UNDP
Empowered lives.
Resilient nations.

cultivate
Innovation for Sustainable Agriculture

31 TECH SOLUTIONS FOR **SUSTAINABLE AGRICULTURE**

CULTIV@TE:

WORKING TOWARDS A MORE SUSTAINABLE AND FOOD-SECURE FUTURE

The planet is reaching a tipping point. By the year 2050, it is expected that the global population will hit nine billion. We need to collectively figure out sustainable methods to feed all those people, and ensure a stable supply of food and crops for years to come.

Here at the UNDP Global Centre for Technology, Innovation and Sustainable Development, we decided to launch an initiative called Cultiv@te, a global innovation challenge with the aim of surfacing radical and transformative digital technologies to help improve global sustainable agriculture practices.

Through this programme, we aim to find bright minds and creative entrepreneurs, startups and R&Ds from all over the world. We are seeking technological and innovative solutions to help farmers, by working with UNDP's Country Offices and the local stakeholders in 11 countries across Africa, Asia and Latin America.

The challenge covers the themes of urban agriculture, rainfed agriculture and livestock farming and aquaculture. We have been thrilled to see the ingenuity, complexity and inventiveness of the solutions from our finalists - including anything from urban agriculture technology to Internet of Things-driven precision agriculture.

In May 2020, we announced 31 finalist teams which will be provided with mentorship, trainings and workshops by our partners, such as leading tech companies, agri-food MNCs and agri-tech experts. The aim is to help these innovators to scale and accelerate the adoption of their technologies and innovations from the developed world, to the developing world.

Read on for a closer look at all 31 finalist teams and the work that they are doing. The hope is that with collective action, they can do their part to build a more sustainable and food-secure future.

Sincerely,

Bradley Busetto

Director, Global Centre for Technology,
Innovation and Sustainable Development Singapore

TABLE OF CONTENTS

■ ELEVEN COUNTRIES

01

02

03

04

05

06

07

08

09

10

11

AND THEIR CHALLENGE STATEMENTS

01 SINGAPORE

SOLVING FOR PEST AND DISEASE MANAGEMENT IN URBAN FARMING

THE WELY DEVICE
www.phytochemconsulting.ca
LLEAF GREENHOUSE TECHNOLOGY
www.lleaf.com.au

02 URUGUAY

FINDING INNOVATIVE SOLUTIONS FOR URBAN FARMING IN SOCIAL HOUSING

CITIPONICS
www.citiponics.com
FRESH LIFE PRODUCE
www.freshlifeproduce.co.za

03 KENYA

PROMOTING YOUTH ENGAGEMENT AND ENTREPRENEURSHIP IN PERI-URBAN AGRICULTURE

FARMZ2U
www.farmz2u.com
LIQUIDSTAR
www.liquidstar.io
MORINGAWHAT
www.moringawhat.com
HELLO TRACTOR
https://hellotractor.com

04 BHUTAN

INNOVATION TO INCREASE THE CLIMATE RESILIENCE OF AGRICULTURE IN BHUTAN'S UNIQUE CONTEXT

AGROSMART
https://agrosmart.br/en/
AGRITASK
www.agritask.com

05 PHILIPPINES

BOOSTING AGRICULTURAL PRODUCTIVITY IN A POST-CONFLICT REGION

CROPIN TECHNOLOGY
www.cropin.com
DIGIAGRI
www.digi-agri.com

06 INDONESIA

IMPROVING AGRICULTURAL PRACTICES AND INCREASING FARMER'S ACCESS TO CREDIT

AGROCLIMATICA
www.agroclimatica.com/en/
BIOPS AGROTEKNO
www.biopsagrotekno.co.id
CROWDE
www.crowde.co
IGROW
www.igrow.asia

07 GABON

BOOSTING FOOD SECURITY WHILE ENSURING NET ZERO DEFORESTATION

SUSTAINABLE NITROGEN
www.tsnf.org.uk
FARMCORPS
www.farmcorps.net

08 ETHIOPIA

APPLYING CLIMATE-SMART INNOVATIONS TO INCREASE AGRICULTURAL PRODUCTIVITY

THE TOOTHPICK PROJECT
www.toothpickproject.org
BOREAL LIGHT
www.winture.de
UJUZIKILIMO
www.ujuzikilimo.com
SOLARISTIQUE NIGERIA
www.solaristique.com.ng

09 ECUADOR

INCREASING THE PRODUCTIVITY AND QUALITY OF LIVESTOCK AND DAIRY PRODUCTION IN THE AMAZONIAN ECUADOR

CONVERGENCE TECH
www.convergence.tech

10 UZBEKISTAN

DIGITAL LAND MANAGEMENT TOOLS FOR THE FAIR AND SUSTAINABLE USE OF PASTURES

ONESOIL
www.onesoil.ai
PASTORAL
www.karakoram.xyz
DIGITANIMAL
www.digitanimal.com
AGSAT BY AGROMART
www.agromart.uz

11 ARMENIA

INCREASING SAFE FISH PRODUCTION WHILE MANAGING AQUACULTURE WASTES SUSTAINABLY

DE REBUS PLANTARUM
www.drp.bio/en/
MAQUAPONICS
maquaponics@gmail.com
ITM-CNR
www.itm.cnr.it

OTHER SOLUTIONS

SEAWATER SOLUTIONS
www.seawatersolutions.org

CULTIV@TE,
OUR AGRITECH INITIATIVE

Cultiv@te, the centre's flagship agritech initiative, is a global innovation programme which aims to find bright minds and creative entrepreneurs, startups and R&Ds from around the world.

This programme seeks to find **technological and innovative solutions** to help farmers by working with UNDP's Country Offices and the local stakeholders in 11 countries across Africa, Asia and Latin America. It covers the themes of **urban agriculture, rainfed agriculture and livestock farming and aquaculture.**

In May 2020, we announced 31 finalist teams that will be provided with **mentorship**, trainings and workshops by our partners, such as leading tech companies, agri-food MNCs and agri-tech experts.

THE WELY DEVICE

ABOUT

Phytochem Consulting, the Canada-based company behind the Wely Device, that develops technological solutions to address the needs of sustainable agriculture. The company has a focus on IoT devices, systematic product development, and precision agriculture. Phytochem has expertise in engineering, electronics, programming, and digital manufacturing and are developing technologies that tackle the challenges highlighted by their many years of experience working on farms.

CORE TECHNOLOGY

The Wely Device is a "weighing lysimeter" that regularly weighs a tray of seedlings to monitor their hydration status. At the core of the device is a full bridge cantilever-type aluminum load cell. Through a 24-bit analog to digital converter the signal is collected, processed and passed on to a server by a microcontroller using Wi-Fi. A precision thermistor is used to compensate for thermal noise in the load cell and report the air temperature. The server monitors for signal outage, stores the data and displays it clearly on a smartphone. It reacts to low hydration by sending an SMS message to the user. The data can be easily integrated into an automatic irrigation system.

IMPACT

The Wely Device increases the quality of care by informing the farmer of the hydration level of seedlings. A record is available from any location via smartphone, reducing unnecessary visits, especially when the farmer works at a distant location. This makes the business more efficient and reduces the loss of yield from over or under watering.

The device essentially helps manage biodiversity in an agroecosystem by using data to support the production of a large variety of transplants. Quality transplants can become part of the agroecosystem, supporting farmers in the use of a number of pest control and nutrient management techniques.

CHALLENGE COUNTRY Singapore

BASED IN Australia

LLEAF
Luminescent-Light Emitting Agricultural Films

ABOUT

LLEAF is an agtech company with a mission to "super charge" sunlight for "super growth". They have developed a greenhouse film material that aims to increase food production per area by optimising natural sunlight. Their thin, polymer films are designed to be retrofitted for greenhouses, both for existing ones and for new greenhouses where the film can be integrated into their roofing panels. LLEAF's aim is to be part of the solution to the world's food security challenge.

CORE TECHNOLOGY

LLEAF's core technology is in its name: Luminescent Light Emitting Agriculture Films, or LLEAF for short.

LLEAF's films are made with polymer materials that are built to be long-lasting, and are tinted with specially designed luminescent dyes. The luminescent materials are able to absorb and subsequently, emit light at specific frequencies (wavelengths).

The film absorbs options of the solar spectrum that are less active in supporting plant growth and thus filters light at wavelengths that are more directly supportive for plant growth. This enhances natural sunlight by shifting the light passing through to a wavelength that is more beneficial for plant growth.

IMPACT

The use of the LLEAF film technology results in faster and bigger crop growth, as well as the ability to induce or inhibit fruiting cycles. Through its pilots, it has been found to achieve up to a 40% increase in protected crops.

LLEAF's solution thus enables sustainable yield increase. The plastic material used for the film can be recycled into other applications, and the technology has no toxic or harmful side effects. This greenhouse farming targeted technology allows farmers to grow produce out of season and grow non-native crops, and can also work well for urban farms. LLEAF hopes to encourage local production through its technology.

CHALLENGE COUNTRY Uruguay

BASED IN Singapore

CITIPONICS
INTELLIGENT FARMING

ABOUT

Founded in 2015, Citiponics aims to enrich the lives of communities through sustainable farming technology, and providing safe and pesticide-free food. They are a team of food and agriculture enthusiasts hoping to reimagine food production and explore how they can tap on underutilised spaces and communities to contribute to food security and food safety in urban areas, in a sustainable and efficient manner.

Citiponics is the first commercial urban farming company in Singapore to sustainably produce leafy-green vegetables using underutilised carpark rooftops. They believe that sustainable agriculture farming should be simple and easily accessible to all walks of life.

CORE TECHNOLOGY

Citiponics' proprietary vertical farming technology, the Aqua-Organic System (AOS), belongs to a solid-based soilless culture. AOS is designed to maximise productivity without the use of pesticides while keeping free from pollutants. It is a zero-waste farming system that is space-saving, water-saving, energy-saving, customisable and anti-mosquito breeding.

The AOS farming technology simplifies farming into 3 steps – seeding, transplanting and harvesting – making farming easy for anyone. The system is able to grow up to 25 different types of vegetables naturally.

IMPACT OF TECHNOLOGY

The AOS has been deployed in Singapore, Malaysia, and China. Given its vertical infrastructure, it is up to 7 times more productive than traditional farming. Its anti-mosquito breeding feature also makes it suitable for commercial farming within tropical and community areas, and every component in the farming system is recyclable and reusable. As every drop of water in the AOS system is kept in a close loop, it uses only 10% of typical hydroponics water consumption and 1% of what traditional farming would use. The AOS system can also be deployed for food production at temperate countries when implemented with localized controlled environment design.

CHALLENGE COUNTRY
Uruguay

BASED IN
South Africa

FRESH LIFE PRODUCE CREATING
AFRICAN
GREEN THUMBS

ABOUT

Fresh Life Produce was launched in 2016 to develop African-targeted sustainable growing systems. This has been a passion of the founder who has spent years working on different growing systems. The Fresh Life Produce solution was a result of his partnership with REEDiSA, a socio-economic and enterprise development enterprise with a focus on rural areas and youth empowerment, to develop a sustainable and holistic model for the deployment of his technology.

CORE TECHNOLOGY

Fresh Life Produce has created a vertical and sustainable growing system – the African Grower System – which consists of multiple growing 'pods' stacked on top of one another. The stack is suspended from any appropriate fixture, making it pest-resilient. It can be deployed in homes to address nutrition needs, or scaled to create economic opportunities.

The features of the African Grower system are:

- Energy saving (no electricity needed in its basic application)
- Space saving (up to 100 plants per square metre)
- Water saving (10% of the water used in soil)
- Sustainable (uses recycled plastic and is able to use grey water)
- Configurable to fit a variety of structures and frames

IMPACT

The African Grower system was developed as a solution to the challenges of a majority of conventional systems, which are often too technical, high in capital costs, time intensive and bulky. The yield-to-cost ratio of typical systems also are too expensive for rural and peri-urban households, which the African Grower system offers a solution for.

In its partnership with REEDiSA, Fresh Life Produce's growing system is integrated with a "Food Hub, Home Grower and Agripreneur" deployment model, which provides for the systemic transformation of communities through a re-designed food system and a holistic approach.

CHALLENGE COUNTRY
Kenya

BASED IN
Nigeria

Farmz2U

ABOUT

Farmz2U is a social enterprise that helps farmers farm better with tailored agricultural expertise using data, and market access via system integrations. For example, using data like soil composition, Farmz2U specifies the quantity of fertiliser to apply. In addition, through their platform, Farmz2U connects farmers to other agricultural service providers like NIRSAL (an agricultural lender) and AFEX (an agricultural commodities buyer).

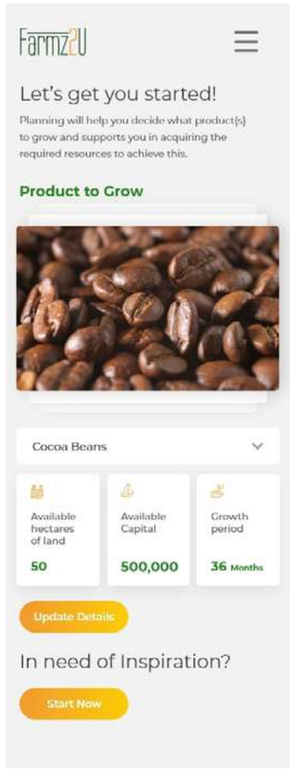
CORE TECHNOLOGY

Farmz2U's core product is a mobile accessible platform that provides technical expertise to farmers to optimise farming operations like fertiliser application and irrigation. Farmz2U also uses remote sensing data to calculate indicators like NDVI to better monitor plant health and other crop conditions. Data analytics and machine learning are key components of the Farmz2U platform. The platform is built with a microservice API architecture which ensures the autonomy of the different features offered to the farmer across the entire farming lifecycle. Farmz2U supports end-to-end farming operations from 'pre-seed' through 'germination', and also 'post-harvest'.

IMPACT

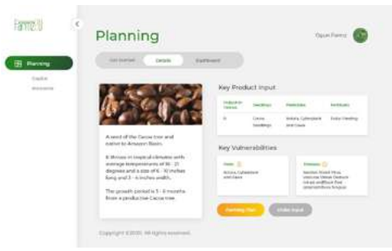
Through proof-of-market tests, Farmz2U recorded improvements across farmers that accessed its solution. This includes a 20% average increase in farmers' output yields, a 38% decrease in farm waste and a $150 increase in average farmer income. Farmz2U has the aim to replicate these improvements on a larger scale. Their 2025 target is to increase crop yields from 33% of global yields (current levels) to 85%, decrease annual farm food waste by 20% and increase farmers' average annual income by $1,800.

MOBILE VIEW



*Our **vision** at Farmz2U is to "empower the next generation of Sub Saharan African farmers with technology".*

WEB VIEW



LIQUIDSTAR

Super Simple Waypoint Impact Monitoring
Source: Liquidstar 2020

ABOUT

Liquidstar is the Uber for electricity. Using a text message-based mobile application, they provide electricity access to customers through an ecosystem of IoT connected hardware which includes solar container-based charging stations and rentable batteries to provide power for small devices, IoT-connected farming devices and vertical farms.

Liquidstar's 10 year goal is to provide electricity to 100 million of the almost one billion people that currently do not have access to energy, which includes 95% of the smallholder farmers in Kenya. They believe that energy access is key to achieving the SDGs, including through providing access to water and increasing food resilience.

CORE TECHNOLOGY

Liquidstar uses a service-based model to rent out batteries through text messages, replacing the need for expensive transmission and distribution infrastructure with people to deliver electricity. Their application, built using distributed ledger technology, facilitates the interactions between battery distributors, battery users, and solar charging stations. This ledger also utilises a secure data logger to manage the charging stations, and handles microtransactions and data reconciliation.

Liquidstar offers batteries of four sizes – 10,000 mAh, 100Wh, and 200Wh, manufactured by their partner Sunsynk, as well as 2.4 kWh recycled lithium batteries that are produced by Betteries. The batteries include a cellular connected IoT chip that provide remote connectivity, charging leveeading and the battery's location. Liquidstar integrates these hardware solutions through its mobile application to facilitate delivery of electricity for farming applications.

IMPACT

Liquidstar's platform is able to reduce costs of electricity installations by as much as 50%. Their Waypoint solar-powered charging stations provide a scalable, cheaper and more sustainable way to access energy, each deployment preventing as many as three premature

deaths and reducing carbon emissions from kerosene lighting by as much as 140,000 lbs per year. With access to affordable electricity, farmers can enhance their efficiency by adopting more advanced smart farming technologies.

MORINGA WHAT

*These technologies will be used to both **bolster** the Moringa local market and provide countless new types of jobs for the local communities.*

ABOUT

Moringa What drives social impact for farmers through equitable Moringa-based supply chains, tackling issues of soil health, water purification, and creating a supply of nutrient-dense food sources. They offer a line of wellness products made from the Moringa (drumstick) plant. Having curated a line of beauty and nutrition products in this niche market, Moringa What provides alternative income opportunities to farmers.

CORE TECHNOLOGY

Moringa What's products are made from various parts of the drought-resistant Moringa oleifera tree, also known as the miracle tree. Moringa has been used for centuries due to its medicinal properties and health benefits. Moringa also contains anti-oxidants, vitamins,essential amino-acids, anti-bacterial and anti-inflammatory properties. All parts of the tree can be utilised.

Moringa What currently sells three products in the beauty and nutritional supplements space and has plans for expansion in these product lines in B2B as well as B2C market segments.

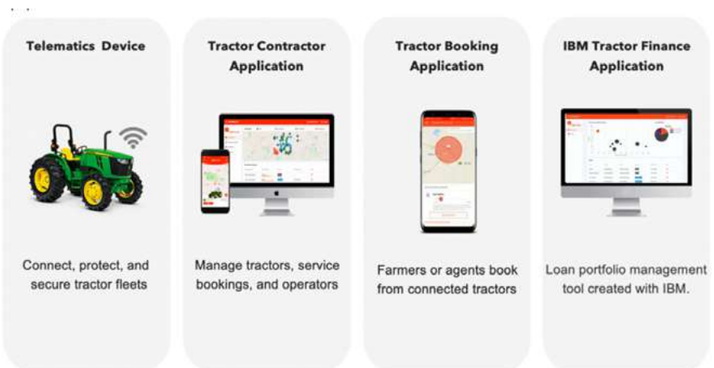
IMPACT

Growing Moringa offers alternative and sustainable income opportunities to smallholder farmers, with a potential to increase incomes by 250% in certain countries. In addition, incentivising farmers to grow Moringa can improve nutritional security of local communities in times of drought and economic decline. Through multi cropping, the plant also increases crop yield and soil health in addition to providing shade to other crops.

CHALLENGE COUNTRY
Kenya

BASED IN
Nigeria/Kenya

hello tractor



ABOUT

Hello Tractor started a movement to revolutionise mechanisation services across emerging markets. They provide technology for tractor owners to better manage their equipment while offering farmers an app to request services from a connected tractor fleet.

To date, they have grown their contractor customer base to over 3,000 tractors, providing services to over 500,000 smallholder farmers, making them the largest digitally enabled tractor network in the emerging markets.

CORE TECHNOLOGY

Hello Tractor places GPS monitoring devices onto tractors and collects location, tractor usage, and tractor health data to ensure that assets are performing; farmers are receiving the services they request on schedule, and fraud is minimised.

All data generated by the GPS monitoring device is fed to the Hello Tractor tractor owner and booking app. In addition, Hello Tractor has partnered with IBM to build an operations centre app that helps de-risk tractor management and tractor finance by assessing the projected debt repayments on an individual tractor, as well as its projected seasonal cash flow and revenue potential.

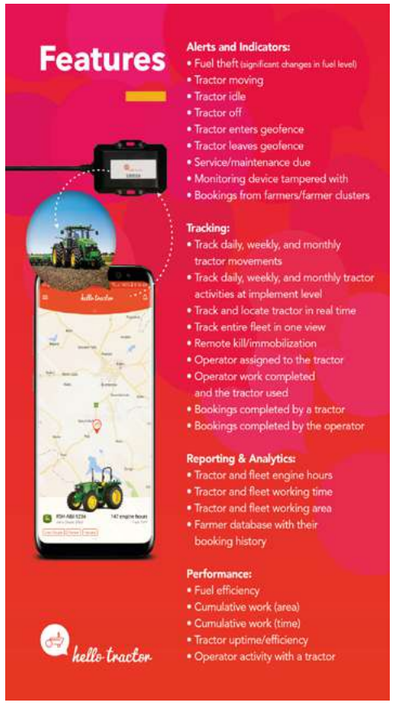
IMPACT

Smallholder farmers need mechanised services to drive agricultural productivity and increase their cultivated land. 50% of the yield gap in African agriculture can be attributed to smallholder farmers' lack of access to mechanisation. Furthermore, rapid urbanisation, aging farm populations and thus the diminishing farm labour force makes mechanisation even more important.

At the same time, tractor owners face barriers to providing services for smallholder farmers at a profitable rate, which slows investment in tractor ownership. This is due to the fact that farmers often operate on small, disjointed plots of land, which makes demand identification and aggregation, as well as delivering services unprofitable.

Hello Tractor's solution bridges these gaps. Their device helps farmers employ mechanised services seamlessly, while providing a profitable platform for tractor owners to loan their services.

Through its work, Hello Tractor is able to empower youth and women with jobs serving as booking agents (demand aggregators) for farmers within their communities. Hello Tractor has so far been able to recruit well over 1,000 agents onto its platform and is steadily growing this number.



CHALLENGE COUNTRY
Bhutan

BASED IN
Brazil

agrosmart®
cultivo inteligente

ABOUT

Agrosmart is a digital platform that collects crop data, processes it and delivers actionable insights, making data available across the food supply chain for more climate-resilient and sustainable agriculture. It generates market and agronomic intelligence based on seed genetics, soil type and microclimate.

Agrosmart supports data-driven R&D and sales strategies for input companies and distributors. Their solution aims to bring transparency, sustainability and traceability to food and beverage industries and enable financial institutions and insurance companies to access differentiated products.

Agrosmart is considered a Technology Pioneer company by the World Economic Forum. The company is experienced in developing adaptive solutions and models for emerging countries and tropical agriculture.

CORE TECHNOLOGY

The first layer of the Agrosmart platform is an IoT solution that can read different sensors and combines technologies such as a proprietary network, Sigfox, NB IoT and satellite communication, to collect data from the fields. It also aggregates data from a mobile field notebook application and API integrations.

Next, the platform uses Machine Learning and Artificial Intelligence to transform data into actionable insights for farmers with crop models such as operational alerts, irrigation management, weather forecasts and disease forecasting. The collective data is then transformed into benchmarks and corporate insights across the supply chain.

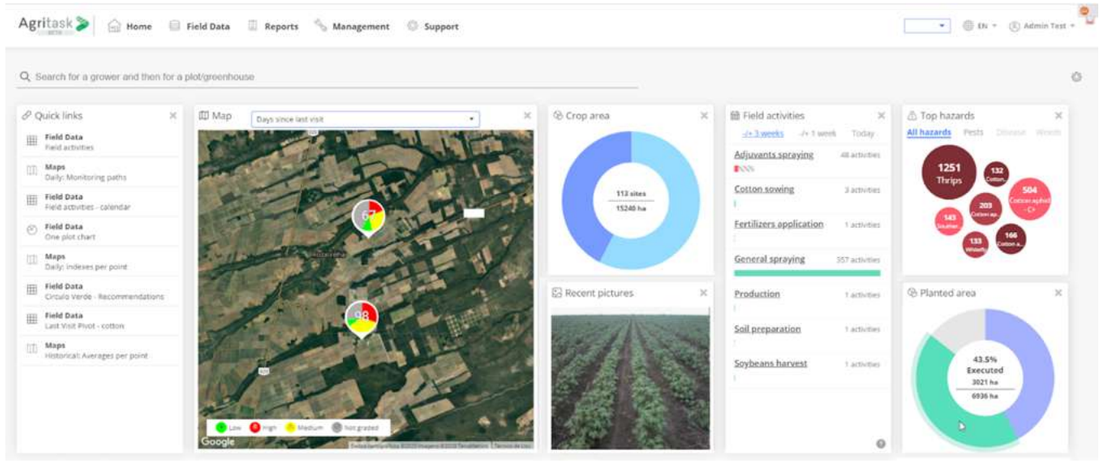
The Agrosmart platform also provides responsive solutions for farmers to receive insights daily on their mobile devices.

IMPACT

Agrosmart's services allow farmers to save up to 60% water, 40% energy, increase yields of up to 20%, and reduce their input and labour hours. The water saved in a single farm from using Agrosmart is enough to serve 70,000 people everyday.

They support farmers of all scales and nudge agricultural corporations to improve their sustainability footprint as well as operational efficiency.

Agritask



AGRITASK'S DASHBOARD
Plot locations, crop area, progress with planned activities, top hazards

ABOUT

Agritask is an ag-tech, SaaS company headquartered in Tel Aviv, Israel. It provides a holistic ag-operations platform, designed to enable fact-based, on-time decisions for agricultural stakeholders. The system is used to support the entire ag-operations process, from pre-planting to post-harvest, in addition to various value chain and grower service activities. Agritask has a vision for farmers globally to benefit from precision agriculture regardless of their starting point. Its multidisciplinary team includes agronomists, remote sensing specialists, and actuaries.

CORE TECHNOLOGY

Agritask's core technology consists of a highly configurable data-driven platform built on a strong core infrastructure. The data capture is facilitated by:

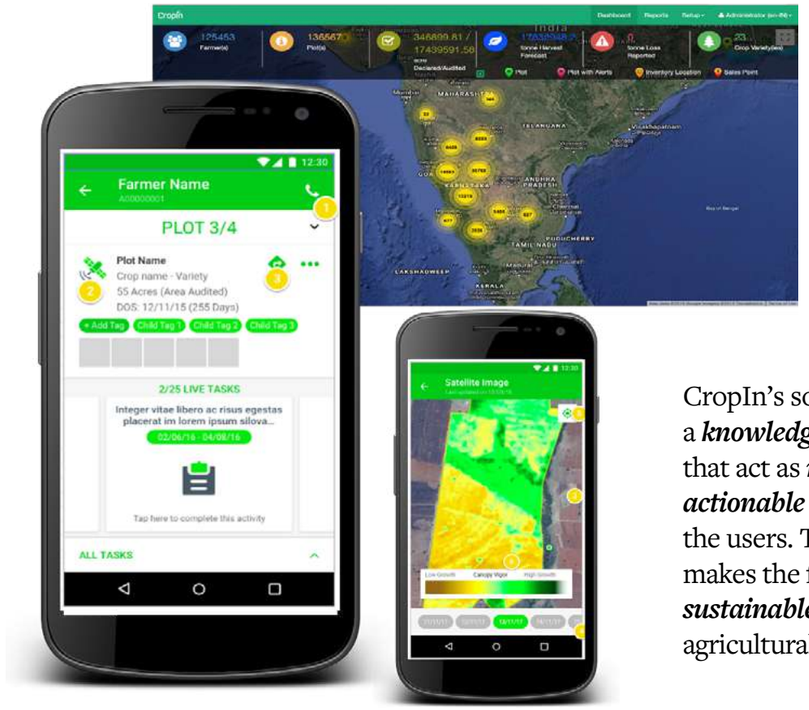
1. Mobile app to simplify field data collection with customisable screens;
2. Remote sensing using satellites and UAVs; and
3. Data acquisition from third-party systems.

Collected data is then aggregated and analyzed to provide actionable insights, underpinned by geographical information systems (GIS) and business intelligence capabilities. Agritask's remote sensing solutions include providing potential yield indicators as well as operational and environmental risks.

IMPACT OF TECHNOLOGY

Agritask serves a wide range of agricultural stakeholders in over 30 countries, including farmers, buyers, farm inputs companies, credit providers, insurers, governments and NGOs. It seeks to use technology to build an ecosystem of high-quality and sustainable services for smallholder farmers, enabled by agronomic data. The impact includes higher yield, more optimal inputs use, greater financial inclusion, and better climate resilience.

Cropin™



CropIn's solutions act as a ***knowledge repository*** that act as ***ready-made actionable insights*** for the users. This eventually makes the farm ***self-sustainable*** through good agricultural practises.

ABOUT

CropIn is a data-powered platform providing digital solutions for key stakeholders in agri-value chains. They provide predictive and prescriptive analytics for risk monitoring, mitigation and forecasting intelligence. Their platform enables data-driven farming by providing real-time advisory for crops based on hyper-local weather information, ground data collection and high-resolution satellite imagery. It analyses cropping patterns and predicts the future of the crop, highlighting risks and opportunities for agri-stakeholders.

CORE TECHNOLOGY

CropIn's solution is an artificial intelligence and machine learning based Software as a Service (SaaS) platform.

CropIn's suite of applications covers the entire value chain, from pre-harvest to post-harvest processes. The SmartFarm and SmartRisk applications offer end-to-end farm data management solutions that monitor all processes leading up to harvest. By tracking, managing and monitoring every step — from input to execution, all in one place— SmartFarmhelps farmers improve efficiency and allows traceability and output predictability. CropIn's solution leverages ground-truth data, hyper-local weather advisory, and accurate insights based on satellite monitoring to enable data-driven farm and business operations. Relevant advisories at each stage are provided to Farmers via the AcreSquare app or SMS. The SmartWare module helps digitise all packhouse-related processes enabling 100% traceability of any product.

CropIn's web interface uses Microsoft's technologies, while its mobile app is available for Android and iOS. The platform also uses Google Maps for visualisation of farms and Jaspersoft for advanced analytics and its dashboard.

IMPACT

CropIn largely works on a B2B model, catering to farming catering to farming and agro-processing companies, input suppliers, financial institutions telecom companies, and government and development agencies working with large networks of farmers. In the last 10 years, their footprint has spanned across 60 countries with a customer base of 250+ businesses. CropIn has digitised over 6.1 million acres of farmland, enriched the lives of more than 2.1 million farmers, and gathered data on 388 crops and 9,400 crop varieties.

● **CULTIV@TE**

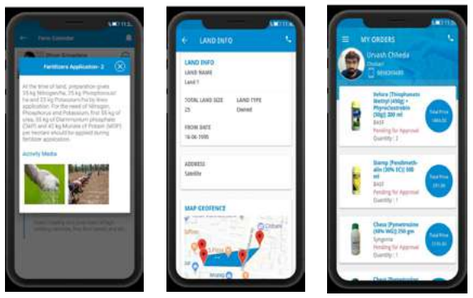
CHALLENGE COUNTRY
Philippines

BASED IN
India

ABOUT

DigiAgri is a technology-enabled initiative that empowers farmers by delivering information, expertise, and resources to them through mobile and smart devices, to increase their productivity and profitability, and hence improve their standard of living. The platform makes decision making in the agriculture ecosystem data-driven, ensuring that farming is both demand driven and climate resilient.

FARMERS APPLICATION



D E F

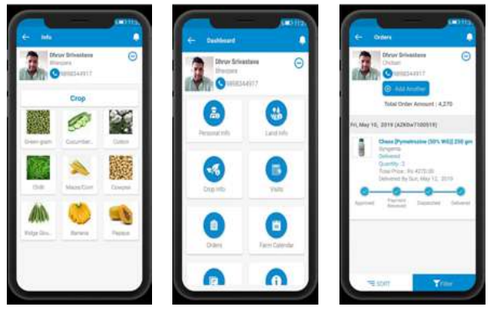
D
GOOD AGRICULTURAL PRACTICE
E
LAND GEOFENCING
F
ORDER DETAILS

IMPACT

Using DigiAgri's platform, farmers get information on what to grow, when to grow, and what inputs to use, while ensuring the quality of inputs they are using. Agripreneurs can support fellow farmers in their own village while having added income opportunities. Agriculture ecosystem players would get last mile access to farmers, along with ground level data and information on farm activities to better deliver services and products.

Farmers thus become sustainable by increasing yield, decreasing cultivation cost, getting access to credit and optimising their produce.

AGRIPRENEUR APPLICATION



A B C

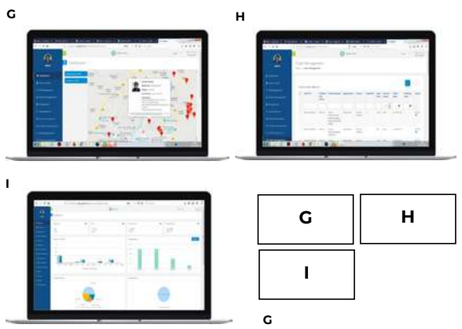
A
CROP DETAILS
B
FARMER ON-BOARDING
C
ORDER MANAGEMENT

CORE TECHNOLOGY

DigiAgri is using Android Native for its frontend technology and for NODE JS, PHP and TensorFlow for its backend infrastructure. Their products include a:

- **FarmApp** for farmers to track and monitor their crops and farming activities;
- **FPO tracker** for FPO managers to manage farmers' needs;
- **AgFin** to provide credit ratings for farmers and help them mitigate risks;
- **AgChain** to provide traceability throughout the supply chain;
- **AgView** for governments and other stakeholders to monitor farms and connect with farmers.

STAKEHOLDERS DASHBOARD



G H I

G
GEO-TRACEABILITY
H
ORDER MANAGEMENT
I
WIDGETS

● **OUR AGRITECH INITIATIVE**

CHALLENGE COUNTRY
Indonesia

BASED IN
Indonesia

ABOUT

BIOPS Agrotekno is a startup focusing on the development of tech-based products for agriculture, with a mission to bring a new era of agriculture to Indonesia. Their product ENCOMOTION is machine-to-machine IoT-powered product that enables farmers to irrigate farms automatically and precisely, based on real-time farm needs and conditions.

The proprietary algorithm embedded in the system can calculate the crop's water needs based on its environment. Besides irrigation, the BIOPS Agrotekno team is developing tech-based adaptable products to tackle the other key problems faced by the farmers.

CORE TECHNOLOGY

ENCOMOTION is a machine-to-machine IoT technology that enables automated irrigation with a precise amount of water. The solution bridges the gap in existing stand-alone monitoring systems and app-based irrigation controllers by integrating both functions through its embedded water-need calculation algorithm and connected automatic irrigation system.

The tool starts with a ground sensor that works similarly to a weather station. Using cloud computing, the data is then processed to calculate how much water is needed by the crops.

This data then sent to the ENCOMOTION controlling device to control the irrigation automatically using irrigation infrastructures such as sprinklers and drip irrigation. The data collected and processed by ENCOMOTION can be accessed in BIOPS Agrotekno's web-based dashboard and mobile app.

IMPACT

ENCOMOTION enables precise and automatic irrigation, leading to climate-smart agriculture and greater efficiency in farming. The technology has shown to reduce the use of water by 40% compared to common irrigation practices, while also reducing the need for human labour in farm operations.

A C B D

A
CONTROLLING DEVICE
B
MONITORING DEVICE
C & D
APPLICATION DEVICE

CROWDE

ABOUT

CROWDE is an agriculture-focused fintech solution that empowers farmers across Indonesia with technology and capital. They provide a farmer-friendly financing ecosystem that connects investors with farmers. In doing so, CROWDE assesses agri-project financing and manages risks pertaining to agriculture, aggregating the entire value chain via a digital platform.

CORE TECHNOLOGY

CROWDE educates farmers on farming, financing management, and how to market their products with the aim to transform farmers into agropreneurs. The platform partners with supply shops, retail shops and offtakers to create a cashless closed-loop ecosystem, helping farmers make better agri-decisions by knowing who will buy, with what price and by how much.

IMPACT OF TECHNOLOGY

By aggregating all players in the value chain, CROWDE enables mutual risk mitigation. Not only will farmers benefit from getting access to alternative financing, every actor also has access to information such as investors' lending appetite, farmer behaviour, product trends, and supply-demand conditions. These help smallholder farmers to better their businesses.

By reducing the unpredictability and lack of information of farming, farmers using CROWDE can make long term plans and start investing better in their business for a more sustainable future.

agroclimatica

Infographic on **Agroclimatica** and **Bioclimatica**

ABOUT

Ingemann Data A/S is the company behind Agroclimatica™ and Bioclimatica™, technologies and solutions for climate smart financing and agriculture respectively.

A Danish family-owned company, Ingemann, started their operations in Nicaragua in 2007. As part of Ingemann's efforts to increase the climate resilience of its own supply chain in Nicaragua, an R&D Project – Proyecto Adapta – was launched in 2016 and it now supports more than 1,500 farmers with climate-smart recommendations.

CORE TECHNOLOGY

Ingemann's data platform offers a range of products and solutions including agroclimatic risk assessments, a climate smart crop identifier, a CO_2 calculator per credit and harvest projections, as well as technical assistance tools, that are beneficial for smallholder farmers and financial institutions alike.

The platform combines local climate, soil, land, crop and livestock data with catalogues of recognized Good Agricultural Practices for all important crops and livestock races in a country, as well as with advanced climate modelling to create climate projections, predict crop/livestock behavior patterns according to the climatic development, and to make agroclimatic risks transparent and quantifiable.

Ingemann's solutions support financial institutions in decision-making for their agricultural portfolio by providing them with climate projections and data analysis on these crops. This enables these institutions to improve their risk management policies and mobilize funds towards the rural areas and the agro sector. The data platform and technology can be adapted for any geographical area and any crop or livestock.

IMPACT OF TECHNOLOGY

Ingemann's platform has been successfully implemented in Nicaragua, Honduras, Guatemala, Ecuador and Kenya and tested within Ingemann's supply chain and producer base, where it has resulted in a 25% increase in the incomes of the participating farmers.

Ingemann aims to practically and sustainably support the UNDP's global efforts towards the achievement of SDGs 1, 2, 8 and 13 through this innovative solution.

CHALLENGE COUNTRY
Indonesia

BASED IN
Indonesia

*iGrow is **beyond** just a peer to peer lending platform, we are agriculture resources integrators. We integrate market access, farming skills and providing capital to the farmers.*

ABOUT

iGrow is the first and biggest agriculture peer to peer lending platform in Indonesia. They provide a connection between farmers, off-takers and lenders to create a feasible farming supply chain. They began their journey in 2014 and are currently operating in 7 islands across Indonesia.

Since then, they have disbursed more than 15 million USD to many small farmers and helped better their livelihoods. More than just a peer to peer lending platform, iGrow is an integrator of agriculture resources. The platform provides farmers with market access, farming skills and capital.

CORE TECHNOLOGY

iGrow has built a seamless agriculture peer-to-peer ecosystem that connects farmers with off-takers, while helping farmers upgrade their skills through education and technology.

The iGrow lending platform provides farmers with capital while offering lenders attractive returns and engagement with these farms.

Their platform uses various technologies such as IoT and blockchain, and is able to integrate hardware precision agriculture systems such as drip technology.

iGrow also uses a unique credit scoring approach to ensure that all financial transactions via its platform are secure and safe for both types of users.

IMPACT

Using iGrow, farmers can scale up their business and gain better opportunities to grow their farms. At the other end, anyone can become a lender and support farming without having land or prior experience.

iGrow's impact on the Indonesian farmers that it works with is evident: farmers have seen an increase in income upon joining iGrow. They have also become more productive with iGrow's capacity development services. Finally, they have seen a significant growth in their lenders who not only see returns from their investment, but also the value of their impact in changing the lives of the farmers.

CHALLENGE COUNTRY
Gabon

BASED IN
United Kingdom

ABOUT

The Sustainable Nitrogen Foundation was established to reduce global pollution and harmful greenhouse gas emissions from synthetic nitrogen fertilisers, while ensuring that crop yields remain or improve.

The Foundation secures funding and supports research for the use of nitrogen-fixing bacteria as an alternative to synthetic nitrogen fertilisers. Particularly, they research on the intracellular nitrogen-fixing bacterium Gluconacetobacter diazotrophicus to apply to subsistence crops such as millet, yams, cassava and sweet potato. The Foundation hopes for its research to lead to the global uptake of this nature-based solution, especially for smallholder farmers in developing countries.

CORE TECHNOLOGY

The discovery of Gluconacetobacter diazotrophicus ('Gd'), a naturally-occurring bacteria, led to the Sustainable Nitrogen Foundation's use of a formulation that can colonise wheat, rice, maize, tomato, potato, grass and soybean for commercial use. This technology has enabled the maintenance of crop yields while reducing the use of synthetic nitrogen fertilisers.

Plant biological nitrogen fixation is the process by which naturally-occurring bacteria take nitrogen from the air and convert it into a form that can be used by both the bacterium and its host plant. The converted form helps to produce proteins, enzymes and nucleic acids needed for growth and reproduction, and assists in chlorophyll production which is required for photosynthesis.

Most nitrogen-fixing bacteria inhabit the soil or plant roots. However, the Gd bacteria has the rare ability to colonise plant cells intracellularly. This allows it to continually fix nitrogen and support photosynthesis alongside the chloroplasts in the leaves.

IMPACT

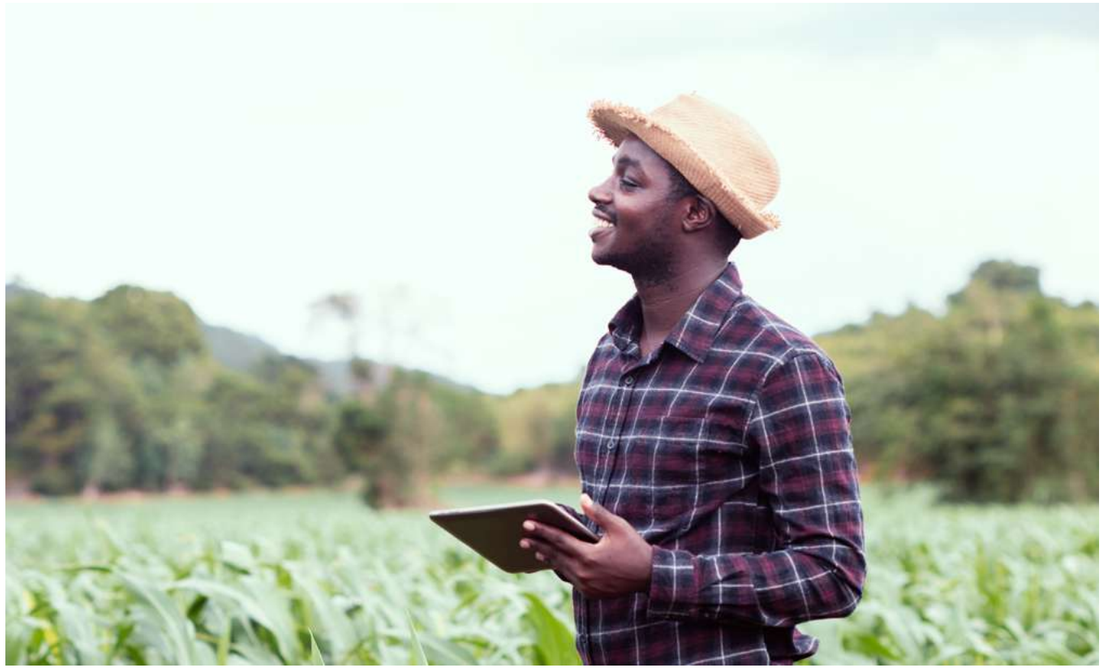
The nitrogen-fixing capability enabled by formulations of the Gd bacteria have been field-tested in Europe, North America and Southeast Asia. These pilots have demonstrated at least three beneficial impacts:

- An increase in grain yield (Kg/ha)
- Quality enhancement (such as in grain protein and essential enzyme content)
- Substitution for synthetic nitrogen fertiliser use

In rice for instance, across three countries - Philippines, Vietnam and Thailand - yield increased by an average of 17% when Gd was applied. Even for those where nitrogen reduction was only reduced by 50%, yields increased on average by 29%.

CHALLENGE COUNTRY
Gabon

BASED IN
Nigeria



ABOUT

FarmCorps is an agri-tech company with a mission to provide mobile technology solutions that enable a seamless connection among African food supply chain actors such as food companies, farmers, agro-input suppliers, financial institutions and extension service providers. They partner with these stakeholders, as well as government agricultural agencies, in countries where they operate.

Their mobile platform helps agro-processing and food companies aggregate quality produce from smallholders by allowing them to initiate production contracts with farmers, monitor their production and manage these clusters of farms. The platform also requires food companies to specify their sales volume in advance, allowing smallholders to plan production according to these demands.

CORE TECHNOLOGY

FarmCorps uses mobile identity systems, risk analysis and the tokenization of funds for their platform. To source for and aggregate sustainable farms, their web platform integrates satellite technology to monitor these farms and provide data-driven advisory for farmers that they work with.

IMPACT

In 2019, FarmCorps conducted a small scale pilot in Nigeria, serving 14 farmers who grew maize on 12 hectares and had yields of approximately 300 tons (an average of 2.1 tons per hectare). With their services, which was focused on youth and women, the farmers experienced a 200% increase in yield compared to the average national yield, and 300% increase in income per hectare.

They are now scaling up their platform to reach 20,000 smallholder farmers and increase their income by 300% in 2 years.

CHALLENGE COUNTRY
Ethiopia

BASED IN
United States of America

ABOUT

The Toothpick Project uses an innovative biocontrol technology to kill Striga, a parasitic weed that attacks an estimated 40 million African smallholder farms annually. Considered the greatest pest threat to African food security, Striga is rampant across sub-Saharan Africa, reducing staple crop yields such as maize and sorghum up to 20-100%. Since women grow 70% of Africa's food, Striga is also a gender-sensitive food security issue.

The Toothpick Project's solution was developed by Professor David Sands at Montana State University, USA and launched in Kenya, where it has been tested on 500 smallholder farms. In addition to improving crop yield, the Project's distribution strategy involves engaging village-level inoculum producers, serving as a level of localized economic development.

CORE TECHNOLOGY

The Toothpick Project's technology uses a locally-sourced fungus, Fusarium oxysporum f.sp. strigae, and selects three strains with an overproduction of specific amino acids that kill Striga but do not harm the staple crop. The resulting product is called FoxyT14 (Kenya trademark is Kichawi Kill). Unlike chemical weed management, it is host-specific (won't damage other plants) and harmless to people and soil fauna.

Grown on toothpicks, the FoxyT14 strains can be stored and delivered at a low cost. To implement this solution, a village-level producer places the fungi-coated toothpick into a locally sourced substrate, such as rice, in an ethanol-sterilized, lidded container. The container is then agitated twice a day for three days to inoculate all of the substrate. The farmer then adds 1.5 gramsof the inoculated substrate per planting hole.

This kills Striga and thus restores crop yield. The Toothpick Project is currently testing seed-coating prototypes of the fungus.

IMPACT

Striga is a barrier to systemic change. Restoring crop yield improves food security and allows farmers to make critical investments in hybrid seeds, more nutritious crops, fertilizers, education, livestock, and medicine.

Paired plot trials show the FoxyT14 strains increase crop yield by 42-56% and are able to give the farmer a return on their investment in the first season. Regulatory third party trials' yields increased by 35-300%. In plots treated with FoxyT14 for several consecutive years, no Striga re-emergence has been seen for at least five years after the last treatment. This demonstrates its persistence in the soil and the long term sustainability of the solution for the farmer.

On the 500 farms tested, the FOXY T14 technology led to a ***yield increase of 56.5% in the long season and 42% in the short season.***

UjuziKilimo

ABOUT

UjuziKilimo Solutions is a Kenya-based agtech company. They provide economic opportunities to smallholder farmers in Africa who produce 80% of the food in the continent and yet make up the majority of those living under $2 per day.

Their approach empowers farmers without technological knowledge, allowing them to make data-driven decisions with instant, up-to-date, personalised, and actionable information. Their vision for the next five years is to enable 50 million smallholder farmers to practice precision agriculture, helping them increase yields and maximise returns on investments, resulting in improved livelihoods, reduced hunger, and economic growth.

CORE TECHNOLOGY

UjuziKilimo provides simple and efficient soil fertility monitoring for smallholder farmers. Their proprietary sensor technology, Soil Pal, measures soil moisture, pH, nutrient levels, location, and electrical conductivity. Soil Pal does not require existing soil maps, is low cost, and thus replicable across varying contexts.

UjuziKilimo's approach is farmer-centered. Within minutes of the cloud servers receiving data from Soil Pal, an SMS message is sent to the farmer with recommendations tailored to achieve the optimal conditions for their specific crop. The sensors are provided to agents, many of whom are women and young microentrepreneurs, who provide UjuziKilimo's sensors as a service to the farmers.

In addition to this, they provide a central registry of all farmers in the cooperative through their integrated platform FARMSUITE. This enables agricultural cooperatives, food sourcing/processing companies, NGOs and governments to boost their farmer network performance. The solution also helps to monitor production per farmer while pushing good agricultural practices to farmers in the network. The platform also has an offline mode support for data collection.

IMPACT

Farmers, by analyzing soil quality and following the recommendations provided, can boost farm productivity by 30-100%. This can substantially impact farmers' revenue, and more broadly, help alleviate the food crisis and prevalence of hunger in Africa.

BOREAL LIGHTS

ABOUT

Boreal Light GmbH is a Berlin-based company specializing in renewable energy solutions for water treatment facilities. The company designs and manufactures affordable solar water desalination systems for off-grid communities around the globe. Systems manufactured by Boreal Light are capable of delivering clean water for drinking, irrigation, fish farming and sanitation purposes. They are fully powered by solar energy, low-cost and user-friendly. Winture® and WaterKiosk® are the two registered trademarks for systems and services offered by Boreal Light GmbH.

CORE TECHNOLOGY

SolaRO® is Boreal Light GmbH's solar-powered water desalination solution. The system runs directly on solar energy without the need of a battery bank or pressure storage. There are four treatment levels provided: for drinking, irrigation, fish farm and sanitation. Producing 1000 liters of potable water from seawater by Winture's SolaRO® costs 0.50€, while not requiring much maintenance.

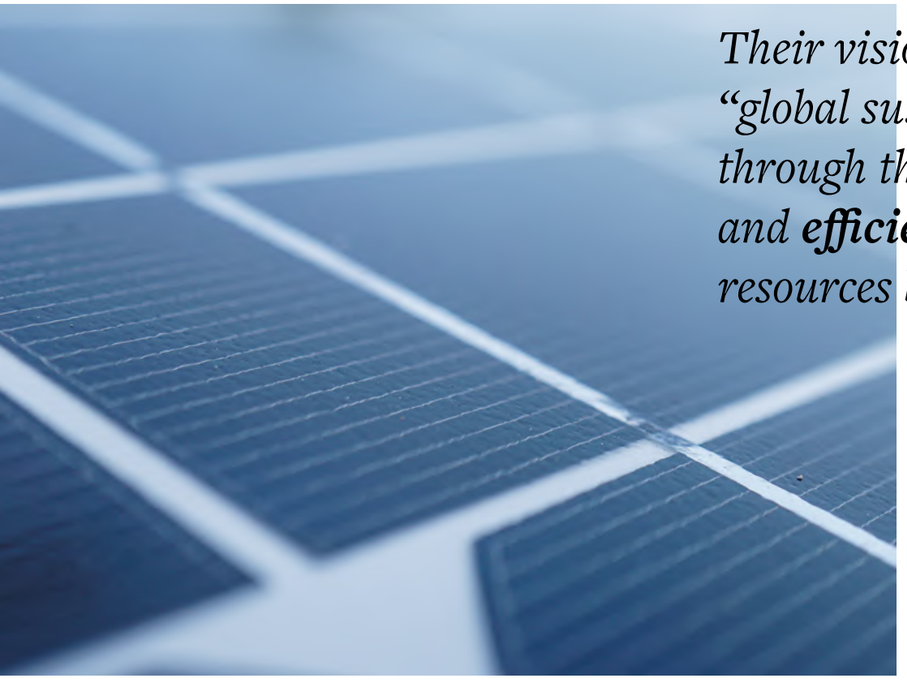
Boreal Light uses sensors to communicate with Winture® via a main controller, which informs the system on precise timings and amounts of water to release. In addition, the sensors measure the nutrient levels of the soil and automatically discharges fertilizers through the irrigated water when there are imbalances

IMPACT

The system is able to offer potable and usable water at the fraction of the prevailing marke This can help farmers in villages who are adversely affected by the increasingly sanilised water – a negative side effect of climate change. Boreal Light's technologies not only help provide vulnerable communities with access to clean water, but also address the food insecurity challenge.

SOLARISTIQUE NIGERIA

Turning wastes into sustainable solutions...



*Their vision is to achieve "global sustainability through the **profitable** and **efficient** use of resources by recycling."*

ABOUT

Solaristique Nigeria is a recycling and clean energy company focused on designing, manufacturing and distributing affordable, sustainable clean energy and environment-friendly solutions targeted at Bottom of the Pyramid (BoP) households in rural and peri-urban communities.

Solarisitique Nigeria is a branch of Peach Water Consulting who are engaged in the recycling of wastes into sustainable solutions. Their vision is to achieve "global sustainability through the profitable and efficient use of resources by recycling."

CORE TECHNOLOGY

Solaristique Nigeria offers several food preservation products that work on solar energy. Their solar dryer, the Eagle Dryer, is made from metallic waste and uses natural convection for indirect solar drying. The dryer uses solar radiation to heat the air passing through hot box units in which agricultural products are stored, drying the section naturally. The Eagle Dryer removes 80-90% of the moisture from cereals such as beans and maize, and is up to 500% faster than the traditional method of drying foodstuff by direct sunlight.

Their other main product, the Solar Cooler, is a solar-powered cooling box which can be used for storing farm produce like milk, vegetables and fruits over long periods of time. The Solar Cooler significantly extends shelf life of fresh produce by up to 21 days. The product comes with a mobile app which allows farmers to monitor and control the box's temperature remotely. It also has an integrated alarm system that notifies the farmer when the produce is about to spoil either due to a high temperature build-up or a dysfunctional system.

In addition to the above, Solaristique Nigeria manufactures solar-powered mobile irrigation pumps and provides various extension services

IMPACT

Using Solaristique Nigeria's food preservation products, farmers can reduce post-harvest losses by at least 40% and increase their revenue by at least 30%. These products, made from recycled refrigerators, air conditioners, and other metallicwaste, help tackle the problem of rapidly growing electronic and metallic waste,help tackle the problem of rapidly growing electronic and metallic waste in Africa. Also, the Solar Cooler does not consist of an electric compressor, thus avoiding the use of refrigerant gases that harm the ozone layer.

Convergence.tech

ABOUT

Convergence.tech advises, develops, and implements leading digital solutions, including blockchain, that are linked to environmental finance and markets. The company has experience operating in diverse markets such as India, Mongolia, and Afghanistan. Their expertise helps stakeholders understand why and how to undertake digital transformation to achieve impact.

CORE TECHNOLOGY

Convergence.tech is building traceability capability across the livestock sector that can integrate certifications. Their core technology uses blockchain coupled with smart data collection and IoT tools such as RFID tags, QR codes, taggants and mobile devices.

Convergence.tech's platform can overlay geospatial data used to monitor activities such as deforestation related to food production. The platform is able to trace meat and dairy products to farms using sustainable agricultural practices to ensure reductions in forest cover loss as well as measure the environmental impact of farming.

The blockchain-based registry will ultimately help link forest-conservation projects to results-based payments and carbon markets, while enabling improved market access and better pricing for a more sustainable supply chain.

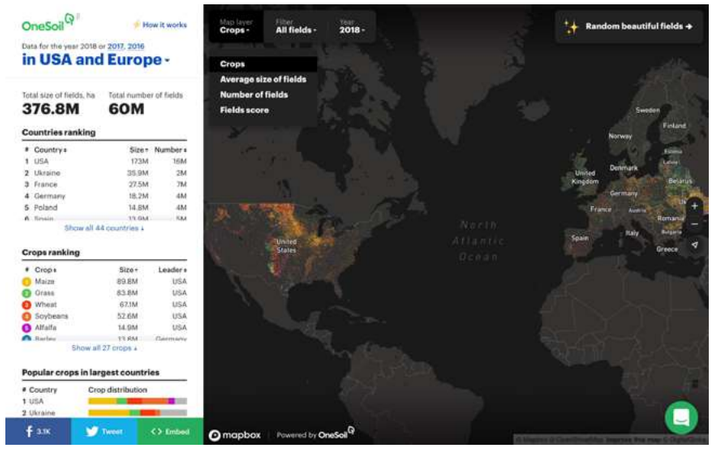
IMPACT

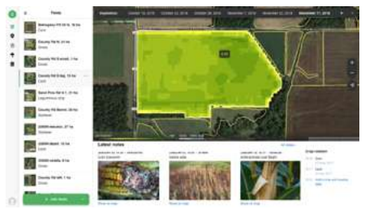
For Cultiv@te, Convergence.tech aims to help Ecuadorian producers to improve product branding, provide greater access to international markets, and gain access to incentive and credit programmes.

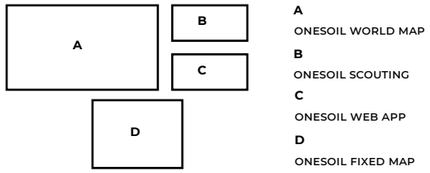
Through providing verifiable traceability from "farm to fork", trust can be built throughout the value chain, preventing fraud or manipulation from supply chain players.

The solution impacts all actors in the supply chain. Producers benefit from selling at higher prices and lower costs; consumers have better confidence in the product quality; and governments achieve a more sustainable livestock sector.

OneSoil







A
ONESOIL WORLD MAP
B
ONESOIL SCOUTING
C
ONESOIL WEB APP
D
ONESOIL FIXED MAP

ABOUT

OneSoil is a Belarus-based startup that has developed an AI-powered platform for precision farming that is currently available in 137 countries. It offers services such as automatic field and crop detection, remote plant monitoring, maps for variable rate fertiliser application and analysis of field operations.

OneSoil provides farmers with a free tool to monitor specific parts of their fields, allowing them to make operational decisions. With OneSoil, farmers can easily track their crops' health and phenostages, plan fieldwork, and apply seeds and pesticides efficiently based on the platform's prescriptions. This helps farmers increase their productivity, reduce environmental impact and become more profitable.

CORE TECHNOLOGY

OneSoil apps run on satellite images, machine learning algorithms, and big data analysis. Field boundaries are detected automatically using satellite images and a machine learning algorithm which was trained by manually marking tens of thousands of fields. This is the cornerstone of the functionality of all the apps.

OneSoil uses normalised difference vegetation index (NDVI), a measure of how plants reflect light at certain frequencies, as an indicator of plant health. NDVI can be calculated within seconds from satellite images. Knowing the farm's NDVI allows a farmer to pay more attention to the problem areas, which makes the field scouting routine easier. Using NDVI, OneSoil also creates maps for variable rate application (VRA) of nitrogen, phosphorus, and potassium fertilisers.

IMPACT

The use of AI and satellite imagery helps farmers optimize yields and reduce wastage of inputs, thus minimizing the ecological footprint of farming. It also improves farmer productivity and profitability.

digitanimal

ABOUT

DIGITANIMAL's co-founders, Carlos, Ignacio and Rubén, met in 2015 as colleagues in a company dedicated to developing tracking solutions. Rubén's father, a farmer, was looking for a solution to track his cows and not lose them during the grazing season. Rubén thus approached his colleagues with this idea, kickstarting DIGITANIMAL's journey.

Since its establishment, the team has overcome many challenges, such as the low connectivity in rural areas, the need for a longer battery of trackers, and the initial mistrust of farmers. Their solution initially only offered information on animal locations, but has since been further developed to include more features.

CORE TECHNOLOGY

The current DIGITANIMAL solution uses three types of IoT devices: collars, ear tags and smart scales.

Smart scales are used only for fattening farms, where industrial scales are adapted to include IoT connectivity and communicate information with the ear tags via Bluetooth.

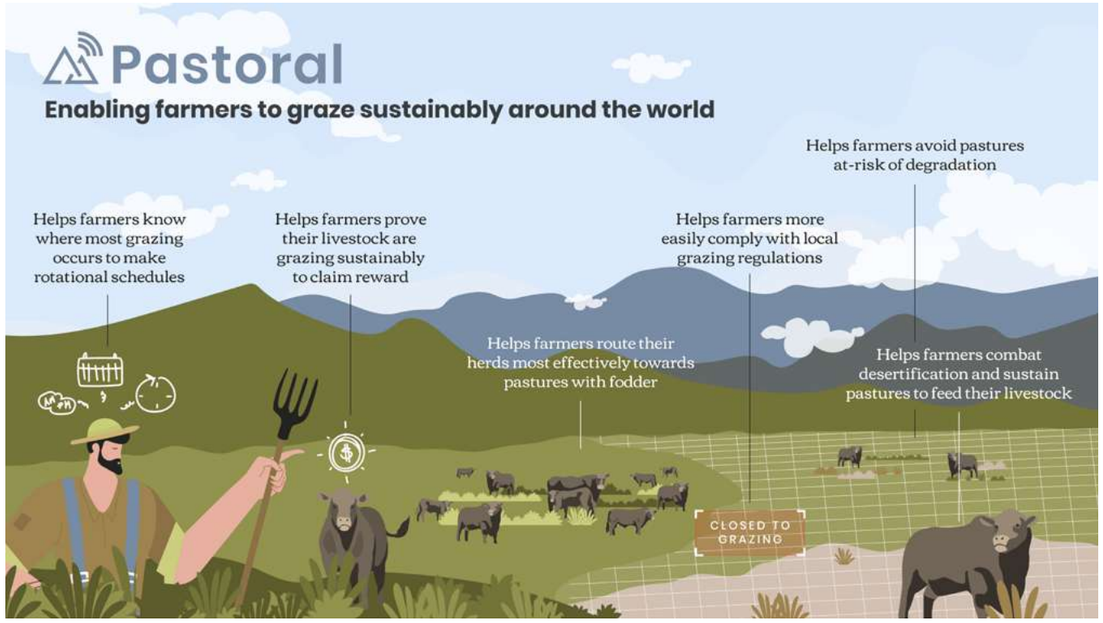
The collars and the ear tags have sensors to record different conditions via a thermometer, activity monitor, and GPS. The collars are connected to the cloud through IoT, while the ear tags communicate with the collars via Bluetooth 5.0. These tools allow farmers to track the location, health and reproductionconditions of their herds, and are integrated with AI, big data and blockchain to analyse and track the data.

DIGITANIMAL also uses external sources such as Sentinel Satellite Imagery to complement its collected data, processing all information through a cloud/edge computing system.

IMPACT

DIGITANIMAL's design reduces the cost of smart tracking deployment by using more ear tags, which are significantly cheaper than collars. In doing so, they can offer their services to farmers at less than 0.60 USD per animal per month.

The company aims to develop an integral solution for animal farmers by providing valuable insights and clear recommendations using data. With their solution, they hope to increase farmers' profitability and help boost the climatic performance of farms by 30%, while reducing carbon emissions and contributing to a more transparent and traceable supply chain.



Pastoral

ABOUT

Pastoral is a prototype digital land management platform and experimental policy proposal that aims to assist with the development of Uzbekistan's pasture land by incentivizing sustainable grazing practices. Pastoral was designed and engineered by Karakoram, a Developmental Innovation Consultancy. Karakoram was founded by Glorious Labs, a Singapore-based VR & Innovation company, and spun off into an independent company in 2020. The Pastoral team at Karakoram is multidisciplinary and consists of engineers, designers, and policy consultants who create experimental solutions through iterative prototypes and Agile production methods.

CORE TECHNOLOGY

Working with the government of Uzbekistan, Pastoral's solution proposes taxes on livestock farming that will intentionally limit the profitability of farmers. At the same time, Pastoral issues one-time-use tax exemption stamps to this livestock surcharge to farmers in exchange for sustainable grazing practices. To enter into the program, farmers use Pastoral's low-connectivity digital land management mobile application, which allows for the tracking of herds and is secured by failsafe tools to automatically limit fraud.

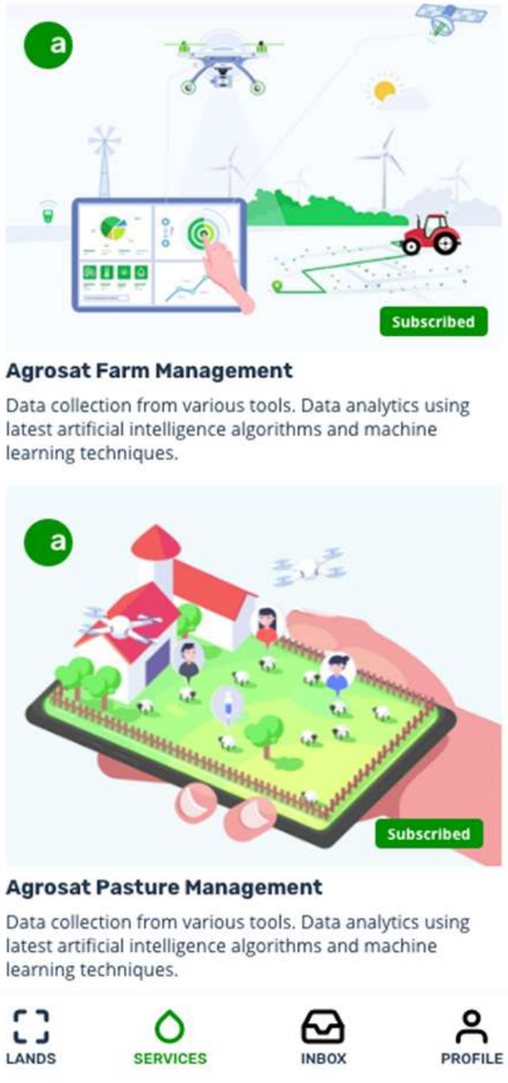
Pastoral's web-based secure portal allows the government to select designated areas for grazing that are in line with sustainable grazing practices. The portal then reports the locations (real-time and recorded) of farmers using the Pastoral platform, providing policymakers with national-level data and a single platform to communicate directly with farmers.

Farmers who stay within the prescribed areas for a set period are automatically issued a unique, one-time-use tax exemption stamp in the same mobile application used for tracking, which is recorded in Pastoral's blockchain system.

IMPACT

Pastoral is currently in closed Alpha-version. Their target is to increase Uzbekistan's national pasture quality and improve livestock productivity. Through the digital platform and experimental policy the Karakoram team hopes to increase biodiversity levels, restore ecosystem health, and improve livelihoods of rural communities and farmers. In doing so, they hope to halt further land degradation by 2024 and see the beginning of its restoration by 2030.

AGROMART



ABOUT

Agromart is one of the few companies providing end-to-end solutions and services to the farming community in Uzbekistan. The Agromart team comprises people from diverse backgrounds, from software engineers to fish farming experts, with a shared vision of helping farmers access knowledge and services. The company provides advisory services to digitise farming practices, enabling access to suppliers, as well as markets. This allows farmers in remote areas to establish farming practices specific to their locations and get on-time advisory support for more sustainable agriculture.

CORE TECHNOLOGY

The AgSat web and mobile application platform developed by Agromart provides users with data on soil and crop conditions on a daily basis using spectral satellite analysis. The application, through easy to use tools and hands-on advisory, enables easy decision making in fertiliser use, crop allocation and rotational grazing by creating a spectral map of the selected area and expert support. Farmers in the selected area can feed in information on their land and crops, as well as send photos from troubled areas, based on which advisory is provided. The app then will use current and historical data to enable decision makers to identify best crops for the selected area, based on soil conditions, climate and historical parameters.

IMPACT

Agromart offers an affordable solution to farmers as it costs only up to USD 3 per hectare for an annual subscription. Agromart also provides additional services such as in-depth analytics and advisory on recommended measures upon request. With more farmers connected and sending in their photos to the system, the system will use machine learning to improve as an analytical tool, and offer more precise and faster solutions.

*"Everything you can **imagine**, nature has already **created.**"*

- Albert Einstein

ABOUT

De Rebus Plantarum is a spin-off of the University of Padova (Italy). They offer advanced services for the protection and enhancement of environmental and territorial resources. In particular, their work focuses on environmental monitoring, the renaturalisation of environments and natural water purification systems.

Since its foundation, De Rebus Plantarum has been aligned to the Sustainable Development Goals (SDGs), particularly for SDG 6: Clean water and sanitation.

CORE TECHNOLOGY

Constructed wetlands are a natural way to purify water as they mimic the chemical, physical and biological processes in self-purifying aquatic ecosystems. Typically, traditional constructed wetlands require large basins and are constrained to shallow waters with low tolerance for water level changes. The patented TECH-IA® solution overcomes this problem by using a Floating Treatment Wetland technique.

The system is a floating platform built in a non-toxic material, characterised by high resistance to chemical, physical and biological agents when placed in water. The floating platform is modular and versatile, and can be easily installed inside water bodies, such as streams, tanks, basins or ponds without needing soil.

IMPACT

From its existing use cases, the TECH-IA® system has been proven to be able to reduce the concentration of impurities in water such as:

- Total nitrogen (by 90%)
- Total phosphorus (by 65%)
- Chemical Oxygen Demand (by 89%)
- Turbidity (by 80%)
- Escherichia coli (E.coli) level (by more than 80%)

With these, wastewater becomes a resource again. In addition to purification functions, the plant roots under the TECH-IA® platforms act as a hotspot for microbial populations, fish and amphibians, while offering birds a shelter in the above-ground vegetation, contributing to the overall biodiversity and ecosystem. .

ABOUT

MAquaponics LLC is an Armenia-based company specialising in controlled-environment agriculture (CEA). They use a patented bioreactor process to naturally convert animal and agricultural wastes into fertilisers for use in aquaponics and hydroponics.

MAquaponics' partners include A&A Epiphany LLC, an aquaculture and aquaponics specialist from the US; AgroTechnik, a CEA specialist from Armenia; Center for Advanced Agriculture at Harrisburg University of Science and Technology; Center for Agribusiness and Rural Development (CARD) in Armenia, and has an exclusive license to use the patented bioreactor technology developed by Integrated Agriculture Systems (INTAG) Inc. from the U.S.

CORE TECHNOLOGY

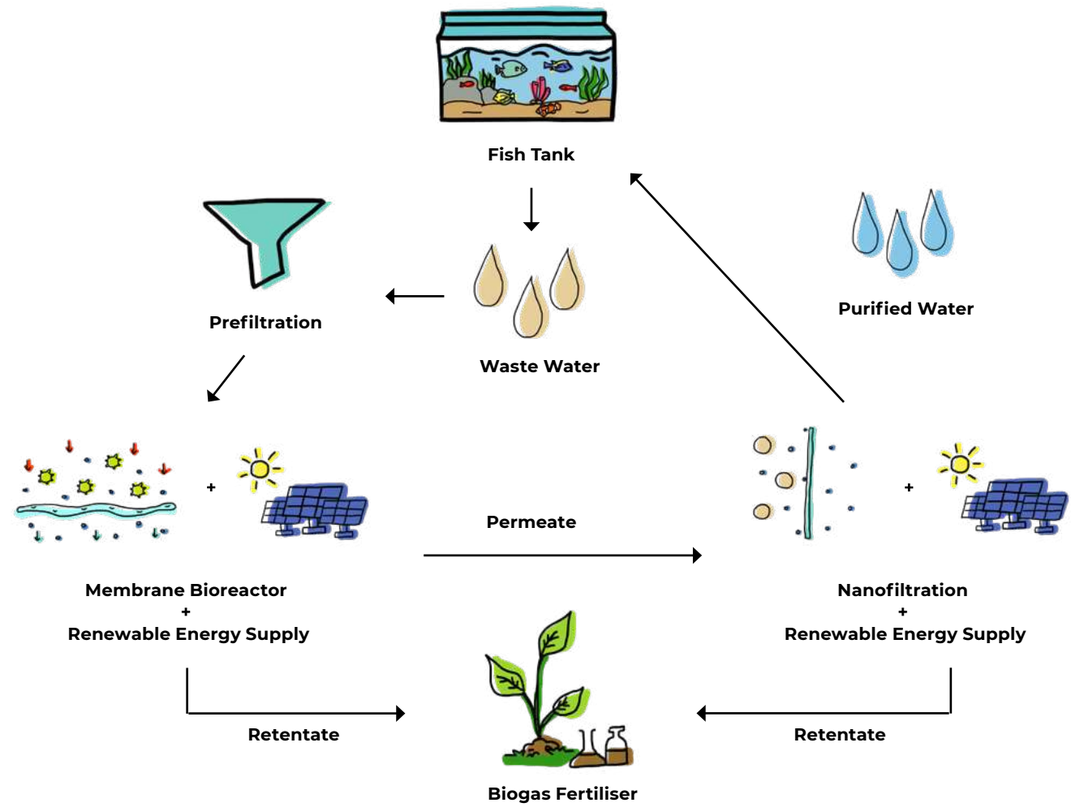
MAquaponics LLC proposes to divert the waste sludge from aquaculture facilities into a bioreactor that will use natural processes for remediating the solid and liquid waste into an organic liquid fertiliser.

In the MAquaponics bioreactor, the liquid waste stream will undergo immediate conversion via nitrifying chemoautotrophic bacteria whereas the solid waste stream will be ingested by Eisenia fetida (California composting worms). These worms reside in an aqueous solution inside the bioreactor and are used to produce wastes which are highly bioavailable chelated micronutrients. This can thus be used to grow produce for human or non-human consumption, for industrial use, or as a value added product that can be used in soil farming and hydroponic plant production.

IMPACT

The opportunity for domestic Armenian aquaculture and controlled agriculture is clear and expanding. This recirculating process is a scalable solution that requires significantly less water and results in a cleaner self-reinforcing ecosystem because of the recycling and reuse of aquaculture effluent that are otherwise released in the environment and lead to pollution. In addition, their market-ready fertiliser product could enable year-round production of healthy vegetables with integrated aquaculture to produce seafood as a source of animal protein without the use of pesticides. This provides an alternative to synthetic chemical-based hydroponic nutrient solutions.

Institute on Membrane Technology
National Research Council of Italy



ABOUT

The Institute on Membrane Technology (ITM) is an institute of the Italian National Research Council (CNR) created in 1993 for the development, at a national and international level, of membrane science and technology. Their research aims to promote knowledge, innovation, and high-level training in the field of membrane technology, for applications in water treatment, gas separation, bioartificial organs, biotechnology, and food and agriculture.

CORE TECHNOLOGY

The ITM-CNR's proposal for Cultiv@te is a technology based on membrane processes for the treatment and reuse of wastewater deriving from aquaculture.

Using a cascade system, wastewater from fish tanks will enter a circuit where a series of membranes will operate. A cartridge filter is the first barrier to macroparticles. Following which, organic, ammonia and suspended solids will be removed through microfiltration or ultrafiltration membranes in an aerobic submerged membrane bioreactor (MBR) system.

The MBR purified stream will then be further treated by nanofiltration membranes to remove ammonium compounds, phosphorus and metal traces dissolved in the wastewater. Through this system, clean water that is completely purified and sanitised can be reused.

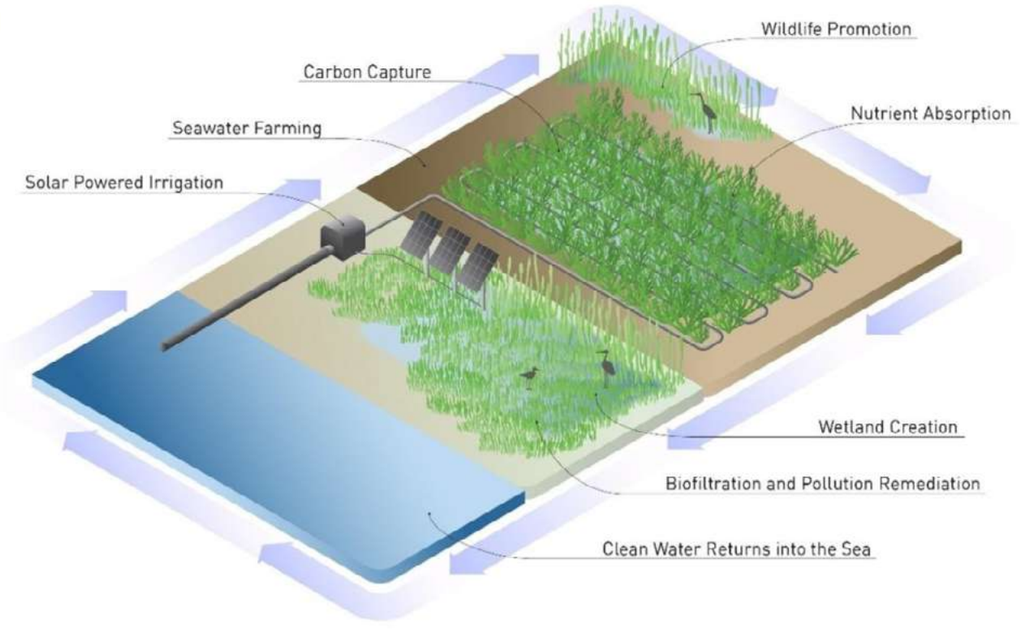
The sludge accumulated as a byproduct can also be reused in biogas plants for fuel production, or be converted to fertiliser. The system works partially on renewable energy via photovoltaic panels.

IMPACT

The solution developed by the ITM-CNR can achieve:

- Reduction in fresh water consumption used by aquaculture by more than 95%
- 100% removal of pollutants, heavy metals, colloids and bacteria
- Removal of total nitrogen compounds and phosphorus by more than 90%
- Up to 75% increase in fish production due better water quality
- 50% energy reduction of aquaculture through using photovoltaic panels

Seawater Solutions



www.seawatersolutions.org

ABOUT

Seawater Solutions is an agri-environmental startup that turns degraded and salinised land into healthy saltmarsh ecosystems, where high-value superfood vegetables are grown in seawater. Their global team consists of environmental engineers and agriculturalists with a shared aim to address environmental conservation and food security through seawater farms.

Seawater Solutions is also pioneering research into the applications of artificial saltmarsh ecosystems, partnering with academic institutions to develop applicable research into carbon sequestration, wildlife promotion, and regenerative crop production.

Seawater Solutions currently has wetland agriculture projects operating globally in countries including Scotland, Ghana, Bangladesh, Vietnam and elsewhere with supporters like DFID, the International Centre for Cooperation, and the Scottish Government. In 2020 alone, the start-up will launch over sixteen further farms globally to tackle food insecurity and support conservation efforts.

CORE TECHNOLOGY

Seawater Solutions uses Integrated Seawater Farming Systems (ISFS) to redevelop degraded land into artificial wetlands. ISFS uses solar and wind-powered irrigation to deliver seawater into coastal farmland and optimise water flows to mimic the natural tidal salt marsh ecosystems in which crops like Samphire and Aster can be grown. These crops are specially bred by partners in Belgium and Bangladesh to suit the specific land requirements of each farm.

The comprehensive package comprising the system and approach together allows for the rapid introduction of seawater farming systems to almost any topography and can allow farms to yield over 30 tonnes of high value crops per hectare, without removing or damaging vital root structures. The system costs under $6,000 per hectare as a one-off cost. It is naturally regenerative and runs renewably, requiring no further input.

IMPACT

Seawater farms capture huge quantities of carbon which can be monetised on the carbon market, along with a host of other ecoservices such as flood adaptation, wildlife promotion, and soil regeneration.

Global Centre for
Technology, Innovation
and Sustainable Development
Singapore

Website: www.sgtechcentre.undp.org
Twitter: @UNDPtech
Facebook: www.fb.com/UNDPtech
LinkedIn: https://www.linkedin.com/company/undptechsingapore
Email: registry.sg@undp.org