189,618
BERRY GARDENS GROWERS LIMITED		£19,445	£9,722
BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY		£262,036	£131,018
CLOCK HOUSE FARM LIMITED		£255,641	£153,385
Manufacturing Technology Centre		£249,963	£249,963
University of Lincoln		£452,964	£452,964
University of Reading		£253,071	£253,071

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Funders Panel Date: 15/05/2020

Project description - provided by applicants
Our vision for future soft fruit farming encompasses fleets of electric robotic and autonomous systems powered by renewable energy that pick, transport, pack fruit whilst gathering data to maximise yield, reduce waste and environmental impacts. Additionally, these technologies underpin industry sustainability by reducing sector reliance on low skilled labour, whilst upskilling the existing workforce. This vision can be delivered by 2025\. However, it's critical the underpinning technologies are demonstrated at scale. This secures a significant KE platform to empower transformation across UK and global supply chains. Our project synthesises and demonstrates the outputs of multiple Innovate UK, Saga Robotics, University of Lincoln, Berry Garden Growers, H2020, UKRI-BBSRC, EPSRC and Research England funded research and innovation projects. It will be the largest known global demonstration of robotic and autonomous (RAS) technologies that fuse multiple application technologies (8) across a single farming system. These will drive resource (carbon, pesticide, water, waste) and labour (fruit picking, handling and logistics) productivity whilst underpinning the transition of one of UK's most vibrant agri food sectors (soft fruit) towards a carbon zero future. Robots will be deployed to optimise physical farm processes, in particular to transport and pick fruit, pack fruit , treat crops to reduce critical pests and diseases (UVC to eliminate powdery mildew / insect pests) and optimise spray use. In addition, they will control the virtual farm by collecting data to monitor crop and fruit growth. Data will be analysed using AI and machine learning technologies, pre-developed at Lincoln, to forecast fruit supply and optimise farm productivity. New insights will be gained in the application of robotic systems across large commercial farming systems, in particular fleet control, charging and logistics operations, optimisation of data processing resources (edge / cloud) and the telecommunications infra-structure required to dispatch large volumes of data. Target deliverables: 1\. Elimination of fossil fuel across all farm logistic operations. 2\. 90% reduction in fungicide use (by UVC) and intrinsic carbon cost. 3\. 30% reduction in packhouse labour,40% reduction in farm labour (plus intrinsic carbon costs associated with people movement etc). 4\. 15% increase in farm productivity (yield per m2) and intrinsic carbon gain. 5\. 20% reduction fruit waste, through accurate forecasting.

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AEH INNOVATIVE HYDROGEL LTD	GelPonic: Smart hydrogels containing graphene-based sensors for precision control of vertical farms	£1,058,418	£709,140
CROP HEALTH AND PROTECTION LIMITED		£325,501	£325,501
LABMAN AUTOMATION LIMITED		£25,553	£15,332

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Project description - provided by applicants
To meet both the demands of a growing population and reduce the environmental impact of agriculture, there is an acute need to radically improve crop production systems globally. Vertical farming, where crops are produced in controlled environments with optimised growth mediums, water, air and nutrients, is a highly promising alternative to traditional agriculture especially in urban and/or water stressed environments. The vertical farming market is worth$3Bn globally and is predicted to reach $22Bn by 2026 (Forbes, 2018). Due to the micro-controlled environment, the resulting produce is of higher quality due to receiving the essential nutrients and water required for optimum growth and pesticide-free. The market is driven by out-of-season, year-round demand for fresh salad vegetables, especially tomatoes and leafy salad, the market value of which was £1.1bn in 2017. This project aims to revolutionise food production via controlled environment agriculture and make it globally accessible, including opening new markets in the developing world and capitalising on growing Middle Eastern vertical farming markets. In collaboration with project partners at Crop Health & Protection (CHAP) and Labman Automation Ltd, AEH Innovation Hydrogel Ltd will develop and demonstrate the novel GelPonic system based on an innovative graphene-based growth media that is affordable, long-lasting, re-usable, water-saving, conservative with respect to nutrients, and that filters out pathogens. The proposed vertical farming system will integrate the latest in renewable energy technologies, sensors and controls to significantly improve the precision, productivity and sustainability of controlled environment agriculture practices, whilst reducing carbon emissions to transform and decarbonise the industry.

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QUALITY MILK MANAGEMENT SERVICES LIMITED	REMEDY: REal tiME DairY. Providing solutions for farmers, vets, consultants and the environment.	£997,110	£697,977
ICEROBOTICS LTD		£349,337	£244,536
THE DAIRY GROUP LIMITED		£250,398	£175,279
University of Nottingham		£671,063	£671,063

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Project description - provided by applicants
This project involves development of a novel, precision, data-driven solution for dairy farmers that will create a complete step-change towards improved resource use efficiency and net zero emissions. For the first time dairy farmers will be able to calculate and evaluate their efficiency, productivity and environmental impact and then use sophisticated simulation tools, calibrated for their own farm, to identify optimal management decisions in real time. Current on-farm precision technologies often deliver isolated solutions to individual components of complex dairy production systems. This research project will focus on combining data and precision technologies (including cow wearables, novel cow health recording technology, detailed data from milk recording and animal health organisations, genomic data, nutritional data and data carbon footprint and emissions), to create software for a real-time decision support system (Real-time dairy, REMEDY) that will, for the first time, place the application of precision, data-driven, solutions at the finger-tips of dairy farmers. REMEDY will accelerate integration of a diverse range of key data sources and utilise state-of-the-art predictive and simulation models to determine the consequences of specific management decisions on future productivity, animal health, profitability, and environmental impact. Farmer decision-making on a real time basis, will ensure genuine, substantial and measurable improvements in productivity, efficiency, environmental footprint and animal welfare. REMEDY represents a significant step change in the utilisation of farm data and will greatly accelerate the on-farm adoption of new integrated solutions by directly supporting day-to-day decision making. REMEDY will provide deep insights into the consequences of future actions, allowing truly evidence-based decision making by farmers, vets and advisors. The predictive engine of REMEDY will employ sophisticated AI and machine learning methods to continuously use a farm's data to provide farm specific predictions to drive increased efficiency productivity and sustainability. We will ensure REMEDY has relevance and a focus on end-users. To ensure this, we have a team of academics, dairy industry specialists, precision technology specialists, veterinarians and farmers. This team has the infrastructure and substantial proven experience to deliver KE, identify target markets, establish the widespread adoption and support ongoing user needs. We will co-design project outputs with a group of vets and farmers and work with social scientists to evaluate the project outputs and determine best routes to break down barriers to achieve widespread dissemination.

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B-HIVE INNOVATIONS LIMITED	A holistic non-destructive data driven demonstrator to quantify potato crops during growth to realise maximum marketable yield and help reduce waste, contributing to net zero emissions - TUBERSCAN-DEMO	£1,519,886	£1,063,920
BRANSTON LIMITED		£339,337	£169,668
Harper Adams University		£294,855	£294,855
The University of Manchester		£400,873	£400,873

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Project description - provided by applicants
Determining the correct date on which to harvest potatoes is one of the most critical decisions potato growers must make. If they lift their potatoes too early, they may be below the optimum size resulting in less than the maximum potential output being produced, if they lift them too late, they may be too large to meet buyer specifications making them unsaleable. Either way the grower loses potential income. A recent proof of concept Innovate UK project (TUBERSCAN) has shown that it is possible to use new technologies to non-invasively measure the total biomass of potato tubers in the soil. Combining this with above ground data of potato plants, number of tubers per potato plant can be accurately determined. In addition, research has been conducted to create a cost-effective technology solution that supports the above on a commercial platform. The aim of this project is to build on the findings from the TUBERSCAN project to develop and test an innovative demonstrator system to measure and map average tuber sizes and yield throughout potato fields. This data will provide insights to will drive early interventions and/or selective harvesting to take place, thereby optimising crop yield and resource use. It is anticipated that this technology could generate an estimated 5 - 10% increase in UK marketable potato production, while assisting with reducing waste throughout the supply chain, working towards net zero emissions in the potato industry.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
OPTIMAL LABS LIMITED	Development and demonstration of data-driven autonomous growing system to raise productivity and resource efficiency in commercial greenhouse horticulture. Dissemination of demonstration results across broad greenhouse sector.	£1,721,045	£1,204,732
LA SERRA LIMITED		£561,876	£393,313
National Inst of Agricultural Botany		£464,038	£464,038

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Project description - provided by applicants
The Industrial Strategy Challenge Fund's Transforming Food Production challenge seeks to produce resilient and sustainable food more efficiently to meet demands in 2050\. Greenhouses go a long way towards meeting this challenge. **Industrial-scale greenhouses** are the **only scalable solution** to meeting the accelerating demand for healthy, locally-grown food - and to **secure our food system against population growth and climate change**. In sizes up to 15 hectares (20 football pitches), greenhouses in the UK already produce \>£100M of vegetables each year. Through control of climate, irrigation and lighting, **greenhouses can create the ideal conditions for crop growth**, in all seasons, **alongside any city on earth**. Crops can be grown for nutritional content rather than transportability, at **10x the yield of field farming, using 90% less water and zero pesticides**. Given that food production must rise 50% by 2050, agriculture already accounts for 70% of global freshwater withdrawals, farmland is being contaminated by heavy pesticide use, and climate change is expected to significantly decrease the yields of field farming - greenhouses are the only scalable solution and are **essential to the UK's agricultural future**. This project will develop 1) **the world's first Autonomous Growing System(AGS)**; 2) **demonstrate the AGS** and 3) undertake a knowledge exchange program. The AGS will provide optimised data-driven growing for any crop variety, in any greenhouse, in any location - **significantly increasing production levels and resource-efficiency** in existing greenhouses, and **accelerating the deployment of new greenhouses in the UK** and around the world. The Industrial Challenge Strategy Fund seeks to invest in **world-leading research** and **highly-innovative businesses**. The partners in this project fit this description. Optimal Labs Limited is a UK SME at the **cutting-edge of greenhouse automation**; NIAB is the **UK's fastest growing crop sciences research body**; La Serra Limited operates the **UK's most modern greenhouse.** The project is supported at no cost to the UK taxpayer by experts from the Dutch horticultural industry. This **£2.75M project** aims to **elevate UK controlled environment agriculture to being the best globally** and therefore much more abundant, fulfilling the aims of the Industrial Strategy Challenge Fund's Transforming Food Production challenge **at the scale that only greenhouses can**.

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