

Results of Competition: Agri-Tech Catalyst Round 9: Agriculture and Food Systems Innovation - Early Stage

Competition Code: 1910_CRD_DFID_AGRITECH_R9_ES

Total available funding is £6.58m across early, mid and late stage

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
Brunel University London	100% Solar energy run Cold Storage (SolCoS)	£208,205	£208,205
COOLSKY LTD		£79,548	£55,684
Kijani Testing Limited		£90,163	£63,114
SOLAR POLAR LIMITED		£120,396	£84,277

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Project description - provided by applicants

The collaborative SolCoS project among two UK industries Solar Polar and CoolSky, one Kenyan industry, Kijani and one UK university, Brunel University London (BUL), aims to deliver a radically innovative cold storage for horticultural produce of smallholders of Kenya. SolCoS cold storage will comprise of three innovative novel features -- (i) a compact, modular heat run (200-250C) diffusion absorption chiller (DAR) able to deliver a chilled space at 13 C at COP of >0.7 ; (ii) a specially developed concentrating solar technology to harness Kenya's vast solar resource supply heating and electrical energy required and (iii) vacuum insulation to achieve a storage level U-value of <0.25 W/m²K. The project will demonstrate the SolCoS technology for banana fruit, though any horticulture produce could be preserved using it. Minimising loss and waste of horticultural products can effectively reduce the area needed for production and/or increase food availability. In Kenya, about 25-45% of Banana fruit is lost due to lack of storage facilities causing economic loss to 400,000 farmers, majority of whom are women, and 500,000 subsector employees. A nutrition loss of a proportionate amount can be comprehended. The solar run cold storage SolCoS technology is proposed as a cost-effective and technologically viable solution because it proposes to maximise the value of high solar resource of Kenya allowing agro-industrial development without biting into network electricity, thus without hindering Kenya's electrification target of reaching power to every household by 2030; current rate is 75%. SolCoS project will design, manufacture and install a prototype comprising vacuum panel insulated cold storage equipped with modular Diffusion absorption chillers and solar concentrator at Kijani's testing site at Kisumu. A successful demonstration at Kisumu will enable rolling out the SolCoS cold storage technology to all major banana production clusters and markets providing a direct route to pass economic benefits to 900,000 smallholders and small businesses. Banana fruit thus saved will deliver nutrition to millions. Additionally, this grant will unleash an opportunity for solar heat technology in African and global banana industry, growing UK's solar energy business. Africa despite the richest solar resources in the world, has installed only 5 gigawatts (GW) of solar power, less than 1% of the global installed capacity, and nearly zero solar heat for industrial processes.

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Cranfield University	Innovations in soil and irrigation technologies to improve Senegalese vegetable production	£158,602	£158,602
BARFOOTS OF BOTLEY LIMITED		£40,740	£20,370
SCL - Société de Cultures Légumières		£183,475	£91,738
SNF SA		£5,900	£0
UNITED PURPOSE		£69,999	£48,999

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Project description - provided by applicants

Cultivating high-value vegetables for both national consumption and export have been shown to generate substantive positive socio-economic impacts whilst also contributing to achieving the UN Sustainable Development Goals. The transformation of agriculture towards export-orientated production can also enhance the livelihoods of smallholder farming communities. However, sustainable agricultural development in Senegal and sub-Saharan Africa (SSA) faces a number of fundamental agronomic, environmental and economic challenges including the need for more integrated approaches to soil and water management to build resilience to climate, water-related risks.

Micro or drip irrigation (DI) is being widely promoted globally and across SSA as a means by which smallholders and commercial farmers can increase yields and reduce vulnerability to climate variability. The low application rates and low energy requirements also provide major scope for improvements in irrigation efficiency, but this is contingent on good in-field management. Managing DI crops on drought prone soils is a major challenge -- farmers often over-irrigate leading to high drainage losses and nutrient leaching. To address these risks, SNF has developed an innovative low-cost polymer that can be applied via the drip irrigation systems. Initial trials in Chile and the USA have shown reduced leaching risks, improved irrigation to the root zone and increased yields. This innovation has the potential to drive a 'step-change' in water and nutrient use efficiency for smallholders and commercial farms growing vegetables in SSA. This exploratory project focuses on a 'dual innovation' -- the evaluation of the low cost soil conditioner coupled with assessing soil health can be improved through the use of a cover cropping can increase yields and economic returns. The tropical legume Sunn Hemp is a valuable inter-season cover crop that helps trap nitrogen, is antagonistic to southern root-knot nematode (a major yield threat in SSA) whilst also increasing soil organic carbon. However, the beneficial effects of Sunn Hemp on soil attributes relevant to water and nutrient management remain unknown. Working with our partners in the UK (Barfoots) and Senegal (SCL Diama), this project will evaluate the combined interactions of the soil conditioner and Sunn Hemp on soil and crop management practices. The project will use field trials on crops grown for local and export markets including sweetcorn, green beans, chillies, onions and 'Niebe' beans. Smallholder dissemination will be led a local NGO (Universal Purpose). The project will also engage with ongoing initiatives to ensure substantial numbers of smallholder farmers are beneficially impacted.

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PCI TECHNOLOGY INVESTMENTS LTD	Feasibility study for the development of an innovative Smart-farming app for smallholders in developing countries. (Agriculture-Productivity-Project) 'APP'	£142,595	£99,816
Federal University of Agriculture Abeokuta, Nigeria		£88,316	£88,316
Manchester Metropolitan University		£137,018	£137,018
ZYBA LIMITED		£88,690	£62,083

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Project description - provided by applicants

Across Africa and in developing countries generally, dynamics of culture, lack of access to finance and poor information dissemination preclude smallholders from best-in-class sustainable farming practices. The project aims to develop a D4Ag (Digitalisation for Agriculture) Smart Farming APP using Smart technologies including machine learning/artificial intelligence and data analysis to enable smallholders in developing regions to access integrated, site specific sustainable farming information, boundary mapping facilities and early disease identification resources. The productivity, welfare and route to market of smallholder farmers will be enhanced by a holistic accessible resource of agri-data and sustainable farming advice.

These farmers find themselves trapped in a vicious cycle of poor productivity and poverty, this is particularly the case for women and young farmers. For example, in Nigeria [insect pests and diseases][0] in [yams][1] resulted in a 25% mean annual yield loss in 2003. Early disease identification via the app will improve smallholders' productivity and profits. The development of the Smart farming APP will address the challenges of plot boundary verification as a means to raising investment, 24% of Nigerian smallholders own their land through customary law, which can preclude them from raising finance. Boundary mapping can help to register official land ownership. Access to disease identification and strategies to mitigate adverse climatic conditions for smallholders, together with information accessibility for improved market access will improve the current under exploitation of smallholder resources.

The increased yield through informed farming decisions via the smart farming APP will create the potential for improved wealth across gender boundaries, enabling women and youth to directly access the information they need to run efficient smallholdings, thus by-passing the patriarchal traditions of information dissemination prevalent in West Africa and developing countries. In a future of uncertain food supply, climatic change and the need for increased efficiency in farming methods, the APP will encourage smallholders to use innovative Smart Farming and precision farming techniques thereby reducing waste, increasing yield, improving the productivity, efficiency and autonomy of smallholders and introducing other uses for existing biomass production and processing.

As the effects of climate change spread, and the global population continues to grow and become urbanized, it is imperative that farmers in these regions, who are the mainstay of rural communities, become successful in the future.

[0]: <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/insect-diseases>

[1]: <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/yam>

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DEBYE LTD	Development of a Mobile Fertiliser Machine for Affordable and Sustainable Access to Nitrogen Fertiliser	£178,499	£124,949
3Js Farms		£35,500	£24,850
THE IMAGINATION FACTORY LIMITED		£227,648	£159,354

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Project description - provided by applicants

Crop yields in sub-Saharan Africa (SSA) are considerably below that of other regions because fertiliser consumption remains the lowest due to poor management of subsidy programs and high retail prices related to transportation costs. A consortium under the lead of Debye Ltd, a start-up company developing plasma-based devices, aims to democratize access to nitrogen fertiliser for smallholder farmers by developing a mobile fertiliser machine, which can produce cheap liquid nitrogen fertiliser in a completely sustainable and affordable way using only air, water and electricity from abundant solar power or mains power.

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C.A.B. INTERNATIONAL LIMITED	Improving soybean production using innovative digital and extension approaches	£179,231	£179,231
Agriculture and Climate Risk Enterprise Ltd		£257,752	£180,426
International Food Policy Research Institute (IFPRI)		£56,893	£56,893

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Project description - provided by applicants

Our goal is to help at least 30,000 farmers, particularly women, successfully access a neglected food market so they can improve their livelihoods. We will do this through a novel blend of digitally-supported advisory services, trained community champions who can introduce fellow farmers to reliable merchants, plus the application of Space and ground technology which observe the environmental conditions that influence insect pest population explosions, and which can help us create medium term pest forecasts similar to equivalent weather forecasts.

Pests and diseases account for pre-harvest crop losses of up to 40% but advisory services help smallholder farmers cope in giving them actionable, timely, and geo-specific pest management information geared to the likely levels of infestation. Farmers who can afford pesticides often inadvertently spray environmentally damaging chemicals, potentially adding unnecessarily to their costs, or use excessive amounts at the wrong time. For those who can't afford such treatments, they can be at the mercy of pest outbreaks which threaten livelihoods and create food losses. In this project we bring together: (a) an existing and effective advisory service (Plantwise), extended from rural to peri-urban farmers, to help women grow and sell soybean crops into urban food systems; (b) a network of up to 300 village extension advisors to teach fellow farmers how to manage pests and supply quality beans safely, without pesticide residues, to food processors; (c) a ground-breaking service for these advisors, providing geo- and time-specific forward-looking alerts of insect pest outbreaks created via sophisticated models, derived from satellite remote sensing and ground data observations, so farmers can tell in enough time when they'll be faced with a pest problem, and how best to cope with it; and (d) a financial safety net for farmers comprised of credit (to buy inputs), picture-based pest insurance schemes (to validate claims against a new type of crop - pest - insurance, so they can recover in the event of devastating pest invasions), and guaranteed purchase prices from a food processor. We have chosen soybean for its high nutritional benefit to consumers, its high-value financial rewards to growers, and its great potential in meeting domestic demand for a crop which currently has to be imported across Africa.

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AB5 CONSULTING LTD	Healthy And Sustainable Agriculture of Cassava in Nigeria (HASAC)	£85,914	£60,140
AMOLEXIS LIMITED		£114,650	£80,255
University College London		£181,286	£145,029

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Project description - provided by applicants

The HASAC (Healthy And Sustainable Agriculture of Cassava) in Nigeria project improves the agriculture and food system of cassava for smallholder farmers. The 15-month feasibility project will be tested in 21 farms of 5 acres each in Oyo state (total is 40 hectares).

Cassava is one the six most important staple foods in the world and Nigeria is its first producer in Africa. However, quantity and quality of crops is not adequately managed or monitored in the country, its price is very volatile resulting in poor profits for farmers and lack of adequate exploitation, both in the processing and use of crops and in farmers' involvement in the value chain and ultimately, in the sale to external markets.

The consortium composed of academic partner UCL, Amolexis of Nigeria, and AB5 of the UK will concentrate their efforts on better management and route to market of cassava culture, integrating test field and technology with a "Making Market Work for the Poor" (M4P) approach and a strategy to adapt and transform food for sale and marketing effectiveness. We are pleased to be able to collaborate of the local development agency OYSADEP, through which farmers and land for the demonstration phase of our project will be provided. The project will also permit to efficiently use resources (e.g. water, fertilisers and pesticides), reducing the impact of climate change. We are also grateful of a collaboration with International Institute of Tropical Agriculture (IITA) for the African Cassava Agronomy Initiative (ACAI) project. This project funded by the Bill Gates Foundation, aims at supporting the farmers' decision process through macro data.

The aim is to develop a profitable model for smallholders, which can then be reproduced in a self-sustainable manner, and contribute to combat hunger and poverty in Nigeria. The project will actively contribute to fighting poverty, by providing farmers tools and information to develop their farms, and sell their harvest at the best price. Export and urban markets will be particularly targeted. We aim towards a zero-waste farm, and will make sure that wastes produced by the farms can eventually be recycled

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AGRI-EPI CENTRE LIMITED	Leveraging remote sensing and ICT to facilitate yield maximisation, structured trading and inclusive value chain participation for smallholder staple grain farmers in Kenya	£102,015	£102,015
Harper Adams University		£87,496	£87,496
Strathmore University		£59,996	£59,996
USOMI LIMITED		£249,584	£174,709

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Project description - provided by applicants

Finger millet grain is a super-food, containing at least 9% protein and a good balance of amino acids. It is an excellent dietary source of calcium, iron, manganese, and methionine, an amino acid lacking in the diets of hundreds of millions of poor who live on starchy foods such as cassava, plantain, polished rice and maize meal. It is a versatile foodstuff used as whole, cracked, or ground flour; a dough; or a grain like rice. It is favoured by and recommended to breastfeeding mothers, given its high calcium and iron content and is often fortified with other grain as a supplementary food for infants. As such, there is high demand for millet flour outstripping production across the country.

Over the last decade, consumption in Kenya has stagnated at 6kg/head, mostly owing to declining production. Additionally, yields have declined to a lowly 200kg/acre against a potential of 1,500-3000kg/acre, while unreliable supplies have led to the loss of interest by millers. This project seeks to introduce finger millet as a cash crop for farmers in marginal agricultural areas during the long rain season, and a rotation crop such as soybean, groundnut, or sesame in the short rain season, to maximise yield and allow farmers to operate beyond subsistence.

We will provide farmers with critical support including access to inputs, agronomic support, data driven advice and mechanisation through a purpose-built precision farming platform. Additionally, USOMI, through use of forward contracting, will guarantee the purchase of the whole crop obtained. We already have market for the finger millet and must increase yield to sustain supplies.

Poultry farming using chickens with higher egg and meat production (adapted to local conditions) will also be introduced not only as a risk mitigation strategy but also as a complementary income source. The poultry will utilise any lower quality grain and other feed sources available in the environment. The recycling of potential waste grain into highly nutritious protein will ensure long term sustainability of the farming system.

Availability of these two complementary enterprises will ensure that socioeconomic, nutritional and food security needs are properly met. Considering most diets in rural Kenya rely on high starch foods lacking balanced nutritional content, this project will increase intake of highly nutritious animal source foods alongside millet, a super-food.

The outcomes of this project will have a high impact on alleviating the paradox of hungry farmers so prevalent in rural Kenya.

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SCENE CONNECT LTD	Saline Aquaculture Network in Ghana	£70,707	£49,495
Centre for Women and Food Security Ghana		£36,188	£36,188
Save Our Beaches Ghana		£40,160	£40,160
SEAWATER SOLUTIONS LTD		£162,061	£113,443

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Project description - provided by applicants

The coast of Ghana stretches 350 miles, binds 4 administrative regions, and is home to more than a quarter of the country's population. Due to increasing salinity of the water and soil, indigenous coastal communities are suffering from a scarcity of safe water for drinking and irrigation, leading to poor agricultural productivity. Soil erosion and flooding are also growing problems along Ghana's coast, with millions of dollars invested in flood protection for major coastal cities [1].

The "Saline Aquaculture Network in Ghana" project - SANGHA - will establish a network of saltmarsh and aquaculture sites to grow halophytic crops from local seawater and solar-powered irrigation. Degraded or redundant coastal lands will be adapted to grow the crops, and existing aquaculture farms will be enhanced with floating beds of samphire halophytes, providing an additional revenue stream for the farmers as well as water cleaning, flood-mitigation, carbon capture, and pollution services.

Scene Connect (SC) is Project Lead with Seawater Solutions (SS) as Technical Lead. SC is an expert in local energy systems and business model development for bottom-of-the-pyramid customers in the Global South. SS launched the first seawater farm in the United Kingdom and will launch Vietnam's first experimental aquaculture farm in early 2020. Various saltwater systems have been developed by SS, including renewable-powered irrigation systems, IoT sensors, and processes to mimic natural ecosystems. This innovation and approach will bring the following benefits to Ghana:

- *High carbon capture
- *Increased agricultural yields and improved soil/water/air quality
- *Promoting organic and regenerative farming practices
- *Promoting ecosystem restoration
- *Defence of coastlines from flooding and erosion
- *Producing high-value 'superfoods' (e.g. Samphire) for domestic and international markets
- *Improving incomes and livelihoods of indigenous coastal farmers, especially women, of coastal communities
- *Developing novel markets across the agricultural supply chain.

In addition to establishing a network of saline farms on coastal land, SANGHA will also leverage an existing aquaculture site to explore crop diversification and water cleaning opportunities through integration with Seawater Solutions' aquaculture system.

Local partners CeWaFS-Ghana and Save Our Beaches Ghana work across national agricultural value chains, female agricultural capacity-building, and

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coastal restoration. They will take an active role in establishing and operating the sites, plus creating and delivering to customers through socially-inclusive supply chains. Ownership of the sites and resources will be transferred to local communities upon completion of the project, with an emphasis on working with female-led organisations and initiatives.

\[1\] [<https://phys.org/news/2018-10-ghana-coping.html>][0]

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