Food and Agriculture Organization of the United Nations

Digital Excellence in Agriculture in Europe and Central Asia

Good practices in the field of digital agriculture

Stocktaking Report

@ITU and @FAO | July 2021

-Living document-

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EXECUTIVE SUMMARY

The present report is the outcome of the joint call on good practices on Digital Excellence in Agriculture, organized by the International Telecommunication Union (ITU) Office for Europe and Office for CIS and the Food and Agriculture Organization (FAO) of the United Nations Office for Europe and Central Asia. The document presents a summary version of the 171 eligible submissions of good practices and innovative solutions advancing the digital transformation of agriculture in Europe and Central Asia. This call complements the joint FAO-ITU review on the Status of Digital Agriculture in 18 countries of Europe and Central Asia (ITU-FAO, 2020)[1] and provides evidence on how Information and Communication Technologies (ICTs) play an emerging role in the agriculture landscapes of the regions, acting as an engine for agricultural development. However, the adoption of digital technologies in agriculture differs from country to country, and from region to region. The review in the 18 countries highlighted that smallholder farmers have yet to experience the widespread benefits of this digital transformation, and they are lagging behind when it comes to the adoption of digital agriculture solutions and innovations due to lack of trust in the potential of ICTs, limited digital skills, connectivity issues and restricted availability of ICT-based solutions to utilize and scale up. Realizing the full potential of digital agriculture transformation requires identifying, sharing and implementing best practices and proven solutions across countries, involving all actors in participatory processes.

As a follow-up action to the reviews, FAO and ITU launched in November 2020 the Digital Excellence in Agriculture in Europe and Central Asia regional contest to identify, showcase and celebrate good practices and innovative solutions that have proven successful in advancing the digital transformation of agriculture in regions. The Call for good practices and innovative solutions advancing digital transformation in agriculture in Europe and Central Asia is the first phase of the contest. It was launched to identify digital solutions and practices addressing the agricultural challenges in the regions. With nearly 200 applicants from 38 countries from Europe and Central Asia, the initiative revealed a diverse, dynamic and forward-thinking ecosystem of innovators and problem-solvers.

This Stocktaking Report provides a compilation of the 171 eligible good practices and solutions received from applicants, as well as a mapping of the digital agriculture landscape in Europe and Central Asia.

This Report is composed of the following sections. The introductory section describes the Digital Excellence in Agriculture regional contest, its Call for good practices, and some insights on the applications received, such as their geographical focus, the technologies applied, and the delivery models behind said technologies. The second part provides a compilation of the good practices and transformative solutions collected through the open call.

The categories are as follow:

Category 1 *Regulatory Frameworks / Enhanced market access / Financial services and insurance* lists practices utilizing ICTs to implement regulatory policies and monitor progress, facilitating market access as well as increasing rural communities' access to financial services and insurance mechanisms.

Category 2 *Capacity Development and Empowerment* presents initiatives and solutions widening the reach of rural communities, improving access to and knowledge of good agricultural practices, stimulating relevant digital literacy and skills and creating new business opportunities.

Categories 3-4-5 refer to the topic *Agriculture Innovations Systems and Sustainable Farming*, with the implementation of successful practices and proven solutions employing various digital technologies at the farm level, e.g. Farm Management Information Systems, Precision Agriculture, Internet of Farm Things, sensor networks, and e-extension, among others. Given the success of the thematic area 3 "Agriculture innovation

[1] FAO-ITU Study on the Status of Digital Agriculture in 18 countries Europe and Central Asia - https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2020/Series%20of%20Webinars/20-00244_Status_digital_Agriculture-revFAOV4.0-MASTER-FILE-20-JUNE_REVIEW-FAO_PL_print%20(002).pdf

systems and sustainable farming" among applicants, which depicts a strong trend in Europe and Central Asia, this area has been divided into three categories mirroring the submissions received, as follow:

Category 3 refers to successful practices employing *farm automation, robots and drones*.

Category 4 showcases *specific solutions* fostering *Agriculture Innovation Systems and Sustainable Farming*.

Category 5 reports initiatives aimed at enhancing application and use of *Connected Farm Management Systems*.

Category 6 *Disaster Risk Management and Early Warning Systems* lists solutions aimed at providing actionable (near) real-time information to communities and governments on reducing disaster risks, including potential climate change-related risks.

Category 7 *Food Loss and Waste / Food Safety and Traceability* refers to practices delivering reliable data to comply with traceability standards and food nutrition aspects and practices aimed at tackling the decrease in the quantity or quality of food by the different actors in the supply chain.

INTRODUCTION

BACKGROUND

The year 2020 marks the beginning of the "Decade of Action" proclaimed by the United Nations for achieving the goals and targets set out in the 2030 Agenda for Sustainable Development. In an increasingly digital world, information and communication technologies (ICTs) play a key role as development enablers that can facilitate countries' capabilities to reach all 17 Sustainable Development Goals (SDGs).

Connectivity, mobile adoption, artificial intelligence, analytics, connected sensors, and other emerging technologies are yielding new growth in the agriculture, livestock, fishery, and forestry sectors. They offer the opportunity to enhance the sustainability of food systems.

While the future of agriculture is connected, the agricultural and rural development in Europe and Central Asia has yet to fully realize the potential of digital technologies to overcome the new challenges facing the sector: climate change adaptation, increased food loss and waste, rural divides and urbanization, small-size farming, and the triple burden of malnutrition, undernutrition, and issues such as overweight, obesity, and micronutrient deficiencies. The digital technology dividends are not automatic, and smallholder farmers in Europe and Central Asia are lagging behind when it comes to the adoption of new technologies due to infrastructure, affordability, awareness, and regulatory issues.

The COVID-19 pandemic has brought these challenges to the fore by disrupting supply chains and changing consumer behaviors. The pandemic continues to ravage so many of our populations and economies and we have never faced a situation of greater urgency. Renewed global recognition of the importance of digital infrastructure, services and skills presents many unprecedented opportunities to make real and rapid progress. The new socially distant economy has been a driving force for digitalization, unlocking access to new markets for farmers and stimulating agripreneurs to bring novel digital solutions to life.

Action, coordination, and involvement of all actors are necessary to capitalize on the opportunities, to tackle the agricultural challenges in Europe and Central Asia, and to sustainably address digital transformation.

ITU-FAO DIGITAL EXCELLENCE IN AGRICULTURE IN EUROPE AND CENTRAL ASIA CONTEST

The International Telecommunication Union (ITU) Offices for Europe and CIS and the Food and Agriculture Organization of the United Nations (FAO) Office for Europe and Central Asia have joined forces to sustainably address the digital transformation of agriculture in Europe and Central Asia.

In 2020, ITU and FAO published a joint review on the Status of Digital Agriculture in 18 countries Europe and Central Asia[2], which demonstrated how Information and Communication Technologies (ICTs) play an emerging role in the agriculture of Europe and Central Asia. While ICTs are acting as an engine for agricultural development and have spawned a consistent wave of innovation in the region, the review also highlighted the need for coordination among stakeholders.

As a follow-up action to the review, the agencies launched the **Digital Excellence in Agriculture in Europe and Central Asia Contest**, aimed at identifying, showcasing, and celebrating transformative digital solutions that are contributing to building resilient food systems in the region. This initiative seeks to contribute to the achievement of the Sustainable Development Goals (SDGs) and, in particular, SDG2 "Zero Hunger", to ensure a sustainable

[2] FAO-ITU Study on the Status of Digital Agriculture in 18 countries Europe and Central Asia - https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2020/Series%20of%20Webinars/20-00244_Status_digital_Agriculture-revFAOV4.0-MASTER-FILE-20-JUNE_REVIEW-FAO_PL_print%20(002).pdf

and inclusive digital transition and to contribute to bridging the digital, rural, and gender disparities, known as the triple divide. The contest is also an important milestone in the implementation of FAO and ITU's Regional Initiatives and cooperation.

CALL FOR GOOD PRACTICES AND INNOVATIVE SOLUTIONS ADVANCING THE DIGITAL TRANSFORMATION OF AGRICULTURE IN EUROPE AND CENTRAL ASIA

The Call for good practices was launched in November 2020 to identify successful digital solutions advancing the transformation of agriculture in the region, as the first phase of the Digital Excellence in Agriculture in Europe and Central Asia contest. The **Call for good practices and innovative solutions advancing digital transformation in agriculture in Europe and Central Asia** invited all actors - whether individuals or public and private organizations and institutions - across the European and Central Asian agricultural sector that are successfully applying ICTs to address any of the following challenges:

1. *Regulatory Frameworks, Enhanced market access, Financial services and insurance*: successful practices and proven solutions utilizing ICTs to implement regulatory policies and monitoring progress, facilitating market access as well as increasing rural communities' access to financial services and insurance mechanisms are listed in Category 1;

2. *Capacity Development and Empowerment:* successful practices and proven solutions widening the reach of rural communities, improving access to and knowledge of good agricultural practices, stimulating relevant digital literacy and skills, creating new business opportunities, etc. are listed in Category 2;

3. *Agriculture innovations systems and Sustainable farming:* successful practices and proven solutions employing various digital technologies at farm level (e.g. Farm Management Information Systems, Precision Agriculture, Internet of Farm Things, sensor networks, e-extension, etc.), fall under Categories 3, 4 and 5;

4. *Disaster risk management and Early warning systems:* successful practices and proven solutions aimed at providing actionable (near) real-time information to communities and governments on reducing disaster risks, including potential climate change-related risks, are presented in Category 6;

5. *Food safety and traceability, Food loss and waste:* successful practices and proven solutions aimed at tackling the decrease in the quantity or quality of food waste by the different actors in the supply chain or at delivering reliable data to comply with traceability standards and food nutrition aspects are listed in Category 7.

Given the success of the thematic area 3 "Agriculture innovation systems and sustainable farming" among applicants, which depicts a strong trend in Europe and Central Asia, this area has been divided into three categories mirroring the submissions received: "Farm automation, robots, drones", "Specific solutions to agriculture innovation and sustainable farming", and "Connected farms management systems".
Therefore, the new categories are as follows:

Category 1 *Regulatory Frameworks / Enhanced market access / Financial services and insurance* lists practices utilizing ICTs to implement regulatory policies and monitor progress, facilitating market access as well as increasing rural communities' access to financial services and insurance mechanisms.

Category 2 *Capacity Development and Empowerment* presents initiatives and solutions widening the reach of rural communities, improving access to and knowledge of good agricultural practices, stimulating relevant digital literacy and skills and creating new business opportunities.

Categories 3-4-5 refer to the topic *Agriculture Innovations Systems and Sustainable Farming*, with the implementation of successful practices and proven solutions employing various digital technologies at the farm level, e.g. Farm Management Information Systems, Precision Agriculture, Internet of Farm Things, sensor networks, e-extension, others.

Specifically, **Category 3** refers to successful practices employing *Farm automation, robots and drones*.

Category 4 showcases specific solutions fostering *Agriculture Innovation Systems and Sustainable Farming*, while

Category 5 reports initiatives aimed at enhancing application and use of *Connected Farm Management Systems*.

Category 6 *Disaster Risk Management and Early Warning Systems* lists solutions aimed at providing actionable (near) real-time information to communities and governments on reducing disaster risks, including potential climate change-related risks.

Category 7 *Food Loss and Waste / Food Safety and Traceability* refers to practices delivering reliable data to comply with traceability standards and food nutrition aspects and practices aimed at tackling the decrease in the quantity or quality of food waste by the different actors in the supply chain.

The call was launched on 4 November 2020 and remained open until 11 January 2021. Nearly 200 applicants from 36 countries in the region responded to the call by filling in an online questionnaire[3] (Appendix I). The respondents were asked to answer a series of questions on their solution, the technology developed or adopted, their delivery model, empathizing elements of innovation and sustainability and eliciting the challenges innovators are facing and their objectives for the future.

1. Requirements

The applications collected through the call were first analyzed against the minimum requirements to enter the Digital Excellence in Agriculture contest, namely:

- the good practice/solution must have already been put into practice or successfully implemented within the last three years; hence, applications that only contained a description of an idea were disqualified from the competition;
- the good practice/solution must have originated or been implemented within European and Central Asian countries[4] (Appendix II);
- the good practice/solution must have been centered on applying innovative methods of ICTs within the agricultural sector - which includes livestock, fisheries and forestry, as well as the food sector as a whole - in the urban or rural areas;
- the good practice/solution must have been based on at least one or a combination of various digital technologies (mobile, satellite, cloud computing, machine learning, sensor networks, IoT, etc.);
- the good practice/solution must have been accessible and affordable to stakeholders in the agriculture sector, so that the practice is replicable and implementable across the region.

Furthermore, to be eligible for participation in the Digital Excellence in Agriculture contest, submitters must have been above the age of 18 and not affiliated with ITU. Lastly, participants must have complied with the intellectual property rights of the applications and technologies described in their submission.
Chapter 4 of this Report includes a compilation of the eligible submissions that met the aforementioned requirements and hence entered the Digital Excellence in Agriculture contest. All applications that met the minimum requirements were also considered eligible for competing at the *UN World Summit of Information Society 2021 Prizes*.

[3] Online Questionnaire - https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Projects/ITU-FAO/Submission%20Template%20-%20Call%20for%20good%20practices%2018.12.2020%20%281%29.docx

[4] https://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx

2. Insights

Out of 192 total submissions received, 171 solutions were considered to meet the eligibility criteria to enter the contest. Among the 192 respondents (both eligible and non-eligible), 22% were female, and 77% male (Figure 1). The 192 solutions originate from 36 European and Central Asian countries[5], with implementation in 53 countries across the region[6] and an additional 16 countries worldwide[7] (Figure 2).

Figure 1 - Gender representation of the 192 respondents

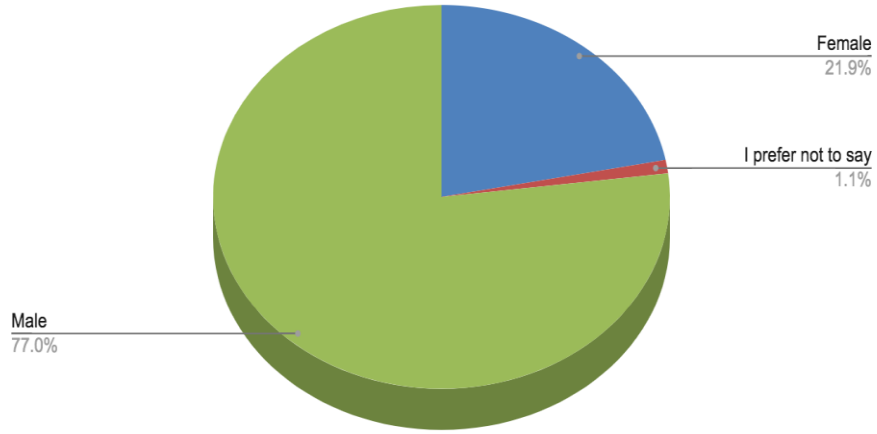


Figure 2 - Geographical coverage of the 192 applications

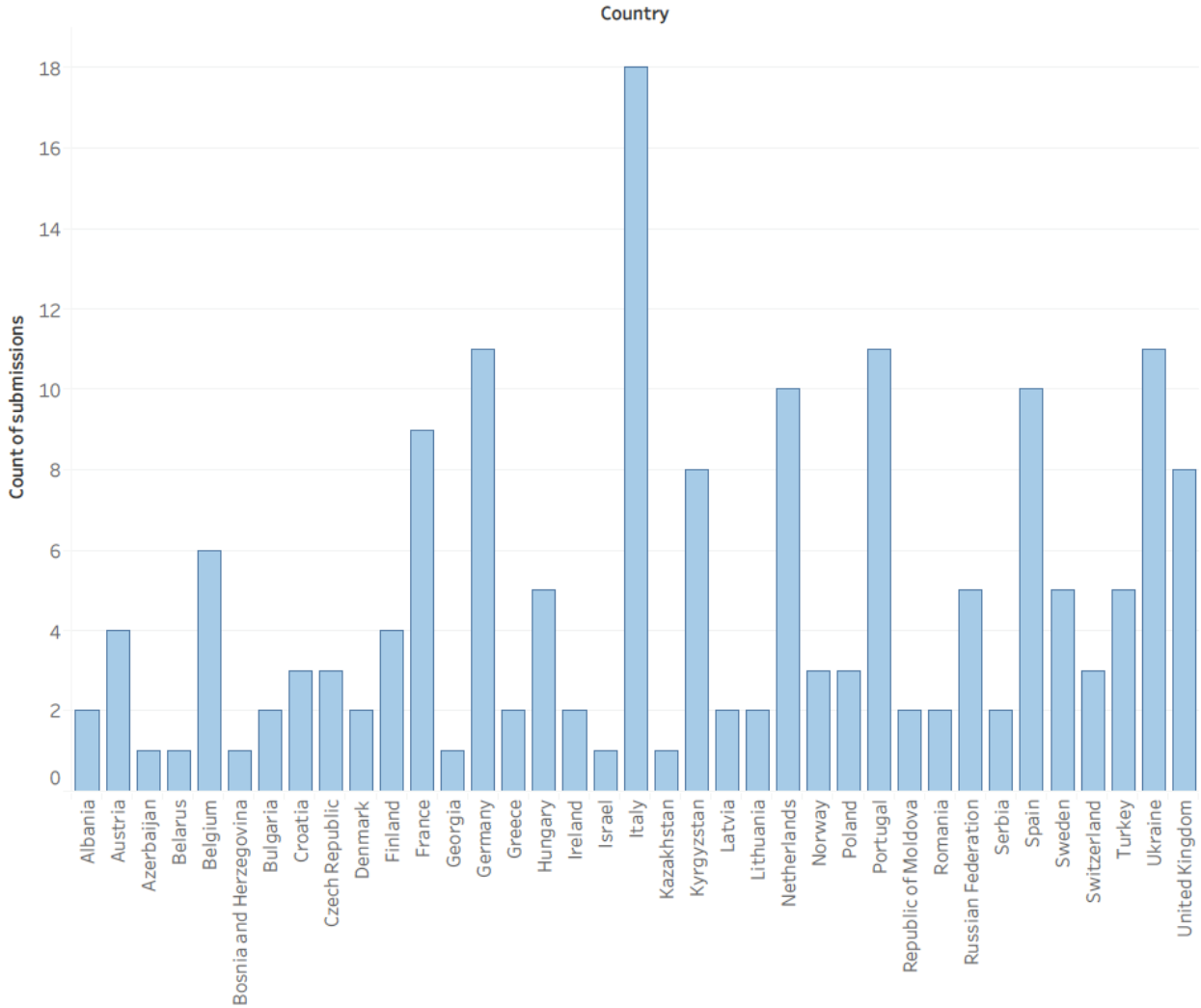
[5] Albania, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Moldova, Romania, Serbia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom

[6] Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Rep. of North Macedonia, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan, Vatican

[7] Angola, Argentina, Australia, Brazil, Chile, Egypt, India, Iraq, Kenya, Mexico, Morocco, New Caledonia, Peru, South Africa, St. Kitts, United States

Figure 3 presents the number of eligible submissions received per individual country of Europe and Central Asia.

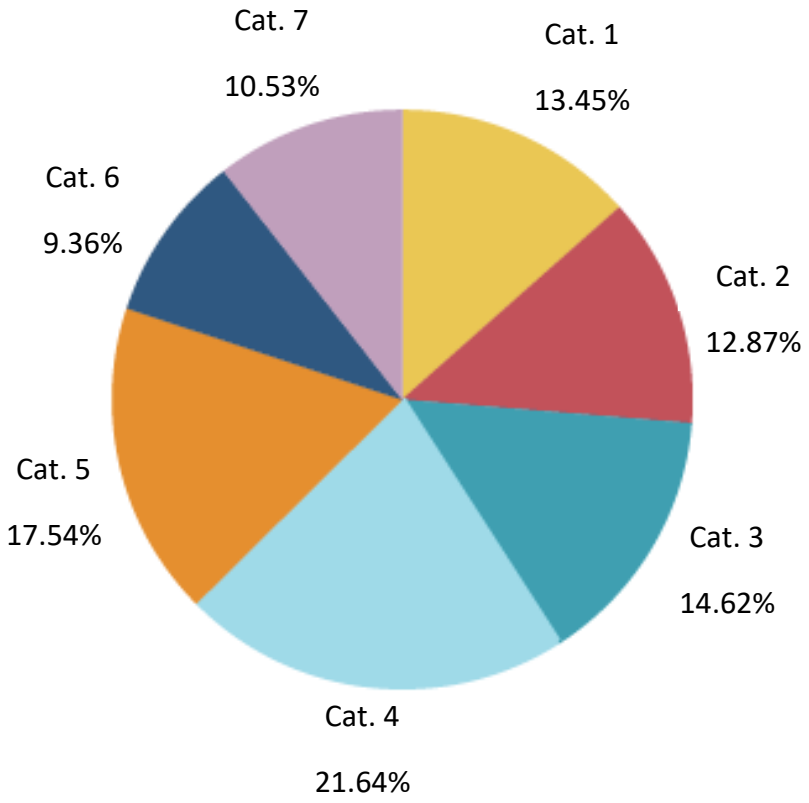
Figure 3 – Number of eligible submissions per country



The majority of the eligible practices and solutions apply digital technologies to innovate agriculture systems to achieve sustainable farming (53.8%), whereas 10.53% of eligible practices and solutions tackle food loss and waste and/or deliver reliable data to comply with traceability standards and food nutrition aspects.

12.87% of the applications received had the objective to stimulate digital literacy and skills and improve access to agricultural knowledge (Category 2), and 13.45% to apply ICTs to implement regulatory policies and monitor progress, to facilitate access to markets or to financial services and insurance mechanisms, whereas only 9.36% aimed to focus on providing actionable (near) real-time information to communities and governments on reducing disaster risks (Figure 4).

Figure 4 - Breakdown by thematic areas



The majority of the 192 practices received (about 90%) were targeted towards improving the livelihoods of smallholder farmers (Figure 5), and 62% were developed in partnership with other entities (Figure 6).

Figure 5: Smallholders Target

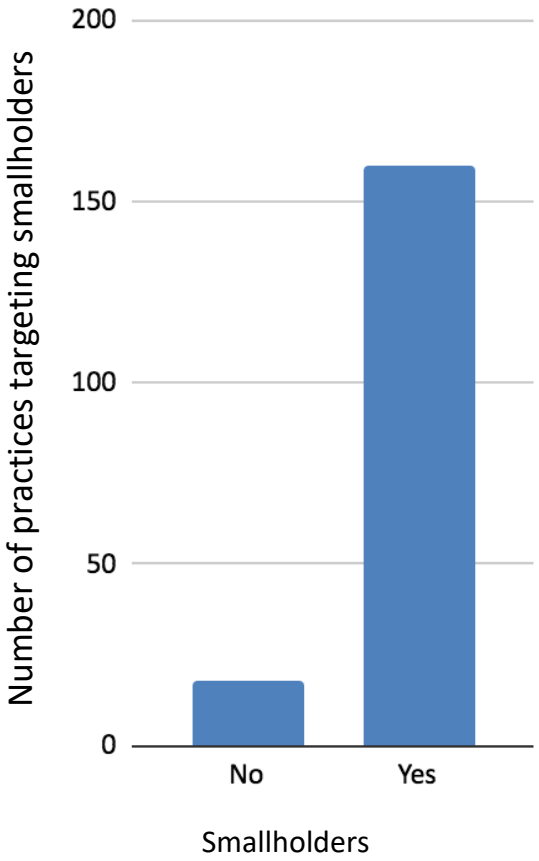
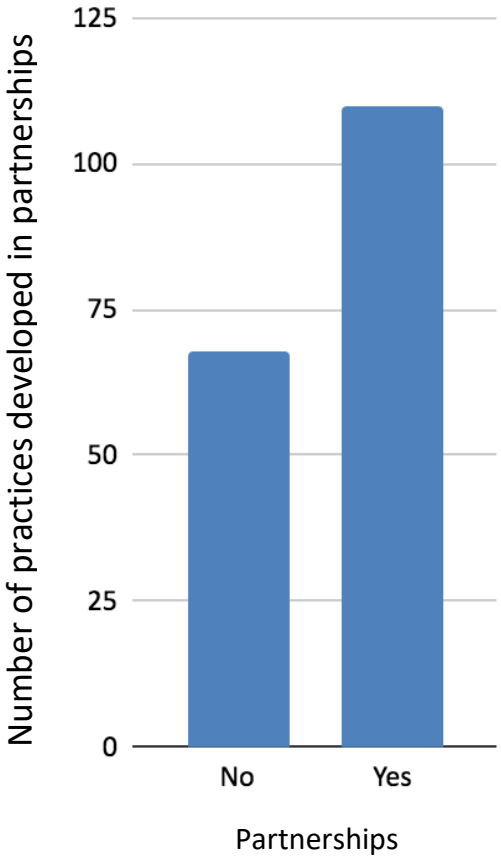


Figure 6: Partnerships



3. Evaluation of applications, nominations and awards

The selection committee, composed of digital agriculture experts from the International Telecommunication Union (ITU) and the Food and Agricultural Organization of the United Nations (FAO), evaluated the eligible submissions received and made a selection of applications based on the following criteria and a 1-to-4 grading system.

Table 1: Evaluation criteria description

Criteria	Description
Impact and Results	Successful results and positive impact must be demonstrated
Sustainability	To what extent is the practice sustainable (socially, economically, and environmentally)?
Replicability and upscaling	To what extent can the practice be replicated in terms of appropriateness/ technology affordability?
Novelty	Are there existing analogues in other regions?
Technology	Complexity and combination of technologies used

Special attention was paid to those solutions targeted at smallholders and family farmers.

As a result of the evaluation process, 28 practices were selected to compete for the final part of the contest on Digital Excellence in Agriculture. On top of the 21 outstanding practices (three per category) nominated to compete for the special recognition of 'Digital Excellence in Agriculture', the Evaluation Committee identified 7 champion practices (one per category) coming from the 18 countries[8] part of the ITU-FAO review on the Status of Digital Agriculture in 18 countries of Europe and Central Asia[9]. They will be featured in the "ITU-FAO Digital Excellence in Agriculture in Europe and Central Asia Report" and in a special promotional video.

On 23 September 2021, nominees will have the opportunity to showcase their innovations and outstanding achievements at the online 'Digital Excellence in Agriculture in Europe and Central Asia Awards Ceremony', during which the awardees will be announced.

[8] Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Montenegro, North Macedonia, Russian Federation, Serbia, Tajikistan, Turkey, Turkmenistan, Ukraine and Uzbekistan.
[9] ITU-FAO review on the Status of Digital Agriculture in 18 countries of Europe and Central Asia (2020): https://www.itu.int/en/myitu/Publications/2020/07/09/15/27/Status-of-Digital-Agriculture-in-Europe-and-Central-Asia

1. Category 1 – Regulatory Frameworks / Enhanced market access / Financial services and insurance

1.1 AGRIFINANCE, UKRAINE

AgriFinance	**AgriFinance**			
Applicant:	**LLC "Grafit Group"** Yevhen Nevierov, Operating Officer			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://www.agrifinance.io/2			
	**Delivery model:**	Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

Farmers need loans for working capital easy and fast but they need to pass through complicated procedures. Agrifinance is a digital platform which allows interacting with farmers in the process of forwarding financing. It allows investors to simplify and expedite the scoring process of farmers' credibility. Farmers can easily and fast get financing using crop receipts on competitive market conditions. AgriFinance is creating a new modern approach to financing farmers and its execution. The service became possible and high in demand because of several reasons:

- High demand for financing caused by long production term and opening of the land market;
- The slow and difficult process of existing financing programs;
- Development of crop receipts what extremely raised total collateral value;
- Opening access to Cadastral map of Ukraine and the real estate register allowed to make the process of estimation computerized;
- Development of digital partners like cloud calculations and satellite services.

The platform allows to get financing easy, in time and reduces lender's risks. Why farmers choose us:

- Simple application;
- Fast decision and loan payment;
- Flexible financing terms and partners;
- Free of charge. The platform which attracts new farmers, scores them using own algorithms, provides analysis to the creditor and monitors borrower's status.

A new approach to relationships between farmer and investor, fast and computerized scoring brings to Agrifinance a wide range of competitive advantages:

- The average duration of request consideration will decrease from 14 to 2 days;
- The subject of collateral will be the future harvest but not the farmers' assets which cause huge growth of credit market; - 24/7 customer support and partnership approach.

The platform allows to get financing easy, in time and reduces lender's risks.

Technology applied:

Software solutions (programs and packages)

1.2 APPLICATION FOR THE NATIONAL SUPPORT SCHEME FOR FARMERS, ALBANIA

	Application for the National Support Scheme for Farmers			
Applicant:	**National Agency for Information Society (NAIS)** Mirlinda Karcanaj, General Director			
Country:	Albania	Implementation in Albania. All the farmers in national level are able to apply through e-Albania platform through the electronic service.		
Website:	https://akshi.gov.al			
App:	https://e-albania.al			
	Delivery model:	Fully free to use	**Stage:**	Proven/ Scale-up stage
Practice description:				
The electronic service 'Application for the National Support Scheme for Farmers' consists on national scheme for financial support for agriculture and rural development from the Albanian government budget. The objective of the service is to digitalize the process of financial supporting scheme from traditional way of applying physically, to a totally innovative way, which is the electronic service through e-Albania platform. Through this service, farmers are identified in their account in the e-Albania platform, fill in the electronic form without the need to upload accompanying documents, and then they are equipped with a tracking number with which they can track their application in any moment. For all those farmers who cannot personally apply from home, are assisted in real time by the offices 'Agropoints' by state employees. After the end of the application period, farmers are notified by the rural and agricultural development agency of the funding measure. The online service has facilitated the process of application for more than 8000 farmers of Albania, who are able to apply online through the e-Albania portal to benefit from support schemes with 0 documents needed rather than traditional way of physically applying at the encounters. The electronic service includes financial support for specific areas in agriculture as: Sheep / goat and cattle farms; Greenhouse; Beekeeping; Cultivation of medicinal plants; Organic farms; Implementation and certification with Global GAP; Agritourism. This electronic service is implemented in the e-Albania government portal, with a dedicated backend system for receiving and processing online applications. Also, the core architecture of this process is the Government Gateway Platform that enables the exchanging of data from other electronic registers, thus eliminating the associated documents required before from the farmers. It saves time for both the applicant and the state officer, being an automated process, it increases efficiency and transparency.				
Technology applied:				
Web platforms (forums, communities, e-governance)				

1.3 AUGMENTED REALITY VOICE POLICY APPLICATION, TURKEY

TARSİM TARIM SİGORTALARI HAVUZU tarımın sigortasıyız	**Augmented Reality Voice Policy Application**			
Applicant:	**TARSIM - Agricultural Insurance Pool** Mert KARAOSMANOGLU, Senior Specialist			
Country:	Turkey	Implementation in Turkey		
Website:	https://www.tarsim.gov.tr			
App:	https://play.google.com/store/apps/details?id=tr.gov.tarsim https://apps.apple.com/us/app/tarsim-mobil/id1434539853			
	**Delivery model:**	Fully free to use	**Stage :**	Proven/ Scale-up stage

Practice description:

Augmented Reality Voice Policy Application integrated to TARSIM Mobile application is designed for cattle, sheep & goat breeders, beekeepers, poultry breeders, fish breeders and farmers. It is the first Augmented Reality (AR) technology used insurance mobile application in Turkey. The application, which can be installed on smartphones and tablets with Android and IOS operating systems, is aimed to work even on low-budget smartphones. Especially the smallholder producers from rural areas who do not have knowledge of insurance coverage and policy details and the inability to obtain detailed information from insurance companies may causes some problems in the loss assessment and the loss indemnification processes. Augmented Reality Voice Policy Application works with both; policy printout (target detection) and policy number (surface detection). Similar scenes are animated in both methods and it is aimed to inform the producer.

In the mobile application, by selecting the policy after the producers' login, or by scanning the QR code in the policy printouts with a mobile device camera, a structure that explains vocal the details of the policy with augmented reality technology on the real environment has been developed according to the insurance type of the producer (cattle, sheep and goats, poultry, aquaculture, beehive, crop). While the producer is listening aloud the indemnity amount to be paid in the event of damages due to hail, storm, whirlwind, fire, earthquake, flood, landslide and other important criteria, clarity is tried to be increased with supporting visual effects and 3D models in accordance with the policy shown on the scene. The goal is that producers who experience our application, which is interesting, easy to use and enjoyable, will learn all the policy details while discovering the application. Through this application, it has been tried to revise conscious insurance notion, to prevent possible faulty situations, to establish a sincere connection with the producers by transmitting understandable and fluent texts with visual and audio assistance.

Technology applied:

Smartphones (features, apps); Software solutions (programs and packages); Augmented Reality

1.4 DEVELOPMENT OF AN ANIMAL IDENTIFICATION AND TRACEABILITY SYSTEM IN KYRGYZ REPUBLIC, KYRGYZSTAN

	Development of an Animal Identification and Traceability System in Kyrgyz Republic			
Applicant:	**FAO** Marina Kichinebatyrova, Project Manager			
Country:	Kyrgyzstan	Implementation in Kyrgyzstan		
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage
Practice description:				
Animal Identification and Traceability System critically contributes to increased food and safety and security for the Kyrgyz Republic and income of farmers and other stakeholders through improved disease monitoring and control, reduced restrictions export of livestock products and improved animal health and productivity and pasture utilization. Furthermore, the AI&T provides a basis upon which to build future systems for improved livestock management and genetic selection. So under project the Ministry of Agriculture and Melioration (MoA&M) of The Kyrgyz Republic, was supported to develop a national strategy and action plan for animal identification and traceability (AI&T) and to design the information technology (IT) system required and develop the necessary software for data collection, storage and exchange. The software development began in early 2015 and continued throughout the first half of the year. Initial versions of the software were operable by July 2015, and ISC staff provided an initial training workshop for MoAM staff and other stakeholders. Software demonstrations were then given each month to the TF. The software was delivered for field tests on 31 August 2015, as planned. In September 2015, the IPS installed the software and provided additional training. An operational National AI&T system allows farmers to achieve standards required for export of livestock and their products, expanding the market and increasing income; and to contribute to increased production and productivity of livestock and income of farmers and to increased food security for all citizens.				
Technology applied:				
Web platforms (forums, communities, e-governance), Cloud (data storage and computing, Big data), Digital communication (telephone, messenger, email), Software solutions (programs and packages)				

1.5 E-AUDIT, ITALY

VALORITALIA	**e-audit**			
Applicant:	**Valoritalia srl** Matteo Balderacchi, consultant			
Country:	Italy	Implementation in Italy		
Website:	https://www.valoritalia.it			
	**Delivery model:**	Part of advisory service	**Stage:**	Market adoption/ Validation stage

Practice description:

Valoritalia IoF2020 case focused on IoT and certification. Wine certification means issuing a certifying document that declares that the wine complies with standard. The certificate is issued only at the end of the production process. During the certified production process, all the production phases are tracked, the production documents are recorded and visits are done to check that the real situation corresponds to the declared one. The auditor is the company consultant that goes to the winery to verify that the traceability is correct, or rather that what the producer stated corresponds to the truth.

The developed software supports the auditor to carry out his/her working tasks and it has been split into two parts: the cellar and the vineyard. In the cellar e-audit allows the user to fill a digital audit report, to read and data to data to DIONOSO, that is the management software of Valoritalia. In the cellar, the auditor benefits from:

- the access to the stored wine data from the software DIONISO, which collects the history and the status of all the winery wines with denomination;
- the national log-book SIAN that it contains all the production steps made and communicated to the public authority from the wine producer;
- data from installed sensors, in particular the wine level in each vat.
- In the vineyard, the smartphone or tablet sensors allows to
- identify the target vineyard;
- access to the information regarding that piece of land;
- record the sampling activity with geodata.

The user benefits the access to 1, the land registry 2, the vineyard cadastral registry 3, DIONISO 4, a number of external sources of data, such as weather data, soil map, or vegetation indexes.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Digital communication (telephone, messenger, email)

1.6 EAIS (EKTIS), AZERBAIJAN

EAIS (EKTIS)	**EAIS (EKTIS)**			
Applicant:	**Agro Researches Center under the Ministry of Agriculture** Turan Shukurbayli, business analyst			
Country:	Azerbaijan	Implementation in Azerbaijan		
Website:	https://atm.gov.az			
App:	https://eagro.az			
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage

Practice description:

Currently, agriculture in the country is developing in conjunction with state subsidies and other incentive methods. At the same time, new strategies, innovations, and information and communication technologies (ICT) are being implemented for the development of agriculture through the Ministry of Agriculture, our organization, and other sub-organizations. An example of the application of ICT is the Subsidies module of the Electronic Agricultural Information System (EKTIS) created by us and the largest platform of the Ministry of Agriculture.

This system contains all farmers' information of the country, all parcels, and other agricultural staff of the country. Thus, gathering data, creating analytical reports, and build models that form a basis for planning future development and become the key requirement of modern data – "Big Data". Farmers declare their area of activity through the system and can apply for a subsidy. This system has the ability to set up monitoring mechanisms to ensure the proper implementation and development of agricultural processes, as well as tracking processes in real-time. Provide better services with high satisfaction, make it easier for the farmers and government. Monitoring is also carried out on the basis of satellite images.

We have granted horizontal and vertical integration of information systems so that farmers don`t waste time collecting documents. Additionally, farmers can apply for insurance services based on EAIS data. The farmer can fill out a declaration to the system from anywhere, regardless of time and place, and may apply for the subsidy with just one click. The subsidies are shown on the profile of the farmer. As a result of integration with the bank, the farmer's payments are paid directly to the bank account. Main impacts are: operativeness and transparency; collection of documents; identification of parcels; lack of interaction with organizations, easy to use and manage.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Broadcasting (TV, radio, online, SMS); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

1.7 EGNSS4CAP, CZECH REPUBLIC

<table>
<tr><td>  </td><td colspan="4">EGNSS4CAP</td></tr>
<tr><td>Applicant:</td><td colspan="4">European GNSS Agency (GSA)
Joaquín REYES GONZÁLEZ, Market Development Technology Officer</td></tr>
<tr><td>Country:</td><td>Czech Republic</td><td colspan="3">Implementation in Czech Republic, Estonia, Italy, Malta, Spain</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.gsa.europa.eu</td></tr>
<tr><td>App:</td><td colspan="4">https://www.egnss4cap.eu</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Open source, community approach</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">EGNSS4CAP is a mobile phone application for Android and iOS that digitises procedures for farmers in the European Union to satisfy their reporting requirements under the current and post-2020 Common Agricultural Policy (CAP) reform. The tool is Open Source, available for free and is able to be integrated by any Android developer. Mass market devices such as smartphones and tablets will be able to run the application and use GNSS to provide location and timing of the photo ensuring required accuracy and authentication for reporting to the paying agencies.

The EGNSS4CAP application will use Galileo differentiators to enable farmers to provide geotagged photos that both support and complement a Copernicus Sentinel-based monitoring approach for CAP. New rules adopted by the European Commission for the current and upcoming CAP allow a range of modern satellite-based technologies to be used when administering and controlling area-based payments. For example, automatic monitoring procedures employing data and signals from both the Copernicus and Galileo programmes can be used to reduce the number of On The Spot Checks (OTSC). The use of these technologies is a part of the European Commission's ongoing commitment to modernise and simplify the Integrated Administration and Control System (IACS) processes within CAP.

The project team has worked closely with the paying agencies responsible for administering subsidies for farmers and JRC to ensure that the minimum user requirements will be met. A beta version has been developed that addresses authentication requirements with the use of OS-NMA version 1.0 and spoofing methods to trap fake GNSS both on the mobile and server-side. Additionally, it attains high accuracy through the use of dual-frequency (L1/L5) and high precision with the convex hull method.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Blockchain (transactions).</td></tr>
</table>

1.8 EMERGE, ITALY

	EMERGE			
Applicant:	**EMERGE** Giorgio Bertolini, founder & CEO			
Country:	ITALY	Implementation in Italy		
Website:	https://www.emerge.biz/en			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage
Practice description:				
We give a FREE B2B digital showcase to small food producers connecting them directly with buyers (restaurants, supermarkets, distributors etc.). Small food producers can create for FREE a profile on EMERGE showcasing its products and describing its story to our community of buyers. Using the digital to connect producers and buyers is much more sustainable than food exhibitions. It's simple but innovative because now small food producers can emerge and be discovered by buyers worldwide, today they are searching product online even more! We have now more than 1.500 Italian small producers. Our goal is to reach 10.000 in Italy to then scale our solutions to other European countries and globally after (Africa, Asia etc.).				
Technology applied:				
Software				

1.9 AGROAPP, UKRAINE

	Agroapp			
Applicant:	**Fintech Pro, LLC** Yaroslav Smakota, Founder			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://agroapp.com.ua			
	**Delivery model:**	It is fully free for farmers. Only banks pay success fee	**Stage:**	Proven/ Scale-up stage
Practice description:				
AgroApp - is a digital lending platform for agribusiness. We believe that small and medium entrepreneurs, in particular farmers, are the solid foundation of any economy. Our solution is aimed at creating easy access for entrepreneurs to financial resources for the growth and development of their business. We simplify and accelerate the process of obtaining a loan for farmers for the purchase of fertilizers, seeds and plant protection products. The farmer only needs to type the company's registration number and the loan amount into the AgroApp chatbot and receive a decision from the bank within two days. Typically, the traditional process takes months and is complicated by paperwork. AgroAPP significantly reduces the time, which is very important when it comes to a sowing company. We believe that small and medium entrepreneurs, in particular farmers, are the solid foundation of any economy. Our solution is aimed at creating easy access for entrepreneurs to financial resources for the growth and development of their business. Our service is based on the consolidation of data from more than 70 open registries such as company register, land register and many other state registers. Our chatbot allows to apply for a loan from messenger anywhere with a minimum mobile Internet coverage. No registrations needed, no special mobile applications download. Based on the open data received, the system generates a credit report, which, through our CRM system, goes to partner banks to make a decision on issuing a loan. The development of the platform was carried out in 2019. We entered the market at the beginning of 2020. During the year, through the platform, farmers received loans of about $ 7 million.				
Technology applied:				
Robotics (agrobots, driverless tractors); Software solutions (programs and packages); Software				

1.10 FOODTECH DATA NAVIGATOR BY FORWARD FOODING, UNITED KINGDOM

FORWARD FOODING	**FoodTech Data Navigator by Forward Fooding**			
Applicant:	**Forward Fooding** Alessio D'Antino, Founder & CEO			
Country:	United Kingdom	Implementation in Belgium, Italy, Spain, United Kingdom		
Website:	https://forwardfooding.com			
App:	https://forwardfooding.com/food-tech-data			
	Delivery model:	Regular service; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

Forward Fooding is the world's first collaborative platform for the food & beverage industry fostering innovation via FoodTech Data Intelligence and corporate-start-up collaboration. Headquartered in London with satellite offices in Barcelona and Rome, we run a global network of AgriFoodTech entrepreneurs powered by entrepreneurs since 2015. We act as an ecosystem enabler to provide the necessary support and velocity to enable meaningful collaborations and partnerships between established food organisations and start-up and scale-up companies.

In 2018 we built and launched the Food Tech Data Navigator, the world's largest data intelligence platform for the AgriFoodTech ecosystem. The FoodTech Data Navigator is the world's largest data intelligence platform that helps entrepreneurs, professional investors, and established food organisations to discover and track the key AgriFoodTech players of the global ecosystem. This includes start-up and scaleup companies, international accelerators and incubators, as well as investment funds and private investors. Our state-of-the-art data intelligence platform captures and monitors over 10,000+ AgriFoodTech start-up companies, investors, and accelerators globally. By merging multiple sources of data, we provide insight-rich and up-to-date information about most of the international AgriFoodtech players, allowing you to discover the most relevant companies and organizations for your business and build your own customized data intelligence tool.

Our solution enables our clients to discover and track the key AgriFoodTech players of the global ecosystem from any laptop. We customize the user experience according to our clients' needs allowing them to build a custom scorecard to assess each player they're interested to monitor or engage with. In addition, upon request, we can enable global connections among ecosystem players with the push of a button without requiring any traveling to occur.

Technology applied:

Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

1.11 FRESH.LAND - STRAIGHT FROM THE FARM, DENMARK

Fresh.Land Straight from the Farm	**Fresh.Land - Straight from the Farm**			
Applicant:	**Fresh.Land** Mathilde Jakobsen, CEO			
Country:	Denmark	Implementation in Belgium, Denmark, Italy, Portugal, Spain, Sweden		
Website:	https://fresh.land			
	**Delivery model:**	Sales platform/market place	**Stage:**	Proven/ Scale-up stage

Practice description:

Fresh.Land bridges the supply and demand of the food supply chain in one integrated digital solution. It allows consumers to buy directly from farmers, bypassing up to 5 middlemen. The platform is right now operational in Denmark and Sweden, and in November 2020 we served 100.000 users. It operates like a regular webshop, and we deliver products to the whole of Denmark and to 90% of the Swedish population. During 2021 we expect to launch sales in Norway, Germany, Switzerland, Austria, The Netherlands and Belgium. It consists of a software that runs a decentralized supply and creates maximum value for producers and consumers. In the end, the platform will handle all the operations in an integrated manner, at scale.

Currently, the platform has various subsystems and core functionalities implemented. It is in an operational environment, used to manage the just-in-time delivery of fresh produce from our current users. The core functionalities are distributed across the platforms four interdependent components:

1. Farmer portal: the interface in which farmers instance product availability , receive allocated orders, and coordinate the shipments between feeders (smaller farmers, who deliver to larger farmers) and hubs (farmers with capacity to ship).
2. Order management: the backbone of our decentralized supply chain, which aggregates customer orders and allocates them to farmers, organizes the shipments in the most efficient way, and ensures complete traceability of every product.
3. Last mile delivery: the app that breaks bulk shipments into smart delivery routes for outsourced drivers, directs them in their deliveries, and tracks all steps (product reception, packing of vans, GPS delivery coordinates, photo of deliveries).
4. Consumer webshop: the interface for the customers, where they can learn and connect with farmers, discover products, place orders, manage subscriptions, trace origin and location of incoming products, and provide feedback to farmers.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Blockchain (transactions)

1.12 IMPLEMENTATION OF WEB-BASED FAO FOOD PRICE MONITORING AND ANALYSIS (FPMA) TOOL, KYRGYZSTAN

FPMA	**Implementation of Web-based FAO Food Price Monitoring and Analysis (FPMA) Tool**			
Applicant:	**FAO** Elaman Diusheev			
Country:	Kyrgyzstan	Implementation in Kyrgyzstan		
Website:	http://www.fao.org/giews/food-prices/price-tool/en			
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage

Practice description:

The Web-based FAO Food Price Monitoring and Analysis (FPMA) Tool was implemented in the National Statistics Committee of the Kyrgyz Republic. This tool gives access to everybody to the National Statistics Committee's full database of price data for 56 consumer goods in 19 cities throughout the Kyrgyz Republic. It provides easy visualization of time series data as well as basic analysis and reporting features. The FPMA Tool is a major component of the FPMA activity. It provides an advanced technical solution for dissemination and analysis of price information.

The FPMA Tool provides an easy way to access the large amounts of data present in the database. It allows users to quickly browse single price series, create comparisons among countries/markets/commodities, download of charts, data and basic statistics such as averages, standard deviations and percentage changes. The tool is linked to the FPMA database, which includes monthly and weekly retail and/or wholesale prices for several food commodities in selected markets of each country. For each price series, supplementary information is included about the commodity (per capita consumption, self-sufficiency ratio) and the market (geographic location and brief description). Besides supporting GIEWS and other FAO Units' analysis, the FPMA Tool and database has become a valuable Public Good for providing the international community and decision-makers with timely and reliable information. The price data is used by a wide range of international organizations, academia and the media. Major users include the World Bank (WB), the World Food Programme (WFP), the Economic Research Service (ERS) of the United States Department of Agriculture (USDA), the Organization for Economic Co-operation and Development (OECD) and the International Food Policy Research Institute (IFPRI).

The Tool was developed in 2010 as part of FAO's initiatives to address the soaring food prices. More information from http://fpmatool.stat.kg/public/

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance)

1.13 AGRIANALYTICA - INTEGRATED ONE STOP SHOP FOR FARMERS TO ACCESS FINANCE, MARKETS, INPUTS, AND KNOWLEDGE, UKRAINE

	Agrianalytica - Integrated One Stop Shop for farmers to access finance, markets, inputs, and knowledge			
Applicant:	**Agrianalytica LLC** Liudmyla Tymoshenko, Director			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://agrianalytica.com/en			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage
Practice description:				
Agrianalytica is a farmer-centric ecosystem, which also offers functionalities for financial institutions, input suppliers, processors, traders/buyers, and agricultural consultants. The main idea is to provide one integrated place with value added services for relevant stakeholders' groups centered around farmers and their needs. Agrianalytica developed comprehensive but simple and easy to use online products to help the small farmers run a more efficient business and meet lenders' requirements: - Agri: Business Plan provides a full substantiation to attract financial resources: - In Agri: Accounting, all accounting entries and reports are generated automatically, including tax forms and financial statements; - Agri: Farm Management tool, enabling farmer to organize effectively production processes, control the use of resources, and provide farmers with the necessary analytics to make informed managerial decisions; - Agri: Credit Analysis allows to generate profitable agribusiness loan portfolio, significantly reducing transaction costs, risks in a very efficient way; - In Agri: Financing module farmers can see various state support programs and financial products from financial institutions, input suppliers, buyers, choose better options and submit online applications; - Using Agri: Trading module farmers can find colleagues nearby (situational cooperation) in order to form a tradable volume for the market with Agri: Shopping farmers have access to online inputs store in their Agrarian Cabinet, where input suppliers offer their inputs. - Agri: Consultant is a digital and cost effective agriculture extension service. Agri-consultant services cover all the above mentioned topics and functionalities for farmers. Agrianalytica platform has been commercially servicing farmers, financial institutions, input suppliers, traders/processors/buyers, agri-advisors for the last 2 years. Currently 11,317 farmers are registered in the Agrianalytica platform, they cultivate 2,082 million hectares of land.			
Technology applied:				
Smartphones (features, apps); Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)				

1.14 LOCAL FOOD NODES, SWEDEN

LOCAL FOOD NODES	**Local Food Nodes**			
Applicant:	**Local Food Nodes Röstånga ek Förening.** Albin Ponnert, Founder			
Country:	Sweden	Implementation in Belgium, Finland, Germany, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, USA, Japan, South Africa, Australia.		
Website:	https://localfoodnodes.org/en			
	**Delivery model:**	Fully free to use; Open source, community approach; Donations free of choice	**Stage:**	Market adoption/ Validation stage

Practice description:

We want to direct our food production to more sustainable methods, beyond environmental degradation, bee extinction, soil erosion, depletion, and dictating intermediaries. We want to strengthen local food networks, increase local resilience, and create direct relationships between producers and consumers. We are creating local food nodes in order to connect local food producers to local food consumers as well as strengthening those relationships that already exist. We want to enable direct transactions, resilient communities and regain control over what we eat and how it is produced. A desire to make food local again.

The result of this desire is an open digital tool where food producers present their food, local consumers order what they like and payments go straight from consumer to producer. Deliveries and pick up of food takes place at a predetermined place and time, this is called a node, this is the physical location where the consumers and producers meet. This type of organization enables producers to deliver to multiple consumers at the same time while consumers can pick up food from many different producers. We create an independent, donation based, fully financial transparent and not for sale, digital open source solution, for peoples driven, pre-orders only, local farmers markets, and a sales tool for small scale farmers to build real life first hand relations with their customers , without revenue loss.

The first version of the mobile app was launched in summer 2018. Version 2.0 of the platform was released in March 2020. We are practicing a free of choice donation financial model, to come with a 100% transparency of our finances, both in and out. We have as of today a bit fewer than 3.000 donors, averaging 13€ each. There are today + 200 drop of locations globally (not sure all are in use) and +750 local food producers connected to the platform. We average 20 new users daily and has had so, well, since launch.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Digital communication (telephone, messenger, email)

1.15 MOBILE APPLICATION "NMA AGRO", LITHUANIA

NMA NACIONALINĖ MOKĖJIMO AGENTŪRA	**Mobile application "NMA agro"**			
Applicant:	**National Paying Agency under the Ministry of Agriculture of the Republic of Lithuania** Aušrius Kučinskas, Head of Direct Support' Control Unit at Control Department			
Country:	Lithuania	Implementation in Lithuania		
Website:	https://www.nma.lt			
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage

Practice description:

In 2018 the Paying Agency of Lithuania launched a free and easy to use mobile application named "NMA Agro", both for IOS and Android. Currently, there are more than 11000 users. It allows to send pictures with precise coordinates and azimuth directly from the area and it can also measure the distance and size. This modern solution helps farmers to report about their performed activities, including cultivation of specific crops, implemented investment projects or the problems related to the fulfilment of commitments not only to NPA, but also to State Veterinary and State Plant Protection services. On the other hand, it helps Paying Agencies and other related institutions to implement the checks from the office and save a lot of time, human, administrative and financial resources, and thus, reduce administrative burden for farmers.

The importance of such mobile application is especially visible during the Covid-19 pandemic, when during and after the quarantine period most of the checks can be done only remotely. The mobile application has access also to all the main LPIS (Land Parcel Identification System) layers, for example, soil erosion, Natura 200 territories. Also, it provides access to constantly updated satellite images of the Copernicus programme 'Sentinel', e.g., vegetation index or crop water stress index, which allow farmers to monitor and assess the condition of the crops grown in their fields and, if necessary, to carry out instantly the necessary farm activities. Moreover, any Lithuanian citizen can freely see all the annually declared parcels and crops in Lithuania and can report about unattended areas with overgrown trees and shrubs, uncultivated land, environmental irregularities, etc. In this way, the transparency of EU subsidies is ensured.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

1.16 ONLINE SELLING PLATFORM, ALBANIA

	On-line selling platform			
Applicant:	**BeNatural shop** Xhevaire Dulja, Idea and Owner			
Country:	Albania	Implementation in Albania, national level		
	Delivery model:	Free and fee	**Stage:**	Early stages/ Ideation stage
Practice description:				
Focus of the platform is mainly food products grown and processed as naturally possible and organic products. Small shops and farmers can be registered here, can sell their products against small commissions to the platform, can develop their profile, can have available statistics of use and operations of their shop, be in contact with consumers or consumers groups etc. The platform is opened to offer possibilities to another groups of products which are artisanal (handcrafts) works of individuals or small producers that process natural materials (wood, wool, organic cosmetic, etc). The practice was started based on an existing physical shop. The challenge continues to include farmers in platform, to train or help them with the good practices of cultivation, storage, packaging and timing with orders, as well as how to gain consumer's confidence. It saves money for the physical shop, offer possibilities of small shops and farmers to be visible at national level, customers can have more information, farmers can increase the added value through a shorter selling channel. The main steps of implementing the platform have been 1. Setting up the physical shop. 2. Experience of selling of my products through other platforms of direct delivery to the consumers (during pandemic). 3. IDEA of creation of my selling platform. 4. Search of service provider for programming (outsourcing). 5. Selection of programming provider studio. 6. Consultation with programmer and translation of idea in elements and services of platform. 7. Selection of platform template. 8. Contact of a marketing studio for market research on communication strategy and channels and the target producers and farmers (outsourcing). 9. Creation of platform logo (outsourcing). 10. Creation of the platform by Programmer. 11. Purchase of domain and host. 12.Test of the platform. 13. Marketing campaign for platform popularization. 14. Linkage with social media. 15. Starting selling through social media with direct delivery. 16. Working for spreading profile of platform in social medias such as Facebook, Instagram.				
Technology applied:				
Internet Selling Platform				

1.17 PARMIGIANO-REGGIANO CHEESE DIRECT SELLING VIA SOCIAL MEDIA, ITALY

SAN PIER DAMIANI PARMIGIANO REGGIANO	**Parmigiano-Reggiano Cheese direct Selling via Social Media**			
Applicant:	**Fondazione CRPA Study e Ricerche** Alberto Menghi, Senior Researcher in Economics			
Country:	Italy	Implementation in Italy		
Website:	https://www.fondazionecrpa.it			
App:	https://www.facebook.com/caseificio.sanpierdamiani			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

The general objective of the platform is the direct selling of Parmigiano-Reggiano cheese based on the social media communications channels (Twitter, Facebook, Instagram). This platform was created by means of an adaptation and combination of the main online web-marketing tools and by adding other elements of marketing, such as the social responsibility of the dairy farm. Beside cheese direct selling an important part of the project was aimed to bring consumers to visit the production system and the integrated supply chain. For these objective specific experiences were created in global platforms such as Airbnb and TripAdvisor. This side activity did create and extra income for the farmers involved in this project. The overall objectives were also the creation of a new corporate identity and a new brand based on preliminary studies and on specific characteristics of the producers (dairy farm and cheese companies).

The creation and management of the social community and social marketing exhibits explicitly the activities of the producers, the traceability of the inputs, the territory and the social responsibility of the dairy farm. The realization of the logistic program and the processes of certification was defined by preliminary studies. The final objective was also to aggregate other producers around the new sales platform, this objective was mainly reached with local honey producers, cured pork producers, wine producers.

In the first year an increasing number of visitors visited the dairy, by the end of the year about 7,000 visitors. Unfortunately due to the COVID-19 pandemic the visits almost stopped in 2020 and from an expected 10,000 visitors only few hundreds came. From the other hand the lockdown was pushing the cheese (and other products) direct selling. The project is still going on and increasing, creating a museum for old tractors, more activities and products to be implemented in the near future.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

1.18 PILOTING MODERN TRADING OPPORTUNITIES IN AGRICULTURE THROUGH CREATION OF INNOVATIVE ONLINE PLATFORM – AGRODEALS, GEORGIA

AGRODEALS	**Piloting Modern Trading Opportunities in Agriculture through Creation of Innovative Online Platform – AgroDeals**			
Applicant:	**Georgian Institute of Public Affairs** Sergo Turmanidze, Project coordinator/Marketing Expert			
Country:	Georgia	Implementation in Bulgaria, Georgia, Romania		
Website:	https://gipa.ge			
App:	https://www.agrodeals.net			
	**Delivery model:**	Regular service, Open innovation plus low-cost commercial services	**Stage:**	Early stages/ Ideation stage

Practice description:

www.agrodeals.net has been created to promote business and entrepreneurship within the Black Sea Basin (BSB) with an objective to increase cross-border trade opportunities and modernisation in the agricultural and connected sectors. agrodeals.net is a web based online platform offering user matching service for the actors operating in the agriculture export-import field that comprises sellers of the agricultural products and value chain service providers. Sellers, buyers and service providers can easily get registered in order to search business partners as well as advertise their products or services. To that purpose the platform offers user registration, online messaging and advertising functionalities, which is operational/visible through the user account and the 'Marketplace' section of the platform. In addition to that, the platform provides a lot of information in the 'Knowledge and Tips' section about agriculture trading related issues such as regulations, standards, laws, publications, events calendar, opportunities, etc. Advantages:

- Advanced, simple and user-friendly web-based platform;
- Modern online agriculture market place for but not limited to BSB countries;
- Advanced space for user matching and information sharing.

Key benefits:

- Free registration;
- Free access to information;
- One space for agriculture trading related information;
- Possibility to trade and find business partners locally and internationally;
- Media channel targeting the agribusiness audience;
- Road mapping information for agribusiness actors: "What to sell, where to sell and how to sell" and "What to buy, where to buy and how to buy".

The platform has been piloted in three countries (Georgia, Bulgaria and Romania), with a financial support of the Joint Operational Programme Black Sea Basin 2014-2020 is co-financed by the European Union through the European Neighbourhood Instrument and by the participating countries: Armenia, Bulgaria, Georgia, Greece, Republic of Moldova, Romania, Turkey and Ukraine.

Technology applied:

Web platforms (forums, communities, e-governance); Digital communication (telephone, messenger, email)

1.19 SOIL HEROES FAIRCHAIN PLATFORM, NETHERLANDS

	Soil Heroes Fairchain Platform			
Applicant:	**Soil Heroes Operations B.V.** Wilkin Kroon, Director			
Country:	Netherlands	Implementation in Austria, Belgium, Germany, Netherlands, United Kingdom		
Website:	https://www.soilheroes.com			
	**Delivery model:**	Free and fee	**Stage:**	Market adoption/ Validation stage
Practice description:				
The Soil Heroes Fairchain Platform is a digital platform connecting farmers and businesses around regenerative agriculture. There is a large potential of farmers interested in a transition towards regenerative farming. Many of the potential farmers lack financial possibilities and/or knowledge to make the transition to regenerative farming. On the other hand, there is a growing number of businesses and organisations that (may) recognize the value of such a transition and want to contribute actively to that in terms of finance, knowledge, networking power, or otherwise. Often these businesses or organisations lack access to farmers, specific regenerative farming knowledge and/or the know-how and tools to connect this transition to their processes, systems and propositions to create value for their business. The Platform is a place where both farmers and businesses can connect, share knowledge, create deals and share results of the regenerative transition with their stakeholders. Main building blocks and technologies of the Platform: - The platform and features of it are available on desktop and mobile (app) - Specific mobile applications are the use of GPS for plot navigation, evidence gathering (camera) and location tagging - Heart of the platform is the community around regenerative agriculture, connecting farmers, business and their stakeholders, to share information and knowledge, find and connect suppliers and buyers of regenerative produce and to make deals/do transactions (via the marketplace for ecosystem services) - For planning, feedback and impact reporting of regenerative practices, the platform makes use of remote sensing (satellites, drones), sensors (weather, soil conditions) - Key purposes of the platform are building and sharing knowledge about regenerative practices, results and impact of that and specific local applications and adjustments; the data that is built up and the learnings from that (Big data, A.I.) are for the benefit of the platform participants (farmers will retain ownership of their data)				
Technology applied:				
Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)				

1.20 STRENGTHENING OF THE NATIONAL FOOD SECURITY INFORMATION SYSTEM IN THE KYRGYZ REPUBLIC THROUGH IMPLEMENTATION OF E-BASED PRICE COLLECTION, KYRGYZSTAN

	Strengthening of the National Food Security Information System in the Kyrgyz Republic through implementation of e-based price collection			
Applicant:	**FAO** Kanykei Ulan kyzy			
Country:	Kyrgyzstan	Implementation in Kyrgyzstan		
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage
Practice description:				
In order to facilitate price data collection (obtained from nine markets throughout the country), the project assisted National Statistics Committee to develop a CAPI (Computer Assisted Personal Interviewing) application, built on an Android-based open-source platform and toolkits. Special software was developed. The project also equipped 21 data collectors with tablets connected to the central server. To improve the reporting of current agricultural statistics, the project contributed to the development of a user-friendly software application running under SQL Server 2007 to facilitate data input into a centralized server located at the National Statistics Committee office in Bishkek. So the main result was shifting of price collection from paper based system to e-based system. The transition from paper-based data collection to the CAPI system helped NSC to reduce the workload of enumerators, improving data quality, data reporting and efficiency. User-friendly software application running under SQL Server 2007 is currently operational with regard to the data entry module and the generation of agricultural statistics reports. This was endorsed by NSC to replace previous software used for data management and processing, which was obsolete.				
Technology applied:				
Smartphones (features, apps); Web platforms (forums, communities, e-governance), Digital communication (telephone, messenger, email), Software solutions (programs and packages)				

1.21 VALUED GRAIN CHAIN, FINLAND

<table>
<tr><td>valued
grain chain</td><td colspan="4">Valued Grain Chain</td></tr>
<tr><td>Applicant:</td><td colspan="4">Natural Resources Institute Finland (Luke)
Liisa Pesonen, Senior scientist/coordinator of the experiment</td></tr>
<tr><td>Country:</td><td>Finland</td><td colspan="3">Implementation in Finland, Sweden</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.luke.fi</td></tr>
<tr><td>App:</td><td colspan="4">https://valuedgrainchain.eu</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Regular service</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">We have developed together with farmers and technology providers a digital grain value chain from field to markets to increase the profitability of cereal production. Identifying the value of the grain yield in in-field scale before the harvest has been difficult and laborious. Also, the logistics from field to markets including harvest, handling and storing for the identified separate grain lots has been difficult in practice. However, if made easier, this could increase the profitability of cereal production farms. So, in this experiment, available digital smart farming solutions are integrated to identify, show and realize the value of different grain lots produced in farms.

The experiment is carried out in close co-operation with farmers and technology providers. The experiment includes 1) precision/smart farming technologies, 2) defining the quality of grain lots and 3) giving them IDs in farms, 4) selling the grain lots with attached product data in electronic grain marketplace. Data integration between the farmers' digital services are realized following networked software architecture, where a data bus type data intermediator service connects diverse farmers' services.

The concept integrates farmers' digital tools to a holistic integrated system. The idea is that the farmer may tailor his/her system, and include those applications or services that are affordable and suitable for his/her farm into it. The only condition is that the service providers agree to exchange data between each other. The data sharing is more cost efficient if data sharing standards are applied but they are not necessary. The aim is that farmers can benefit more of their purchased digital tools and services when they exchange data between each other and play together, even automatically.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Internet service bus technology</td></tr>
</table>

1.22 VIRTUAL TOURS FOR PRODUCERS AND EXPORTERS, REPUBLIC OF MOLDOVA

	Virtual Tours for producers and exporters			
Applicant:	**Fruit Producers and Exporters Association Moldova Fruct** Liliana Beregoi, PR Specialist			
Country:	Republic of Moldova	Implementation in Moldova		
Website:	https://moldovafruct.md/en			
App:	https://moldovafruct.md/en/map			
	Delivery model:	One-time sell; Regular service	**Stage:**	Market adoption/ Validation stage
Practice description:				
After borders closed and flights were grounded due to the COVID-19 pandemic, the Fruit Producers and Exporters Association of Moldova created an alternate way for prospective buyers to 'visit' some of Moldova's producers and exporters. Using 3D panorama imaging technology and videos, buyers that are interested in Moldovan fruit and grapes can 'step into' orchards, vineyards, and post-harvest facilities of Moldova's producers and exporters through virtual tours. The tours capture the entire horticultural infrastructure of each of the ten participating companies, from production to post-harvest handling. Foreign buyers, as well as any interested consumer, can virtually view the super intensive orchards, modern cold storage facilities, as well as available sorting, grading, and packaging equipment, while enjoy breathtaking views of Moldova's countryside. With the support of HVAA and USAID, 11 producers and exporting companies benefited from Moldova Fruct's assistance in developing the 'Meet your exporter' virtual tour program. Also, a general video with the brand 'Moldova taste makes the difference' was developed. The virtual tours have been incorporated on the association's webpage (https://moldovafruct.md/en/map/). Impact: First of all, virtual tours address the existing COVID related restrictions, i.e., impossibility to participate at diverse international exhibitions and trade fairs, limited possibility to travel (organizing and hosting trade missions). Secondly it would allow the producers to cover a much wider range of potential clients and give them the opportunity to familiarize with producers just in few clicks. Thirdly, the virtual tours would allow to optimize the costs of promotion with potentially much bigger impact. It also could easily work in tandem with traditional marketing activities after the pandemic. For 2021 year MFA will help to produce virtual tours for other interested companies, which eventually the association will develop as a service provided to its members.			
Technology applied:				
Digital communication (telephone, messenger, email)				

1.23 VKURSI ZEMLI, UKRAINE

Vkursi Zemli	**Vkursi Zemli**			
Applicant:	**Vkursi Agro** Roman Hrab, CEO			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://vkursi.pro/zemli			
	**Delivery model:**	Free and fee; Regular service	**Stage:**	Market adoption/ Validation stage
Practice description:				
The Vkursi Zemli platform is a service that provides data and analytics about the land of Ukrainian agricultural producers broken down by land plot, owner, and user. We have created the Vkursi Zemli online platform for Ukrainian agricultural producers to be able to perform an automated audit of their land banks, to perform a land data analysis based on their own and open state registers. This is a SaaS solution that uses a direct connection to all the open state register databases of Ukraine. Agro producers set up their accounts with the platform, which is followed by a brief training on how to work with the system. After the training, the user can obtain full and up-to-date information on any land plots available in the state registers, their owners, users, restrictions and encumbrances, generate analytical reports, monitor changes, and verify their counterparties. All that is needed is to select the method of generating land analytics. After an option is selected, Vkursi Zemli receives information from state registers and generates in the system an analytical report. The generated report includes both summary analytical indicators in the form of BI diagrams and the data itself with specific parameters of land plots that can be visualized on an interactive map or downloaded in the following formats: .xls., .json, .geojson, .kml, .shp. An agro producer selects the format he needs, downloads reports, and adds data to his GIS, FMS, accounting systems. Besides, the API function that allows delivering all the information directly into the user's software products was implemented. To regularly monitor changes in the data contained in state registers regarding land plots, individuals, and legal entities, the Events and Monitoring menu was made available to the user enabling him to select the registers to be regularly checked by the Vkursi Zemli robot in order to notify the user of changes if any. The Vkursi Zemli platform was released in May 2020. As of January 1, 2021, there were 2,650 users who registered with the platform.				
Technology applied:				
Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning)				

2. Category 2 – Capacity Development and empowerment

2.1 ABTERRA, ITALY

	Abterra			
Applicant:	Farzane Akbari			
Country:	Italy	Implementation in Italy		
	**Delivery model:**	Fully free to use; Open source, community approach	**Stage:**	Early stages/ Ideation stage
Practice description:				
We are a small team of passionate agricultural students that combine our passion of the digital world and apply it to the sector of sustainable farming. Our idea is to develop a platform where farmers can communicate with technician, specialists and nearby colleagues in order to share updates about their field like the presence of new pests or diseases, as well as the status of the crop and share advices. For example, specialists may have problems traveling to all the field because of the pandemic situation and it would be more useful and rapid for them to examine media files, such as images or videos, and take decisions in a more efficient way. The platform with increased usage by many farmers can create a database of information useful to feed additional data for Decision Support System and Artificial Intelligence learning, that can be more precise and trigger alarms when there is an epidemic or the risk of a pathogen in the area. Features like area updates where organizations, stakeholders and other farmers can share advices and tips about good practices and methodologies applicable for increasing yields, quality and safety of the crops. We were inspired by Smart Villages in Niger because they showed that the availability of information is crucial for everyone and their existence can create value and positive externalities. In order to develop our solution in a community-centric approach, we have decided to favour the utilisation of open-source softwares and technologies so that our utilisation can actively support the growth and maintenance of the code base. In order to build the platform WordPress is the most rational choice along utilisation of plugins and add-on. The personalised platform will be supported by other systems like IVR, SMS and chatbot to favour also communities with low-level technologies and have a wider approach for users that may not have an internet connection readily available. Our medium term objective is to develop a Minimum Viable Product by September 2021.				
Technology applied:				
Smartphones (features, apps); Web platforms (forums, communities, e-governance); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)				

2.2 AGROBI, PORTUGAL

AGRO BI Uma marca registada Consulai	**AgroBI**			
Applicant:	**CONSULAI, Lda** Rui Almeida, Director			
Country:	Portugal	Implementation in Portugal		
Website:	https://consulai.com/en			
	**Delivery model:**	Part of advisory service	**Stage:**	Market adoption/ Validation stage

Practice description:

AGRO BI aims to provide real-time and ubiquitous information that traditionally requires a lot of time and resources to compile and organize, enabling faster analysis and management of KPIs in each activity through custom dashboards. Business Intelligence (BI) allows the collection of data and consequently their transformation into useful information and timely for decision making in areas such as purchasing and sales, operations, human resources and sustainability. Whether on laptop or mobile phone, implementing AGRO BI will enable you to achieve three key goals these days:

1) better knowledge of data and organization;
2) better analysis of useful data;
3) monitoring of important indicators with impact in the organisation.

This service uses data processing programs such as Power BI® and Microsoft Excel®, allowing information to be combined and analysed in a single working environment, by one or several users. These programs enable the AGRO BI® service to transform and relate different sources of data, enabling more efficient and informed decision-making. Among the various features of the AGRO BI® service, the following: evaluation and diagnosis of the farm as a whole, interpretation and integration of the particular processes of each farm or plot, the development of relevant indicators and the monitoring of the organization's evolution, always with the focus on a service tailor made to its real needs. Small farmers are one of the target end users of the AGRO BI solution.

Our service includes not only the management and processing of large amounts of information, but the starting point includes a need assessment in each farm / plot / crop, helping small farmers to better understand their business, and how to overcome barriers, in their day-to-day practice but also digital adoption barriers. Training is also part of the service, and our experience with small farmers has been, until now, quite amazing and revealing. It is importance to notice, that in Portugal 72,8% are small farmers.

Technology applied:

Web platforms (forums, communities, e-governance); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

2.3 AGROMEDIUM, HUNGARY

Agromedium	**Agromedium**			
Applicant:	**Agromedium Kft.** Muntyán Krisztián, managing director			
Country:	Hungary	Implementation in Hungary		
Website:	https://agromedium.com			
App:	https://play.google.com/store/apps/details?id=hu.muntyan.pesticides https://apps.apple.com/us/app/agromedium/id1421632491			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

The Agromedium is a mobile application, a digital information database for the Hungarian farmers and agricultural advisors. The users can use it offline and online too, and they can get up to date information about the agricultural input market. It is primarily aan up to date collection of plant protection products, fertilizers and seeds. It is a mobile application available for Apple, Google and Huawei platforms. It was created about 3 years ago, and now we have 10 000 users in Hungary.

The system was created with a practice-oriented interface. You can browse and make simple and complex comparison between the products, so you can make a good decision which is the best product for you. We had good connection with the multinational companies and we follow the licensing of the products, including emergency approvals. We associate additional information with the active ingredients of the products, such as active ingredient group, Resistance Action Committee codes and the mode of action of the ingredient. The farm management softwares can connect to our database so their plant protection product, fertilizer or seed databases can be up to date too, and no need for human resources for this work. We can make market research for the input product manufacturers, governments, authorities and we can show trends for they, even for the whole of Europe. We can help the flow of information to adopt good practices in other countries.

Our solutions target the big farms and the smallholder farmers too. Each type of farms need to make good decisions about plant protection, nutrient replenishment and sowing. We have many good rating in the App Store and in the Google Play (5 / 4,829 star with 70 ratings). We were promoted for the 'Agricultural Man of the Year' award in 2018 in the 'agricultural innovation category'.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

2.4 BEES DIGITAL FARM 1.0, NETHERLANDS

	Bees Digital Farm 1.0			
Applicant:	**Bees Digital Farm** Sagar Ratilal Bavarva, Founder / Lead Chief Researcher			
Country:	Netherlands	Implementation in Germany, Netherlands		
Website:	https://beesdigitalfarmcom.wordpress.com			
App:	https://beesdigitalfarm2.wixsite.com/website			
	**Delivery model:**	Regular service; Part of advisory service; Open source, community approach	**Stage:**	Early stages/ Ideation stage

Practice description:

At Bees Digital Farm (BDF) we have decided to start with the source of inefficient production and contamination in our food systems: the agricultural production process. The goal? To build-up to tomorrow's food for today's future by linking farmers and tech communities. Our platform will help them share best practices, prototype, and test digital tools, and improve the currently unsustainable production chain. Here at Bees Digital Farm, we enable a trivial solution of farmers, tech-developers, and investors together using a sustainable community-based platform to valorize the technologies and systems all under one roof.

We at Bees Digital Farm always target both ends of the agriculture supply chain: the farmers and the end consumers. Farmers will be empowered through advice based on data analysis on their own farms and will get the tools and knowledge needed to optimize their business in terms of sustainability. So basically our technology is a sustainable platform engagement used for consumers in the plight of sustainable farmers and in return will help them get information on greener alternatives in their supermarkets and nearby local region and within the Dutch farming ecosystem. In nutshell, Bees Digital Farm will make farming sustainable again, for farmers and for all of us! Last year we researched Dutch farming practices and performed iterative analyses on our concept to come up with a first prototype. As Fellows of the FAO, we would plan for closer collaboration and exchange within the Germany and Netherlands networks of farming and tech-developers. In order to take the sustainable actions we envisioned, we would:

1. Connect and brainstorm with leaders in both agricultural and tech-developers groups
2. Conduct co-creation workshops to find simple and inclusive UX and UI design
3. Prototype the digital platform and test the community engagement.

All of these efforts will be communicated in our BDF platform, in a transparent way for our partner ecosystem. We aim to advance the Dutch Chapter by 2021, so we can learn and expand the solution to other countries who need it even more!

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.5 DEFINITION OF CROPS AND CREATION OF A DATABASE FOR THE AUTOMATED SYSTEM FOR PLANNING AND MONITORING OF CROP USING REMOTE SENSING IN THE MINISTRY OF AGRICULTURE, FOOD INDUSTRY AND MELIORATION OF THE KYRGYZ REPUBLIC, KYRGYZSTAN

<table>
<tr><td> 
</td><td colspan="4">Definition of crops and creation of a database for the Automated System for Planning and Monitoring of Crop using Remote Sensing in the Ministry of Agriculture, Food Industry and Melioration of the Kyrgyz Republic</td></tr>
<tr><td>Applicant:</td><td colspan="4">GIS Pro
Talantbek Akmatov, Tech Director</td></tr>
<tr><td>Country:</td><td>Kyrgyzstan</td><td colspan="3">Implementation in Kyrgyzstan (Ministry of Emergency Situations of Kyrgyz Republic, developed by GIS Pro)</td></tr>
<tr><td></td><td>Delivery model:</td><td>Regular service</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Digitalization and automation is one of the main directions in the development of the economy in the country. Digitalization reduces the risks of the emergence of corruption systems in local governments, and also allows the efficient provision of services to the population. An automated system allows the population to receive information in a timely manner and without wasting time. The resources of geospatial information available in the Kyrgyz Republic on agriculture, and in particular data on soils and vegetation cover of pastures, remain on paper and are not fully utilized, which prevents the realization of all the potential benefits of using a wide layer of potential users. The result of the project is an innovative approach to the creation of a database of cultures on the territory of the Kyrgyz Republic, as well as the development of a management system.
- Automated agricultural land management system;
- Digital map of agricultural lands;
- Preliminary analysis of the area and volume of crops of agricultural land;
- Effective use of pasture lands;
- Support for farmers;
- Sales of agricultural crops
- Recommendations for sowing crops in the area; etc.
The republic needs complete automation and thorough mapping of natural conditions taken into account in agriculture. The importance of maps for the population and the economy as important tools in solving problems of rational use of labor resources and the territorial organization of productive forces will rapidly increase. Also, along with thematic maps designed for long-term use, the need for operational short-term maps is increasing. They can be drawn up in the shortest possible time for the current work and visualized in analytical form individual elements of the natural and economic situation and their changes, for example, the dynamics of pasture degradation and soil erosion, the state of crops, ripening of crops, etc. Our solution will be implemented on the territory of the Kyrgyz Republic for the first time. This methodology was used in the Netherlands.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)</td></tr>
</table>

2.6 E-SERVICES USING DRONES FOR QUANTITY BUYER, POLAND

Wielkopolski Ośrodek Doradztwa Rolniczego w Poznaniu	**E-services using drones for quantity buyer**			
Applicant:	**Wielkopolska Agricultural Advisory Centre in Poznan (WODR)** Maciej Zacharczuk, IT Project Manager			
Country:	Poland	Implementation in Poland		
Website:	http://wodr.poznan.pl			
	**Delivery model:**	One-time sell; Regular service; Part of advisory service	**Stage:**	Market adoption/ Validation stage

Practice description:

The Flagship Innovation Experiment within the SmartAgriHubs project has run and implemented e-services advisory system for agriculture with the use of drones. It has consisted 4 services, especially on the market of small and medium-sized farms, which at the moment cannot afford expensive solutions. Important element for the experiment was financial analysis carried out by Digital Innovation Hub - DIH Agro Poland. The solutions and services exist but are limited to a narrow market or are in the experimental phase.

The task of the pilot was to implement, test and prepare e-services for mass use. The reduction of costs was related to the connection of services with public agricultural consultancy, which supports a large number of farms in a given area (grouping of recipients and services). The scope was to analyze, choose and implement minimum 4 of 10 identify possible e-services. The experiment involved 26 farms: large, medium and small ones. In the experiment we have completed 119 tests and validations. Most important challenges were:

- Enable high tech drone services for mass using, especially for small and medium farms;
- Implementation and dissemination of online tools for close cooperation between farmers, advisory and ICT providers;
- Combine drones mapping with complex agriculture advisory;
- Determination of financial challenges, cost-effectiveness of e-services and accessibility for a mass audience;
- Adequate understanding of the needs of the users in the aspect of the availability of services at the level of medium and small farms

The final product is an application in web technologies based on software frameworks and open libraries, including GIS, using network solutions such as rest API. The application is modular, based on microservices technologies. The user interface is divided into 2 separate parts for 2 different users: farmer and agricultural advisor. We plan step by step running 4 e-services in 2021. First step is spring this year to implement first one for biological plant protection in maize. The objective is to popularize this kind of drone service and this kind of plant protection.

Technology applied:

Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

2.7 EASE (USE OF GNSS), SPAIN

	EASE (use of GNSS)			
Applicant:	**ESSP** Sofía Cilla, Service Adoption Manager			
Country:	Spain	Implementation in All Europe		
Website:	https://www.essp-sas.eu			
App:	https://egnos-user-support.essp-sas.eu/new_egnos_ops/resources-tools/ease-tool-page/agri-ease-tool			
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage

Practice description:

In the routine labour farmers have to do when using machinery they have to face the problem that the so called 'pass-to-pass error' poses to them. This error implies that farmers overlap while working, that is, the same area is treated twice, so there is a waste of inputs (fertilisers, chemicals etc), fuel and time. By reducing the overlap, thanks to the guidance GNSS systems provide (EGNOS in particular), less chemicals, fuel and labour time are required, supporting a more sustainable farming.

EASE is a tool that allows users to decide if EGNOS is a technology worthy to be adopted by them for machinery guidance. EGNOS benefits for farming are available in this other free of charge tool: GEAR https://egnos-user-support.essp-sas.eu/new_egnos_ops/resources-tools/egnos-agricultural-demonstrator The EASE (Egnos sAvingS in agriculturE) tool intends to provide farmers with cost-benefit analyses on the introduction of EGNOS for machinery guidance in some of their typical agricultural labours. A comprehensive (but pragmatic) model has been built, in order to try to be simple but also in line with reality. The methodology takes into account the specific circumstances, considering both costs and labour practices, of each farmer.

The tool can perform scalable studies, including as many operation tasks as the farmer considers relevant. In the end, the user can print or export the results obtained. The EASE tool is recommended for those types of crops that do not require very high precision solutions, i.e. extensive crops in dry areas, such as dryland cereals, legumes and sunflowers. EGNOS technology was started to be use in European farming over 6-8 years ago. EASE tool was developed in 2018. EASE tool has been developed by ESSP in the frame of the activities ESSP does under GSA contract for EGNOS service provision. GSA is the European Agency in charge of EGNOS program (within others) management.

Technology applied:

Sensors (weather, GPS tagging, livestock); EGNOS is a European free of charge service that corrects GPS measurements.

2.8 ELECTRONIC AGRICULTURAL MAPS, KYRGYZSTAN

АГРО TJ ИНФОРМ Информация для развития	**Electronic agricultural maps**			
Applicant:	**AgroInformAsia** Evgeny I. Ryazanov, director			
Country:	Kyrgyzstan	Implementation in Kyrgyzstan, Russian Federation, Tajikistan		
Website:	https://agro-asia.com/ru			
App:	https://maps.agroinform.asia/krg/ru			
	**Delivery model:**	Free and paid, Regular maintenance	**Stage:**	Market adoption/ Validation stage

Practice description:

Small-scale farmers, as a rule, do not have long-term contracts for the supply of grown products for processing or export. The choice of crops for growing is based on a survey of neighbouring producers and their success in the past season. This practice leads to overproduction, a sharp drop in retail prices and losses. Choosing a vegetable store for storing products in anticipation of a higher price in winter or spring. Small farmers who do not have their own storage infrastructure can rent storage space based on the information available about functioning storage facilities and the contact information of their owners. Electronic agricultural maps, https://maps.agroinform.asia/krg/ru with information on Kyrgyzstan, Tajikistan and Russia, at the level of a single country with the provision of information at the district level, allow solving problems:

1. Optimization of agricultural production: producers, as well as organizations involved in planning agricultural production, can analyze and determine trends in the production of a particular crop at the level of the district, region, country and decide on the cultivation of this crop in the current year;
2. Optimization of processing and trade of agricultural products in the domestic market and export: identification of regions of the country with the largest production of a certain culture, identification of opportunities and prospects for processing and sale / export;
3. Optimization of transport costs for the delivery of certain agricultural products for processing or export, produced in a certain area of the country;
4. Assessment of food security at the district level for a certain agricultural product. Result = Gross production - (Annual per capita consumption * Number of inhabitants in the district). This layer also allows you to estimate the movement of a certain product within the country;
5. Facilitating the interaction of various actors in the agricultural value chain through access to decision-making information and contact information.

Technology applied:

Computers (Desktops, Laptops & Tablets); Smartphones (Features and Apps)

2.9 FARMFORESIGHT, UKRAINE

FARM FORESIGHT	**FarmForesight**			
Applicant:	**FarmForesight** Alexander Eine, CEO			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://farmforesight.com			
App:	https://app.farmforesight.com/signup			
	**Delivery model:**	Free and fee; accounts are completely free, but there are premium options that improve QOL of gameplay, allow better scenarios customization and provide improved analytics	**Stage:**	Market adoption/ Validation stage

Practice description:

FarmForesight is a gamified business simulation, that allows training of decision-making skills. It shows great results as a staff assessment and training tool, as an aid for HR in choosing proper candidates, as a team-building and event instrument. FarmForesight innovates the training and assessment process by turning it into a game-like experience, allows competitive solutions refining by team members, easily involves staff into the learning process, and allows to decrease hiring costs and adaptation period.

FarmForesight is a web-application built on Java and React.js which allows to model multiplayer sessions of virtual plant production company that can be tuned to be similar to real company (region, company size, specific weather and prices condition). Core analytic algorithms in modeling are based on BigData and tuned by experts to give as realistic forecasting as it is possible in virtual modelling. Gamification makes the modeling process fun and involving. The model can be adapted to almost any crop type in any country if there are enough historical data to analyze and build cause-effect links.

FarmForesight is developed in partnership with Latifundistmedia, a Ukrainian media holding, which owns media resources covering different areas of the agriculture market in Ukraine, Belorussia, and Kazakhstan. It was launched in February 2020 and already gained few leading companies as corporate clients. There are ~4k accounts already in modeling, more than 20k sessions played, each session models at least 1 calendar year of plant production. We conducted a cyber sport tournament event between Ukrainian agricultural companies with a $10k prize.

Technology applied:

Cloud (data storage and computing, Big data); Software solutions (programs and packages)

2.10 GENPRO, PORTUGAL

	Genpro			
Applicant:	**Ruralbit Lda** Manuel Silveira			
Country:	Portugal	Implementation in Portugal, Spain		
Website:	https://www.ruralbit.pt			
App:	https://genpro.ruralbit.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Genpro is an online platform developed for recording data related to the management of Stud Books, presently being used in the management of 67 breeds (of cattle, sheep, goat, horses and pigs) representing nearly all of the Stud Books existing in Portugal. Our application allows the recording of all kind of animal data, such as ear tags, ID numbers, genealogies, weights, artificial insemination and medication, and many others. It has, so far, nearly 8.2 million animals registered and more than 2200 users.

Genpro was developed for farmers' unions and associations that manage Stud Books and the development of this platform has kept us in close contact with them, giving us a deep knowledge of the livestock production sector in different regions. Maintaining healthy populations of indigenous breeds is a challenge: these breeds are mainly maintained by small farmers, in isolated areas, often in the mountains; hence, difficulties arise in marketing products and ensuring sustainability. Keeping data recording is crucial for the monitoring of local domestic breeds. It is important to identify the animals, study the breed population (often dispersed in numerous small scale farms) and implement breeding strategies that allow for:

a) keeping the genetic health of the breed, avoiding inbreeding
b) prevention that the use of industrial crossing leads to the extinction of the breed
c) the development of provisioning and marketing strategies of these animals, making the local communities more sustainable.

By using Genpro, the technicians form the farmers' associations can collect the data from all the several farms and obtain a full portrait of the breed they manage. Those data can then be used to design and implement conservation programs, taking the information back to the farmers.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.11 HERDSMAN+, UNITED KINGDOM

<table>
<tr><td>HERDSMAN+</td><td colspan="4">Herdsman+</td></tr>
<tr><td>Applicant:</td><td colspan="4">UNIVERSITY OF STRATHCLYDE
Ivan Andonovic, Professor/Team Lead</td></tr>
<tr><td>Country:</td><td>United Kingdom</td><td colspan="3">Implementation in Serbia, United Kingdom</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.strath.ac.uk</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>One-time sell; Regular service; Part of advisory service</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Dairy farmers are experiencing pressure to increase food production to secure the food supply for a growing global population. Precision Livestock Farming is a means to meeting demand for good quality, sustainable food products not only addressing issues of animal welfare but also deriving benefits in reducing greenhouse gas emissions by optimising production and feed. Herdsman+ is a decision support and services provisioning platform that harnesses digital technologies to support the integration of multiple on-farm data streams, the foundation for the provision of a rich mix of data-driven animal-centric services that bring further benefits to the livestock community. A number of applications that have demonstrable benefit to the farmer owing to Herdsman+:
- Accurate detection of oestrus: accurate heat detection significantly increases the likelihood of pregnancy.
- Improved animal health: a reduction in illness of the dairy herd impacts milk production.
- The Herdsman+ system alerts the farmer real-time to reduced time spent feeding and/or ruminating and prompts an investigation of the level of lameness before the onset of criticality.
- Feeding/rumination alerts are also being used to detect cows suffering with heat stress prompting an action to cool animals down.
- Early detection of mastitis also reduces veterinary fees and avoids loss of milk production.
Herdsman+ increases the operational efficiencies on dairy farms through for example, shortening of the calving cycle by better heat (oestrus) prediction and advanced health monitoring with an alert functionality for the onset of damaging health conditions. The platform is amenable to bring value to smallholdings within a co-operative scenario. Although each smallholding manages a relatively modest number of cows, a cluster of similar-sized businesses can harness the same physical data gathering infrastructure and cloud-based storage in so doing reducing the initial cost of acquisition by sharing the costs of the deployment reducing the return-on-investment time.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)</td></tr>
</table>

2.12 INFLUENCE OF GREEN MANURE (GREEN FERTILIZER) ON THE PHYTOSANITARY STATE OF FIELDS DURING THE CULTIVATION OF POTATOES IN THE CONDITIONS OF KYRGYZSTAN, KYRGYZSTAN

	Influence of green manure (green fertilizer) on the phytosanitary state of fields during the cultivation of potatoes in the conditions of Kyrgyzstan			
Applicant:	Карабаев Нурсултан, Аспирант (PhD)			
Country:	Kyrgyzstan	Implementation in Kyrgyzstan		
	**Delivery model:**	Completely free to use	**Stage:**	Early stages/ Ideation stage
Practice description:				
At present, a gross violation of the recommended agricultural technologies for the cultivation of agricultural crops in the farms of the Kyrgyz Republic worsens the phytosanitary condition of the fields, which poses a threat to food security and the ecology of the country's biosphere. So, ignoring and non-observance of crop rotation systems, re-cultivation of row crops create the prerequisites for a decrease in soil fertility and the spread of diseases and pests of agricultural crops and weed fields. The deterioration of the phytosanitary state of fields when the threshold for the spread of pests, diseases and weeds is exceeded has a negative impact on the yield and quality of agricultural plants. This reduces the profitability of agricultural production in the agricultural sector. The use of green manure crops on irrigated arable land in Kyrgyzstan has not yet become widespread. One of the main reasons for this is the poor knowledge of the elements of cultivation technology and the selection of green manure crops for each soil and climatic region of the country. For this, it is necessary to develop methods for determining the phytosanitary state of fields and provide a scientific justification for the use of green manure crops as fertilizer and a means to limit the spread of harmful organisms in the cultivation of agricultural plants. Based on the research results, recommendations for farmers will be given on how to use green manure when growing potatoes in Kyrgyzstan. They are environmentally friendly, cost-effective, based on the use of solar energy resources for the production of organic fertilizers. Catch crops introduced after harvesting early-harvested grain crops and plowing their fields in autumn as green fertilizer, which improve the phytosanitary state of fields and soil fertility, are investigated. This increases the yield of potatoes and improves the quality of the tuber.			
Technology applied:				
Computers (desktops, laptops & tablets); Remote sensing (satellites, airplanes, drones); Broadcasting (TV, radio, online, cellular); Communication (Phone, messenger, email);				

2.13 IRMA_SYS, A PARTICIPATORY DECISION SUPPORT SYSTEM FOR IRRIGATION MANAGEMENT, GREECE

	IRMA_SYS, a participatory Decision Support System for irrigation management			
Applicant:	**IRMA_SYS** Ioannis L. Tsirogiannis			
Country:	Greece	Implementation in Greece		
Website:	https://irmasys.eu			
App:	https://irmasys.eu/accounts/edit_profile/demo			
	**Delivery model:**	Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

IRMA_SYS, a participatory web-based open-source Decision Support System (DSS) for efficient irrigation management, provides its services since 2015. It uses agrometeorological data and information regarding soil and crop parameters, irrigation system efficiency and actual irrigation events to a) model irrigation water balance for each field on daily basis, b) keep relevant records and c) provide recommendations for future irrigation events.

The DSS is based on the methodology proposed by FAO's guidelines. It can operate without the need for sensors in each field, as it uses data from public services or other providers that cover the area under consideration as well as field parameters and information regarding irrigation events which are inserted by the farmers and/or their consultants. For the setup of fields, the DSS provides suggestions regarding generic crop water usage coefficients, root depths, irrigation system efficiency as well as maps for the basic soil moisture levels like saturation, field capacity and wilting point etc.

User support is provided via multiple ways that include user manuals, operation of a Helpdesk (via telephone, email, forum), organisation of training sessions and a yearly event called WATERinMARCH! in the framework of UN's World Water Day. IRMA_SYS is targeted to farmers, their consultants, Land Reclamation Organizations, Water Managing Authorities of Participatory Irrigation Systems, public authorities that are involved in water policies and irrigation training providers. The available evaluation data and the experience that has been gained up to now, showed that the use of IRMA_SYS improves water use efficiency and builds consciousness regarding irrigation water usage.

Technology applied:

Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.14 MANURE NUTRIENT EVALUATION ROUTINE (MANNER-NPK) -NUTRIENT MANAGEMENT DECISION SUPPORT TOOL, UNITED KINGDOM

MANNER -NPK	**MANURE NUTRIENT EVALUATION ROUTINE (MANNER-NPK)** **Nutrient management decision support tool**			
Applicant:	**ADAS** Dr Lizzie Sagoo, Principal Soil Scientist			
Country:	United Kingdom			
Website:F	https://www.adas.uk			
App:	http://www.planet4farmers.co.uk/Manner.aspx			
	**Delivery model:**	Fully free to use	**Stage:**	Proven/ Scale-up stage

Practice description:

MANNER-NPK is a software decision support tool for calculating crop available nutrient supply from applications of organic materials (nitrogen, phosphate and potash) to land based on algorithms for each of the main nitrogen pathways. The MANNER-NPK model combines the relevant UK research investigating factors affecting crop available nutrient supply from the application of organic materials. The MANNER-NPK nitrogen model includes algorithms for calculating nitrogen transformation and loss pathways including ammonia volatilization, denitrification, nitrate leaching and mineralization. An extensive national research programme has improved our understanding of nitrogen transformation and loss processes following the land application of organic materials.

The MANNER-NPK tool has been successful because it translates the complex science of nitrogen transformations and losses following applications of organic materials into an accessible format that enables farmers to calculate crop available nutrient supply. Importantly, MANNER-NPK was designed to be easy to use and to require only a few simple inputs which should be readily available to all farmers (e.g. location, soil type, crop type, application date, application method, application rate and organic material incorporation details). The impact and success of MANNER-NPK has been increased by its availability within a number of other guidance and software tools. This widespread availability of the MANNER-NPK calculations has been critical in establishing the tool as the recognized 'industry standard' method for calculating the nutrient supply from organic materials in the UK.

We think that the majority of farmers and farm advisors with a basic level of computer literacy should be able to use MANNER without any training or additional support. The MANNER-NPK software tool is free to users and there is a large existing user base (c. 5,000 registered users of the standalone tool, plus an additional c.22,000 registered users of the PLANET nutrient management tool which incorporates the MANNER-NPK calculations).

Technology applied:

Software

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2.15 ON-LINE DSS FOR OPTIMIZING FERTILIZERS - PULS FOR FERTILIZERS, POLAND

POZNAŃ UNIVERSITY OF LIFE SCIENCES	**On-line DSS for optimizing fertilizers - PULS for fertilizers**			
Applicant:	**Poznań University Of Life Sciences** Tomasz Wojciechowski, Dr eng. / Coordinator of Flaghip Innovation Exmerimentr in SmartAngriHubs project			
Country:	Poland	Implementation in Netherlands, Poland, European Union		
Website:	https://www.puls.edu.pl			
	**Delivery model:**	Free and fee; Part of advisory service	**Stage:**	Early stages/ Ideation stage

Practice description:

The subject of the submission is the cloud-based Decision Support System (DSS) for the National Agricultural Advisory System on the functionality of use by science and industry. It includes tailored advisory services, models and algorithms used by these services, as well as dictionaries used for semantic representation and annotation of source data sets. Two services for farmers and agricultural advisors are designed, as the first one, within the advisory platform. Both services focused on the soil protection.

The first one provides the possibility to determine an optimised method of soil sampling for the implementation of soil-protective precision farming techniques. The second service offers the possibility of implementing second precision farming technology, i.e. optimized nitrogen management on the farm by providing digital fertilization maps for variable rate technology (VRT). The digital services proposed within the DSS are implemented with the support of the Wielkopolska Agricultural Advisory Centre and its infrastructure. The cloud platform and services provided will be a component of integrated digital agricultural advisory systems. The implemented practice will make it possible to overcome more effectively the challenges facing modern agriculture in the face of climate and social change.

Our solution will directly contribute to optimizing the use of farms inputs, especially mineral nitrogen fertilisers. This leads to protection of the soil, water and air environment, and is in line with national, European (Green Deel) and global sustainable development strategies (Agenda 2030). The developed digital technologies are one of the effective tools for implementing these objectives. We believe that in order not to overlook in the digital revolution small and medium-sized farms, which, in Poland's conditions, are to a large extent family farms, it is necessary to disseminate digital technologies in practice with the help of agricultural advisors from the public sector and to make extensive use of data.

Technology applied:

Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

2.16 ORGANIC FARM KNOWLEDGE – ONLINE PLATFORM TO PROMOTE KNOWLEDGE EXCHANGE AMONG ORGANIC FARMERS AND ADVISORS, BELGIUM

IFOAM ORGANICS EUROPE	**Organic Farm Knowledge – online platform to promote knowledge exchange among organic farmers and advisors**			
Applicant:	**IFOAM Organics Europe** Maria Gernert, TP Organics Coordinator			
Country:	Belgium	Implementation in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Netherlands, Poland, Serbia, Spain, Sweden, Switzerland, United Kingdom, Canada, Colombia, Lebanon, New Zealand, Pakistan, United States		
Website:	https://www.organicseurope.bio			
App:	https://organic-farmknowledge.org			
	**Delivery model:**	Free and fee	**Stage:**	Early stages/ Ideation stage

Practice description:

The online platform Organic Farm Knowledge brings together scientifically validated and accessible agricultural knowledge at the European level, providing access to a wide range of tools and resources for farmers and farm advisors. The platforms' tools include factsheets, guides, online calculation tools and videos that present scientific and practical knowledge designed for and by practitioners, facilitating access and implementation. They cover themes such as arable crops, soil quality and fertility, nutrient management, pest and disease control, weed management, animal husbandry, ration planning, organic seed, and plant breeding. More themes will follow soon, such as fruit production, farm economics, food chain management, biodiversity and more.

The platforms' overall aim is to provide knowledge that is ready for use and helps improve methods applied in organic farming. The platform was designed with the users' experience in mind. Every tool entered into the platform is described by metadata that helps users to find the most relevant tool addressing their needs. This metadata is used to categorise the tools according to the thematic organisation and the platform's core, the 'toolbox'. The toolbox can be searched with arbitrary text or filtered with numerous filters like themes, keywords, languages, and more. The platform is available in 14 languages, making it accessible for practitioners across Europe.

The platforms' materials are written in English, and translations are done using Google and Deepl. Disqus is used to facilitate discussions within themes and specific tools. The Organic Farm Knowledge tools are permanently stored on the Organic Eprints database, the online archive for publications and other material related to organic farming research maintained by the International Centre for Research in Organic Food Systems (ICROFS).

Technology applied:

Web platforms (forums, communities, e-governance); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.17 QUICKTRIALS, SWITZERLAND

QuickTrials	**QuickTrials**			
Applicant:	**RESONANZ Group** Eric Seuret, CEO			
Country:	Switzerland	Implementation in France, Israel, Netherlands, Switzerland, United Kingdom, Indonesia, Myanmar, Vietnam, India, Malawi, Mali, Kenya, Uganda, Brazil, Mexico, USA, Canada, Australia		
Website:	https://www.resonanzgroup.com			
App:	https://www.quicktrials.com			
	**Delivery model:**	Regular service; Software-as-a-Service	**Stage:**	Proven/ Scale-up stage

Practice description:

Our solution QuickTrials, provides a modern, innovative way to perform agricultural field trials using mobile devices (phones and tablets). QuickTrials greatly simplifies the process of collecting and collating data, as well as enabling powerful analysis possibilities. QuickTrials is a Software-as-a-Service platform that comprises of a WebApp (accessible via any web browser) and mobile Apps for Android and iOS. The WebApp is used by trial coordinators, researchers and managers to create, manage and analyse trials. The mobile apps are used by field staff to record measurements in the field. The mobile apps can be used off-line and data will be synchronised with the cloud whenever a network connection (Eg. Mobile data or WiFi) becomes available.

The platform uses Google cloud technologies and a data warehouse concept to facilitate big data analysis. The solution supports the integration of 3rd party analysis tools such as Tableau, Power BI, statistical tools such as R, or other software via Google BigQuery. Measurements taken in the field can be GPS-tagged and overlaid on a satellite map. The solution can provide localised weather data including min/max/mean temperature, rainfall, solar intensity, evapotranspiration, soil moisture and leaf wetness index. QuickTrials provides data validation and the ability to capture photos and GPS coordinates, which results in higher quality data than was traditionally available. Trial results are also easier to compare thanks to the data centralisation and normalisation features provided by QuickTrials. For example, users are able to directly compare yields across different countries or regions without needing to manually convert numbers between units such as acres/hectares, tons/Kg's, etc.

All of these features greatly improve the process of collecting field trial data and analysing the results in a more streamlined and powerful way. QuickTrials can be used by anyone who conducts agricultural field trials. It works with all types of crops and is currently being used in 17 countries.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.18 SMART VILLAGE, TURKEY

	Smart Village			
Applicant:	**TABİT** Tülin AKIN, Founding Manager			
Country:	Turkey	Implementation in Turkey, New Zealand, India, Kenya, Egypt, Tanzania, Ghana.		
Website:	http://en.tabit.com.tr			
App:	http://digitalmodel.akillikoy.com http://www.vodafoneakillikoy.com/			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

Smart Village is an R&D and training center, established in a 300-decare field, developing information and technologies on greenhouses, orchards, beekeeping, and husbandry operation, and developing interfaces to increase the ease-of-use by the small family farmers of the existing technologies. Smart Village Project is a platform with 18 entities' contribution. Some of the solutions are solely developed by TABİT while some of them are co-created. Smart Village Project is a platform with 18 entities' contribution. Some of the solutions are solely developed by TABİT while some of them are co-created. Vodafone Telecommunications is the main sponsor of the Smart Village and provides SMS, IoT and M2M solutions. AI-Backed Irrigation System is developed with partnership of an international irrigation systems company, NETAFIM. Husbandry projects are developed with TE-TA's partnership. Turkish State Meteorological Service, Ministry of Agriculture and Forestry, universities, NGO's and farmers themselves are the stakeholders of the project as well as critical contributors.

The number of people trained in Smart Village on applied technologies in agriculture is 65.310, and the number of visiting farmers is 81.352 since 2016. The visitors aim to understand, visualize, and apply the technologies used in Smart Village. Most of these farmers are from Turkey but not limited to. Most of the international visitors are from Romania, Thailand, Pakistan, Uzbekistan, Kazakhstan, Tajikistan, Italy, and Brazil.

Plans: Implementing the Smart Village project in different countries. With the charming characteristics of the technology, encouraging youth to develop entrepreneurial activities in the agriculture industry. Decreasing the average age of farmers, by using Smart Village training and R&D center as an area of attraction and supporting newer generations' technological and innovative approach for agricultural activities.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.19 STRATEGEEK/ SYSTERRE®, FRANCE

SYSTERRE	**STRATEGEEK / SYSTERRE®**			
Applicant:	**Arvalis - Institut du végétal** Laurène Casal, Project manager - multi-criteria assessment tool			
Country:	France	Implementation in Belgium, France, Germany, Italy, Netherlands, Sweden, Switzerland		
Website:	https://www.arvalisinstitutduvegetal.fr/index.html			
	**Delivery model:**	Training on the tool : fee for 1 day of training + tutoring (validation of a personal case study)	**Stage :**	Proven/ Scale-up stage

Practice description:

The innovative solution developed within STRATEGEEK (a Flagship Innovation Experiment) is a strategic decision support tool (DST) based on the already existing SYSTERRE® multi-criteria evaluation tool, which will be further developed and made available in web format. These components will form the solution for crop farmers maintain a high-level of production in terms of quantity as well as quality while implementing more sustainable and environmentally practices.

SYSTERRE® is accessible on a webserver with secure access. It uses of a PostgreSQL DBMS to allow networking and interoperability with other databases and tools. Several forms are available to describe the farm (farm equipment, plots and their areas, workforce), to record by crop and per year practices and to inform economic data, and technical results (yield, quality for example). SYSTERRE® already calculates a set of 20 standardized indicators that can be detailed into more than 200 secondary indicators. Indicators are calculated from the recorded information and internal databases and made available in the form of dashboards (i.e. without aggregation or ponderation) by plot, by crop and by cropping system(s). The indicators are restituted at different scales: the farm, the crop, the plot of land, or the parcel.

The solution developed makes it possible to establish a precise diagnosis of agricultural practices on a farm. On the basis of this situational analysis, the expert will be able to carry out an assessment of the farm's multi-performance (economic, technical and environmental) and advise the farmer according to his priorities. If the farmer wishes to make a change in practice or make a specific investment, he will immediately be aware of the economic, technical and environmental repercussions. For example, a farmer planning to convert his farm to organic agriculture will know before he even starts the impact this will have in terms of work organisation, economic results and environmental footprint. He will therefore make his decision in a fully informed manner.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

2.20 TELEGRAM BOT "DYIKANDOS", KYRGYZSTAN

<table>
<tr><td> 
</td><td colspan="4">Telegram bot "DyikanDos"</td></tr>
<tr><td>Applicant:</td><td colspan="4">State Enterprise Information Marketing Center "Aiylmaalymat"
Semetey Turusbekov, Director</td></tr>
<tr><td>Country:</td><td>Kyrgyzstan</td><td colspan="3">Implementation in Kyrgyzstan</td></tr>
<tr><td>App:</td><td colspan="4">https://t.me/strong_village_bot</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Fully free use; Free and paid; Regular service</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Our project, in turn, creates a universal and convenient platform for farmers in which everyone can receive useful information for themselves, receive open data from the Ministry of Agriculture and its subordinate organizations, and receive document templates, a roadmap upon receipt of documents. In addition, it will be possible to file a complaint about corruption schemes in the Ministry of Agriculture, etc. We carried out a study, during which one of the biggest problems was the problem of the lack of information among farmers about:
1) New technologies in agriculture;
2) Access to information of departments and agencies of the Ministry of Agriculture;
3) Ineffective bureaucracy in agriculture, etc.
In this project, the telegram bot technology is used, a system that allows you to respond to user requests in an online format and provide users with all the necessary information as quickly and conveniently as possible. The bot is also able to monitor the number of clicks and give users an estimate of the quality of this or that information, which will allow keeping only the most accurate and useful information for farmers in the bot's database.

Our project will allow small farmers to receive advice on growing, give access to telegram channels of agricultural associations, information on subsidies, grants, loans and leasing, and farmers also have access to reference books and books on agriculture.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Computers (Desktops, Laptops & Tablets); Smartphones (Features and Applications); Internet of Things (IoT) (M2M, WiFi, local area networks); Communication (Phone, messenger, email); Software (Apps and packages)</td></tr>
</table>

2.21 TITRIS (THE APPLIED RESEARCH AND RESULTS INFORMATION SYSTEM), LITHUANIA

	TITRIS (The Applied Research and Results Information System)			
Applicant:	**LAAS (Lithuanian Agricultural Advisory Service)** Monika Dmukauskiene, Project administration specialist, TITRIS administrator			
Country:	Lithuania	Implementation in Lithuania		
Website:	https://www.lzukt.lt			
App:	https://titris.lzukt.lt			
	**Delivery model:**	Fully free to use	**Stage:**	Market adoption/ Validation stage

Practice description:

The Applied Innovation Research and Results Information System (TITRIS) collects, publicizes and compiles data on applied innovation research and results that can potentially contribute to more efficient, sustainable and environmentally friendly farming. The object of TITRIS is non-commercial research and innovations created in practice that have and can have a lower or higher significance for sustainable agricultural production.

Innovation is understood as a technological and/or organizational improvement of an agricultural and forestry product, process, technology, production and/or service method that can be tested, demonstrated and adapted to production conditions. The providers of data on applied research and innovation to TITRIS system are scientific institutions, farms, and other specialized producers. Prior to publicizing innovations in TITRIS, all data is carefully evaluated by a competent specialist of the Lithuanian Agricultural Advisory Service. The purpose of this evaluation is clarification, novelty, adaptability and relevance of the publicized information. The system of TITRIS was developed to disseminate good practice. Farmers can adapt the announced innovations in TITRIS on their farms or gain experience access with them. Scientific innovations and farm management models are also announced which can contribute to the successful performance in the farms of farmers as well.

The TITRIS system, with its announced innovations and the success of other farms, provides an example of how to manage your farm more economically and innovatively. For example in the innovation “The automatic steering system for tractors and the management system of automatic sprayer boom section” we can find how the automatic steering system allowed to save duplication of fertilization and spraying costs in fields, and to reduce maintenance costs of winter wheat. The investments made it easier for the Farm to comply with environmental requirements, which contributes to sustainable farming, and it helped to facilitate and speed up the work of the tractor driver. This contributes not only to innovative but also to sustainable farming.

Technology applied:

Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email)

2.22 TUTORED ONLINE TRAINING COURSE ON AFRICAN SWINE FEVER PREPAREDNESS, HUNGARY

	Tutored online training course on African swine fever preparedness			
Applicant:	**FAO REU** Daniel BELTRAN ALCRUDO, Technical Advisor (Animal Health)			
Country:	Hungary	Implementation in Albania, Armenia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Georgia, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, and many more		
App:	https://eufmdlearning.works			
	**Delivery model:**	Regular service; Open source, community approach	**Stage:**	Proven/ Scale-up stage

Practice description:

The African swine fever (ASF) is a viral disease of pigs (and wild boar) whit a lethality rate that can reach 100%. The disease first jumped outside of Africa in 2007 into Georgia, and has been gradually spreading ever since westwards into Central Europe and eastwards all the way into China. To ensure optimal preparedness, early detection, and response against an ASF incursion, it is paramount to reach and train the first responders, i.e. the veterinarians. With this in mind, FAO Regional Office for Europe and Central Asia (REU) developed standardized training materials, including presentations, guidelines, and other materials that can be easily translated and adapted to a country's specifics. It was decided to move to an online format, building on its obvious advantages: it is easy and cost-effective to scale up, can reach hundreds of people even in remote locations (as long as an internet connection is available), and allows trainees to learn at their own pace and at the most convenient time. Therefore an online course was developed using a combination of modalities including interactive self-directed online modules, videos, live webinars, quizzes and an online discussion forum. The interactive online modules include case study exercises and real-life examples.

The course is hosted on a Moodle based virtual learning environment. This mix of learning modalities allowed the audiences to study at a time and pace to suit their busy lifestyles. Critically, the live webinars and discussion fora allowed participants and international experts to interact with each other, adding a vital "human element" to the training. This allowed participants from different countries to share their experiences of often similar challenges. Participants from countries already affected by ASF shared their experience with others from countries currently free of the disease. Issues related to backyard farmers (being one of the main challenges for the effective control of ASF) are covered in depth as well.

Technology applied:

Web platforms (forums, communities, e-governance)

3. CATEGORY 3 – AGRICULTURE INNOVATIONS SYSTEMS AND SUSTAINABLE FARMING - FARM AUTOMATION, ROBOTS, DRONES

3.1 AGROTEC, UKRAINE

ROBOTEC LIFESAVING ROBOTICS	**Agrotec**			
Applicant:	**Robotec** Reznichenko Alex, co-founder, CEO			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://robotec.ua			
	**Delivery model:**	Free and fee; One-time sell; Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

Agrotec offers no-till, chemical-free, fully autonomous farming based on artificial intelligence:

- OH-/H2O2 Mist Sanitization - we are experimenting with a developed OH-mist spray system to sterilize crops without the use of chemicals and are planning to be among the first to introduce this technology.
- Weed control - no-till and chemical free farming is a modern, integrated farming system that requires special equipment and technology. Our agrocomplex quickly identifies weeds at an early stage and eradicates them using precision high density microwave treatment. Here we also have great advantages, and after numerous experiments that we are conducting, we plan to get an effective tool for weed control.
- Intelligent Vision System - a combination of multispectral images and can be analyzed using AI algorithms to detect anomalies at an early stage in pathogen development.
- Autonomous movement: our robot senses its environment using GNSS RTK (GPS), stereo camera, IMU and wheel odometry and special algorithms developed at ROS.

We can do all the same as our competitors: autonomous precision movement across the field; work of a fleet of robots; computer vision; recognition of weeds and diseases; precision local impact,; analysis of information in the Cloud; weed control; elimination of diseases, fungi, bacteria but we do it all with no-till and chemical free method.

We conduct series of experiments, research work that will allow: increase the efficiency of microwave exposure; bring microwave technology to a commercial level; select the exact drop size and ozone concentration in the water mist; select the frequency of processing both weeds and crops both by microwave and ozone. We started work on a robot for the agrosphere in early summer 2020 and have not yet brought scientific research to the level at which it is possible to implement the technology in real conditions, but we plan to do so this spring.

Technology applied:

Robotics (agrobots, driverless tractors); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

3.2 ASSEMBLY OF AUTONOMOUS LIGHTWEIGHT AGRICULTURAL ROBOTS, UNITED KINGDOM

	Assembly of autonomous lightweight agricultural robots			
Applicant:	**Acorn bots Ltd** Colin Herbert, CEO Acorn bots Ltd			
Country:	United Kingdom	Implementation in UK (national), then Europe country by country		
Website:	https://www.acornbots.com			
	Delivery model:	n/a	**Stage:**	Proven/ Scale-up stage

Practice description:

Our autonomous lightweight robotic vehicles can carry out most tasks on a farm. They can make very precise application of a treatment that reduces chemical usage in the environment. They also dramatically reduce water usage. Finally, they avoid soil cultivation and minimise CO2 release into the atmosphere, helping to reduce climate change. Our software enables easy classification by AI of weeds, pests and diseases. Other software enables a whole field to learn the best treatment for that field which is revolutionary.

- Lightweight autonomous vehicles made from lightweight materials like Carbon Fibre
- Miniature solenoid nozzles treating square only 9mm x 9mm
- Revolutionary new process for creating AI training datasets - a global first
- Revolutionary method for fi Impact:
- Reduce climate change by reducing soil compaction and so reducing cultivations and so minimising CO2 release from soils
- Minimise impact on the environment from chemicals
- Minimise clean water usage for spraying
- Reducing costs of production of machinery and minimising its impact on the environment and climate change

Acorn bots started on 12th September 2018. The technology is not totally unique, but the AI process and the field learning process are revolutionary and globally new. The vehicles work autonomously, 24/7 and identify problem weeds, pests and diseases. A treatment (according to the problem) is applied to a time area or a specific weed leaf rather than large sprayers applying treatments to whole fields. Big Data is collected which is structured and actionable within these fields in which it is gathered, maximising production within that field. Vehicles are sold through dealerships but operated by farmers themselves due to the simplicity of the vehicles. Main advantages: Electric operation - Quiet operation - Reduced chemical residues in the crop, soil and water - Reduced water usage - Cheaper to produce and ship than heavy machinery - Farmer can control herbicide-resistant weeds (global first) - Big Data helps us learn ultimately how the crop is produced at a plant level.

Technology applied:

Robotics (agrobots, driverless tractors)

3.3 BAKUS, FULL ELECTRIC AND AUTONOMOUS VINEYARDS ROBOT, FRANCE

ViTiBOT	**Bakus, full electric and autonomous vineyards robot**			
Applicant:	**VitiBot** Michael FONTANIN, Chief Marketing Officer			
Country:	France	Implementation in France		
Website:	https://www.vitibot.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

VitiBot is a French industrial company, on the market of autonomous and electric vineyards robots. The company accompanies the winegrowers in the improvement of their vineyards with the latest technological solutions. VitiBot reconciles contemporary environmental and economic issues by offering a driverless solution. Finally, our vineyards robots ensure greater hygiene and safety for workers in the vineyards.

VitiBot has created a universal platform to accommodate a large number of smart and power tools. The company's objective is to place the technological breakthrough called Bakus in the context of sustainable viticulture. Reducing the use of phytosanitary products, preserving the environment and biodiversity, increasing the safety of operators and the shortage of skilled labor are major contemporary issues in viticulture. Bakus, our viticultural robot, is able to meet these challenges in a sustainable way. The possibility to mount electric tools (innovations of our own creation) but also passive tools already owned by the operators allows to suppress the use of herbicides. Autonomous movement in the vineyard allows the operator to supervise the robot using a simple smartphone and to dedicate it to more noble tasks, in complete safety. Finally, the innovative technologies make it possible to plan many other applications in the vineyard (spraying with recuperator panels, new tools) without major transformations of the robot.

Bakus is a 100% electric and autonomous monorang vineyard straddle. It allows to perform most of the soil working tasks in the vineyard, under the supervision of an operator, in order to reduce or even eliminate the use of phytosanitary products. The robot works in total autonomy in the plot. Its 100% electric propulsion allows it to cross vines with difficult slopes (up to 45°) and complicated inclines (>20°). It works very quietly and in respect of its environment. The product has been on the market for more than 18 months and brings great satisfaction to our partner customers.

Technology applied:

Robotics (agrobots, driverless tractors)

3.4 BIOLOGICAL CONTROL OF THE EUROPEAN CORN BORER IN THE AIR, POLAND

	Biological control of the European corn borer in the air			
Applicant:	**Agrofly** Mateusz Machnik, Company owner			
Country:	Poland	Implementation in Poland		
Website:	https://www.agrofly.pl			
	**Delivery model:**	Free and fee; One-time sell	**Stage:**	Proven/ Scale-up stage
Practice description:				
Agrofly combines the knowledge and experience of many specialists in the field of agriculture and information/digital technologies to offer a specific solution to the client. In accordance with the idea of Industry 4.0, we combine the physical, digital and biological world into a product that solves problems that cannot be solved from the ground. Our technology is based on: 1. Hexa-copter and octo-copter drones with an autonomous flight and altitude maintenance module of Polish production 2. Applicator of the Trichogramma preparation with its own GNSS module and a Polish production drop counter 3. Moth exit monitoring network (light traps) - own production 4. Biopreparation with Trichogramma larvae in the form of balls - a product of the Biocare.de company. Both drones have a quick assembly system for the Trichogramma can in the form of balls. Both drones and applicators have their own independent navigation system. The drone's flight path is planned on the computer and uploaded to the drone's operating system. On its basis, the drone moves around the planned points. The applicator is responsible for the precise application of the TRICHOSAFE® beads. The applicator (box) has a capacity of 1,000 balls and is made of ultra-light materials. It has an electronic module on which you can: 1. Establish the frequency of ball drop in two ways: by measuring the distance (meters) and time (seconds) 2. Ask a specific number of balls to be dropped over the field, after reaching the set number, the applicator stops 3. Arm or disarm the can depending on which field the drone is currently on 4. Read the number of balls dropped after the mission (based on laser measurement) 5. Generate a drone flight map that is presented to the customer at the time of billing. We use our own design of lamps with a fluorescent lamp in ultraviolet color to monitor the exit of the blackthorn moth. Every morning, our employees count the caught insects. The technology we currently have is able to apply TRICHOSAFE® on an area of up to 150ha/day.				
Technology applied:				
Remote sensing (satellites, planes, drones); Biologization				

3.5 BIOLOGICAL PROTECTION OF PLANTS BY ENTOMOPHAGES USING UNMANNED AERIAL VEHICLES, RUSSIA

FLYSEEAGRO	**Biological protection of plants by entomophages using unmanned aerial vehicles**			
Applicant:	**LLC "Fly and See Agro"** Ptitsyn Vasily Nikolaevich , general director			
Country:	Russia	Implementation in Russian Federation		
Website:	https://flyseeagro.com; https://flyseeagro.ru			
	**Delivery model:**	One-time sale; Regular maintenance	**Stage:**	Proven/ Scale-up stage
Practice description:				
The proposed technology helps to protect plants from insect pests without the use of insecticides. Pests do not develop resistance, the pesticide load on the land is reduced, land degradation slows down due to the use of pesticides. Two special dispensers and methods of their application have been developed, which make it possible to use entomophages for protecting plants from insect pests in the open field. The dispensers allow the introduction of either entomophage eggs (trichogramma, lacewing) or entomophage pupae (habrobracon hebetor) using drones. The dispenser has the necessary infusion channels for operation in different modes, on different crops and its own GPS-module, which makes it possible to automate the process of introducing entomophages. The performance of one specialized drone of 20 hectares in 14 minutes of flight. The drone maintenance crew is 2 people. Average productivity of the crew per shift is 700 hectares. The use of entomophages to protect plants from insect pests contributes to: - reducing the pesticide load on plants and growing organic crop products - preserving the earth and slowing down the oxidation and aggradation of the soil - contributes to the preservation of bees and other pollinator insects - reduces the use of agricultural machinery, reducing the cost of its depreciation - reduces overconsolidation of the soil due to the use of heavy agricultural machinery. Currently, the company 'Fly and See Agro' is developing in the framework of R&D directions: 1. Development of pheromone traps for monitoring the summer of pests with remote control 2. The use of activated water as a plant growth stimulator using spray drones 3. Application polarized water for the preparation of working solutions of biological preparations 4. Development of a dispenser for UAVs for the use of the predatory posidius bug for pest control on potatoes 5. Development of a budget-class UAV for introducing trichogramma in the open field. Smallholder farmers can use the entomophagous field treatment service to control insect pests. In the future development of the project, it is possible to manufacture own, inexpensive unmanned aerial vehicles for independent use by farmers.				
Technology applied:				
Sensors (Weather, Geolocation, Livestock); Robotics (Agrobots, drone tractors); Software (Apps and packages)				

3.6 CHICKENBOY, SPAIN

<table>
<tr><td>  </td><td colspan="4">ChickenBoy</td></tr>
<tr><td>Applicant:</td><td colspan="4">Faromatics
Heiner Lehr, CEO</td></tr>
<tr><td>Country:</td><td>Spain</td><td colspan="3">Implementation in Germany, Hungary, Spain, Ukraine, United Kingdom</td></tr>
<tr><td>Website:</td><td colspan="4">https://faromatics.com</td></tr>
<tr><td></td><td>Delivery model:</td><td>One-time sell;
Regular service</td><td>Stage:</td><td>Market adoption/
Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The ChickenBoy is the world’s first ceiling-suspended robot that monitors broilers 24 hours a day from the first to the last day of production. The ChickenBoy uses 9 different sensors in combination with artificial intelligence and big data analysis to monitor all kinds of parameters that affect health, welfare and growth of the animals as well as productivity of the farm workers. The robot helps animals to improve their living conditions, farmers to get better economic return, integrators to manage their farm base smarter and consumers to obtain a product they can eat with more ease of mind.

The ChickenBoy uses a selection of sensors in conjunction with artificial intelligence and big data to identify potential challenges in a poultry farm. This helps maintain animal welfare high, while at the same time reducing the footprint of poultry farms. Less mortality and lower feed conversion ratio means less environmental and social impact of poultry production - a key sector especially for countries coming out of poverty.

The company had a first prototype at the end of 2016. The full solution is available since 01/2021.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)</td></tr>
</table>

3.7 CROP SHEPHERD, CROATIA

CROP SHEPHERD	**Crop Shepherd**			
Applicant:	**Plant Shepherd d.o.o.** Leon Andrec, Co-founder			
Country:	Croatia	Implementation in Croatia		
Website:	https://www.cropshepherd.com			
	**Delivery model:**	One-time sell	**Stage:**	Early stages/ Ideation stage
Practice description:				
We are building an autonomous, GPS guided, solar-powered robot that uses AI and a very powerful laser beam to selectively destroy unwanted vegetation on agricultural surfaces. This solution is necessary to achieve sustainable food production in an environment where there is a constant lack of low-skill workers who perform weeding manually. We use a class IV visible beam laser targeted using computer vision and artificial intelligence. This technology is mounted on a highly capable 4x4 robotic platform that we developed in-house. This solution is sustainable because the robot does not use any herbicides or fossil fuels. All our competitors focus on large scale farmers, whereas we intend to make our solution viable even for small farmers who work on surfaces as small as 1 hectare, for example, small and mid-scale organic and conventional farmers of butternut pumpkins, hemp, sweet-potatoes, and leafy greens.				
Technology applied:				
Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Software solutions (programs and packages)				

3.8 DATA COLLECTION ROBOT FOR MONITORING OF GREENHOUSE CROPS, ISRAEL

GrowPonics	**Data Collection Robot for Monitoring of Greenhouse Crops**			
Applicant:	**Growponics Ltd.** Assaf Shemesh, Project Manager			
Country:	Israel	Implementation in Israel		
Website:	http://www.growponics.co.uk			
	Delivery model:	Regular service; Part of advisory service	**Stage:**	Market adoption/ Validation stage
Practice description:				
Growponics Ltd. has developed an inspection and data collection robot for greenhouses and farming applications. The robot is rail mounted, battery powered, and equipped with a powerful camera and other sensors. Remote connection capabilities enable it to monitor the greenhouse from anywhere. The robot analyses the imagery and sensor measurements from strategic points in the greenhouses, and provides vital information to the farmer that optimizes plant growth and yield. Advanced data analysis using artificial intelligence (AI) can yield priceless information on any predicament in the field that requires attention, based on minute changes in growth rate, colour composition, or other parameters. The success of the innovative DCR will be demonstrated by improving the yield. The robot makes use of an electric motor, powered by a chargeable battery, to drive on a rail, and take readings from any point on the rail. A combination of precision mechanics and image analysis endow the robot with the ability to repeatably pinpoint an exact location on the rail and take a series of pictures from the same point of view, enabling the accumulation of valuable data. The analysed images are crossed with sensor readings and other parameters in the database, and enable AI guided conclusion drawing out of the gathered big data. Machine learning is advanced through the contribution of expert agronomists and engineers, in order to train the system to identify core issues in the greenhouses, such as pest and disease identification, growth conditions deviation and equipment failure. The farmer receives a full report of the greenhouse status, troubleshooting instructions and improvement recommendations. The overall impact achieves a thorough optimization of plant growth.				
Technology applied:				
Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)				

3.9 FORFARMING, TURKEY

<table>
<tr><td>  </td><td colspan="4">ForFarming</td></tr>
<tr><td>Applicant:</td><td colspan="4">ForFarming
Levent Atlas, Co founder</td></tr>
<tr><td>Country:</td><td>Turkey</td><td colspan="3">Implementation in Germany, Spain, Turkey, United Kingdom</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.forfarming.co</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>subscription</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">In a world where population is growing rapidly, arable areas are decreasing, and freshwater is getting more and more scarce every year; we have to find better agricultural methods to grow more food in smaller areas by using fewer resources. We develop smart applications of vertical and greenhouse farming to increase its yield, product range, and energy and water efficiency; and create practical, turnkey solutions for both agricultural producers and places of consumption to provide fresh and healthy food to people.

Using our cloud-based IoT solution; Using basic equipment, we can connect remotely to any farm and automatically control all parameters required for controlled environment vertical farming. We also benefit from our agricultural knowledge by providing plant recipes. This allows anyone to start a smart farming business anywhere without developing sophisticated technology, purchasing expensive automation systems, or prior farming experience. With ForFarming, securely record all your activities for every batch, from sourcing seeds to harvest. Make your plants' journey visible. Strengthen your customers' trust in your products by transparently advertising your certificates, facility analysis reports and travels of your facilities to them. No need to buy new expensive automation systems!

ForFarming can be connected to your lights, shade screens, irrigation and fertilization systems, HVAC units and many other devices. You can control more than one area separately. You can integrate in a simple way and make your facility smart. Keep up-to-date on everything happening on your farm, as if you were always there. Always be aware of your farm as if you were always there.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Software solutions (programs and packages); Blockchain (transactions)</td></tr>
</table>

3.10 HELIOCORE LIGHT CONTROL, SWEDEN

heliospectra	**helioCORE Light Control**			
Applicant:	**Heliospectra AB** Sarah Basiri, VP of Marketing			
Country:	Sweden	Implementation in Denmark, Germany, Netherlands, Sweden, Rep.of North Macedonia, United Kingdom		
Website:	https://www.heliospectra.com			
	**Delivery model:**	Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

Heliospectra's helioCORE™ light control system is a software platform with sensor integrations designed to give growers immediate control of their LED grow lights and plant response or performance in greenhouse facilities, indoor vertical farms, research facilities and plant growth chambers. Compatible with the company's adjustable spectrum horticultural LEDs, the helioCORE light controls incorporate a proprietary user interface, software and algorithms, wifi-enabled lights, a closed loop network and control box, and sensors placed in the growing environment.

Growers program light spectra or wavelength, light intensity and duration or schedules across diverse crops and production cycles to build a library of customized lighting strategies to influence plant characteristics, biomass, color or appearance, flavor and taste at each stage of growth. helioCORE offers remote alerts and notifications via any mobile, tablet or computer with real-time data and energy monitoring so businesses can respond to changes in their growing environments in real-time. The biofeedback loop created between the plants, lights and sensors enable automated light response to changes in local weather or seasonal daylight conditions, dynamically adjusting the LED lights to ensure plants receive the precise quality and hours of light they love and need. helioCORE also tracks run times and energy use so that businesses can schedule lights to run at lowest cost utility hours for more resource-efficient operations. Businesses are also able to eliminate plant damage and waste, while using irrigation, nutrients, and growing media more effectively.

helioCORE is developed by Heliospectra's in-house development team in collaboration with their technical cultivation experts and commercial food growers to ensure customers can make data-driven decisions to grow their business and that growing environment are truly connected and intelligent. All Heliospectra solutions are manufactured and assembled in Sweden with rigorous quality assurance, testing and certifications.

Technology applied:

Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

3.11 HIGH-PRECISION WEED CONTROL IN ORGANIC FARMING - BONIROB, GERMANY

FH Westküste Wirtschaft und Technik	**High-Precision Weed Control in Organic Farming - Bonirob**			
Applicant:	**West Coast University of Applied Science** Prof. Dr.-Ing. Stephan Hußmann, Project Manager			
Country:	Germany	Implementation in Germany		
Website:	https://en.fh-westkueste.de/en/home			
	**Delivery model:**	One-time sell	**Stage:**	Market adoption/ Validation stage

Practice description:

In 2013, the project 'High-precision weed detection in organic farming' was launched at the West Coast University of Applied Sciences. Over the next years the hardware (Robot) and software (AI + Control) for this 1-track functional pattern was developed and implemented. The aim of this project is the further development of an existing prototype (Bonirob) for automatic weed control of organic carrots from 1-lane to 8-lane operation.

The system is based on the three technologies artificial intelligence (AI), robotics and Big Data. A reproduction of the human brain (deep learning) was trained to distinguish crops (e.g. carrots, beetroot, spinach) from weeds. By training the AI with large amounts of data collected over the last 5 years, the system achieves a high accuracy of about 98 % under constantly changing weather and environmental conditions. Our robotic systems then use this AI to destroy the weeds with pinpoint accuracy without any chemicals. We have specialised in products such as carrots or beetroot, in order to achieve millimetre-precise weed removal in the row even with randomly sown plants. Our solution aims at automating the cost-intensive task of manual weed management, making it a viable solution for sustainable weed management used by farmers of all sizes around the world and thus tackling the environmental challenge of providing food for an expanding population.

Our solution is fueled by the recent innovations and rapid developments in the areas of image processing and artificial intelligence. The first key innovation is the development of an advanced weed detection algorithm that differentiates between weeds and crops in real-time enables a robotic system that can manage weed with an adequate area yield performance. The second key innovation is the mechanical weeding mechanism which can perform the weeding with millimeter precision without using any chemicals, thus avoiding any negative impact on the environment. In 2018 the 8-track robot was developed. The spin-off from the university into Naiture GmbH & Co. KG took place in December 2018. In 2020 the 8-track robot was tested and evaluated.

Technology applied:

Robotics (agrobots, driverless tractors); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

3.12 INTELLIGENT WATERING TAKING ADVANTAGE OF THE EXISTING IRRIGATION INSTALLATION, SPAIN

BrioAgro Technologies	**Intelligent watering taking advantage of the existing irrigation installation**			
Applicant:	**BRIOAGRO TECH, S.L.** José Luis Bustos Jiménez, CEO			
Country:	Spain	Implementation in Italy, Portugal, Spain		
Website:	https://brioagro.com			
	**Delivery model:**	Regular service; Pay per use	**Stage:**	Proven/ Scale-up stage

Practice description:

BrioAgro is an intelligent irrigation platform which uses low-cost technology based on information obtained by sensors (field and satellite). The soil moisture calibration algorithm is our most differential innovation: by connecting this data with the irrigation system, we can automatically irrigate when the crop needs it, by calculating very precisely the amount of water. This allows the prevention of excessive use of water. We also provide alerts to the farmers of conditions that may threaten crops, to take proper action in real time via mobile app. In this sense, we allow anticipate reaction of the decision–making over irrigation and fertilization.

This ICT-based solution collects and integrates soil and environmental data (humidity, conductivity, temperature, etc.) in real-time through sensors and other sources. BrioAgro analyses intelligently the aggregated data, stratifying through a standardized process the recommendations according to each crop and soil type, allowing anticipate reaction of the decision–making over irrigation and fertilization. As result, BrioAgro avoids production losses risks, increasing exploitations performance (20% or more) as well as quality. Remarkably reducing the percolation of fertilizers and plant protection products that go to underground aquifers. (In tests in 2019 in olive groves in Spain and Portugal they were reduced by about 70%.)

Beyond prevention, BrioAgro delivers also smart irrigation and fertigation, triggering watering when needed, at the right time and using the right amount of water, as a way to increase farmers' profitability. It also uses all the information it collects to create predictive models of harvest by crop in each region. This solution has been tested with many farmers from different regions of Spain, attending requirements of small and large agricultural enterprises, adapted to all types of irrigated crops.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

3.13 IRRIOT - WIRELESS PRECISION IRRIGATION AUTOMATION PLATFORM, SWEDEN

IRRIOT AB	**IRRIOT - wireless precision irrigation automation platform**			
Applicant:	**IRRIOT** Johan Wendt, Co-founder and CMO at IRRIOT			
Country:	Sweden	Implementation in We currently have installations in: Sweden, Germany, Denmark, Norway, UK, Israel, Russia, St: Kitts and New Caledonia. We have approximately 40 installations that are mostly farms(horticulture).		
Website:	https://www.irriot.com			
	Delivery model:	Regular service	**Stage:**	Proven/ Scale-up stage
Practice description:				
70% of the world fresh water consumption is done by the agricultural sector. This is where the greatest water wastage happens and the largest savings can be done. Manual irrigation is still extremely common and is a huge factor to the water waste. By automating the irrigation with IRRIOT we reduce the human factor in irrigation and irrigate based on data. IRRIOT offers a completely wireless solution that fully automates irrigation. The brain in our system is our base station (controller) which communicates using LoRa (long range radio) with remote stations. The system can communicate up to 5 km distance. The remote stations have two tasks: the first is to execute the irrigation commands send by the base station, the second task is to gather sensor data (soil moist, air/soil temp, pH, salinity, flow meters etc) and send that sensor data back to the base. The logic is stored locally in order to have redundancy against internet being down but once the base is connected to wifi everything can be set up, monitored or edited through our cloud software platform. Physical obstacles that are common at farm sites (e.g. roads, rivers, trees) often make the wire based systems impossible to install. IRRIOT, installed and ready, cost about one third of the wire based systems. On top of this we use many more sensors ending up in a much higher precision. The farmers save up to 50% of water, increases crop yield with 30% and saves hundreds of work hours. For the longer term we expect these numbers to increase with new and more advanced features being applied to our system.				
Technology applied:				
Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning);				

3.14 KRAY PROTECTION, UKRAINE

KRAY Technologies	**Kray Protection**			
Applicant:	**Kray** Dmytro Surdu, CEO, Founder			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://kray.technology			
	**Delivery model:**	Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

We propose the new robotic crop spraying technology which will replace existing ground sprayers and agriculture airplanes due to 10 times reduction of the application cost to $2/Ha. It is a fully autonomous drone system with industrial productivity (up to 500 hectares/day) and application safety. Sense: The technology is offered to farmers in the form of readily available spraying service with 10 times lower cost than current services' one. It enables farmers' frequent applications of crop protection and fertilizers, increasing effectiveness of their usage and resulting yields. As a final consequence, land conservation and climate change mitigation with no-till technology becomes economically attractive for farmers which powers the shift toward more green agriculture.

Kray Protection UAV is a precisely controlled (less than 10 cm errors) high speed (30 m/s) VTOL compound multirotor drone. It has a 4-meter wingspan and carries up to 80% of its weight by the fixed-wing lift force. A centimeter control precision achieved in all flight speed modes and allows high-dynamic maneuvers, so Kray is perfectly suited for both zoom-turn field processing and field borders in-place turns. 30 m/s combined with a 5-meter application strip gives about 60 Ha/hour (or 600 Ha/day) operational productivity. Moreover, the high speed allows fast back and forth flights to the operational point, drastically reducing maintenance time. Combined inter-flight time is just 3 minutes, so real daily productivity is ranging from 270 to 470 Ha per day depending on the application rate. Note that this productivity is achieved in combination with high precision as spraying cone expansion is just 20%. The controlled level of expansion is achieved due to the application with electrostatically charged droplets at the altitude of 1 meter over the crop.

Technology applied:

Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning)

3.15 MECHANICAL WEEDING ROBOT, NETHERLANDS

	Mechanical Weeding Robot			
Applicant:	**Odd.Bot** Martijn Lukaart, Founder & CEO			
Country:	Netherlands	Implementation in Belgium, Netherlands		
Website:	https://www.odd.bot			
	**Delivery model:**	Regular service; Open source, community approach; Weeding-as-a-Service	**Stage:**	Market adoption/ Validation stage

Practice description:

Odd.Bot has successfully developed a mechanical in-row weeding robot for the high density sowing crops: carrots, onions and chicory. The robot is using A.I. / Machine Learning to detect and distinguish weeds from crops and remove the weeds mechanically. The current conventional chemicals farming method is to use full field sprayers to spray their fields with herbicides. One of the biggest challenges agricultural farmers face is the competition from weeds. Weeds continuously compete with their crops for nutrients, light and space. That is why weeds can cause up to 40% reduction in yield, if not handled properly.

The 'Weed Whacker'-robot from Odd.Bot supports organic farmers with their hand-weeding tasks first. For this strenuous work it becomes harder and harder to find staff, and if found it is a challenge to motivate them and its becoming more and more costly. The challenge all farmers face is that they have to switch to more sustainable agriculture using lighter machines to battle soil compaction. Conventional chemical farmers face the reduction in chemicals allowed, potentially leading to higher costs and/or a reduction in yield. Our mission is to enable all farmers to switch more sustainable agricultural methods with less manual labour and without chemicals.

The 'Weed Whacker'-robot its detection algorithm is being trained by a convolutional neural network feeded with thousands of photos that are being labelled with tags of weeds and the crops initially. This algorithm is being used to detect and distinguish weeds from crops. Early Odd.Bot will show the 'crop sentinel', a 5G powered inspection/detection robot that can be put on the field to either remotely verify the performance of the detection algorithm or collect more training data if needed. This robot is being used to be send ahead so that if the detection is at the right level, we can send in the 'Weed Whacker'.

Technology applied:

Robotics (agrobots, driverless tractors); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Edge computing

3.16 MOVING FLOOR CONCEPT, SWEDEN

MOVING FLOOR CONCEPT	**Moving Floor Concept**			
Applicant:	**Moving Floor Gotland AB** Peg Söderberg, CEO			
Country:	Sweden	Implementation in Austria, Finland, Germany, Netherlands, Norway, Sweden, Russian Federation, China, Canada, Japan		
Website:	https://movingfloor.se			
	**Delivery model:**	One-time sell	**Stage:**	Proven/ Scale-up stage

Practice description:

Moving Floor Gotland AB (MF) is a Swedish technology company with a mission to fundamentally improve global animal protein production by increasing yield and reducing emissions and antibiotic use. MF aims to disrupt the animal husbandry industry by bringing a completely automatic and digital cleaning solution for farm buildings allowing for a more sustainable and circular system. MF has developed a patented technology, the Moving Floor Concept, to give farm animals “a toilet” substantially improving the living conditions for the animals and, for pigs, resulting in estimated 19% less carbon footprint. MF leapfrogs the current competition by introducing an affordable high-tech solution in a low-tech industry.

The Moving Floor Concept is a patented green-tech system that provides automatic floor-cleaning and bedding for livestock such as e.g. pigs and calves. The MF Pig Module is a product where the flooring consists of an endless belt that slowly moves forward in programmed intervals. When the belt moves, bedding material is distributed on one side and the manure is cleaned away on opposite side. A cleaning cycle takes 5 minutes, and about 15-20 cleaning cycles are carried out every 24 hours. Thus, most of the time the belt is not moving. In addition, there is a safety feature to make sure the pigs are safe during cleaning cycles. Tests show that the animals are not affected by the movement. MF Pig Modules are prefabricated units on legs easily installed on flat flooring. They can be combined with commercially available automatic scraper systems and feces storage/treatment solutions such as e.g. biogas or compost – all provided by other suppliers. The modules are placed side by side and scalable to any farm size. Each module is assembled with standard components on an assembly line and brought to the market as a volume product. The digital potential MF presents a unique opportunity to digitalize in-door farm operations. In our current TRL 7 level the user controls and optimizes operations digitally, resulting in up to 85% decreased ammonia levels in the barn.

Technology applied:

Robotics (agrobots, driverless tractors)

3.17 NEWMAN (NON-CHEMICAL WEEDING MACHINE), CZECH REPUBLIC

	**NEWMAN (Non-chEmical Weeding MAchiNe)**			
Applicant:	**ULLMANNA** Martin Ullmann, CEO			
Country:	Czech Republic	Implementation in Austria, Czech Republic, Poland, Slovakia		
Website:	https://ullmanna.eu			
	Delivery model:	One-time sell; Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

The proprietary technology NEWMAN (Non-chEmical Weeding MAchiNe) helps organic farmers replace manual labor with an intuitive robotic system and also supports conventional farmers in positioning themselves against future regulatory restrictions with a more sustainable deep tech approach. The system is capable of intra-row weeding even at the earliest stages of crop growth. Weed control has undoubtedly been the number one enemy of modern food production. As a result, sustainable agriculture faces two major challenges: decreasing the use of pesticides and scaling organic production. While conventional farming in Europe relies on 380 000 tons of pesticides to grow crops every year, organic farming is heavily restricted by the cost of manual weeding. The initiatives such as the EU's Green Deal enhances the level of urgency to quickly adopt advanced and more sustainable approaches.

The NEWMAN machine is mounted behind the tractor and contains multiple cultivation parts for each crop row (usually 6 rows setup). Every cultivation part has a high speed camera which can operate in day and night conditions and provide the visual input to the embedded HW, where AI accelerator is used for the very fast inference – object detection. There are 2 knives which are weeding in the row and when the right crop is detected thanks to the AI model, the software layer triggers the release of the knives via pneumatic valves and the crop is not harmed. This has to be done very fast, usually 3-4 cycles in one second. The software can recognise the selected crop based on the neural network model, which was designed and massively trained to get correct results. This method is called machine learning. It requires to build and maintain a large dataset of selected crops. Learning requires massive computation resources which increase the costs. The benefit is that one trained model can be deployed easily on all of the available machines at very low costs. Over the time the model is continuously improved and generalised to constantly boost the operation conditions range.

Technology applied:

Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning)

3.18 PER PLANT FARMING, UNITED KINGDOM

Small Robot Company	**Per Plant Farming**			
Applicant:	**Small Robot Company** James Burrows, Marketing Executive			
Country:	United Kingdom	Implementation in United Kingdom		
Website:	https://www.smallrobotcompany.com			
	**Delivery model:**	Innovative 'Farming-as-a-Service business model breaks down adoption barriers and eases delivery.	**Stage:**	Market adoption/ Validation stage

Practice description:

Small Robot Company is reimagining farming to make food production sustainable. Using robotics and artificial intelligence, we have created an entirely new model for ecologically harmonious, efficient and profitable farming. We call this Per Plant farming. Our autonomous farmbots Tom, Dick and Harry will farm each plant individually, with minimal waste. We are currently focused on arable crops, developing non-chemical weeding to eliminate herbicides. We're taking farming from analogue to digital, driving a fourth agricultural revolution, starting from scratch with today's technology (robotics and Artificial Intelligence) to replace yesterday's (tractors). Our new model gives Per Plant precision, meaning each plant can be farmed individually, with minimal waste. The benefits include cutting chemicals and emissions by up to 95%, delivery of Net Zero targets, improving biodiversity exponentially, and increasing yields by up to 20 tonnes per hectare for wheat, from the current UK average of 8.5.

The farming industry needs to increase its productivity, profitability and resilience in the future, which will be crucial for businesses to thrive in an increasingly volatile world. These concerns are felt urgently by the farmers we have consulted as we develop our service. The overwhelming feedback is that farming is not working. Yields are stagnating, machinery costs are rising, and profit suffering. It is estimated that as many as 85% of UK farms would not be viable today without subsidies. We believe that Per Plant farming will be the dominant agricultural system by 2040. We are now on the cusp of a fourth agricultural revolution. Food production and environmental care is at the heart of that: but to achieve this, farming needs urgent change. Precision, rather than speed, will define the fourth agricultural revolution. Our technology could bring radical and exponential changes to food production. It will enable permaculture at scale - completely changing what's possible on the farm.

Technology applied:

Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

3.19 ROBOTIC TECHNOLOGY FOR THE DETECTION AND DESTRUCTION OF RODENTS IN CROP PRODUCTION, RUSSIA

ФЛОРА СЕРВИС	**Robotic technology for the detection and destruction of rodents in crop production**			
Applicant:	**LLC "Flora-Service +"** Sergey Terekhin , Leader			
Country:	Russia	Implementation in Russian Federation		
Website:	https://agro-fly.com			
	**Delivery model:**	One-time sale; Regular maintenance	**Stage:**	Market adoption/ Validation stage

Practice description:

This technology is designed to combat rodents. Losses from rodents in grain fields are, according to various estimates, up to 30-40% of the winter crop. Today the work is carried out mainly by hand. The robotic complex 'Plant Protection' is intended for automated protection of plants from pests (rodents) by remote detection of burrows (colonies), issuing target indications, building routes and point delivery of drugs (pesticides) to the minks of rodent habitats. The proposed robotic rodent control technology is based on the following principles:

- the use of unmanned aerial systems (UAS) at all stages of work - aerial photography (flight altitude 80-120 m)
- obtaining a basic orthophotomap
- detailed perspective survey (flight altitude 10-25 m)
- obtaining data for decoding burrows ('residential' - 'non-residential' burrows)
- determination of coordinates of mouse colonies and assessment of their habitability, construction of routes
- introduction of chemicals by the method of 'point discharge' with a radius of <1 m into the colonies.

To date, work to combat rodents is carried out in the traditional way - on foot. A chain of 5-20 people walks across the field at a distance of 7-9 m from each other and pours pesticides into the mice. Productivity: 1 person per day can cultivate from 4 hectares to 5 hectares. The use of traditional technology at large agricultural holdings is ineffective due to the high cost, low productivity and the growth of the human factor. As a result of studying the topic, an idea appeared to solve this problem using unmanned technologies. During 2017-2018, our team carried out work on the development and creation of two operating units to accomplish this task - using a UAV and using a self-propelled unit. As a result of the tests carried out, the efficiency of this technology was confirmed. The actuators are triggered with an accuracy of 0.5 m from the point of the planned discharge. The key advantages of this technology for the customer are:

- low cost of the task
- high productivity
- 40 times higher than manual performance of work to combat rodents
- high accuracy of pesticide layout.

Technology applied:

Sensors (Weather, Geolocation, Livestock); Robotics (Agrobots, drone tractors); Software (Apps and packages)

3.21 SAGA ROBOTICS, NORWAY

	**Saga Robotics**			
Applicant:	**Saga Robotics** Tale Hagelsteen, Head of Marketing and Design			
Country:	Norway	Implementation in Norway, the UK and the US.		
Website:	https://sagarobotics.com			
	Delivery model:	Function as a service	**Stage:**	Proven/ Scale-up stage

Practice description:

Saga Robotics develops robotic solutions that address the growing labour shortages in agriculture, and makes farming more sustainable and energy efficient. Saga Robotics is responsible for the design, development, and production of the world-leading agricultural robot, Thorvald. Thorvald is a highly advanced agriculture robot with smart design which adds value to farmers, improves grower economics and has no direct CO2 emissions during operation. Thorvald is a new module-based robot design that allows for vastly different robots to be built using the same basic modules, and rebuilt using only basic hand tools. The modules are designed to enable high quality robots that can quickly be customised for a given application in a given environment, such as a greenhouse, tunnel, open field and orchard.

Thorvald has a highly advanced in-house developed software, autonomy and guiding system. It allows for the platform to be configured without the need for reprogramming every time the shape of the platform is changed. The platform operates entirely on its own. It is robust, modular and lightweight and can be configured for most agricultural environments. It is both environmentally friendly and low cost. The platform is multipurpose and scalable as it can perform multiple tasks at a farm. The system uses a combination of sensors for navigation, including GNSS and Lidar. The robots are equipped with SIM cards for remote control.

The Thorvald robot is small, intelligent and cheap, and changes farming completely. It makes farming cheaper, better and more environmentally friendly. Saga Robotics works to improve the operation of growers, currently focusing on strawberry and wine producers. As Thorvald is modular it can be used in different farming practices in the near future. The FaaS solution with the Thorvald platform is adding value to farmers, while establishing a robust business model for Saga Robotics. FaaS model is linked to utilization of intelligent and autonomous robots - sold per unit of service provided (i.e. hectare treated, kilogram harvested, etc.); meaning low cost for farmers and aligned incentives.

Technology applied:

Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks)

3.22 SIRIUSX, GERMANY

CROCUS LABS	**SiriusX**			
Applicant:	**Crocus Labs** Tim Schäfer			
Country:	Germany	Implementation in United States		
Website:	https://crocuslabs.com			
	Delivery model:	One-time sell; Part of advisory service	**Stage:**	Early stages/ Ideation stage
Practice description:				
Crocus labs is developing ultra high efficiency smart lighting solutions for Indoor Farming. With one product line customized for greenhouses and one for Vertical Farms. Our novel smart lighting systems will guarantee state of the art in electrical efficiency across the entire PAR spectrum while enabling optimized plant growth and yield. We control our whole value chain which helps us to be cost efficient and offer our lights at a significantly lower price than comparable products. Vertical Farms especially will benefit with significant(~40-50%) OPEX savings related to electrical costs. We want to make modern Farming even more efficient, sustainable and profitable. Greenhouses, Indoor and Vertical Farming are widely considered to be potential solutions for two of the world's most eminent problems: Feeding a growing population without contributing to environmental destruction like conventional agriculture does. Indoor growing can already produce food twice as efficiently as conventional agriculture. While at the same time reducing or eliminating the use of pesticides. But until now Indoor Farming could not develop its full potential due mainly to inefficient, expensive lighting systems. Particularly Vertical Farms are being held back. They must stick to low value crops like leafy greens, making it hard to be profitable. Crocus Labs wants to change all that. Starting with their proprietary Diodes the company controls their complete value chain including sensors, luminaires and software components, helping to monitor and optimize plant growth. Costing only about a third of state-of-the-art competing solutions providing a more powerful spectrum thus enabling Vertical Farms to grow a much wider variation of crops and pushing energy efficiency to 40% above market standards. Their technology could be used in any Indoor application, ranging from food production to flowers and medicinal plants. First successful tests were conducted in 2020.				
Technology applied:				
Cloud (data storage and computing, Big data); Software solutions (programs and packages)				

3.23 SKIPPY SCOUT, UNITED KINGDOM

SkippyScout	**Skippy Scout**			
Applicant:	**Drone Ag Limited** Alexander Macdonald-Smith, Chief Operations Officer			
Country:	United Kingdom	Implementation in Israel, Poland, United Kingdom, USA & Canada		
Website:	https://skippy.farm			
	**Delivery model:**	SaaS - (Software as a Service)	**Stage:**	Market adoption/ Validation stage

Practice description:

Skippy Scout is a smartphone app and cloud-based reporting system that automates leaf-level, real-time crop analysis using standard, off-the-shelf drones. Skippy allows Farmers & Agronomists to check growth stage, green area index, pest, weed & disease levels throughout crops - remotely and with no arduous processing time. Skippy utilises a standard DJI drone such as a Mavic or Phantom - and a normal smartphone. The phone is connected to the drone's controller, this way, the app flies the drone around a field, descending at multiple points to only two metres above the crop. At each point, the drone takes a high-resolution, leaf-level image of the crop and sends it back to the user's smartphone. The app then uploads the image to the cloud to be processed in near real-time, using its custom AI system and then, reporting back to the user with a concise, clear PDF report, showing what it sees in each image, down to fine details.

Skippy Scout is first and foremost a time-saving tool, automating the flight of drones to scout fields faster and in more detail than possible on foot and then using the aforementioned AI system to analyse the images and give growers a simple, understandable report on the crop, in minutes. Skippy Scout can help a grower to minimise chemical & nutrient use, in turn maximising chemical & nutrient efficiency and therein helping to maximise yield potential. In short, it means that problems are found faster and targeted better, reducing labour, fuel use and subsequent carbon emissions, chemical use, soil damage and on the whole; environmental impact.

Skippy Scout itself is a brand new development, in that it is something innovative, that has never been done before with regards to its features, but it is also an evolution of drone use within agriculture. The commercial version of Skippy Scout has been available since March 2020 and is currently in the ongoing process of iteration and development, and has amassed 120 users since launch, despite the Covid-19 pandemic hampering marketing plans.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

3.24 SUPERCAM UNMANNED SYSTEMS, RUSSIA

SUPERCAM ГК Беспилотные системы	**Supercam Unmanned systems**			
Applicant:	**Unmanned systems LLC** Tedor Kutalia, Business development manager			
Country:	Russia	Implementation in Kazakhstan, Russian Federation, Uzbekistan		
Website:	https://en.supercam.aero			
	**Delivery model:**	Regular service; Part of advisory service; Building the expertise in the remote sensing to share the acquired knowledge with industry stakeholders.	**Stage:**	Market adoption/ Validation stage

Practice description:

The company's activities help farmers and SMEs to deploy advanced technologies which are known for the acquisition and processing of accurate data in the agricultural management. We build our expertise around the integration of Unmanned Aerial Vehicle (UAV) with the multispectral sensor as well as processing of airborne imagery with further analysis of NDVI reflectance maps. Learning on the crop development constitutes the foundation for vegetation strategies and estimating the crop yield. The multispectral sensor mounted on the UAV in addition to the RGB camera makes a great tool when assessing the field and orchard conditions. Models of Supercam unmanned aircraft systems have been tailored for integration with various multispectral sensors as well as the optical RGB cameras and global navigation receivers for precision and geodetic survey execution.

Supercam is a mini-UAV with a flight endurance of up to 4,5 hours which has been made possible because of the aircraft configuration that features the fixed wing composition of the airframe. Every single unit of the remote sensing platform is designed by the local engineering community. The autopilot, INS as well as software for operation and control are constantly evolving because of the growing technical expertise. Application of unmanned aircraft platform with multispectral sensor for surveying in the agriculture have the opportunities for different market players.

Even those who do not have the vast fields for land cultivation can still enjoy the benefits given the variety of Supercam models. For small farmers Supercam has a small UAV to offer for application with a multispectral sensor and flight endurance of up to 1 hour. Every market player involved with the generation of sustainable yield and agricultural production might pick a suitable model prepared for multispectral surveying with the software for the flight mission and operation. In addition to services, training and supply, the company's engineering community have been actively involved in the proactive development of pioneering technological solutions and methods of advanced precise agriculture.

Technology applied:

Remote sensing (satellites, planes, drones); Integration of the UAV with the multispectral, hyperspectral and RGB sensors

3.25 SUSTAINABLE FOOD PRODUCTION IN MODERN CITIES, FINLAND

	**Sustainable food production in modern cities**			
Applicant:	**iFarm** Kirill Zelenski, CEO, iFarm Europe, Intellectual Farms Oy			
Country:	Finland	Implementation in Europe, ME, Russia and CIS		
Website:	https://ifarm.fi			
App:	https://growtune.com			
	Delivery model:	Software as a service	**Stage:**	Proven/ Scale-up stage

Practice description:

Farm innovation is in technology, we are combining together all modern hardware and software developments and researches. iFarm hardware may fit room in house, and industrial size from 20 to 20,000 sq meters. iFarm system is planting without pesticides, giving clean and tasty ecological food the whole year round.

iFarm SaaS-solution is based on a wide range of modern technologies such as IoT-sensors and controllers, robotic irrigation, planting and harvesting systems, blockchain technology, computer vision and machine learning. It helps to plant automatically and accurately, maximizing workload, issues clear instructions to plant breeders on planting care and monitors the progress of daily agricultural and technical work, provides tools for online monitoring of climate and production on farms, allows to get a predicted crop at a given time and significantly reduces the burden on farm staff. iFarm innovation is in user interaction methods, when consumers are not obliged to know how crops are growing, rather just deciding what they want to grow and push one button on their PCs.

iFarm system is easy to use, economically feasible and truly universal, giving a possibility to grow almost anything due to self-educational technology and a lot of agrotechnical maps of crops inside. iFarm is constantly working on adding new agrotechnical maps of crops, having more than 120 by the date and adding 20 more each month. iFarm system is also flexible and allow to change personal characteristics of food by defining climate in totally controlled indoor environment by the wishes of customers. iFarm innovation in business model, when we go to all customers groups same time, with help of partners, providing them our IP how to build and giving our software as service to both customers and other farm builders. We are building new markets for us we selves. Our partners are hardware and software developers; farmers and farm designers; seeds and food producers; governments and agencies; Agriculture Universities and associations.

Technology applied:

Robotics (agrobots, driverless tractors); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Software solutions (programs and packages); Urban Agriculture/Vertical Farming

3.26 VITIROVER, FRANCE

	VITIROVER			
Applicant:	**VITIROVER SAS** Arnaud de la Fouchardière, CEO			
Country:	France	Implementation in Belgium, France		
Website:	https://www.vitirover.fr			
	**Delivery model:**	Regular service; We do not sell robots, we sell maintained hectares, "Vitirover as a Service"	**Stage:**	Proven/ Scale-up stage

Practice description:

Vitirover replaces Glyphosate for the permanent maintenance of vegetation in agricultural (vineyards and orchards) and industrial plots (railways, airports, photovoltaic farms,...) with fleets of connected industrial autonomous mower-robots.

Around a processor card designed and produced by Vitirover, mounted on an ad-hoc support card allowing the cards to be used for dedicated functions. All software, embedded, cloud, websites, UI were written by Vitirover. Li-ion batteries and solar panels were made to our specifications. A card manages the 9 potential motors: 4 for the wheels, 3 for the mowers, 1 for the mower lift, 1 service not used to date. A card manages the IMUs and the compasses. There are 2 IMUs and 2 compasses. A sub-assembly is in the tractor part, another in the tool block part. A card manages energy. It is connected to the solar panel, power supplier, Li-ion battery and consumers. An electronic card manages the GPS. Several models exist depending on the OEM module used (Ashtech, Septentrio, SwiftNav, to date). 450Mhz ARM9 processor mounted with Digi EmbeddedLinux. With Vitirover, we are deploying herds of autonomous robot weeders, which replace Glyphosate by a permanent work of maintenance of the vegetation.

Vitirover robots are exclusively powered by their solar panel, they work in the GPS coordinates of the plots, they are small (20kg) and slow, they do not compact the soil and contribute to the creation of meadows which become carbon sinks contributing strongly to reduce the carbon footprint of agriculture. We can talk about carbon-positive robots. For smallholders: a herd of robots is composed of around 50 autonomous robots but they can be deployed in 15 or 20 different farms. For the pilots, tests, etc, we deploy one or two robots and it works perfectly.

Technology applied:

Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

4. CATEGORY 4 – AGRICULTURE INNOVATIONS SYSTEMS AND SUSTAINABLE FARMING - SPECIFIC SOLUTIONS

4.1 AGRIROUTER, GERMANY

<table>
<tr><td>  </td><td colspan="4">agrirouter</td></tr>
<tr><td>Applicant:</td><td colspan="4">DKE-Data GmbH & Co. KG
Dr. Jens Möller, Managing Director</td></tr>
<tr><td>Country:</td><td>Germany</td><td colspan="3">Implementation in Austria; Azerbaijan; Belarus; Belgium; Bulgaria; Czech Republic; Denmark; Estonia; Finland; France; Germany; Hungary; Ireland; Italy; Kazakhstan; Latvia; Lithuania; Luxembourg; Netherlands; Norway; Poland; Portugal; Romania; Slovakia; Slovenia; Spain; Sweden; Switzerland; Russian Federation; Ukraine; United Kingdom</td></tr>
<tr><td>Website:</td><td colspan="4">https://my-agrirouter.com</td></tr>
<tr><td></td><td>Delivery model:</td><td>Free and fee; The DKE-Data business model is a B2B model.</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The cross-manufacturer connectivity of agricultural machinery and agricultural software applications is becoming increasingly important in the context of digitalization. To achieve this, six competing agricultural machinery manufacturers got together at the beginning of 2014 and decided to work together in the area of data management and to convince other agricultural machinery manufacturers to participate in the newly founded initiative.

The agrirouter as a central element fulfils all currently known requirements for cross-manufacturer data exchange along the value chain and has a high degree of flexibility for integrating new elements. It is a universal data exchange platform for farmers and contractors, with which agricultural machinery and agricultural software from different manufacturers can be networked. Users thus simplify their operational processes and increase the profitability of their businesses. The agrirouter transports data (similar to the post office transports letters and parcels), it does not store them. The data transport is encrypted and the data packets are not ’opened’ to analyze their content, as is the case with the post. As the need to network different participants in agricultural production processes increases, so does the complexity. The technical approach of the agrirouter enables the user to easily set up his customized data network. The farmer and contractor thus always retain control of his data in his network at a central point.

The consortium currently has 16 agricultural machinery companies as shareholders (10 when founded in 2016) with 27 agricultural machinery brands. Software and hardware providers along the entire value chain from very small to very large companies can also join the consortium as partners at any time without discrimination.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)</td></tr>
</table>

4.2 APIARY BOOK, ROMANIA

<table>
<tr><td>Apiary Book</td><td colspan="4">Apiary Book</td></tr>
<tr><td>Applicant:</td><td colspan="4">Apiary Book Ltd.
Iordache Bogdan-Stelian</td></tr>
<tr><td>Country:</td><td>Romania</td><td colspan="3">Implementation: It is already used by 22.000 monthly active users from around the world</td></tr>
<tr><td>Website:</td><td colspan="4">http://www.apiarybook.com</td></tr>
<tr><td>App:</td><td colspan="4">https://web.apiarybook.com</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Free and fee</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Apiary Book’s objective is to help all beekeepers from around the world to make better informed decisions based on historical data, current conditions and best practices, and to minimize bee colonies loses, increase productivity. We are providing a complete solution for management of apiaries (applications developed for different devices: smartphone, tablet, computer), monitoring of beehives (remote IoT sensors) and data analysis (decision system, big data). Main offered functionalities:
1. Apiary Book allows recording of information on the number, health and maintenance of each bee’s colony, activities, inspections, treatments carried out, and other operations in the field of beekeeping.
2. Apiary Sense is a remote hive monitoring hardware system that provides information on bee colony status automatically.
3. Analytics, Decision system to enable beekeepers to make better-informed decision: all collected data is analyzed in relation to a knowledge base of beekeeping best practices.
4. Apiary Inform is a management and communication solution for beekeeping associations. Beekeepers receive beekeeping news, best practices, disease/pest alerts, event details and other information directly on their email or mobile phone (in-app notifications, SMS).
5. Apiary Report is a platform designed to record and help the early detection of problems/incidents affecting health of bee families and a valuable tool connecting beekeepers with farmers and with local authorities.
6. Apiary Academy is eLearning platform that aims to help beekeepers from around the world to overcome the current challenges of modern beekeeping.
7. Community Support is an initiative that aims to support and promote the beekeepers by providing useful programs such as mentoring, access to know-how and best practices from around the world, communication tools to talk with other beekeepers, get valuable advice and share information.
8. Apiary Marketplace is a platform that facilitates the commercialization of apiary products to end consumers or wholesale buyers and the sale of beekeeping equipment and supplies to beekeepers.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Sensors; Software</td></tr>
</table>

4.3 APISPROTECT HONEY BEE MONITOR, IRELAND

ApisProtect	**ApisProtect Honey Bee Monitor**			
Applicant:	**ApisProtect** Aoife O Mahony, Head of Marketing			
Country:	Ireland	Implementation in Ireland, United Kingdom		
Website:	https://apisprotect.com			
	**Delivery model:**	One-time sell; Regular service	**Stage:**	Proven/ Scale-up stage
Practice description:				
ApisProtect has developed honey bee monitoring technology to increase productivity and prevent honey bee losses powered by IoT and AI. The global bee population, vital for the environment, human health, and food security, is declining and under continued threats, including climate change, biocides, pathogens and poor management practices. Beekeepers' inability to detect problems early or increase productivity due to a lack of information are major issues. Our solution combines the power of the IoT and AI to address these issues. IoT enables our unique combination of sensors to remotely observe conditions inside hives. AI analyses the raw data to provide clear actionable insights, allowing beekeepers to make well-informed and timely decisions. Insights include whether a hive is dead or alive, hive strength and colony population trends. Earlier intervention in hives requiring attention is facilitated by our insights, allowing beekeepers to use their existing skills and knowledge far more effectively. This technology has been developed for commercial pollination operations. Our insights enable beekeepers to reduce losses and costs, rear stronger colonies, and expand operations, thus improving both the quantity and quality of the hives they deliver. ApisProtect's technology comprises three main components: - hardware including sensors and a base station to collect raw data associated with hives remotely; - a data science and artificial intelligence system to process and interpret this data forming actionable insights algorithmically and; - an information delivery system to clearly display and allow useful access to these insights.				
Technology applied:				
Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)				

4.4 AQUAC+, GERMANY

AQUA C+	**AquaC+**			
Applicant:	**Versuchs- und Kontrollring für den Integrierten Anbau von Obst und Gemüse im Land Brandenburg e. V.** Andreas Jende, EIP Project coordinator			
Country:	Germany	Implementation in Germany		
Website:	http://www.vkr-bb.de/ueber-uns			
App:	https://aquacplus.info			
	**Delivery model:**	Free and fee	**Stage:**	Market adoption/ Validation stage

Practice description:

AquaC+ provides an internet-based information and advisory system for improving water use efficiency in orchards: precipitation, temperature, solar radiation, humidity and wind speed, but also soil properties affect the moisture content in the root zone and thus the water availability and irrigation needs of the plants. The impact by the soil is spatially assessed in AquaC+ through mapping the apparent electrical conductivity (ECa). These measurements provide information on the site-specific variability of the particle size distribution in the soil and, consequently, on the calculated value of soil water status in the root zone. However, rooting depth of modern orchards, orchard-individual timing of crop coefficients, and individual leaf area per tree haven't been available so far.

In the AquaC+ approach, the water balance is made available online and in a mobile app, also considering the leaf area and timing of Kc based on the fruit growth rate Commercial fruit growers, extension service, and young researchers in AquaC+ currently developed a solution for precise irrigation in fruit growing. Via an internet-based information and advice system the results shall be available to fruit producers in the region and beyond. The aim is to increase water use efficiency through water balancing and detailed plant information. The basis for this is a close monitoring of local and satellite weather data sources and current plant status data. Close monitoring: daily, the effective and varying water requirement in the phases of plant development, in particular during fruit development, is classified for pome and stone fruits. Few times per season the Kc is readjusted according to the fuit developmental stage and the leaf area is integrated in the water balance.

Validation measurements were carried out in five Brandenburg's commercial orchards with drip irrigation. Location-related data is collected via weather stations, by means of soil analyzes, and, in addition, plant sensors provide field-relevant information for water balancing.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Proximal sensing

4.5 ARIDGREEN TECHNOLOGIES, GERMANY

ARIDGREEN Use less. Grow more.	**Aridgreen Technologies**			
Applicant:	**Aridgreen Technologies** Dr. Avdesh Chaudhary, CEO			
Country:	Germany	Implementation in Germany, India		
Website:	https://aridgreen.org/application/oplant.html			
	**Delivery model:**	One-time sell; Regular service	**Stage:**	Early stages/ Ideation stage

Practice description:

As the temperature on our planet Earth is increasing because of the increase in the emission of carbon dioxide in the environment at the same time many diseases like cancer are on rise in the world because of excessive use of pesticides and hormones in our food. Moreover, climate change is leading to more problems like water shortage or drought especially in the fruit-basket of Europe – Spain, and the food production is at stake.

Combining several technologies for optimal growth of plants in a greenhouse we offer the way forward. AI driven, carbon negative, resource friendly organic farming system. It can absorb Carbon dioxide from the environment and pump it into the greenhouse that is equipped with our IOT technology and Artificial Intelligence (AI) based software. Our solution is applied by combining several approaches: Directly capture CO2 from the air. Pump this CO2 into greenhouses and increase plants growth. Our greenhouses are monitored and optimized by IOT technology and Artificial Intelligence. It reduces the amount of water and nutrients.

We aim for 70% more yield of organics and saving of more than half of the resources like water. Instead of chemical fertilizers we use organic soil and fertilizer (e.g., composting organic households waste) thereby reducing biodegradable waste which prevents Nitrogen loading in underground water. Our fertilizer does not use phosphorus (that is being used in artificial fertilizer and has to be sourced via mining). Smart watering helps combate water wastage. Our product doesn't need pesticides which is found to be one of the major contributing factors to diseases like cancer and polluting the environment. Farmers don't have to worry about losing the crops due to extreme weather conditions like storms, as our technology can be implemented in a closed environment like a greenhouse or a rain shelter. We also have an affordable High-Tech/Low-Tech version of our system for small farmers.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

4.6 ARTIFICIAL INTELLIGENCE FOR MODERN LIVESTOCK MANAGEMENT, NETHERLANDS

SERKET AI For Livestock Health Management	**Artificial Intelligence for modern livestock management**			
Applicant:	**Serket B.V.** Ou Yan, Fundraising Manager			
Country:	Netherlands	Implementation in France, Germany, Hungary, Netherlands, Spain, Thailand		
Website:	https://www.serket-tech.com			
	**Delivery model:**	Free and fee	**Stage:**	Market adoption/ Validation stage

Practice description:

Inspired by the hardworking farmers who feed the world, Serket is developing a sensor-free artificial intelligence that uses camera vision to enhance farm productivity and promote the health of individual animals. By monitoring changes in animal behaviour in real time, we enable farmers to pin-point sick livestock and intervene immediately. With Serket, farmers can minimize antibiotics usage, reduce feeding costs, and lower mortality rates to animal welfare and raise healthier livestock. Serket addresses key problems faced by the EU livestock sector:

1) the need to control contagious diseases and epidemics;
2) the need to reduce antibiotic use and zinc-oxide in livestock management;
3) the need for Decision Support Systems to improve livestock health; and
4) the requirement to comply with Council Directive 2008/120/EC on animal welfare.
5)The expectation of the alignment with SDG of UN that challenges are facing globally-Zero hunger, Good Health and Well-being, Decent Work and Economic Growth and Industry, Innovation and Infrastructure.

Our technical approach used and applied is based on 2 key fundamental points: 1. To use Artificial Intelligence—the evidence-based method with the greatest potential for improving animal health—to track individual pigs' behavior and correlate it with health status. We use behavior-recognition technology to identify potentially problematic animal behavior and alert farmers, who then intervene appropriately. We use ordinary security-camera video streams, with noninvasive or expensive hardware required. Our livestock management tool provides a 24/7 live stream of animals' health status. Based on the latest deep-learning technology for multi-object detection and tracking, Feedmaster's proprietary AI algorithm detects behavioral pattern anomalies in drinking, eating, movement, and aggression levels. The algorithm associates the anomalies with diseases or other problems, warns the operator, and suggests solutions. 2. To combine the data with a series of feeding trials that will verify the impact of nutrition and drug interventions on pig health—with the goal of reducing antibiotic use.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

4.7 BIF-APP, SPAIN

digitanimal	**BIF-APP**			
Applicant:	**Digitanimal** Carlos Callejero, CEO			
Country:	Spain	Implementation in Andorra, Austria, Bulgaria, Croatia, France, Greece, Italy, Portugal, Romania, Slovakia, Spain, United Kingdom, Kenia, South Africa, Morocco, Colombia, Mexico, Canada, USA, Australia, etc		
Website:	https://digitanimal.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

We have developed a smart livestock solution based on IoT devices to monitor farmed animals, a relevant innovation in livestock farming, especially for small beef breeders. Currently our service identify the animals and provides their location, managed by an easy-to-use app, covering important needs for farmers, and leading them to safe operating costs. We are generating now a Business Intelligence Analytics Platform together with four New advanced IoT devices that include (a) new functionalities to achieve all farming types, (b) high connectivity, (c) long battery life and plug and play installation, (d) high intelligence with edge computing techniques, (e) pioneering eco-friendly tools, and (f) data sharing among beef chain stakeholders.

In addition, we have recently launched information on traceability that is given to the consumer through a QR code, including animal welfare indicators. This has been a milestone because it is based on the data automatically stored by the sensors and analyzed by algorithms together with the blockchain, which guarantees its inviolability and the possible risk of errors in data entered manually by humans.

DIGITANIMAL proposes a disruptive solution in the livestock sector that overcomes the problems of the cattle beef farms, both grazing and fattening, thanks to development of a Business Intelligence beeF Analytics Platform (BIF-AP). BIF-AP uses the most advanced Artificial Intelligence (AI) and Machine Learning (ML) tools to transform the information provided from our cutting-edge smart kits of IoT devices and from external data sources (Sentinel imagery, weather information, market prices evolution) into functionalities to improve the livestock and farm productivity, animal feeding, animal health and welfare, in a sustainable way.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); Blockchain (transactions)

4.8 BIG WINE OPTIMIZATION, FRANCE

BIG WINE OPTIMISATION	**Big Wine Optimization**			
Applicant:	**STMicroelectronics** Mario Diaz Nava, R&D Programmes Manager			
Country:	France	Implementation in France		
Website:	https://www.st.com			
	**Delivery model:**	Regular service, Part of advisory service	**Stage:**	Market adoption/ Validation stage
Practice description:				
A complete IoT system solution was developed to collect the data coming from the vineyard and cellars, perform data analysis and use the results to provide useful information to the wine grower/wine producer to make the more adequate viticulture and wine making monitoring decisions. Examples of the benefits obtained by the data analysis: - The vine growing conditions can have a strong impact on the wine quality. Carrying out cultivation operations at the right time allows to follow the optimum itinerary. - Rainfall periods at key stages, temperature accumulation, cool nights, water stress, humidity, etc. are among the parameters useful to monitor - Data analysis enables to decide whether it is advisable to treat with phytosanitary products with more precision than is currently done today. - For winemaking, studying the fermentation profile makes it possible to quickly detect slowdowns and alert the winemaker. - From the environmental side, data analysis can be used to detect excessive use of resources such as water and electricity. The gathered data gives the possibility to perform a precise viticulture. For this, the FMIS Process2Wine was extended with data analysis models to satisfy the wine producer requirements. This solution was developed targeting smaller and middle holder farmers. The developed technology implements a complete IoT system based on a LoRaWAN network. It covers the three IoT domains: device/edge, cloud, and application. Main devices tested: weather conditions are monitored through the Weather stations; ambiance conditions stations were also deployed to monitor wine aging conditions; fixed and mobile camera inspection sensor nodes with embedded computer vision capabilities were installed; dissolved oxygen sensor node; Water and electricity meters; LoRa Gateways. It should be noted that the resulting IoT System is modular, inexpensive, private cloud solution. The final cost will be related to the farm size and the number of devices to be deployed. It should be noted that in the current project the adoption of a LoRaWAN network avoids paying a telecom subscription.				
Technology applied:				
Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Software solutions (programs and packages)				

4.9 BIODIVERSITY TAXIS 2.0, GERMANY

RLP AgroScience	**Biodiversity Taxis 2.0**			
Applicant:	**RLP AgroScience gGmbH** Matthias Trapp, Dr., head of main topic Applied Digitization			
Country:	Germany	Implementation in Germany		
Website:	http://www.agroscience.de			
App:	http://www.biodiversitaetstaxis.de			
	**Delivery model:**	Free and fee; Open source, community approach	**Stage:**	Market adoption/ Validation stage

Practice description:

An innovative concept for the promotion of transhumance shepherds and biotope connectivity by using machine learning algorithms for the detection of new grazing potentials and geodata-based drift path simulations in the West Eifel, Germany. The aim of the study was finding new potential pastures as well as improving the driving path situation to achieve an optimal accessibility of the new potential areas as grazing areas by using state of the art scientific methods. The overall aim of the research project was to improve the economic basis of transhumance shepherds by improving the area equipment and the connecting pathways as corridors. Another objective of the project was to highlight the importance of transhumance for the promotion of biodiversity by developing a scientific data basis. This included demonstrating the ecosystem services sheep provide for plant species migration and gene flow between populations, and what a loss of transhumance sheep farming would mean for our biodiversity.

Machine learning was used to classify grassland sites and similar types of use in terms of their efficiency. For grazing, particularly valuable extensive locations could be detected and evaluated with high resolution. In addition, GIS-based simulations were carried out to improve sheep trail conditions. The basic results of the study are the geodata-based detection and evaluation of new pasture potentials as well as optimized drive path simulations based on high sophisticated GIS methods for better accessibility of pasture areas in the study area Westeifel, Germany.

The generated geodata were prepared in interactive web maps and can be accessed at www.biodiversitaetstaxis. The homepage informs in detail about the project and the achieved results. By using browser-based webmaps and apps even for tablets and smartphones the shepherds were enabled to use the results indoor for planning and outdoor for navigation and traveling. The project was realized within a time frame of 4 years, but the results were used ongoing from the involved shepherds.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); geographic information systems

4.10 DIGITALIZATION IN AQUACULTURE, ITALY

<table>
<tr><td> 
</td><td colspan="4">Digitalization in aquaculture</td></tr>
<tr><td>Applicant:</td><td colspan="4">Department of chemical, pharmaceutical and agicultural sciences, University of Ferrara
Alberto Cavazzini, Full Professor/Head of Department</td></tr>
<tr><td>Country:</td><td>Italy</td><td colspan="3">Implementation in Italy</td></tr>
<tr><td>Website:</td><td colspan="4">http://www.unife.it</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Free and fee</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The solution introduces an innovative automated system in aquaculture to continuously control water quality at fish/mussel farming sites. The developed technology is based on an integrated sensor network for monitoring the quality of water at farming sites where several sensors are deployed to obtain environmental data. The information is 24/7 collected and stored in a dedicated server-cloud. The scope is to inform in real-time aquaculture operators through a dedicated app about the onset of critical situations.

Traditional parameters used to assess water quality (such as, dissolved oxygen, temperature, pH, conductivity, salinity and oxidation reduction potential, ammonia, nitrites, chlorophyll, turbidity, etc.) are continuously monitored by the moving sensor network GPS-controlled. Through the help of mathematical algorithms and control charts, data are processed to support decision making. Operators will be able to continuously monitor the through a very intuitive control dashboard (customizable to meet specific needs), with the possibility to be promptly informed (e.g., through alert via smartphone app) about the need to intervene in case of criticality. Meanwhile, the aquaculture monitoring system will record and store all measured data to create an aquaculture database that will be useful for obtaining relevant information on aquaculture facilities to be used to further refine the performance of the integrated automated system.

The designed solution was born exactly to meet requirements by smallholder fish farmers. The scope is to provide them with a user-friendly, robust solution that can help and facilitate their everyday operations. Indeed, the idea was originally promoted by some SMEs with which we were cooperating for a long time.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Digital communication (telephone, messenger, email)</td></tr>
</table>

4.11 DIGITALIZATION OF PASTURE INFORMATION FOR COMMUNITY-BASED PASTURE MANAGEMENT, KYRGYZSTAN

IFAD Investing in rural people	**Digitalization of pasture information for Community-based Pasture Management**			
Applicant:	**International Fund for Agricultural Development** Samir BEJAOUI, Country Director			
Country:	Kyrgyzstan	Kyrgyzstan, regional level (Naryn and Issyk-Kul)		
Website:	http://meteo.kg/			
	Delivery model:	n/a	**Stage:**	Proven/ Scale-up stage

Practice description:

Under the project Livestock and Market Development Project (LMDP), a two-phased project jointly financed by IFAD and the Government of the Republic of Kyrgyzstan, the country has developed a digital community-based pasture management and an early warning system (EWS) of weather and hazardous hydrometeorological phenomena in pasture areas. The practice allows the users to establish pasture inventory and to provide local authorities with the information on soil and vegetation, infrastructure available, maps with borders and easements, as well as recommendations on carrying capacity of pasture plots.

The technology would help to make planning process socially just and environmentally sustainable. Once maps are established, local authorities can update them on a regular basis, depending on demand and plots carrying capacities, which can result overall in more accurate land tax charges, improved management plans, and in resolution of land use disputes. The complementary Early Warning System (EWS) is capable of forecasting the weather 10 days ahead and providing information on drought, precipitation, frost, floods, and storm warnings. The GIS technology has been used to better assess the availability of fodder over different periods of the year. The delineation of pasture plots have also contributed to the reduction in pasture users dispute.

According to the impact survey made for the 1st phase of the Project, the share of respondents who reported being involved in disputes and conflicts over pasture use was 42.4% at baseline, 22.7% in 2016, and 21.4% in 2018. For the second phase of LPDP-2, it has been recorded that disputes regarding access to pastures reduced by 8%. One of the main objectives of the project is to increase the pasture productivity and make it more climate change resilient and increase the additional fodder accessible to livestock. According to the impact survey undertaken to assess the results of the 1st phase of the project, it has been recorded an increase in milk yield by 4% and in animal live weight by 20-50% for the beneficiaries.

Technology applied:

Remote sensing (satellites, planes, drones); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

4.12 E-EXPLORAÇÃO, PORTUGAL

ruralbit	**e-Exploração**			
Applicant:	**Ruralbit Lda** Manuel Silveira			
Country:	Portugal	Implementation in Portugal		
Website:	https://www.ruralbit.pt			
App:	https://e-exploracao.ruralbit.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Farmers (mostly livestock producers) need to keep record of their animals, both to make consistent and objective management decisions and to meet legal obligations. Our work has been to develop a software solution to record different kinds of data related to livestock production at the farm level: identifications, productive and reproductive data and genealogies. We have developed an online platform called “e-Exploração” (it can be roughly translated as “e-farm”) where livestock producers can register data and get reports. These reports can be used to identify the best and worst animals according to the farmer’s criteria (such as calf’s weight at birth and/or at weaning and calving interval, longevity of cows) and make a rational selection. They can also be used to meet legal obligations (filling in legal documents, which often require information on livestock).

This platform is currently being used in the management of nearly 1500 farms, mainly beef producers, and it is proven to be a useful tool. As it works online it can be accessed from any device with an internet connection. E-Exploração has a modular structure and, at this time, the modules for cattle, sheep, goats and horses are available. Each producer only subscribes to the modules he/she needs. Access can be done by each producer individually or you can delegate that task to an entity, such as a farmers’ association. This entity is responsible for registering the information and delivering to each producer the reports that are important for the management of their animals.

E-Exploração is an online platform, with no need to install any application on the farmer’s computer. The hosting of all registered information is guaranteed, as well as backup copies. Field data collection can be done manually or using the Android app R.campo. E-Exploração works as Software as a Service, in which the farmer pays an annual fee for the service. It has been implemented since 2008 and at the moment more than 1 million animals are registered, belonging to more than 1500 farms. There are 1065 registered users.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

4.13 FARMLAB, GERMANY

STENON	**FarmLab**			
Applicant:	**Stenon GmbH** Niels Grabbert, Co-Founder and CTO			
Country:	Germany	Implementation in Germany, United Kingdom, USA		
Website:	https://stenon.io			
	**Delivery model:**	Rental Business model (1, 3,12 or 24 month rental-time is possible)	**Stage:**	Market adoption/ Validation stage

Practice description:

Stenon has developed the first real-time soil nutrient and soil health indicator measurement system and launched it in June 2020 to market. The System is called FarmLab and provides growers directly in the fields fast and cheap with results about Nmin, N-Total, P, Mg, SOC, SOM, Fixed CO2 per ha, Soil Moisture, pH, Soil temperature results and soil texture. All measurements are referred a GPS position as well as measurement date and are made available to the user in Stenon's web portal. The user can also access the web portal with his smartphone. Moreover, the Stenon Web platform is providing fertilizer recommendation based on Soil measurement done with the FarmLab and the German fertilizer law to help preventing over-fertilization.

Due to its easy and flat-rate measurement approach growers can create sampling grinds with high resolution with no extra cost and are enabled to place fertilizer only where it is needed. This will increase productivity and protect the environment at the same time. Carbon farmers have with the Stenon FarmLab an easy and cheap tool to monitor their soil organic matter increase and verify if their carbon increase practices are individually working-out (no-tillage, Fertilization with compost or biochar, using catch crops and Crop rotation). Testing organic carbon with conventional lab methods is almost impossible to afford on a large scale and even on a small scale is still too expensive for many farmers. But it is necessary to enable the possibility to monitor CO2 soil storage easily worldwide. This will only be reached with fast, cheaper, and equally accurate technologies.

Fast crop cycles like within vegetable farming are needing quick soil nutrient results to act correctly. Growers don't want to wait for soil results days or weeks but rather having them in seconds directly in the fields, the FarmLab is enabling exactly that. Due to a rental business model also smallholder farmers can rent our system for a short time and affordable price, to check their current soil properties.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

4.14 FARM SUSTAINABILITY AUDIT, IRELAND

Farm Sustainability Audit	**Farm Sustainability Audit**			
Applicant:	**Teagasc** Katie Starsmore, Technician			
Country:	Ireland	Implementation in Ireland		
Website:	https://www.teagasc.ie			
	**Delivery model:**	Regular service, Part of advisory service	**Stage:**	Market adoption/ Validation stage
Practice description:				
This project is aiming to develop a robust sustainability audit systems applied to Irish dairy farmers to ensure sustainable practices are being carried out. The overall goal of this project is to identify key sustainability metrics and to facilitate benchmarking and the improvement of sustainability at a farm and national level through the combination of on-farm sensors, existing farm data, internationally recognized models, integrated databases and various key players in Irish agriculture. This process that has been developed through this project has been developed alongside the Smart Agri Hubs project. A range of physical on-farm sensors, such as water and electricity meters have been deployed on to the monitor farms selected for the validation of the project. Currently the project has 120 water meter sensors and 100 electricity meter sensors deployed out on 20 farms across Ireland. These sensors provide data every 15 minutes to the central database with water and electricity use for up to 15 different aspects of the dairy farm. The use of this data is critical to be able to determine the total electricity and water used on a farm and also provides key feedback to farmers on issues or inefficient practices. There are cellular modems on each of the monitor farms to communicate this data to the database. Data is reliably flowing from these sensors into the central database. This central database has been developed to incorporate many different types of incoming data. This data is kept to its highest integrity and is converted into a file format that is appropriate for ICBF to run the sustainability model. This project is applicable to all farm sizes. A benefit of this project is automating the data flow so there are less handling errors and a reduction of labour intensity on both the farm and the auditor.				
Technology applied:				
Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)				

4.15 FINAPP - COSMIC RAYS NEUTRON SENSING, ITALY

Finapp "Life from cosmos„	**Finapp - Cosmic rays neutron sensing**			
Applicant:	**Finapp srl** Luca Stevanato, CEO and Founder			
Country:	Italy	Implementation in Italy		
Website:	https://www.finapptech.com			
	**Delivery model:**	One-time sell; Regular service	**Stage:**	Proven/ Scale-up stage
Practice description:				
Finapp has developed an innovative probe for water sensing, based on the measurement of environmental neutrons produced by cosmic rays (Cosmic-Ray Neutron Sensing). Cosmic Ray Neutron Sensing (CRNS) bridge the gap between point probes, satellite observations and integrated approaches. It is a valid and solid alternative, which offers many advantages: it is contactless (probe installed 2 meters above the ground), allows the quantification of soil moisture averaged over large areas with a single probe and is not invasive for operations on the field. The probe uses innovative materials, combined with proprietary software and components developed in house and represents an innovative way of measuring the water content in any form. It ensures a significant advantage in different fields compared to the existing probes on the market. Our company aims to provide a solution for sustainable consumption of water in agriculture. Our product is able to measure the water content of the soil, mediated on a large area (about 5 ha), up to 50cm deep with only one probe by measuring the neutrons produced by cosmic rays. This quantity is directly related to the water content in the soil. Precise knowledge of soil moisture content, available for plant growth, is one of the key pillars on which precision farming is based. The innovation of Finapp consists mainly in having applied the innovation in the field of neutron detectors to the Cosmic Ray Neutron Sensing technique, developing an optimized device for this technology at significantly lower costs than those of the devices currently available on the market. Actually we are running a proof of concept program with the goal of realizing an extensive field test of the technology (16 sites across Europe, one of it at IAEA headquarters in Vienna) in order to spread to farmers and university the possibility of using this new approach in agriculture and water management. Thanks to this program we also defined the scale-up program and from spring 2021, we will be ready to scale up the production at industrial stage.				
Technology applied:				
Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Cosmic rays neutron sensing				

4.16 GeoJSON ADAPT plugin, an open source solution for machine interoperability, Belgium

	GeoJSON ADAPT plugin, an open source solution for machine interoperability			
Applicant:	**CNH Industrial** Jason Roesbeke, Data Architect			
Country:	Belgium	Implementation in Worldwide (as this is a global solution)		
Website:	https://www.cnhindustrial.com			
App:	https://github.com/ADAPT/GeoJSONPlugin			
	**Delivery model:**	Open source, community approach	**Stage:**	Proven/ Scale-up stage

Practice description:

The GeoJSON ADAPT plug-in provides a solution to handle different communication languages used by farm machines. It is a main enabler for off-line and real-time electronic communications between IoT entities in Ag (Agriculture), and as such an important enabler for the Ag Data Ecosystem and Data Space. The first problem is that the data coming from Ag machines are either in a format that is not easy or impossible to be read (e.g. proprietary OEM's format or a standard but complex format such as ISO11783-10). This creates an interoperability issue where users of the farm machines cannot share or easily share the data generated on those machines with the FMIS (Farm Management Information Software) of their choice. The solution facilitates the sharing of the data of those machines thus solving the interoperability issue.

An underlying key driver is that authorities and stakeholders in the ag value chain request different kind of documentation/reports that use different rules or data depending in which region they are located in. For example: what is planted in the field can be described very differently, how much of pesticide is applied on the field can be calculated differently. This means that it is near impossible for OEM's to create tailor-made reporting tools for all the different reporting authorities in Europe or worldwide. To solve this, we need standardized reporting and we identified that communication standards are the first step to that. How data is shared and communicated relies on many things such as data formats, data conversion, M2M communications and IoT Platform architectures. If the Ag Ecosystem has communication standards, the Ag OEM's can share much easier the machine data with local software companies, who then, in their turn, can create the regional tools that implements the rules of the regional reporting authority for the end-customer, the farmer.

Technology applied:

Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

4.17 GS MOBILE APP - GOOD PRACTICE FOR SUSTAINABLE IRRIGATION SCHEDULING, GERMANY

Hochschule Geisenheim University	**GS mobile app - good practice for sustainable irrigation scheduling**			
Applicant:	**Hochschue Geisenheim University** Jana Zinkernagel, Prof. Dr. / Head of Departement of Vegetable Crops			
Country:	Germany	Implementation in Germany		
Website:	https://www.hs-geisenheim.de/en			
	**Delivery model:**	Regular service	**Stage:**	Market adoption/ Validation stage
Practice description:				
The app ‘GS mobile’ transfers the irrigation method "Geisenheim Irrigation Scheduling" (GS) into a practical decision support system for efficient, sustainable irrigation in open field vegetable production. This supports vegetable growers in making efficient and sustainable irrigation decisions in a simple and objective way. It is based on an online, server- and GPS-supported application. Special emphasis is placed on the usability and thus the applicability of this approach. This was achieved through intensive cooperation and feedback within the consortium of science, practice, consulting and programmers. The integration of farm-specific requirements represents an innovation in the field of DSS for irrigation in vegetable production, which can significantly contribute to a higher acceptance and implementation. The smartphone-supported application of GS for vegetable crops makes it possible to monitor the current water status of the crops from any device connected to the internet and to receive timely irrigation recommendations. In doing so, the decision support goes beyond previously known formats such as a so-called “traffic light system”. In addition to a clear, simple and distinct recommendation through modeling, individual decisions based on practitioners’ own expertise also find influence in the algorithm. This makes the specific requirements of DSS for irrigation in practice visible and tangible, which in turn potentiates their use in vegetable production and thus supports sustainable management for the future. Many intensive vegetable production systems in Europe do not meet the requirements of the EU Nitrate Directive or of the EU Water Framework for good ecological water status. The application of ‘GS mobile’ will appreciably assist in the implementation of these regulations, which require that many vegetable growers must adopt management practices that improve water use efficiency.			
Technology applied:				
Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data)				

4.18 HIVE-TECH, ITALY

	Hive-Tech			
Applicant:	**3Bee Srl** Niccolò Calandri, CEO and Co-Founder			
Country:	Italy	Implementation in Italy		
Website:	https://3bee.com			
	**Delivery model:**	One-time sell	**Stage:**	Proven/ Scale-up stage

Practice description:

3Bee is an AgriTech startup born in 2016 from an idea of Niccolò Calandri and Riccardo Balzaretti. The vision is to shift from a chemical-driven approach in farming to a data-driven one. In order to realize it, 3Bee develops customized IoT monitoring systems powered by AI algorithms. The core business is represented by the Bee Project, for the support of bees, beekeepers' role and job, and more in general sustainability. The hardware developed by 3Bee is an innovative DSS based on AI algorithms.

The high degree of innovation and novelty is connected to the new technologies involved, which are sensors, proprietary algorithms, IoT devices, all strongly integrated. The innovative process of monitoring started from the collection of data, the transmission through GSM network and the procession of the information with satellite images, weather conditions and GPS position. The result is the possibility to suggest to beekeepers how to implement focused intervention, overcoming a standardized approach and substituting it with a specific one. The use of this technology was proven to reduce the mortality of bees by 20% and to increase the productivity of 30%.

3Bee's whole business is focused on sustainability. Indeed, it supports environmental biodiversity by giving new tools to beekeepers (Hive-Tech hardware) and by involving final customers in this big vision (Adopt a BeeHive project). In addition, the firm has developed CSR projects with corporates for the valorisation of the territory and the creation of real value for the ecosystem. The startup leverages technological innovation to produce sustainable solutions for different farming sectors. The process allows rationalizing the employment of input resources in farming, generating economic, social and environmental advantages. The product is commercialized through a freemium business model. Customers purchase the device, and they can choose between a basic service – rough data transmission - or a premium one – advanced set of services.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning)

4.19 I-BEE, UKRAINE

i-bee	**i-bee**			
Applicant:	**IT INNOVATIONS** Elizabeth Kochevykh, Product manager			
Country:	Ukraine	Implementation in Belarus, Moldova, Poland, Ukraine		
Website:	http://www.i-bee.net/en			
App:	ios: https://apps.apple.com/ua/app/i-bee/id1442548233?l=ru android: https://play.google.com/store/apps/details?id=www.i_bee.net&hl=uk			
	**Delivery model:**	Fee and free; One time sell; Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

The bee is recognized as the most important creature on the planet, therefore, constant control and monitoring of the state of their vital activity is a very important task. With the help of i-bee system, beekeepers get the full control over their apiary using special devices and smartphone with the app. I-bee helps to receive push notifications in the application in the shortest possible time in case of emergency. We have developed a solution that consists of special sensors and software.

A base station i-bee HUB is installed on the apiary, which transmits data to the server via GSM or Wi-Fi channel about the state of the apiary. The base station is powered by 220V or solar panel. Weather sensors can be connected to the base station optionally - precipitation, air temperature and humidity. I-bee HIVE sensors are installed on the hives that fix the temperature, humidity and sound inside the hive, the weight of the hive, and also perform a guard function in the case of a fall, tilt or theft of the hive. Optionally, external sensors at the entrance can be connected to the HIVE sensors, which count bees. All data collected on the server is displayed in a mobile application that is installed on smartphones based on iOS and Android. The beekeeper can continuously remotely monitor the status of his apiary and hives in real time. Data from the hives is received once every 30 minutes.

By obtaining data on the weight of the hive, beekeepers can control the honey harvest. Temperature and humidity data in the hive give the beekeeper information all year round about the need for insulation or ventilation. Sound information provides the beekeeper with information about the brood of the queen and the swarming process. The i-bee COUNTER sensor is an indispensable tool for beekeepers who provide pollination services. Also we have a beekeepers diary, which is free of charge. In 2021, we plan to launch automatic algorithms for sound analysis and forecasting the state of bees; to launch mass serial production of the bee counter sensor.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

4.20 IDA – THE INTELLIGENT DAIRY ASSISTANT, NETHERLANDS

	Ida – the intelligent dairy assistant			
Applicant:	**Connecterra** Jenn Gbur, Product Marketing Manager			
Country:	Netherlands	Implementation in Belgium, Denmark, France, Germany, Hungary, Ireland, Netherlands, Spain, United Kingdom, USA, Canada, New Zealand, Mexico, Kenya, Pakistan		
Website:	https://www.connecterra.io			
App:	https://ida.io/ida-for-farmers			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Ida helps farmers to become more efficient by combining animal behavior data (standing, walking, lying, eating, ruminating, etc.), collected by the sensors on the cows' collars, with data from other sources, like the Farm Management System, the farmer's feedback or weather data. Ida's artificial intelligence processes this data using Machine Learning Algorithms and transforms it into actionable insights on fertility, health, and operational issues. These are presented to users on multiple devices, in a user-friendly app.

Understanding these patterns are key for animal fertility and health management. For example, when a female cow is in heat (fertile) it will walk more than normal and/or eat less. When an animal is sick, it might walk less and will stop ruminating. Animal behavioral patterns are therefore directly linked to the profitability of the farm. When farmers understand behavioral patterns of a healthy cow, anomalies become apparent and it is easier to proactively manage the herd. An anomaly can mean that the cow is getting sick. Ida identifies health problems 1-2 days earlier then visible symptoms appear, and sends an alert, notifying the farmer the cow needs to be checked. An anomaly can also signal heats, calving or irregular estrus cycles. Ida's Fertility insights notify farmers of these changes and help them maximize reproduction rates. Anomalies can also signal management or operational issues, such as a cow that does not have access to feed or is stuck in the feed fence.

These insights allow farmers to adjust protocols or deal with a problem before it becomes critical. Last, Ida collects feedback from the farmer on the insights shown in the app and uses AI to constantly learn and improve precision and accuracy.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

4.21 IoT Supply Chain Platform for Animal Feed Industry, Spain

INSYLO® SMART FARMING REVOLUTION	**IoT Supply Chain Platform for Animal Feed Industry**			
Applicant:	**Insylo** Daniel Mount, Marketing Manager			
Country:	Spain	Implementation in Denmark, Norway, Spain, Sweden, United Kingdom, Mexico, Saudi Arabia		
Website:	https://www.insylo.com			
	**Delivery model:**	One-time sell; Platform - Saas	**Stage:**	Market adoption/ Validation stage
Practice description:				
The key challenge Insylo has proven to address in the agricultural industry is how to optimally organize logistics and production with a previously an unknown variable of demand by providing accurate live data and predictive forecasting. Insylo has developed a smart volumetric IoT sensor that consists of a 3D sensor with embedded computer vision algorithms that measures the volume of the silo's content. It is powered by solar energy and is equipped with rural Internet connectivity, being fully independent of the farms' resources. The Proprietary 3D volumetric sensor accurately monitors (error <1%) stock volume (RGB + depthmap) and quality (temperature + humidity), generating an inner silo 3D map. A cloud-based service, the Collaborative Smart Feed Logistic Platform (SFLP), also developed by Insylo, applies 'Vendor Managed Inventories' (VMI) principles. The IoT collects volume+environmental data from silos, gathers farms/suppliers' historical data from Enterprise Data Storage Systems (EDSS), process it through Machine Learning (ML) / Optimisation Model algorithms and generates a Digital Twin System (DTS) that reflects the real world into a digital representation optimising businesses. This becomes a decision-making tool with the aim to give farmers / feed suppliers high-valuable insights of their daily operations, when is the right time and the right amount to refill each silo in order to minimise the logistics cost. The key challenge Insylo has proven to address in the agricultural industry is how to optimally organize logistics and production with a previously an unknown variable of demand by providing accurate live data and predictive forecasting. Silos from isolated areas can access to the SFLP thanks to 6lowPAN wireless network. Remote farms do not need internet connection to facilitate sensor connectivity. Moreover, sensor zero-maintenance removes the risk of associated workplace accidents, which improves farmers' quality of life and lets them retain focus on core activities.			
Technology applied:				
Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email)				

4.22 IRRISTRAT, PORTUGAL

HIDROSOPH	**Irristrat**			
Applicant:	**Hidrosoph** Daniel Ribeiro, Partner			
Country:	Portugal	Implementation in France, Italy, Portugal, Spain, Morocco, Chile, Peru, South Africa, Australia, Mexico, USA, Argentina		
Website:	http://www.hidrosoph.com/EN			
App:	https://www.irristrat.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Provide accurate, site specific, irrigation recommendations: Our solution integrates several converging methodologies and is based on more than 10 years of data from thousands of sites and sensors. Our solution has allowed farmers to optimize performance and surpass expected yields by matching the specific daily needs of each crop and site.

The technology is based on our proprietary Irristrat SAS platform, where the sites are modeled and connected to sensors, remote sensing and weather forecast. The key aspects to be modeled are the crop, the soil and the irrigation system. Besides the precision of the outputs, the platform is extremely user friendly and flexible to integrate the farming operation, a key factor for the success of any project. It also has complete set of communication tools to guarantee easy communication with the fields and people on site. For improved results, we have a very experienced team for remote support and onsite training.

Optimizing water usage targeting sustainable water consumption and maximizing yield per water applied: Our solution has complete planning functionalities to target the best strategy for each year and site, before the start of the season. It then provides real time information to growers, adjusted by weather forecast and weather records, sensors and remote sensing to implement the defined and sustainable strategy. The invocation is on the unique way it uses information from several sources and methodologies to provide a precise irrigation plan for the coming days, as well as alerts and KPI for the irrigation efficiency and crop development. Irristrat has been proved extremely successful and a large variety of crops, from tree crops, to row crops, fruits and vegetables.

We started developing in 2008 and first commercial projects started in 2012. 2015 we started in Spain and since 2018 we have international partners installing and supporting in other countries.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

4.23 IRRITEC DIGITAL EVOLUTION, ITALY

	Irritec Digital Evolution			
Applicant:	**Irritec S.p.A.** Giulia Giuffrè, Irritec Group Marketing & Sustainability Ambassador			
Country:	Italy	Implementation in Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Germany, Italy, Kazakhstan, Moldova, Portugal, Romania, Slovenia, Spain, Ukraine, Uzbekistan, Africa; USA; South America; South-East Asia		
Website:	https://www.irritec.com			
	**Delivery model:**	Fully free to use; Free and fee; One-time sell; Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Irritec digital solutions provide sustainable improvement of irrigation and fertigation practices by means of products, technologies and solutions that can be adapted to different crops and application needs. It is aiming to efficient and effective optimization of primary (water and energy) and secondary (fertilizer) resources; providing management, control and active monitoring to all processes (supply, distribution and application) relating to water in its path for irrigation prevention and management of risks and waste thanks to automatic and semi-automatic detection systems and evaluation processes.

We develop, adopt and integrate technology and technical solutions capable of managing and controlling all the processes (primary and secondary) of the operations of supply, filtration, distribution and supply of water and nutrients by means of modern and efficient irrigation techniques. The solutions are scalable and adaptable to different needs and are developed by means of an integrated and interconnected use. Thanks to current communication technologies, we are to support modern electronic programmers with sensors and precision detection devices by leveraging efficient micro-irrigation products, such as to manage in efficiently also all other common 'mechanical' devices (valves, filters, pipes, etc.).

Irritec Digital Solution provides continuous and constant innovation in the awareness of an efficient and effective use of resources through R&D, integrating technical solutions, products, technologies and best practices and carrying out an educational and training process at all levels and for all stakeholders (industry, institutions, training institutions, industry professionals and farmers). It is adaptable to different needs (both of the crop and of use), simple and oriented towards a technology affordable and accessible to everyone.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Software solutions (programs and packages)

4.24 MOONSYST SMART RUMEN MONITORING SYSTEM FOR DAIRY AND BEEF CATTLE, HUNGARY

	Moonsyst Smart Rumen Monitoring system for dairy and beef cattle			
Applicant:	**Moonsyst** Peter Gelser, CEO & Founder			
Country:	Hungary	Implementation in Czech Republic, Finland, Hungary, Ireland, Italy, Netherlands, Poland, United Kingdom		
Website:	https://moonsyst.com			
	**Delivery model:**	One-time sell	**Stage:**	Proven/ Scale-up stage

Practice description:

Moonsyst specialized in high-tech sensor networks (IoT with LoRaWAN and NB-IoT) development with cloud-based data processing for continuous remote monitoring of dairy and beef cattle. The Moonsyst Smart Rumen Monitoring system for dairy and beef cattle consists of a Smart Rumen Bolus and a cloud-based data processing application and a mobile app. The Smart Rumen Bolus has to be swallowed by the cattle and sinks in the rumen, where it typically resides in the reticulum of the animal for the remainder of their life.

The device is capable for multiple physiological and chemical data (temperature, rumen and body activity, pH level) monitoring. With the newest communication technologies (NB-IoT, LoRaWAN) will allow us location tracking which makes our product outstanding in the cattle monitoring market. The intelligent cloud-based system uses fine-tuned algorithms to translate the raw data into useful information for more efficient farm management. The application is supported by Big Data service, Machine learning technologies and Artificial Intelligence (AI) solutions to provide accurate information and future data, forecasts, predictions to, farmers and other system users (i.e. veterinarians, etc.).

Most of the farmers need to increase their productivity and produce higher quality food with less use of antibiotics or medication. They are getting older and the younger generation is becoming less interested in farm life. The farmer who is ready to use the newest technologies will be successful with these challenges. The Moonsyst Smart Rumen Monitoring technology can be used in ruminants where the bolus device stays in the reticulo-rumen of the animal. Moonsyst currently focuses on dairy and beef farmers and on veal producers. The rumen is the key of the dairy and beef production and specific information can be collected from it with this technology. The physical and chemical sensors built in the bolus can provide information which is beyond the scope of existing solutions such as neck collars or pedometers.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning)

4.25 N3tSensors AGRO Plus/Plus Plus w/ Hawk-EyeTM Systems Build-in, Portugal

	N3tSensors AGRO Plus/Plus Plus w/ Hawk-EyeTM Systems Build-in			
Applicant:	**Numbersagain, Lda.** Maria Ribeiro, Managing Director			
Country:	Portugal	Implementation in Portugal, Ukraine, USA, Mexico, Ecuador		
Website:	http://www.numbersagain.pt			
	**Delivery model:**	One-time sell	**Stage:**	Market adoption/ Validation stage
Practice description:				
N3tSensors AGRO with the built-in Hawk-Eye™ system (N3tSensors AGRO +/++) are Smart Software Platforms aim to the Agribusiness, accessible through a simple Internet browser, crafted for the automation of the monitoring and control of Sensors and Agricultural Systems. N3tSensors is a Middleware Platform, made up by a suite of software modules, and prepared to interact with all types of probes & sensor systems and/or others software systems thru the use of API's or Web Services. The Hawk-Eye™ Systems are fully autonomous, 24/7/365, remote sensing and reporting systems that image and measures canopy temperature in the far-IR band and canopy colour in the visual band from image data captured and reported every ten minutes, day and night. From the data indices, notices, and enhanced imagery of the crop are available to certified clients in real-time via internet to phones, mobile devices, and desktops. Measurements are processed in real-time to assess and report canopy colour, homogeneity, and crop stress; and to provide irrigation guidance. The indices can be formatted to actuate irrigation, fertigation, and precision applications of herbicides, pesticides and other amendments. All the imagery and data are archived for look backs and record keeping. Hawk-Eye™ camera set is established near the crop to gain a view of the canopy. May be mounted at any point that has a view of the crop. The mobile communications send from the field to Hawk-Eye™'s cloud. Powered by DC/AC and easily relocated when needed. Hawk-Eye™ System distils the extremely large amounts of data to provide pertinent and actionable real-time messages from the crop. Use it to scout for early warning of disease, pests, drainage issues, and the impact of cultivation practices. Use it to prescribe irrigation. It will recommend needed irrigation and can be tuned to provide deficit irrigation guidance. As result of the Hawk-Eye™ System performance, part of data will be collected by N3tSensors AGRO +/++, with which, and based on the established rules and parameters, will interact (Communicate Module) with the Devices and/or Agricultural Systems.			
Technology applied:				
Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Remote Thermal and Visual Image Data Cameras				

4.265 NEDAP COWCONTROL, NETHERLANDS

	Nedap CowControl			
Applicant:	**Nedap Livestock Management** Rudy Ebbekink, Global Marketing Manager			
Country:	Netherlands	Implementation in Austria, Belarus, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Kazakhstan, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Russian Federation, Turkey, Ukraine, United Kingdom		
Website:	https://www.nedap-livestockmanagement.com			
	**Delivery model:**	One-time sell	**Stage:**	Proven/ Scale-up stage

Practice description:

Nedap's SmartTag, which is worn around the neck or leg of the cow, identifies each cow electronically and monitors her activity, health, reproduction and location 24 hours a day. Nedap CowControl cleverly turns SmartTag data into real-time and relevant alerts, to-do lists, reports and barn maps to help farmers manage and control their herd from their computer or mobile devices. In terms of health monitoring, the SmartTags measure the eating, rumination, standing, lying, walking and inactive behavior of each cow 24/7. If it deviates from normal behavior, the farmer receives a warning and the cow appears on a list of animals to be checked. Health issues are therefore detected 2 to 3 days earlier than they are visible to the human eye and can be prevented or treated before they become severe. This ensures improved cow health, herd longevity, animal welfare and a significant reduction in antibiotic use.

Monitoring group behavior provides insights on the basis of which, for example, feed efficiency and cow comfort can be increased. In terms of reproduction, Nedap CowControl ensures that cows become pregnant in a sustainable way. The SmartTags automatically detect cows in heat and their optimal insemination moment. This allows cows to be inseminated based on their natural heat/cycle, without the need for hormone programs. This is better for animal welfare and drastically reduces hormone use, while it vastly improves repro results. This reduces labor shortages and ensures a better work-life balance. An important effect is that it also ensures less stress for cows and, for example, shorter lock-up times. The system has proven to increase milk production, feed efficiency and animal health and welfare, while reducing antibiotics and hormone use. An ultimate sustainable technology.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); RFID, UHF data communication, Augmented Reality

4.27 ON-FARM DRY MATTER MONITORING: FROM SILAGE SAMPLING TO MOBILE TOTAL MIXED RATION (TMR) RECIPE ADJUSTMENT, FINLAND

UNIVERSITY OF OULU	**On-farm dry matter monitoring: from silage sampling to mobile total mixed ration (TMR) recipe adjustment**			
Applicant:	**University of Oulu, Unit of Measurement Technology** Tuija Kallio, Mrs. / Researcher			
Country:	Finland	Implementation in Finland		
Website:	https://www.oulu.fi/measurement-technology			
	**Delivery model:**	Free and fee; One-time sell	**Stage:**	Market adoption/ Validation stage

Practice description:

Smartfeed EIP-AGRI project developed silage quality monitoring system that enhances time management at the farm by combining silage sampling to other work tasks and provides tools to measure dry matter and edit the total mixed ration (TMR) recipe on site. Thus, farmers can react to changes in silage dry matter even daily. The amount of concentrated feed fed to the cattle depends on the dry matter (DM) content of silage. Therefore, the economic impact can be significant if too dilute or concentrated TMR is fed resulting in milk yield reduction or extra bough-in feed costs.

In the Smartfeed EIP-AGRI project, solutions for easy and representative silage sampling of silage bales, rapid (10-20 min) dry matter measurement at farms and mobile TMR recipe adjustment were designed, developed and combined as a silage and TMR dry matter monitoring system. The dry matter measurement and mobile TMR recipe adjustment can be used in farms having TMR feeding. The system is well applicable also to small family farms. An Android application was designed to utilize DM measurement results to adjust TMR recipe on-site during TMR preparation. In the app, first the used feeds, silage batches and TMR recipes are added and stored to a cloud database. Then, the app allows to calculate the changes in the amounts of different components of a TMR recipe in situations where the DM% of silage changes or the amount of a component is changed. The app is available in Finnish and in English and it is free of charge.

To facilitate regular dry matter measurement on-farm, a commercial halogen moisture analyzer used routinely in the food industry was tested for silage and TMR samples. The results were promising, but no larger studies have been performed yet. Finally, the most tedious part in the regular monitoring of silage quality is often sampling. Therefore, a new silage sampler attached to a bale gripper was designed and tested. The sampler consists of a sampling tube (42 mm in diameter) and a support spike attached to a pivotable adapter allowing the probe to be folded down for other work tasks. The sampling tube has length of 43.5 cm reaching the centre of bale and allowing representative sampling.

Technology applied:

Smartphones (features, apps); Cloud (data storage and computing, Big data); Software solutions (programs and packages); mechanical sampling device; analytical laboratory device

4.28 OPTIMILK, BOSNIA AND HERZEGOVINA

KOMPEKS	**Optimilk**			
Applicant:	**Kompeks, ICT Company, East Sarajevo** Grujica Vico, Expert			
Country:	Bosnia and Herzegovina	Implementation in Bosnia and Herzegovina		
Website:	https://kompeks.net			
App:	https://optimilk.mljekarirs.com			
	**Delivery model:**	It is currently only available to members of the Association of Agricultural producers - dairy farmers of Republic of Srpska.	**Stage:**	Market adoption/ Validation stage

Practice description:

Optimilk is unique web-oriented application for ration optimization of dairy cows in the Western Balkan Countries. The feeding costs share with more than 50 % in total costs of dairy production. The dairy farmers should to optimize dairy cows ration to achieve better economic production performance. It needs a very complex mathematical calculation with Simplex algorithm (Linear programming method). In other hand, there are a lot of small dairy farms in Bosnia and Herzegovina, without feeding experts. They do not have the necessary knowledge to optimize the ration of dairy cows and they need a simple and user-friendly solutions. There are a few desktop applications with module for optimization dairy cows ration in Bosnia and Herzegovina. But they have a very wide specter of modules and they are a very complex for a wide range of small farmers. Also, the farmers have to spend a lot of money for installing some of them.

OPTIMILK is web-oriented application with user-friendly interface. There is a feed database with their nutrition components and default values of them. Farmers can access to the application through their web browser, make a profile and use it. Also. They can record their ration(s), change nutrition values, share ration etc. It provides an easy access for all kinds of dairy farmers. It does not require farmers to know the methodology of creating ration. They just should to fill a few simple values about their cows (body mass, milk yield, fat content in the milk, data about gravidity, age). In same time it is a simple and power tool for reducing feeding costs in dairy production. OPTIMILK is a multi-user web application developed according to the latest web standards and good practices in web development. It provides user-friendly interface and easy access to the application from different kind of internet connected devices (mobile phones, tablets, desktop computers). Several user roles are available, which allows for authorized access to appropriate features of the application.

Technology applied:

Software solutions (programs and packages)

4.29 OPTIMIZING NITROGEN USE THROUGH VARIABLE RATE APPLICATION OF CONTROLLED RELEASE FERTILIZERS IN VINEYARD, ITALY

	Optimizing Nitrogen Use Through Variable Rate Application of Controlled Release Fertilizers in Vineyard			
Applicant:	**Università Cattolica del Sacro Cuore** Matteo GATTI, PhD / Associate Professor			
Country:	Italy	Implementation in Italy		
Website:	https://www.unicatt.it			
	**Delivery model:**	Once the fertilizer VR spreader is bought, vigour and prescription maps need to be updated yearly.	**Stage:**	Proven/ Scale-up stage
Practice description:				
Variable rate (VR) application of controlled release fertilizers (CRF) in vineyard is the good practice proposed with this application, aiming at achieving better supply-demand equilibrium in N fertilization as well as significant savings in the amounts of applied fertilizer. There is general consensus that variations in vineyard soil texture, water holding capacity and depth are major factors affecting crop variability and, hence, vine performance. Natural variability relies upon geological origin and soil formation; however, it can also be easily fed or aggravated by questionable agronomical decisions concerning land preparation, soil drainage, vine training etc. Variable Rate Technologies (VRT) automate input application according to prescription maps allowing site-specific management of different zones of a single vineyard block that will be treated in different ways (e.g. fertilized vs. unfertilized). Since 2012, two experiments were performed for assessing long-term effects of VR N-supply. In both cases, pre-trial NDVI-based vigour maps of two heterogeneous vineyards were ground-truthed and prescription maps defined accordingly. In order to get a more balanced and uniform vineyard as well as to limit environmental impact, N-supply was reduced according to vigour. Urea and a CRF were used. Over four years, VR application of the prompt-effect urea led to a more homogeneous vineyard by reducing spatial variability of canopy growth from a variation coefficient (CV) of 8.2% to 1.42%. CRF allowed faster responses in low vigour areas fostering desired increasing in total leaf area and yield. Contrariwise, N-supply in high and medium vigour zones did not differ to control demonstrating that fertilization was not required in those areas. VR application of hi-tech CRF improved efficiency of vineyard fertilization, reduced N waste in high vigour and lowered environmental impact with a potential fertilizer saving up to 33%. Coupling agriculture innovations such as VR Application of novel Controlled Release Fertilizers will optimize economic performance of wineries towards increased competitiveness, resource use and vineyard sustainability under a new climatic context.			
Technology applied:				
Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Software solutions (programs and packages); Variable rate Technologies				

4.30 OUTFIELD, UNITED KINGDOM

<table>
<tr><td>  </td><td colspan="4">Outfield</td></tr>
<tr><td>Applicant:</td><td colspan="4">Outfield
george@outfield.xyz, Business Development Lead</td></tr>
<tr><td>Country:</td><td>United Kingdom</td><td colspan="3">Implementation in United Kingdom, South Africa, New Zealand, Australia, Uruguay</td></tr>
<tr><td>Website:</td><td colspan="4">https://outfield.xyz</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Regular service</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Outfield provides a yield measurement and orchard management system for high value fruit crops. Outfield helps you track yield estimates throughout the growing season, from blossom to fruit. This data let’s you plan harvest campaigns, deploy farm resources efficiently and arrange sales contracts with confidence. Outfield makes growers more efficient, sustainable and profitable but also helps reduce fruit wastage.

Outfield is a platform for gathering, analysing and viewing the data you need to manage your orchard effectively. Our flagship product of providing accurate fruit counts up to 8 weeks before harvest will be seen across apple orchards. Outfield allows you to track data gathered from drone surveys, aircraft surveys, satellite data, fixed weather stations, in-field assessments and more. Outfield is driving the future of precision fruit farming by incorporating scans of tree health, water stress, assessments of blossom density and orchard weather data, Outfield can help you visualise and track the parameters that matter to you and your farm. For valuable fruit orchard crops, Outfield offers you a whole new level of precision farming.

Outfield growers on four continents are deploying inexpensive drone systems to quickly survey orchards and gather high resolution images. Outfield uses machine learning to analyse this imagery, providing detailed maps of fruit loading and fruit counts that help you visualise and track the parameters that matter to you and your farm. The main impacts are: operativeness and transparency; collection of documents; identification of parcels; lack of interaction with organizations; easy to use and manage. Our system is completely scalable meaning that small or big orcarchd farmers can use it. The main target group at the moment is apple producers, but soon plan to expand to other types of high-value fruit crops (pears, mangos, cherries etc.).</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Robotics (agrobots, driverless tractors); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)</td></tr>
</table>

4.31 PITSTOP+ - AUTOMATED PRECISION SUPPLEMENTATION, DENMARK

microfeeder for your supplements	**Pitstop+ - Automated Precision Supplementation**			
Applicant:	**MicroFeeder A/S** Henning Lyngsø FOGED, Director			
Country:	Denmark	Implementation in Denmark, Germany, Latvia, Lithuania, Norway		
Website:	https://www.microfeeder.com			
	Delivery model:	One-time sell	**Stage:**	Market adoption/ Validation stage
Practice description:				
We have developed Automated Precision Supplementation (APS) in response to a needed rethinking of dairy cow supplementation. APS means that dairy cows' need for minerals, vitamins and protein throughout the lactation is adjusted to their needs, even despite they are fed Total Mixed Ration (TMR) feeding. A better resource economy is achieved by reducing the content of protein, minerals and vitamins in the TMR, and instead offering more of this to the cows during the critical transition period from about 3 weeks before calving and until about 3 months after calving. By this is achieved a dramatic improvement in dairy production resource economy, and the cows' health are substantially improved due to better immune status, which in turn also increases their productivity and means better animal welfare. Other important effects count reduced environmental loads and climate footprint of dairy production. Our commercial solution for APS is called Pitstop+, which is an IoT technology that via advanced supplement feeders and cloud-based services and data integration enables individual and restricted supplementation of dairy cows. Our invented APS system with the commercial name Pitstop+ is equipped with electronic components, such as RFID based technology to identify the cows via ISO standardised HDX/FDX electronic ear tag, dosing devices, LoRa communication between the feeders and a master unit, and Azure IoT Hub and MS SQL cloud solutions for data storage. The system is managed through an app based on the innovative Progressive Web App (PWA) technology. The system brings Internet of Things (IoT) into dairy cow supplementation practices, utilising the fact that electronic ear tagging of dairy cows is becoming a common practice in EU and other countries, e.g. Norway and Chile, to comply with regulations for identification and registration of bovine animals, and has since 2010 been a mandatory requirement in Denmark. We have estimated that the economic value for the dairy farms of the response on cow performance is 67€ per cow per year, which is substantially. The best result was obtained in a German farm, where the value of APS was assessed to be 246 € per cow per year.				
Technology applied:				
Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)				

4.32 PIXOFARM, AUSTRIA

Pixofarm	**Pixofarm**			
Applicant:	**Pixofarm GmbH** Farid Edrisian, CEO & Co-Founder			
Country:	Austria	Implementation in Austria, France, Germany, Italy, Netherlands, Poland, Slovenia, Spain, United Kingdom, South Africa, Chile, Australia, New Zealand, Argentina		
Website:	https://pixofarm.com			
	**Delivery model:**	Regular service; yearly subscription plan based on the size of orchards	**Stage:**	Proven/ Scale-up stage

Practice description:

Pixofarm is a digital solution, which empowers fruit producers worldwide to get the most out of their orchards by providing reliable yield monitoring and forecast data. With these data, they can increase their production and efficiently plan and optimize their operational activities like logistics, packaging, warehousing, sales and marketing. All they need to do is taking pictures of a certain number of fruits and trees with their smartphones. We use artificial intelligence, machine learning, image processing technology as well as satellite data to accurately measure and count fruits and calculate forecasts. By digitalizing manual processes like fruit counting and fruit measurement and using state-of-the-art technologies, they can know in advance, which quality classes they are going to have at the end of the season, they can market them correctly and decrease food waste. And they can benefit from all these advantages without any investment in infrastructure or any hardware devices. All they need is their smartphone.

We have developed a technology that empowers growers to use their smartphone as a measurement tool to precisely measure and count fruits on trees. It gives them flexibility and digitalizes many manual processes and no investment in expensive hardware devices is required. They can have a smart solution immediately in their pocket! It is very complicated to develop such a noise-resistant solution that works on all smartphones in the market, having in mind different operating systems, sensor sizes, camera specifications, different lightings, etc. We also fetch in data from different sources (Satellite weather data, etc.) and make use of the advantages of big data and machine learning to give them most accurate results possible.

Since our solution doesn't require any additional hardware device and zero investment in infrastructure, it is perfectly suitable for smaller growers. Pixofarm was founded in 2019. Our first commercial season was 2020 for the European market. In September 2020 we have started our sales in the southern hemisphere.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); Image processing, Predictive algorithm

4.33 SINASENS SMART AGRI, FRANCE

	SinaSens Smart Agri			
Applicant:	**Sinafis SAS** Ari KAMBOURIS, Co-Founder and Director of Business Development			
Country:	France	Implementation in France		
Website:	https://www.sinafis.com			
	**Delivery model:**	One-time sell; Regular service; One-time material sell and yearly service fee	**Stage:**	Proven/ Scale-up stage

Practice description:

SinaSens Smart Agri is a solution composed of sensors that measure the temperature and humidity of the soil, air and leaf humidity. The data is sent over a low frequency radio network, Sigfox, and then displayed on a secure client internet site. The system is modular – you can plug in different sensor configurations based on the crop type and lifecycle – and alerts can be set for each sensor on a system (high/low temp, etc.). Using the same 5 data point, here are the results for all crops and selected extraordinary results for specific crops:

- All crops: Identification of the Available Water Content zone, increased efficiency in the application of auxiliaries (larvae, mini wasps, bumblebees, etc.) by correlating the plant's life-cycle and the various measured values of the environment, better disease prevention and optimization of bio-control treatments.
- Vegetable farmers: Up to 20% reduction in water consumption, better quality and longevity since the vegetables are not over- or under-irrigated, re-organization of the farm tasks since a longer shelf-life means that the produce can be harvested earlier for the markets
- Vineyards: Early frost detection, ground cover management, detection of water born diseases in anticipation of treatment, reduction in the quantity of phyto-sanitary treatments by up to 25%
- Corn/Soy/Sorghum: Up to 15% yield increase
- Olive trees (and other stone fruit trees): 30-40% yield increase over 2-year cycle, irrigation management, anticipate water-borne diseases and monitor the development of bacteria impacting buds, leaves and young shoots and to detect as soon as possible the larvae of insect pests

SinaSens Smart Agri was conceived of in-house by Sinafis SAS. The technology is common (no IP) and the design takes into account the objective of producing a low-cost, simple-to-use, and robust industrial solution. The components are fabricated in Castres, France. The prototype systems were delivered for testing to our pilot groups at the end of 2016. The first production run was in September of 2017 and the full-fledged marketing operation began in January of 2018.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

4.34 SOIL CARBON ASSESSMENT USING REMOTE SENSING, GERMANY

SMART CLOUD FARMING	**Soil Carbon Assessment using Remote Sensing**			
Applicant:	**SmartCloudFarming** Suvrajit Saha, Co-Founder & Chief of Product and Innovation			
Country:	Germany	Implementation in Denmark, Italy, USA		
Website:	https://smartcloudfarming.com			
	**Delivery model:**	Regular service; Part of advisory service	**Stage:**	Market adoption/ Validation stage

Practice description:

Soil carbon content is a key indicator of soil fertility and good farming practices. It is also an indicator of the amount of carbon storing capacity of soils. With Big-Ag moving towards regenerative agriculture, the current practice of collecting and analysing soil samples is not a viable solution. This is not just cost- and labour-intensive, but also slow and non-scalable. Soil carbon needs to be measured and tracked at scale and at all times. What you cannot measure, you cannot change. This is also true for soil carbon content.

Our solution makes it possible to track changes to soil carbon content and relate it to farming practices. It will also enable farmers to prove their carbon farming efficacy and earn money through carbon credits. SmartCloudFarming is using a combination of remote-sensing and advanced AI to determine and track soil carbon remotely, fast, and at scale. We are using advanced neural networks and remote sensing data to determine the content of soil carbon on vast tracts of land remotely. This is possible by using a combination of different soil data to train the algorithms that then determine soil carbon content and track changes in soil carbon over time. Currently, we have an average error of < 3% for soils that we have analysed with the best best 0.2%.

The technology is currently being trialled in pilot projects (a service), with a customer-facing product in planning. Ultimately, the customer will be able to select the land himself and see the carbon content directly. We started work on our solution in March/April 2020. Since that time and till today, we have trialled our technology in USA and are currently trialling it with our industry partner in Italy and another partner in Denmark. In total, our solution has been trialled for approx. 5 months. Our plans for the future is to create a soil databank that has soil data with a large number of parameters for different soil types and from different regions. We want to have a very robust model that can only be obtained when the training dataset is varied and time-continuous.

Technology applied:

Remote sensing (satellites, planes, drones); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

4.35 SOIL SCOUT MONITORING SERVICE AND WIRELESS UNDERGROUND SENSOR SOLUTION, FINLAND

SOIL SCOUT	**Soil Scout monitoring service and wireless underground sensor solution**			
Applicant:	**Soil Scout Ltd** Johannes Tiusanen, Chief Science Officer, Founder, Inventor			
Country:	Finland	Implementation in Estonia, Finland, Germany, Iceland, Italy, Lithuania, Netherlands, Sweden, Russian Federation, United Kingdom		
Website:	https://soilscout.com			
App:	https://soilscout.com/applications/agriculture			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Soil Scout expands the Smart Farming in-field variability management to the underground. Soil Scout has developed the first truly wireless and fully buried environmental sensor that has been specifically designed to remain buried underground for a long period of time. The “Scout” transmits through soil, turf, clay, ice, snow and even stone from up to 2m below ground and provides an on-going insight into critical moisture, temperature and salinity information - every 20 minutes with a superior battery lifetime for up to 20 years.

Soil Scout sensors measure soil moisture, temperature and salinity, and transmit the data to a proprietary Base Station for uploading to the server with regular intervals. Farmers can log onto the web-based Hub for soil conditions anytime, anywhere with a smartphone, tablet or laptop. Soil Scout has patented an exceptional radio technology. It empowers the sensors with the capability of communicating efficiently in all soil types by autonomously adapting the underground antenna to current soil conditions. Combining the unique antenna with an equally unique method of creating a high-energy radio transmission burst with unparalleled power, no other solution can compete with the communication reliability and battery lifetime Soil Scout delivers.

The opportunity to permanently bury wireless Soil Scout sensors across fields, do fieldwork, and forget about the sensors makes soil monitoring simpler and more consistent than ever. By being buried, Soil Scout offers out-of-sight permanence. This enables our customers to have a 365x24 insight into below ground conditions, allowing them to make informed irrigation decisions and therefore reduce water consumption. As a by-product energy consumption and fertiliser application are reduced, with highly positive environmental impacts. As a summary: By putting fields on-line, Soil Scout finally let’s farmers take soil under control.

Technology applied:

Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

4.36 TRACKING HIGH VALUE HUNGARIAN GREY CATTLE HERDS IN PASTORAL LIVESTOCK MANAGEMENT USING IOT TECHNOLOGY, HUNGARY

	Tracking high value Hungarian grey cattle herds in pastoral livestock management using IoT technology			
Applicant:	**ÖMKi** Attila Nagy, advisor			
Country:	Hungary	Implementation in Hungary, Kiskunsag Puszta, Apaj Farm level (one of the largest pastoral cattle breeder in Hungary)		
Website:	https://szomordezso.eu			
	Delivery model:	Part of advisory service	**Stage:**	Market adoption/ Validation stage
Practice description:				
The practice demonstrates an example of using various ICTs in order to efficiently track the movement and other parameters of cattle in pastoral environment, wandering over large areas, in the Hungarian Puszta. The main applied technology is based on LoRaWAN, that is a Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks, and targets key Internet of Things (IoT) requirements such as bi-directional communication, end-to-end security, mobility and localization services. LoRa enables long-distance telecommunications (this can be up to more than 10 km in open terrain) with low energy consumption. The cattle tracking device was developed in the form of an electronic eartag, consisting of several sensors, including GPS, accelerometer, thermometer, and also a solar panel for battery recharge. The transmitted data is connected with farm management software, supplemented by a map view to visualize the movement of the cattle in real time. The innovation is not only achieved at the technical level, but rather by the mode of delivery, as the solution is offered as part of a farm advisory service package. In order to monitor the motion, geolocation and environmental parameters of Hungarian Grey Cattle (longhorn), especially the high value breeding bulls, put on the herds wandering around large areas of the Hungarian Kiskunság Puszta (national reserve), a durable, long lasting and long distance solution was developed and used, based on IoT technology, by LoRaWAN radio communication. The aim of the practice is to provide an efficient ICT solution to the tracing, monitoring and data collection needs of livestock management of native and other cattle breeds based on grazing in pastoral environment, in accordance with the national zootechnical development strategy, connecting related product and service development opportunities, with affordable technical solutions according to the ranchers' financial capabilities, by state of the art ICT technology,			
Technology applied:				
Web platforms (forums, communities, e-governance), Internet of Things (IoT) (M2M, WiFi, networks)				

4.37 xSeedScore, Germany

xseedscore® accurate performance prediction	**xSeedScore**			
Applicant:	**Computomics GmbH** Anna sowa, Portfolio Management			
Country:	Germany	Implementation in Belgium, France, Germany, Sweden		
Website:	https://computomics.com			
App:	https://computomics.com/our-services/xseedscore.html			
	Delivery model:	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

As Europe is implementing actions to accelerate its adaptation to the changing climate, it needs to take advantage of artificial intelligence–based technologies which are able to address the complexities surrounding the many dimensions of crop production. Crop characteristics (phenotypes) are affected by three aspects: genetic makeup (G), Environment (E), and the management systems in place to grow them (M). xSeedScore is a data analytics tool that helps data scientists and plant breeders of field crops in the Americas and Europe to identify the crop varieties that generate the greatest yield with the greatest accuracy faster and more reliably than other solutions. We call our product xSeedScore, because the output is a scoring and selection rating of the seeds that our clients want to use, based on the genome of the plant.

xSeedScore is capable of transforming the way the industry decides what available crops to plant and how to breed new crops for specific environmental challenges. As phenotype is the result of the non-linear interactions of G x E x M, they can be uniquely modeled by our xSeedScore technology (artificial intelligence-based algorithms). This AI technology is trained to incorporate genetic information from plants and pair it with information about past and future environmental influence on plant phenotypes, to predict traits which would strengthen crops relative to specific environmental challenges and sustainability goals. Use of xSeedScore results in (i) reduced time-to-market for a new variety (up to 5 times faster), in (ii) varieties better suited for specific climates, in (iii) decreased land and water use, and in (iv) a competitive alternative to genetic modification by using naturally available biodiversity. This disruptive approach to breeding predictions and seed production with data-driven decisions means that Europe stands prepared to meet the dual demands of the future: increased yield and increased sustainability.

We currently have clients in 11 countries and have completed 138+ projects to date. Our solution is targeted to seed companies and is then filtered down to farmers. One of our collaborators (IRRI) is focused on smallholder farmers all over the world, and specifically in Africa at the moment.

Technology applied:

Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5. CATEGORY 5 – AGRICULTURE INNOVATIONS SYSTEMS AND SUSTAINABLE FARMING - CONNECTED FARM MANAGEMENT SYSTEMS

5.1 AGRICOLUS PLATFORM, ITALY

AGRICOLUS MAKING AGRITECH SUSTAINABLE	**Agricolus platform**			
Applicant:	**Agricolus s.r.l.** Andrea Cruciani, CEO			
Country:	Italy	Implementation in Albania, Austria, France, Germany, Greece, Hungary, Israel, Italy, Moldova, Netherlands, Poland, Portugal, Romania, Serbia, Spain, Turkey, United Kingdom		
Website:	https://www.agricolus.com			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

Agricolus is a cloud platform that it is accessible directly from the web by creating a simple account. Agricolus platform is composed of the best innovative technologies for agriculture: field mapping by using GIS (the service provider is Esri) to allow farmers to geolocate their fields and register all the information about them; vegetation indices elaborated internally by Agricolus team from satellite imagery (the service providers are Copernicus and Airbus) to allow farmers to assess crops development and health remotely and efficiently plan interventions in the fields; forecast models (developed with proprietary algorithms based on machine learning) for phenology, irrigation, pest and diseases to allow farmers to act promptly against harmful insects and/or diseases and to reduce the use of water, fertilizers, plant protection products; smart scouting with mobile app Agricolus Farmer in order to allow farmers to geolocate crop operations carried out directly in the fields; prescription maps for fertilizations obtained by using vegetation indices to allow farmers to reduce the use of fertilizers and use the right amount needed.

What's new is having all these tools available within a single, easy-to-use platform, able to integrate data from different sources and provide farmers with a complete Decision Support System (DSS). Agricolus supports farmers who must increase productivity and profitability, also given a greater demand for food, and the need for agriculture to requires less impact on the environment in order to avoid desertification, loss of biodiversity, and maintaining the balance of ecosystems. Agricolus allows to prevent and monitor the climatic adversities and pest and diseases of crops allowing a healthy development of the territory and reducing the environmental impact of agriculture, thanks to continuous and systematic monitoring allowed by the combination of satellite imagery, forecast models, and smart scouting. We are proud to say that we have reached more than 4000 users in 56 countries, we have 33 partners in 4 continents and the platform is available in 6 languages so far.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.2 AGRIVI FARM MANAGEMENT SOFTWARE, CROATIA

AGRIVI	**AGRIVI Farm Management Software**			
Applicant:	**AGRIVI d.o.o.** Anita Flajslik, Senior Marketing Lead			
Country:	Croatia	Implementation in Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Rep.of North Macedonia, United Kingdom		
Website:	https://www.agrivi.com			
App:	https://app.agrivi.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

AGRIVI Farm Management Software helps growers to establish sustainable farm management practices and reach profitable crop production. By providing farmers with knowledge about farming best practices and with real-time insight into farm performance, AGRIVI helps farmers to make smart decisions timely, make preventive actions that eliminate the risk of low yield and perform actions that boost high yields. The platform has full localization capabilities that are very complex when it comes to serving a global market – so AGRIVI platform supports different languages, measurement units, currencies, but also provides algorithms that are fine-tuned with local databases for pests and diseases, crop protection products, and fertilizers with details about ingredients they are made of to enable intelligence and insights.

AGRIVI's is delivered as a cloud-based solution to customers on a software-as-a-service business model. Customers access the solution via www.agrivi.com and there is also a possibility to deploy the solution on-premise to customer's infrastructure to meet specific corporate security policies. AGRIVI is the central agricultural platform for farmers to manage their entire farm operations, from agronomic to business activities of a farm. Farmers plan, track and analyse all their farming activities on the field. They get information not only what is needed to be done on a field to increase yields on the field, but also which are the best things to do from business side to make farming business profitable. Powerful analytics help farmers to make decisions based on data.

Platform also helps value chain stakeholders like input manufacturers, food processing companies, banks, insurances, development organizations and others to collaborate with growers, provide agronomic advice to help growers be more efficient, ensure traceability is sourcing produce from growers and secure sustainability of their agricultural eco-system. AGRIVI solution is available on the market for 8 years, since the founding and first versions of solutions in 2013.

Technology applied:

Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.3 AGRODOX, CROATIA

Agrodox SIMPLE FARM MANAGEMENT	**AGRODOX**			
Applicant:	**INTERTIM Ltd.** Jan Marinac, CEO			
Country:	Croatia	Implementation in Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia, Slovenia, Rep.of North Macedonia, Turkey, United Kingdom, UAE		
Website:	https://www.intertim.hr			
	**Delivery model:**	Fully free to use	**Stage:**	Early stages/ Ideation stage

Practice description:

Here in Agrodox we are redesigning digitalisation to suite agriculture and not the other way around. According to our own experience, the main issue to get a busy farmer to learn and to use new technology is to get their engagement. The solution is Agrodox - a mobile platform that effortlessly connects farmers with the benefits of technology in agriculture. Agrodox app features: simple farm management, tracking field activities and cost analysis, generating reports and data export, precise agro weather forecast for all your fields, simple agro calculators for making things easier, summarised info about popular crops, info about usage of Intertim innovative fertilizers, news from agro business and more, solving interactive quizzes to improve your practice and make your production even better. Solutions that are already on the market targets big farmers and large systems that have resources to implement such new technologies.

Our solution is oriented to smallholder farms since they usually don't have enough time and resources to implement big/heavy systems, which aims to solve these problems:

- farmers' extensive work schedule makes it difficult for them to find time for additional education and new technologies - technologies aimed at farmers are usually not adapted to their "mindset" and logic of thinking
- 2/3 of EU farms are less than 5 ha and lacking digital solutions
- agriculture is a traditional branch of economy not accustomed to modern technologies
- farmers face challenges in sales of commodities because of the limited local market.

Agrodox app has great user stories since many farmers and especially young farmers are using our app since it's simple and free to use. But more importantly they're saying that this app is developed in a way they understand and they can easily implement in their farm production. Agrodox app is on worldwide app market for less than a year.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance)

5.4 AGRORADAR - SOIL-WATER-PLANT ANOMALIES DETECTION BY MEANS OF REMOTE PROBES: SMARTS SAMPLING, FERTILIZATION AND PESTICIDES APPLICATION, PORTUGAL

AGROINSIDER Connect field to innovation & science	**AgroRadar - Soil-Water-Plant anomalies detection by means of remote probes: Smarts sampling, fertilization and pesticides application**			
Applicant:	**AgroInsider** José Rafael Marques da Silva, Responsible Researcher			
Country:	Portugal	Implementation in Portugal, Romania, Spain, El Salvador, Nicaragua, Honduras, Guatemala, Brazil, Mozambique, Vietnam, Australia		
Website:	https://agroinsider.com			
App:	https://agromap.agroinsider.com/login			
	**Delivery model:**	One-time sell; Regular service; Part of advisory service; Dividing risks and profits	**Stage:**	Proven/ Scale-up stage

Practice description:

Based on these EO data, AgroInsider developed a platform - AgroRadar - that integrates, aggregates and analyses collected data to develop value added information to its various customers. Thus, AgroRadar reveal to be a powerful tool to increase efficiency in agriculture by optimizing the use of resources because: i) can detect a lot of soil-water-plant anomalies in agriculture plots; ii) can divide plots or different geographic units in different management zones; iii) can produce and develop smart sampling strategies; iv) can forecast yield considering benchmark curves for each crop type; v) can forecast biomass/carbon considering benchmark curves for each soil occupation; vi) can calculate the spatial structure of any region being observed and with this calculate different spectral bio-diversity indexes; vii) can detect changes in land occupation; viii) can record events in the field, etc. Making use of big data in proprietary machine learning algorithms and data models through AgroRadar, AgroInsider is able to provide decision support tailor-made reports to farmers and stakeholders, which have the following benefits:

1. Soil smart sampling and soil quality studies: smart soil nutrition for all type of crops;
2. Monitoring and inspection of plots (IoT proximal sensors and remote sensors): reduction of operational risks and inputs optimization in time;
3. Soil-Plant-Water processes optimization: reducing waste and pollution and maximizing output;
4. Spatial and temporal spectral biodiversity analysis: spatial and time structures of habitats and land occupation;
5. Biomass and yield forecasts and carbon inventories: decision support.

AgroRadar provides data at different spatial and temporal scales making the AgroInsider solution targeted to both smallholder and family farmers or to large holders' farmers. The minimum study area of AgroInsider solution depends on the spatial resolution of the satellite images that feed the AgroRadar platform (R = 10 m).

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.5 AGROSENSE, SERBIA

	AgroSense			
Applicant:	**BioSense Institute** Dragana Petkovic, Project Manager			
Country:	Serbia	Implementation in Serbia		
Website:	https://biosens.rs/?page_id=12564&lang=en			
App:	https://www.agrosens.rs/#/app-h/welcome AgroSense			
	**Delivery model:**	Fully free to use; Free and fee; Regular service; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

AgroSense is a multi-functional digital platform that provides support to farmers and agricultural companies in planning and monitoring the growth of crops and coordinating the agricultural activities in the Republic of Serbia. The platform relies on multiple information sources, with various algorithms developed by researchers, as well as an innovative weather station module. There are many different sources of data on the plot, such as maps of yields, elevations, electrical conductivity of the land and images from drones and satellites. Also, there is the use of sensors and weather stations, which is very important for farmers, who make production decisions based on soil moisture, temperature below and above ground and other parameters.

AgroSense allows the access to the whole system through a single user profile: web application intended for work on a PC and Android application that turns a mobile phone into a new useful tool for farmers. Web application is designed for visualisation and in-depth analysis of data, while the Android application gives instantaneous insight into all data and allows for a quick and easy input. The following services are available free of charge:

- Diary of agricultural activities
- Weather forecast for the location of the parcel
- Satellite indices of crops that describe plant growth, photosynthesis intensity and the availability of water and nutrients - Overview of soil analysis
- Overview of photographs of crops
- Information about smart technologies used in agriculture
- Latest information about the occurrence of pests and plant diseases.

The solution increases the efficiency of farmers, saves time for accessing information and provides info that is otherwise inaccessible. The platform is easy to use and presents one of the first steps towards implementing innovation for many traditional farmers in Serbia.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email)

5.6 AKKERWEB, NETHERLANDS

	**Akkerweb**			
Applicant:	**Wageningen University and Research** Bernardo Maestrini, Researcher			
Country:	Netherlands	Implementation in Belgium, Germany, Netherlands, The blight app, a component of Akkerweb, is used all over the world (4000 fields).		
Website:	https://www.wur.nl			
App:	https://akkerweb.eu			
	Delivery model:	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

Akkerweb (www.akkerweb.eu) is a web-based portal for precision agriculture, that collects apps (aka modules) that aid arable farmers to perform different tasks, e.g. herbicide application, fertilization or crop protection. Many platforms offer advice to farmers, but they often look at a single task (e.g. irrigation, or fertilization) and rely on a single data source (e.g. satellite or drone images, soil moisture sensors). The main strength of Akkerweb is that using a single platform the farmer can receive advice on multiple tasks using multiple data sources.

Akkerweb is composed of many apps (26, with more in the pipeline at the moment) each addressing a different farmer task (e.g. fertilization, pesticide application, tractor route planning) using different data. This is possible because Akkerweb is a collaborative effort between research institutions, farmer cooperatives, and private companies. In fact, each of these actors can stage their own apps in Akkerweb, like crops models from Wageningen University and Research, decision support systems for fertilization from Agrifirm (an agricultural cooperative), or herbicides apps from Syngenta. Several apps that offer basic functionality (e.g. visualization of satellite images) are free whereas others are available for a fee (e.g. the late blight app costs 250 €/year per company).

Akkerweb provides farmers and their consultants with access to external data sources such as parcel boundaries, global weather, satellite imagery, and farm management data stored in the commercial Farm Management Information Systems (FMIS) Crop-R1 and CropVision2. In addition, Akkerweb allows users to upload their own geo-referenced data. Frequently uploaded data include maps of soil ECa, drone imagery, and the output of tractor-mounted canopy reflectance sensors. High-resolution, multi-band drone images of several GB in size can be accommodated without problems. The provider of an app decides on whether and how much to charge for the app, i.e. commercial use of the platform is possible.

Technology applied:

Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

5.7 BIOFARMINGMANAGER, ROMANIA

<table>
<tr><td>  </td><td colspan="4">BiOFarmingManager</td></tr>
<tr><td>Applicant:</td><td colspan="4">BiOFarmingManager startup
Cristian LAC, Project Manager</td></tr>
<tr><td>Country:</td><td>Romania</td><td colspan="3">Implementation in France, Greece, Hungary, Romania</td></tr>
<tr><td>Website:</td><td colspan="4">https://biofarmingmanager.com</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Free and fee; Part of advisory service; Open source, community approach</td><td>Stage:</td><td>Early stages/ Ideation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The big problem today for small-sized to middle-sized farms is the lack of proper dimensioning and integrated management of all the inputs and outputs referenced to their own local resources. The need for organic farmers today is to leverage every bit of available data (soil nutrients, seed varieties, available weather data, certified organic practices, techniques, products and strategies) to help them achieve knowledge and sustainability over the long term reduce farming risk and improve productivity while reducing costs. Farmers today lack : i) access to all data needed for farming planning and management, ii) limited or no data analysis available, iii) limited know-how to certified organic practices, techniques, products and strategies that usually translate in problems with low yields, low nutrients absorption, high input costs especially for small-sized farms(seeds, fertilizers, pest treatments, irrigation materials and water usage and storage), unrealistic income projections and ultimately generate cash flow problems.

The Solution. Cloud based central application that will aggregate publicly available data (using Big Data techniques) and help farmers accelerate their knowledge about agro-ecology (in terms of strategies, know-how and certified practices), give them a step by step guidance on all the farming processes (from initial investment to actual profit) and also help them measure and manage their business by making use of a smart sensors IoT kit!

We plan a public beta PILOT program with initial user base of 100 organic farmers. These initial farmers will be part of a franchise program plan to run as a pilot and would be expected to promote BiO Farming Manager for other farmers in their respective geographical region.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Blockchain (transactions)</td></tr>
</table>

5.8 CLEVERFARM, CZECH REPUBLIC

CLEVER° FARM'	**CleverFarm**			
Applicant:	**CleverFarm a.s.** Adam Zloty, Bussines Developement			
Country:	Czech Republic	Implementation in Czech Republic, Estonia, Latvia, Lithuania, Poland, Serbia, Slovakia, Ukraine, United Kingdom, Kenya, South Africa, Vietnam, Chile Paraguay, Sudan		
Website:	https://www.cleverfarm.ag			
App:	https://app.cleverfarm.cz			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

CleverFarm addresses the challenge of helping to feed fast growing global population while the amount of available land for farming is reducing. CleverFarm vision is to make the agricultural practices more automated, economically efficient and sustainable with strong accent on environmental protection. This we achieved by engaging new technologies in such as IoT, Remote sensing and using artificial Intelligence for analytics.

CleverFar, is cloud base application adopted to be used on devices connected to internet such as laptops, tablets and mobile phones. Remote sensing is used to apply for precision farming principles aiming on entire cycle providing saving on material such as fertilizers, seeds, and chemistry, yield and quality increase. Portfolio of IoT sensors is used for effective management of agro operations, pest and disease prediction occurrence, effective use and proper timing for plant protection products, irrigation management and commodity protection in grain stock hals or grain bins. Artificial Intelligence is used to analyze collected data from IoT sensors and satellite data and provide recommendations, warnings and notification to the end user.

In the domain of satellite data we work with biophysical parameters such as such chlorophyll content, water content and biomass conditions monitored on the crop level, providing detailed inside in plant/crop conditions. Its allow to go for dedicated treatment and timing of agro activities. Data collected from IoT sensors provides user warnings about best and disease stress, significantly reducing the use of chemistry. Solution is suitable for any farm size and type of production. In our portfolio we have large scale producers of crops on arable land, small scale producer of permanent crops- mainly fruits, horticulture and vegetable producers. CleverFarm has been established in 2016 and become market/product operational in 2018. Since 2018 we have about 30% grow of customer base on annual basis.

Technology applied:

Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.9 DIGI-PILOTE, FRANCE

ARVALIS Institut du végétal	**DIGI-PILOTE**			
Applicant:	**Arvalis - Institut du végétal** Emmanuelle Gourdain, Project leader Head of Digital Innovations, Methodology and Experimental Materials Department at Arvalis			
Country:	France	Implementation in France		
Website:	https://www.english.arvalisinstitutduvegetal.fr			
	**Delivery model:**	Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

Arvalis and its partners are developing through DIGI-PILOTE (a French Flagship Innovation Experiment), a Decision Support tool, accessible on any devices for real-time control of nitrogen fertilisation and wheat irrigation, adapting to the year's climate and the crop conditions. The tool makes it possible to adapt fertilisation and water supplies as closely as possible to the needs of the wheat crops, by taking into account the climatic conditions, the soil and plant specificities, the agricultural practices and the daily level of N and H2O stresses of the crop.

Consequently, it works to reduce losses in Nitrogen use efficiency, which can lead to eutrophication phenomena which cause ecosystem degradation and that can impact air quality and human health (ammonia = precursor of fine particles). It also enables the preservation of water resources at local and territory scales. The decision support system uses fields data from sensors on the field, satellite imagery and crop models (CHN Arvalis crop model) to match crop conditions and weather forecast in order to help farmers optimize wheat fertilisation and irrigation. Practically, it generates technical and strategic advice for its end-users accessible from various devices and enables to connect with other farm softwares.

To continuously upgrade the tool's calibration and extend its functionalities, DIGI-PILOTE is supported by a network of digital farms (DIGIFERMES®) as well as farmer associations, which currently rely on different Decision Support Systems (DSSs) and field management software, each with their own data standards. In order to successfully manage the centralised information processing, the seamless data transmission to the cloud combined with assimilated data from various sensor systems solutions is at the heart of this tool. For the moment, the solution is already deployed in the South-East region of France. The ambition is to make it more robust, usable in all conditions, so that it could be expanded on the whole French territory and abroad.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

5.10 EXACTFARMING, RUSSIA

ExactFarming	**ExactFarming**			
Applicant:	**ExactFarming LLC** Anna Kudinova, CEO			
Country:	Russia	Implementation in Armenia, Azerbaijan, Belarus, Bulgaria, Kazakhstan, Kyrgyzstan, Moldova, Romania, Russian Federation, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan, Argentina, Benin, Brazil, Venezuela, Ghana, Zimbabwe, Cameroon, Kenya, Morocco, Mexico, Niger, Nigeria, Uganda, Uruguay, South Africa		
Website:	https://exactfarming.com			
App:	https://demoapp.exactfarming.com			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

ExactFarming is a digital agriculture platform allowing its participants to effectively manage agricultural business, make timely decisions and reduce risks, as well as develop transparent cooperation. Our digital agronomy solutions are used not only by agricultural producers, but also by financial sector (banks and insurance companies) and producers and distributors of seeds, CPAs and fertilizers enhancing cooperation across the crop production process. We use such cutting-edge technologies as Big Data, machine learning, computer vision and neuronets to create a simple user-friendly product allowing to solve particular tasks.

To start working with ExactFarming nothing but the field boundaries and crop rotation specification is needed. Our key solutions include land productivity assessment, agrochemical soil analysis support and VR fertilizer application prescription maps ensuring wise land treatment and soil fertility preservation, as well as satellite monitoring of vegetation making crop production informed and resilient. The proprietary developments of ExactFarming are a unique guide on pests and diseases and a unique algorithm of field agrophytocenosis development anomalies foci detection empowering farmers to grow and treat crops knowledgeably and sustainably. Particular use cases and the results of our pilot projects prove the fact our solutions allow farmers to get higher yields and save money.

Our solutions are based on the processing of Big Data within the framework of the proprietary platform for their storage and analysis. We work with such technologies as machine learning, computer vision and neuronets. ExactFarming collects data from different sources: field sensors, weather stations, satellites, UAV — and simultaneously acts as a data source itself. ExactFarming was founded in 2014, and we have been having sales since 2018.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Neuronets, NFC

5.11 FAROS - FARM SATELLITE OBSERVATION SYSTEM, ITALY

FAROS FARming Observation System	**FAROS - Farm satellite Observation System**			
Applicant:	**iptsat** valerio caroselli, CEO			
Country:	Italy	Implementation in Italy		
Website:	http://www.iptsat.com/index.php/en			
	**Delivery model:**	Regular service; we want the sell the services in a "netflix" like model, small price depending on how big is the customer.	**Stage :**	Market adoption/ Validation stage
Practice description:				
FAROS aims to combine satellite remote sensing technology, precision farming applications in a simple and immediate system to use, which leaves artificial intelligence to process data and give the user the best decision. The main objective is: 1. To launch an innovative WEB service in the field of “precision agriculture” aimed at farms 2. To transform BIG DATA from SPACE into SIMPLE INFORMATION (maps for farmers) 3. To enter the emerging market for commercial. This multilevel and multiscale system can deliver value added map services (NDVI Map, chlorophyll map, Disease plant map, Ground map), which derived from Copernicus Constellation (e.g. Sentinel 1 and Sentinel 2). It then send these maps directly to farmers from a simple web-GIS system to improve farmers for their fields and crops. All the necessary data are obtained from satellite pictures taken by European Copernicus Constellation including from sentinel-1 to sentinel-6. Satellites cover big area (290 square kilometres) with a resolution of 10 meter, thus this system can control even small areas. Besides, data from satellite images are now given in near real time (by summer every 5 days) are scientifically tested and validated. Agronomists and farmers need information in their hands quickly, in ways that fit with their workflows, so they can focus on identifying in-season crop anomalies and take immediate action before it is too late. Farm satellite Observation System is developed in a cloud computing and software environment and make possible to build an automated infrastructure to handle terabytes of daily imagery, and deliver this data in near-real time, in easy to-use formats. It supports the monitoring of a wide range of variables which affect crops, allowing the farmer to make better informed decisions in planning, planting and growing the new crops. The solution can be applied to small farmer with minimum 10 hectar of agricultural area.				
Technology applied:				
Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones)				

5.12 FIE20: GROUNDWATER AND METEO SENSORS, LATVIA

<table>
<tr><td> 
</td><td colspan="4">FIE20: Groundwater and meteo sensors</td></tr>
<tr><td>Applicant:</td><td colspan="4">Baltic Open Solutions Center, Ltd.
Michal Kepka, Project manager</td></tr>
<tr><td>Country:</td><td>Latvia</td><td colspan="3">Implementation in Czech Republic, Latvia</td></tr>
<tr><td>Website:</td><td colspan="4">https://bosc.lv</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Free and fee</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The solution developed under the SmartAgriHubs project in the scope of the Flagship Innovation Experiment FIE20 Groundwater and meteo sensors is an expert system to support farmers in decision-making process and planning process of field interventions. This FIE20 solution integrates various data sources and different analytical processes in a complete system and provides users an easy-to-use web map application as a common user interface. The FIE20 solution utilizes components of the SmartAgriHubs Digital Innovation Hub where it is deployed and it uses services from individual DIHs of team members, especially cloud services for data storage and large computations.

The FIE20 solution integrates different types of data - local sensor data and online analysis based on this data, Earth Observation and remote sensing data, farm and regional thematic spatial data, weather model and forecast data - to be visualized in web application and used in implemented analytical functions. Available analytical functions provide decision-support results oriented on fields status and conditions, support based on long-term data from EO observations, weather models and measurements.

The web map application provides overview of the locality with visualization of different thematic spatial data on local or regional level, Earth Observation data and various indices. The web map application provides weather forecasts for the locality of the farm and different analyses based on the weather forecast and the forecast model data. Various analytical functions based on spatial and EO data are available in the web map application, these analyses provide information oriented on fields and crops on fields in different stages. Data layers providing - yield productivity zones delimitation from the long time period data, fertilizers variable application maps and NDVI index daily average trend from short time period data represent products of EO data and analytical functions.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)</td></tr>
</table>

5.13 FIELD MONITORING LABORATORY – USING INTERNET OF THINGS DATA COLLECTION, HUNGARY

SZÉCHENYI EGYETEM UNIVERSITY OF GYŐR	**Field Monitoring Laboratory – Using Internet of Things Data Collection**			
Applicant:	**Széchenyi István University** ANIKÓ ÉVA NYÉKI, DR., project leader			
Country:	Hungary	Implementation in Hungary		
Website:	https://uni.sze.hu			
	Delivery model:	State-of-the-art data collection standard and method for sustainable precision agriculture with the aim of agricultural digitalization, new scientific results and extension service for farmers	**Stage:**	Market adoption/ Validation stage

Practice description:

The aim of the project (Field Monitoring Laboratory practice) is the elaboration and operation of a farmer-supporting decision-promoting system with the help of which agricultural management can be brought to a level fulfilling the requirements of present challenges in an environment-friendly and input-saving way. The state-of-the-art sensors and telecommunication systems are now available for testing and validation. Based on these, the Field Monitoring Laboratory was established in Mosonmagyaróvár (Hungary) in 2020.

The set of sensors (from different producers) were installed in two experimental fields on seven geo-positioned locations. The placement of sensor sets are based on the heterogeneity of the soil physical (texture) variety, because the previous research results also proved that the soil types is one of the most influencing factor affecting plant growth. The experimental fields contain three soil types: loam, sandy loam and silt loam soil (based on ASABE standard). The systems main purpose is to collect data from crop fields and from the surrounding natural (or quasi-natural) areas. Thereby, the relationship between natural ecology and agro-ecology can be profoundly studied. One of the tools of processing Big Data is using artificial intelligence. The system consists of soil, crop, environment and atmospherics sensors. These sensors (Raspberry Pi, Arduino and Libelium platforms) are based on solar energy power. The data are collected with LoraWan communication protocol in 10-15 minutes intervals depending on sensor type.

The aims of this Laboratory are to compile soil and micro-climatic information and their effects in site-specific – precision - crop production. Maize and winter wheat cultivation were tested, in order to utilize Big Data that later will support the decision system for farmers. The core part of this activity is automating data collection, extending remotely obtained parameters of crops, and accessing real-time data from any device at any time. The real challenge is the fusion of data gathering from different platforms. The practice was developed by the “Precision Plant Production Research Team” at Széchenyi István University.

Technology applied:

Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data)

5.14 FLUROSENSE, UKRAINE

FluroSat	**FluroSense**			
Applicant:	**FluroSat** Anastasia Volkova, PhD, CEO/founder			
Country:	Ukraine	Implementation in Bulgaria, Denmark, France, Greece, Ireland, Kazakhstan, Moldova, Romania, Serbia, Spain, Switzerland, Turkey, Ukraine, Our solution is used in 45 countries around the world		
Website:	https://flurosat.com (https://www.regrow.ag/)			
App:	https://flurosat.com/flurosense (https://www.regrow.ag/flurosense)			
	**Delivery model:**	Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

FluroSense in an agronomic decision support platform that allows farmers and their advisors to save time and money or on-farm operations through cut-back in the use of fertiliser, water, fuel and labour hours to manage crop stress, and yields optimally. Our platform provides monitoring, report and optimisation tools across the areas of crop performance, crop stress, crop nutrition, yield, and sustainability practices.

FluroSense platform automatically collects a range of data for an agricultural field (satellite imagery, soil maps, equipment application maps), and applies a range of scientific/agronomic and ML&AI models built into it. A built-in crop simulators used to simulate crop behavior, its input requirements, and yield potential across all food production environments. To power this simulator FluroSat has developed technology to translate satellite imagery into crop phenology metrics, geo-located crop stress markers and site-specific fertiliser recommendations. Some additional technology examples include ML models to identify crop types post-season and in-season, ability to translate satellite imagery into nitrogen sufficiency maps and identify whether a farm has conservation practices used on the field. Using these information layers, a decision support tool for each of the key agronomic decisions from planting to harvest, and again to planting are offered to the farmer and their agronomic advisor.

The solution has several main benefits 1) reduction of uncertainty when making decisions around fertiliser application, irrigation, and timing of farming operations, 2) reduction in time and hence lag between the plant signal and grower's ability to respond to it, which results in higher yield through cut-back yield loss and ability to seize opportunities to grow a better crop when they arise. Finally, the solution is not built in a 'silo', it connects to all major Farm Management Systems, which shortens time to value for the farmer. The technology is widely available across the majority of the features, and is now being used in 45 countries around the globe.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Robotics (agrobots, driverless tractors); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.15 GAIASENSE, GREECE

<table>
<tr><td>  </td><td colspan="4">gaiasense</td></tr>
<tr><td>Applicant:</td><td colspan="4">NEUROPUBLIC S.A.
Vassilis Protonotarios, Outreach & Networking Manager</td></tr>
<tr><td>Country:</td><td>Greece</td><td colspan="3">Implementation in Cyprus, Greece, Poland, Portugal, Spain, Ukraine</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.neuropublic.gr/en</td></tr>
<tr><td>App:</td><td colspan="4">http://www.gaiasense.gr/en/gaiasense</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Regular service; Part of advisory service; Smart Farming as a Service (SFaaS)</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The gaiasense smart farming system is a Greek innovation that combines information technologies with agricultural science in a holistic way. gaiasense is pioneering at a European level in the field of smart farming; it enhances and optimizes the decision making and precise applications in agricultural crops no matter how small or large scale they are. gaiasense collects data from the field, the satellite, the scientist / the agronomist and the farmer, and provides the tools to the agricultural advisor, the researcher and the farmer in order for them to take advantage of every opportunity to produce better, more and economical agricultural product from the fields.

The gaiasense system, along with the agricultural advisor who harnesses its tools, accurately calculates the quantities of fertilizers, pesticides and irrigation water that are required by each crop under specific conditions. Combined with their timely application, they prevent excessive and unnecessary use. This helps farmers to significantly reduce their production costs and increase their profit, while at the same time reducing the impact of their agricultural activities on the environment. gaiasense supports a high number of crops in Greece and abroad (Spain, Portugal, Poland, Ukraine and Cyprus at the moment), such as grapes, olives, potatoes, cotton, peach, almonds, tobacco, kiwi, vegetables and many others. For each one of these crops scientific models for the irrigation, the fertilization and crop protection have been developed in collaboration with experienced researchers. gaiasense was designed from scratch with the smallholder farmers in mind. Taking into consideration their usually limited financial and technological capacity, it is available to them through a low annual subscription.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)</td></tr>
</table>

5.16 HZPC DECISION SUPPORT SYSTEM, NETHERLANDS

<table>
<tr><td>  </td><td colspan="4">HZPC Decision Support System</td></tr>
<tr><td>Applicant:</td><td colspan="4">HZPC Holland BV
Antti Hintikka, Business Development Manager</td></tr>
<tr><td>Country:</td><td>Netherlands</td><td colspan="3">Implementation in Finland, Netherlands, India</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.hzpc.com</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>YouTube video for growers in Europe, expBundled with potato seed price (software is very low-cost compared to seeds)</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">HZPC developed the concept of HZPC Decision Support System (“HZPC DSS”) as a precision agriculture tool enabling growers to “become their own agronomists” for HZPC’s potato varieties. It is a mobile and web-based application which embeds HZPC’s knowledge inside and the growers can consult with through the entire growing cycle. To execute on this vision, HZPC works with Agritask (www.agritask.com) as a technological partner. Agritask provides an agronomic management software for agricultural stakeholders, with high flexibility to accommodate each client’s unique requirements. It has a strong track record of collaborating with agronomists and other experts to deliver tailor-made digital tools for growers in their value chains.

HZPC DSS has on-field recommendation tools based on specific data input – such as recommended seed amount and planting distance, based on specific data input on growing purpose, variety, crop size, soil type, soil humidity and others. In addition, HZPC DSS utilizes external data sources such as satellite to assess crop maturity and heath. The tools are dynamic allowing the growers to test out different scenarios. The similar concept applies for recommendations for fertilizer, haulm killing, irrigation and fertigation. In addition, HZPC DSS enables growers to document field data digitally through the season. These include digitizing the planting date and distance, tuber sampling, disease management (e.g. late blight), yield estimation, and actual yield reporting. Such data will be processed and visualized so that growers will have clear visibility at any point in the season on where they stand in terms of crop growth and health. This empowers the growers to make better decisions using facts in a timely manner.

While there are other digitization tools available for growers such as IoT sensors and satellite data, HZPC DSS is unique in its ability to transfer HZPC’s deep agronomic knowledge to farmers, tailoring to individual needs and conditions.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)</td></tr>
</table>

5.17 IoT-based Platform for Greenhouse Vegetable Production, iVeg, Spain

	IoT-based Platform for Greenhouse Vegetable Production, iVeg			
Applicant:	**University of Almería** Jorge Antonio Sánchez Molina, PhD/Associate Professor			
Country:	Spain	Implementation in Spain		
Website:	https://www.ual.es			
App:	https://iof2020.ual.es			
	**Delivery model:**	Free and fee	**Stage:**	Market adoption/ Validation stage

Practice description:

In this solution, some challenges are present, such as processing and accessing sensor data, building a cloud solution that can scale up depending on the data requirements, providing an open system so that new and heterogeneous sensors and devices can be easily added, and the possibility to provide greenhouse models as a service. The aim of this work is to contribute to this digitalization of the agricultural sector, where the implementation of a cloud-based solution for greenhouse crop production is presented. The proposed approach provides different services for economic and environmental benefits of the agricultural activity and improving the system efficiency by providing suggestions for the use of water, pesticides, fertigation, or energy.

The aim is the development of an IoT web-based system for greenhouse tproduction involving large amount of data, physical and virtual sensors, models and algorithms focusing on important aspects like water and energy use efficiency, safety and transparency. The core service of the proposed IoT platforms is the GreenHouse Model as a Service. When a greenhouse is registered in the system, specific models for inside climate, crop production, fertigation and early warning are implemented in the platform as particular services. These model-based services provide the user a DSS tool to obtain forecast about indoor climate conditions, crop production, or fertigation needs, among others. The models are implemented in M code using Matlab and are embedded as services in the Matlab Production Server environment.

The system is really powerful for farmers, since they can use the proposed model- based services to make predictions and estimations about climate, production, and irrigation of their greenhouses to be used as DSS. In fact, when the models for climate and irrigation are requested, the system provides suggestions for the control system inputs such as set-point temperature, irrigation volume, irrigation time, nutrients or early warning in a prediction horizon, from 24 hours to days or weeks. The main challenge is to reduce inputs and increasing energy efficiency, avoiding/reducing the use of pesticides.

Technology applied:

Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages

5.18 OPI - OBSERVE, PREVENT AND INTERVENE, ITALY

agri-climatic intelligence system	**OPI - Observe, Prevent and Intervene**			
Applicant:	**Evja** Paolo Iasevoli, CMO and co-founder			
Country:	Italy	Implementation in Greece, Italy, Netherlands, Serbia, Bangladesh, South Africa		
Website:	https://evja.eu			
	**Delivery model:**	Leasing	**Stage:**	Proven/ Scale-up stage

Practice description:

OPI is s a decision support system for growers that improves three key agronomic activities:

- Irrigation: by combining micro-climatic monitoring and innovative agronomic models, through suggestions based on each phenological stage, OPI allows to check the amount of water available for the plant and that already evapotranspirated. Growers can thus achieve a more efficient water management and maximize the effectiveness of their chemical treatments.
- Precision nutrition: based on plant stress, OPI suggests the right time for fertilization, so that not a single drop of nutrient is wasted.
- Protection: disease predictive models powered by artificial intelligence optimize the usage of pesticides, so that growers can use them only when it is actually needed, given the micro-climatic conditions of the crops.

The result is a lower chemical residue on the final product and a lower soil pollution. The software provides real time remote monitoring from pc and mobile devices, data history, charts and task calendar. An all-in-one, accurate and timely system to monitor and predict along the whole crop cycle. OPI also allows growers to improve their indoor facilities management, being glasshouses or vertical farms. Heating, lights, ventilation and irrigation are all made efficient by the accurate and constant monitoring of the crops micro-climate, providing plants exactly what they need, at the right time. This boosts the yield and cuts the energy bill. Moreover, with a perfect micro-management of their crops, growers have supporting data to forecast their yield and avoid losses caused by plant diseases, wrong irrigation and ineffective nutrition. This means they can harvest more food from the same arable land. OPI also allows tracking food from seeding to harvest.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.19 PHORLAND, PORTUGAL

Phorland	**Phorland**			
Applicant:	**Phosphorland Lda** Raul Pinheiro, CEO			
Country:	Portugal	Implementation in Portugal, Angola, Brazil		
Website:	https://phorland.pt			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

Phorland provides the perfect management tools to farms.
A solution based in the most important concept 'FROM agronomists TO agronomists'.
Is a farm management software owned by Phosphorland lda, a portuguese company located in Braga and allow to register all information of your farm. As a responsive cloud-based software, is available everywhere and to everyone. It is also a very intuitive and user-friendly system. The digitalization has come to improve all sectors and agriculture will receive a boost adopting these practices.

Phorland gives farmers the ability to empower their collaborators to register their daily work and to develop more tasks everyday. Improves the management of any farm and gives information to increase sustainability, in term of consumables and products harvested. All products have a traceability file to assure food safety. Phorland is a web based software that helps farmers to improve all the organization. As a farm software, Phorland helps farmers to see and get reports/charts that provide important information to perform operations more accurate. From water, fertilizers, machine and fuel use to yields, Phorland give users the information about stock, use, and cost.

The main goal is to advise farmers to reduce or apply the precise amount of these resources, generating a lower carbon footprint and harvesting more sustainable products. Any product produced has a traceability file that helps the certifications/audits easier. This gives a bigger trust to clients. We are starting to develop a project where farmers can get to clients and sell their products with a sustainability stamp (optional) where it states the sustainability level of his products. This solution will allow clients to scan a batch and see this traceability file and see all its production process. Phorland started to be developed in 2014 and went to the market in 2015. Since then, users have been increasing every day.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.20 PROGIS, AUSTRIA

PROGIS Software that shows	**ProGis**			
Applicant:	**PROGIS Software GmbH** DI Walter H. Mayer, CEO			
Country:	Austria	Implementation in Albania, Armenia, Austria, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Greece, Hungary, Italy, Kazakhstan, Lithuania, Montenegro, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland, Rep.of North Macedonia, Russian Federation Turkey, Ukraine, ~15 more (A(sia, USA, Chile, Australia, Egypt, Nigeria, South Africa, Zimbabwe).		
Website:	http://www.progis.com, https://www.geomatic-intelligence.com			
	**Delivery model:**	One-time sell	**Stage:**	Proven/ Scale-up stage

Practice description:

WinGIS was the 1st GIS system in 1990, embedded WHERE, WHEN, WHAT with raster- and vector-maps and apps for farm-, forest-mgmt. and forest inventory. Also a mobile GIS with central and mobGIS for use on machines to manage cooperatives in Austria/Germany with over 160.000 members. Partners did with WinGIS and other apps.

PROGIS started sales in 40 countries, 4 continents, supported translation, did database for local needs: Crop costs, revenues, trees, models etc. with local experts. From the perspective of farmers/foresters and from the view of public and private user groups we started step 1 WinGIS development, powerful but easy to use. Parallel were integrated time management or the WHEN and also the WHAT as database. Local experts can fill it with data, crops, trees, seeds, costs, revenues etc. that enables users to calculate prices to integrate regional data fine-tuned to local user groups. To enable this, in parallel it gave us possibility to enlarge with models to COUNTRYWIDE STATISTIC as X measurements we get Y percentage precision. It can be used for small / large regions managing user groups or entire countries.

WinGIS took time the first 3 years, then we started development of agriculture-, forestry-management and enlarged to other user groups. Named DokuPlant was for farm management, ForestOffice for forest-management, then added FOREST INVENTORY model where we linked growth tables for all tree-sorts to it. First from Austria but today with local experts we also can enlarge them for any region of the globe and we can use the same method to do it for different tree sorts and evaluate them with classification groups, many quantities, and qualities. We work to enlarge to agriculture inventory, link soil, weather, geology etc. and growth quality/quantity.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Broadcasting (TV, radio, online, SMS); Digital communication (telephone, messenger, email); Software solutions (programs and packages); E3 integrate Economy Ecology Energy

5.21 SKYSCOUT, RUSSIAN FEDERATION

intterra	**SkyScout**			
Applicant:	Alina Komleva			
Country:	Russian Federation	Implementation in Belarus; Kazakhstan; Moldova; Russian Federation; Ukraine		
Website:	https://intterra.ru/en			
	**Delivery model:**	Free and fee	**Stage:**	Market adoption/ Validation stage

Practice description:

Intterra's SkyScout is a single system for managing farm agronomic service. The system was created by agronomists for agronomists using cutting-edge technologies, taking into account the whole experience and problems related to managing a farm. It provides a full crop condition insight throughout the season based on reliable data, gives you access to expert knowledge and saves time on making agronomic decisions. SkyScout can:

1) Inform agronomists about all challenging sites at the fields
2) Perform the most effective fertilizer distribution
3) Provide supervision over the staff
4) Store the "field history" (process operations, phytosanitary situation of the field, recommendations from leading manufacturers of chemical crop protection products)
5) Monitor weather conditions of each field
6) Assist to identify phytosanitary problems using guides/identifiers
7) Assist to individually select crop protection products using guides/selectors.

The product uses Earth remote sensing technology in several ways: 1. Satellite monitoring of agricultural land. To ensure the high-quality assessment, high-resolution satellite imagery materials are used along with a cloud and shadow mask developed by IntTerra. 2. Maps of field productivity (performance) for the module of precision farming.

The SkyScout product interface allows you to customize the parameters for plotting field performance maps (the number of allocated zone classes, their minimum area, fine-tuning of the satellite imagery materials used for calculations). The precision farming module developed by IntTerra makes it possible to set fertilizer application rates for individual contours of zones using automatic calculation of heterogeneity (difference in performance capability between zones) and save the result in the format of a task map that can be downloaded into the on-board systems of equipment from different manufacturers.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Cloud (data storage and computing, Big data);Software solutions (programs and packages)

5.22 SOIL ANALYSIS BASED ON SATELLITE IMAGES AND ML, BULGARIA

SoilViews	**Soil Analysis based on satellite images and ML**			
Applicant:	**SoilViews** Dimitar Dachkinov, Co-Founder and Developer			
Country:	Bulgaria	Implementation in Bulgaria		
Website:	http://soilviews.com			
App:	https://soilviews.com/soilviews-app			
	**Delivery model:**	Regular service; Free for testing and help in validation	**Stage:**	Early stages/ Ideation stage

Practice description:

SoilViews started as an idea to combine satellite image data with traditional farming techniques. Soil content changes and land climate take effect year over year. This demands for more efficient ways for farmers to inspect their plots of land. Ground sampling is an excellent practice but it is often expensive, especially for large plots of land. SoilViews analyzes a large number of geolocated soil surveys, and uses them for ground validation of deep learning models for image classification in order to create useful map for the farmers to use.

SoilViews offers a fast web application service allowing farmers to quickly obtain soil analysis of their plots of land. Although most competition products rely on the analysis of the plant part (NDVI, LAI, GNDVI, EVI, and other indexes) of the Agroecosystems, we believe that, the most important part for the growth and development of healthy crops is the soil, as the condition of the crops depends to a large extent on the condition of the soils. Therefore, we want to use Copernicus products for analysis and modelling of soils (pure soil without vegetation cover), their condition and distribution. We have a large database (including digital) of geolocated soil surveys in the country and we plan to use it as a strong asset for a ground validation of our models. When we determine the exact soil indices based on Copernicus data, we will be able to quickly make and provide as a service accurate spatial analysis of the distribution of the required soil types, their qualities and especially their suitability for growing a particular type of crops.

SoilViews is a cloud-based Single Page Application delivered as SaaS. It relies on modern web development frameworks to provide scalability and agility. The application is hosted on Firebase cloud and uses its storage, hosting, authentication, performance monitor and Google analytics capabilities. It is built on top of Node.js web server in the backend and React.js framework as frontend - Modern web development stack where speed, scalability and cross-platform features are our strongest advantages. For the EO data in collaboration with ESA, we use Copernicus remote sensing data. The solution is currently under development stage and we are collecting more date in order to improve our algorithm and validate it.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.23 SOLARFERTIGATION, ITALY

SolarFertigation	**Solarfertigation**			
Applicant:	**SF System srl** Sergio Strazzella, CEO			
Country:	Italy	Implementation in Italy		
Website:	https://www.solarfertigation.com			
	**Delivery model:**	One-time sell; Open source, community approach	**Stage:**	Market adoption/ Validation stage

Practice description:

Today we face major problems such as poverty and the shortage of primary resource. Water consumption is growing: since the 1980s it has increased by 1% every year and it is estimated that by 2050 it will be born by 20-30% compared to the current ones. Our practice seeks to address and solve some of the challenges we are going through. Water management in agriculture represents a strategic area for guaranteeing sustainability and competitiveness if supported by research and innovation. Solarfertigation is born to counter these problems, which achieves four of the sustainable objectives of Agenda 2030: 7th 'clean and sustainable energy', 12th 'responsible consumption and production', 13th 'act for the climate' and 15 ° 'promote life on earth'. Thanks to SF you can have a more responsible consumption and optimize resources that are already scarce enough, without damaging the environment and increasing food safety.

Solarfertigation is an intelligent fertigation system composed by a software for support the farmer's decisions and a hardware capable of translating decisions into actions (fertilization and irrigation). The developed solution is energy self-sufficient, thanks to the integration of a stand-alone photovoltaic system. The system collects environmental data from the field, integrates them with weather forecasts taken from the network and elaborates the correct fertigation solution for the type of crop selected and the specific growth phase. A subsequent Big Data analysis enables the processing of the agronomic database of crops for optimize the use of water resource and increase the productivity of agricultural fields.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); Blockchain (transactions)

5.24 TARGIS-VRA: SMART VARIABLE RATE FERTILISATION, TURKEY

	TARGIS-VRA: Smart Variable Rate Fertilisation			
Applicant:	**GEOSYS GIS & Consultancy Services Ltd.** Hasan Imge Celik, Business Development Manager			
Country:	Turkey	Implementation in Turkey		
Website:	https://www.geosys.com.tr			
App:	https://app.hassastarim.com			
	**Delivery model:**	One-time sell; Regular service; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

TARGIS®-VRA, a patented technology and trade mark of GEOSYS GIS & Consultancy Services, brings a next generation precision agriculture technology to the farming industry of all sizes and allow farmers to exploit their already existing traditional, legacy machinery in the modern interconnected environment, achieving huge benefits in their production. TARGIS®-VRA enables small and medium sized farms to apply precision agriculture fertilizing - spraying operations using their old machinery without having to purchase new and expensive VRA compatible implements. Also, the product will enable farmers to assess the environmental impact of their fertilizing-spraying operations and identify hot spots in their operations. That is, TARGIS®-VRA offers a unique online and real-time Life Cycle Analysis (LCA) for fertilizing - spraying operations.

The targeted application has been focused on fertilization and spraying processes which is the most expensive input cost of agricultural production. Within this concept the smart design of “modenization kits” makes precision fertilization and spraying issues possible with traditional machinery which have been widely used by small and medium sized farms. With the development of platform, the vision has been evolved to innovate in cloud-based fertilization infrastructure with an effective use of AI and Machine Learning algorithms. As a result, Platform offers both a product and a service to reshape and develop competitive advantage in the agricultural market. TARGIS®-VRA is compatible with all type of agricultural machineries with use of different controller components as linear actuators, spray valves.

The system has been also supported with a software platform which is consisted of mobile and web applications. Mobile Application makes possible to manage mechanicals components by connecting via Bluetooth protocol and getting data from cloud services to make input management in a variable way. Web and mobile platform have been supported with AI based algorithms and models based on analysis of satellite imagery, weather services and different parameters.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.25 THE AI-POWERED ONESOIL PLATFORM FOR PRECISION FARMING THAT IS FREE FOR FARMERS TO USE, SWITZERLAND

<table>
<tr><td>  </td><td colspan="4">The AI-powered OneSoil platform for precision farming that is free for farmers to use</td></tr>
<tr><td>Applicant:</td><td colspan="4">OneSoil
Rada Klimenko, Head of Business Development</td></tr>
<tr><td>Country:</td><td>Switzerland</td><td colspan="3">Implementation in Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Kazakhstan, Latvia, Lithuania, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland, Russian Federation, Turkey, Ukraine, United Kingdom</td></tr>
<tr><td>Website:</td><td colspan="4">https://onesoil.ai</td></tr>
<tr><td>App:</td><td colspan="4">https://app.onesoil.ai</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Fully free to use</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The OneSoil mobile app offers field monitoring and crop scouting features, as well as weather forecasts to every farmer. For advanced and more experienced users, the platform offers data visualization from agricultural equipment and variable-rate application of seeds and fertilizers in their web app. OneSoil web app ensures interoperability with various brands of agricultural equipment: a farmer can upload files of different types to the system and download files with tasks for onboard computers of various brands. Main functionalities:
1. Automatic field boundaries detection using AI and satellite images. This simplifies user onboarding. A farmer no longer needs to travel around the farm on a GPS-equipped ATV or ask for this work from some third-party companies.
2. NDVI is calculated in seconds. This saves time and efforts on crop scouting and field monitoring. Using satellite images, we can understand how plants are developing. When a farmer knows NDVI, their field scouting routine becomes easier.
3. Crops, sowing and harvest dates, yield, and growth stages — all this data can be recorded for all fields in a handy way.
4. Productivity zones are calculated in seconds. This helps understand the best- and worst-performing field zones.
5. Variable-rate seeding and fertilizer application maps are created automatically in a couple of clicks.
6. Notes for field problem areas ease the crop scouting routine.
7. A 5-day weather forecast helps plan fieldwork.
8. The spraying time feature helps select the best time to spray crops.
9. Growing degree-days and accumulated precipitation charts help predict growth stages and plan fieldwork.
10. Onboard computer data visualization helps check the accuracy of field operations. Also, we create a prescription file for an onboard computer in one click.
OneSoil makes farming technologies simple, fast, and free to use.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Artificial Intelligence (Machine / deep learning)</td></tr>
</table>

5.26 VITE.NET, ITALY

HORT@ From research to field	**vite.net**			
Applicant:	**Horta srl** Valentina Manstretta, Dr			
Country:	Italy	Implementation in Bulgaria, France, Greece, Israel, Italy, Montenegro, Portugal, Romania, Slovenia, Spain, Canada, USA, Brazil		
Website:	https://www.horta-srl.it			
App:	https://www.horta-srl.it/en/portfolio-item/vite-net/			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

A Decision Support System (DSS) called vite.net® was developed for vineyards by Horta, in order to help farmers in the decision making process for the sustainable management of the crop. Vite.net® is a web-based tool able to: i) collect multiple information/data in real time about different vineyard components (air, soil, plants, pests and diseases) by using IoT technologies; ii) analyse these data by advanced modelling and bigdata solutions; and iii) make up-to-date information, alerts and decision supports for vineyard management.

The DSS considers grapevine growth and development, risk for diseases (downy and powdery mildews, black rot and Botrytis bunch rot), pests (berry moth, American leafhopper and mealybugs), abiotic stresses (low temperature, water deficiency). Other functionalities of the DSS are related to the use of Plant Protection Products (PPP), and the calculation of sustainability indexes. The DSS platform is open to the integration of new components or add-on services provided by the last results from research. The DSS was validated over a network of 21 organic farms in Italy in seasons 2011 and 2012. The average saving obtained by organic growers using vite.net® was 195 €/ha/year relative to their usual farm practice. In the following year, the DSS was used on large scale by about 50 farmers and 50 technicians (both private and public) in different Italian grapevine growing areas, from Friuli to Sicily, on about 3,000 ha. Since then, the use of vite.net® has increased in numbers and in covered countries: in season 2020, the DSS was used by 550 users on around 20.000 ha of vineyard across Italy, Spain, Portugal and pilots were started in France, Greece, Bulgaria, Montenegro, Romania, Slovenia, Israel, Canada, USA and Brazil.

Statistics about the use of the DSS by the users based on their access to the web portal of vite.net® as well as the feedback collected during the regular contacts with them showed an average reduction in the number of treatments and, as a consequence, in the cost of grapevine's pest and disease control. The use of the DSS significantly increase the farmer's profit and decrease the environmental impact of crop production.

Technology applied:

Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

5.27 WATCHITGROW, BELGIUM

	**WatchitGrow**			
Applicant:	**VITO** Sven Gilliams, Interantional Business Development Manager			
Country:	Belgium	Implementation in Belgium, Germany, Italy, Netherlands, Uzbekistan		
Website:	https://remotesensing.vito.be/applications/remote-sensing-agriculture			
App:	https://watchitgrow.be/en#about			
	Delivery model:	Free and fee; Regular service; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

WatchITgrow is an online platform to support growers to monitor arable crops and vegetables in view of increasing yields, both qualitatively and quantitatively. WatchITgrow helps to monitor the status and evolution of crops very closely. WatchITgrow uses various types of data starting with satellite data combined with e.g. weather data, soil data, IoT data and field data provided by the grower. These data are combined using new technologies such as big data analytics and machine learning to provide growers with more timely and personalized advice. It gives you an overview of the status of all your crops 24/7. The platform is available at any time to gather all necessary crop-related data. Users receive warnings when something goes wrong and get timely advice on where and when actions need to be taken (fertilize, irrigate, …). This allows growers to save time and cost while production can be increased. They have access to their data in just a few clicks to achieve higher and more sustainable production.

WatchITgrow is a collaboration platform for everyone in the sector, from growers, contractors and advisors to buyers. The platform offers numerous functionalities and benefits to monitor your crops more smoothly, but it also offers the possibility to set up a closer cooperation between individual growers and buyers. The platform allows growers to access and store large amounts of data via a personal account. The data of the user remain property of the user at all times and will not be shared with third parties unless the user explicitly gave permission. VITO, as an independent party, guarantees full data privacy, data security and data access.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email)

5.28 WISECROP, PORTUGAL

	Wisecrop			
Applicant:	**Wise Connect, S.A.** Tiago Sá, CEO			
Country:	Portugal	Implementation in Italy, Portugal, Spain, Brazil		
Website:	https://www.wisecrop.com			
App:	https://app.wisecrop.com			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

Wisecrop is the Agricultural Operating System. A centralized easy-to-use online platform to completely manage the farming business. Specifically designed for small farmers growing high-value open-field crops, it also supports medium and big holdings growing any type of fruit, vegetable, herb or cereal. Wisecrop serves as an aggregator of different technologies and sources of data, centralizing and enhancing the usability of the data collected. Being able to gather data from sensors independently on their technology/protocol (IoT) at the same time it connects with irrigation controllers for remote control of crop's irrigation needs, it becomes a centralized interface to improve efficiency when managing the field. Also, it connects with other sources of data such as machinery and scales, combining this data with manual inputs of several users (from the field to the board of the company), providing actionable, predictable and comprehensive insights about the company's results, day after day, season after season.

Because of its integrative features, Wisecrop is also useful for Associations/Cooperatives, supporting their experts to better manage their associated farmers, which usually have very small areas. Wisecrop provides benefits by decreasing operational costs, while improving the results, enhancing the profits of the whole season. Some examples:

- Reduction of up to 40% in water and energy usage;
- Reduction of the number of phytosanitary treatments applied;
- Reduction of the fertilizers applied; Improvement of the yield; Improvement of quality produced;
- Adaptation to the best timings to harvest in order to have the best market prices possible;
- Improvement on the efficiency of operations. Wisecrop was designed to support mainly smallholders.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

5.29 XARVIO PORTFOLIO: XARVIO SCOUTING| XARVIO FIELD MANAGER| XARVIO HEALTHY FIELDS, GERMANY

xarvio™ Digital Farming Solutions	**xarvio portfolio: xarvio SCOUTING| xarvio FIELD MANAGER| xarvio HEALTHY FIELDS**			
Applicant:	**xarvio (TM) Digital Farming Solutions** Andree-Georg Girg, Global Head Commercial Operations Digital Farming			
Country:	Germany	Implementation in Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Slovenia, Spain, Sweden, Switzerland, Russian Federation, Turkey, Ukraine, United Kingdom		
Website:	https://www.xarvio.com/global/en			
App:	https://fm.xarvio.com/gb/en_gb/login			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

xarvio™ Digital Farming Solutions is a global leader in the digital transformation of agriculture. It is committed to delivering digital farming solutions that optimize crop production, improve social mobility, reduce costs, support sustainable farming and eliminate food insecurity. All xarvio products are based on a world-leading plant modelling platform. This provides independent field-zone specific agronomic advice to help farmers produce their crops as efficiently as possible and take preventative action, when required. xarvio products - SCOUTING, FIELD MANAGER and HEALTHY FIELDS – are used by in more than 100 countries worldwide.

SCOUTING is a mobile application and is the most comprehensive, automatized, agronomical problem identifier available worldwide. Free to download and use, it is available in more than 40 languages including English, German, French, Spanish, Dutch and many more. The app is configured to local agricultural environments - crops, pests and diseases. Farmers and advisors using the app can quickly identify in-field stress based on algorithms and fully automized problem identification, such as unknown weeds, diseases, insects and nitrogen uptake just by taking a picture with a smartphone. Subsequently, the app connects farmers to impartial product recommendations to help manage the identified problem. A community-based radar function is a key feature, which shows farmers threats in fields surrounding their fields and notifies them once a threat is close to their area. The app helps educate and empower farmers, who may not have access to other agronomic information sources and is free of charge in all countries.

FIELD MANAGER helps farmers optimize crop production from seeding to harvest for multiple crops in multiple climatic zones. Field and field-zone specific input factors combined enable a fully digital and automatized solution to improve yield, efficiency and sustainability in crop production. Launched in 2020, xarvio HEALTHY FIELDS is a market first. It is an outcome-based digital solution that provides a field and season specific crop protection strategy that guarantees plant health at the start of the season for a fixed price.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

5.30 xFARM, ITALY

	xFarm			
Applicant:	**xFarm** Riccardo De Nadai, Content Marketing manager			
Country:	Italy	Implementation in Albania, Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Moldova, Netherlands, Poland, Portugal, Romania, San Marino, Slovenia, Spain, Switzerland, Turkey, Ukraine, United Kingdom, Colombia, Costa Rica, USA, Morocco, Chile		
Website:	https://xfarm.ag			
App:	https://cdn.xfarm.ag/install-app/index.html			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

Today's farmers face numerous challenges. On top of the traditional agricultural activity, there are more and more regulations, certifications, and consumers increasingly attentive to the origin of the food they eat. At the heart of all these challenges, there is one main thing: the farmer's data. xFarm is a platform created by a farmer to take farms into the digital age, by simplifying data collection and analysis, thus reducing paperwork, improving efficiency and sustainability. xFarm is based on free farm management software in the cloud, IoT field sensors, and Premium services. Aggregating data from sensors, machinery, and observations, xFarm supports farmers in their work allowing them to base their decisions on data. xFarm is a wide view working deck including:

- a comprehensive management software that helps farmers run their farms by improving data management and creating all the documents that are now essential, in a simple and intuitive way,
- an IoT sensors (xSense) part that captures local data and uses them for several functions for informing and alerting in real-time the user and for xFarm internal database. This is crucial to anticipate possible plant pathologies, save on water consumption for irrigation, and reduce the use of pesticides. The whole above is realized with software that is appealing, simple, and minimizes the number of clicks to input the data.
- Blockchain to increase transparency and traceability of all the operations in the field.
- Cloud computing to allow users to have access to the data and to increase the agility and flexibility.
- Remote sensing allows the farmer to receive in their smartphone a lot of precious data from the field, such as vegetation index, and the possibility to compare the same or different field in the different moment and with different index. Furthermore, we offer a tool that provides prescription maps that allow to carry out variable-rate fertilization. The application is translated into 6 different languages and is available for everyone in the free version, so it suitable for farms with different needs, dimensions, and possibilities.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Blockchain (transactions)

6. CATEGORY 6 – DISASTER RISK MANAGEMENT AND EARLY WARNING SYSTEMS

6.1 AGRIFIND ALERTES, FRANCE

AGRI find Cultivons nos données comme notre Terre !	**Agrifind Alertes**			
Applicant:	**Agrifind** Alexis Lopez, Charged of commercial development			
Country:	France	Implementation in France		
Website:	https://www.agrifind.fr			
App:	https://play.google.com/store/apps/details?id=walltreesoft.com.agrifind https://apps.apple.com/gb/app/agrifind-alertes/id1296239799			
	**Delivery model:**	Open source, community approach	**Stage:**	Early stages/ Ideation stage

Practice description:

The Agrifind Alerts application allows farmers and technicians to share their observations on pests and bio-aggressors, and to discuss their cultivation practices, in real time and in a geographically. The technology we developed is based on collecting data from farmers and agricultural technicians. With those data we are able to locate and share observations about diseases, pests, weather damages, weeds, etc. Moreover, we offer access to discussion groups to observe and share agronomic innovations and practices. The data are created by setting a mark on their field/culture.

Our app is contributing to face agriculture challenges by connecting farmers who share observations and good practices in real time. Also, we give access to data sheets about agronomic practices and phytosanitary products regulations, as well as informations about pests and diseases of more than 25 cultures. For farmers, Agrifind makes it easy to communicate with its network and to broadcast and receive alerts in real time; stay connected with your professional network; benefit from technical information; keep up to date with what interests you; share your know-how; get training in new agricultural practices. For advisers, it is a turnkey solution to spend less time in the office and connect technicians to their network; develop and promote advice; acquire and disseminate new data; innovate and follow experiments; lead groups of farmers; access simple digital tools and powerful dashboards.

Unique functions and ergonomics for an experience that promotes human ties: locate and share observations, diseases, pests, weather damage, weeds or even your questions; observe and share agronomic innovations and practices; position a reference point to personalize your summaries; documentation. Pest index cards: wheat, barley, triticale, corn, rapeseed, soybean, peas, field beans, sunflower, flax, potato, beet, vine, etc. Technical sheets: agronomic practices and phyto regulations. Community: Farmer and technician post feed, comments, search with personalized filters (crops, pests, pressures, groups, dates). Weather module: professional 14-day weather forecast with treatment ranges.

Technology applied:

Smartphones (features, apps); Cloud (data storage and computing, Big data)

6.2 AGRONET – DIGITAL PLATFORM FOR SUSTAINABLE FARMING, SERBIA

<table>
<tr><td></td><td colspan="4">agroNET – digital platform for sustainable farming</td></tr>
<tr><td>Applicant:</td><td colspan="4">DunavNET
Senka Gajinov, Product manager - Digital farming solutions</td></tr>
<tr><td>Country:</td><td>Serbia</td><td colspan="3">Implementation in Europe: Serbia, Montenegro, Slovenia, Georgia</td></tr>
<tr><td>Website:</td><td colspan="4">https://dunavnet.eu</td></tr>
<tr><td>App:</td><td colspan="4">https://digitalfarming.eu</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Regular service</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">agroNET includes a comprehensive range of sensors, data loggers with multiple communication options, data analytics modules, integrated farm dashboard, secure, scalable and reliable cloud environment. The practice relies on a combination of new technologies (sensors, IoT/ML) and domain expertise to provide recommendations and guidance tailored to a specific crop, its vegetation state and the weather conditions. The practice goes beyond simple visualization of sensor data and acts as agronomy consultant providing adequate recommendations, notifications and alerts whenever an important event was detected, or a new phase started. The IoT/ML platform is acting as a farm data interoperability hub, using specific data analytics algorithms. Data collected and the actions taken are logged and made available to other actors in the supply chain, contributing to the increased transparency of the complete agri-food supply chain.

The first step of introducing agroNET is choosing and installation of different devices depending on client' requirements and communication available at the site. We combine hardware components from multiple vendors to get the best cost/performance ratio. Gathered data are sent to the cloud and visualize at the agroNET web and mobile applications where different expert modules are available. Instructions on activities to be undertaken are created automatically by combining embedded expert modules and gathered infield measurements. For having decision support in pest and disease management weather stations for monitoring environmental parameters (air temperature and humidity, precipitation, wind speed and wind direction, solar radiation etc.) are installed in vineyards, orchards and at fields where arable crops are produced. Some of environmental parameters (air temperature and humidity, precipitation) as well as leaf wetness are used as inputs in pest and disease prediction models providing information when and what type of pesticide to use in order to avoid disease spreading and insects' overpopulation.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)</td></tr>
</table>

6.3 BIOCHECK.UGENT, BELGIUM

	Biocheck.UGent			
Applicant:	**Ghent University** Jeroen Dewulf, Prof. dr.			
Country:	Belgium	Implementation in Albania, Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Russian Federation, Turkey, United Kingdom, Australia, Bangladesh, China, Philippines, Vietnam, Thailand		
Website:	https://biocheck.ugent.be/en			
	**Delivery model:**	Free and fee	**Stage:**	Proven/ Scale-up stage

Practice description:

In a world where we want to feed the growing human population with healthy and sustainable produced food, farm biosecurity is key. It encompasses all measures that are taken to prevent the entry and spread of diseases (and pests) on a farm. Higher levels of on-farm biosecurity will result in improved animal health and welfare, lower mortality, morbidity and less need for medicine such as antibiotics. Biocheck.UGent provides an objective and scientifically validated risk-based scoring tool to measure and evaluate the level of on-farm biosecurity in livestock production.

The system is survey-based with separate surveys for cattle, poultry and pig production. The calculation algorithm that takes into account all important risks for introduction and spread of diseases, their frequency of occurrence and interaction, uses the survey's results to compute a score which is then compared with national and global averages to allow for benchmarking. Separate scores are given for external biosecurity (= the measures taken to prevent disease entry) and internal biosecurity (=the measures taken to prevent disease spread). Furthermore, the system also provides separate scores for several subcategories which represent the most important aspects of the specific type of animal production. These scores can then be used to identify the strengths and weaknesses of the farm's biosecurity programme and thus advice where improvements are to be made. On a regional/national level, information on biosecurity levels can help with the control of (re)emerging infectious diseases.

Small-scale farmers can use the surveys to identify the weaknesses of their farm's biosecurity program so that they can make a more informed decision on where to make improvements. All the surveys of the Biocheck.UGent system can be tried out immediately (i.e. no registration required) and for free at https://biocheck.ugent.be/en/surveys. It generally takes about 20 minutes to completely fill in a survey.

Technology applied:

Web platforms (forums, communities, e-governance); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

6.4 CROP CLIMATE AND WEATHER RISK ANALYSIS, MONITORING, AND PREDICTION, SWITZERLAND

meteoblue weather close to you	**Crop climate and weather risk analysis, monitoring, and prediction**			
Applicant:	**meteoblue AG** Christoph Ramshorn, Chief Cooperation Officer			
Country:	Switzerland	Implementation in Belgium, Czech Republic, Germany, Greece, Israel, Italy, Latvia, Netherlands, Slovenia, Spain, United Kingdom. The solution works worldwide. It has been presented and discussed with experts in the countries marked above, plus Ghana and Kenya.		
Website:	https://www.meteoblue.com			
	**Delivery model:**	Regular service; Open innovation plus low-cost commercial services	**Stage:**	Market adoption/ Validation stage

Practice description:

Local climate analysis and weather forecasts combined can help agricultural agencies and farmers to mitigate climate change risks, provided the information they entail is made available in a form suitable for informed decision making. We have developed a novel way to combine climate, weather, and crop data to (1) assess local crop-specific climate risk based on a suitably chosen reference period, and (2) predict local crop-specific weather risk during a crop's growing season. The information is presented in an integrated form that is always up-to-date, to the point, and more easily understood than trying to make sense of climate data, weather forecast, and static crop calendars.

Regional climate variability over the past 30 years is known at good spatial and temporal resolutions. With our method, risk to crops based on climate data can be quickly assessed, and different locations, seasons, and crops can be easily compared. This information can be used for decisions such as which crops or crop varieties to preferably choose for a particular region. Future changes can be predicted as well, albeit only with some margin of uncertainty. Local mid-range and seasonal weather forecasts make it possible to monitor drought, heat, and frost risk for a particular crop at a particular location during its growing period. Data required include the current season's weather to date, a 7-day forecast, and a seasonal forecast. Information from reference periods can be included for comparison. This information supports operational decisions such as when to plant, fertilize, irrigate, etc.

The innovation is in the combination of climate, weather, and crop information. The service is sustainable as it is low cost, can be accessed at any time and for any location worldwide. The service fosters sustainable farming as it takes into account all available pertinent information.

- Identify suitable crops for a region experiencing climate change
- Find similar regions that have already experienced similar conditions and can share their knowledge
- Use weather forecast for better crop management

Technology applied:

Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); Weather and climate modelling, weather data archive, machine learning to improve weather forecast with measured data

6.5 DISEASE AND PEST FORECAST WITH ARTIFICIAL INTELLIGENCE, AUSTRIA

METOS®	**Disease and Pest Forecast with Artificial Intelligence**			
Applicant:	**Pessl Instruments GmbH** Gottfried Pessl, CEO			
Country:	Austria	Implementation in Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Israel, Italy, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Rep.of North Macedonia, Russian Federation, Tajikistan, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan		
Website:	https://metos.at			
	**Delivery model:**	Regular service; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

You cannot control the weather. But you can control how you respond to it. Agriculture is without a doubt one of the most weather-depended industry sectors. Therefore having accurate, precise and reliable weather data automatically and in real is crucial for successful crop management and production. Planting, harvesting, spraying, irrigation? With METOS solutions you will always know which step to take next.

With this technology farmers will spray less due to better weather information from the fields and save money and protect the environment. Some diseases are difficult to control and timing of fungicide application is crucial in keeping diseases under control for over 80 different crops. We help growers worldwide comply with the legislation and have a healthy crop with less pesticide usage. Use Metos to protect the environment and grow a better crop. A complete solution for environmental monitoring, disease models, soil moisture, insect flights and more, iMETOS is a durable and flexible data logger for all climatic conditions, powered by rechargeable battery and a solar panel. The data logger has a built-in modem for direct communication with the FieldClimate platform, and can handle up to 600 sensors through the intelligent sensor bus system.

The system is extremely reliable due to non-volatile internal memory and can store up to 8 MB of logged data (ca. 1 month). The iMETOS can also send SMS Alarms (user-defined via Internet) to alert you in cases of frost, strong rain, high temperature and more. Data is regularly uploaded to FieldClimate platform where you can access it from any place at any time in real-time. Along with accessing the historical data and daily evapotranspiration values, you can also take advantage of decision support solutions like localized Weather Forecast, Disease Models and Irrigation Management.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

6.6 EC2CE, SPAIN

	ec2ce			
Applicant:	**Easytosee Agtech SL** Ricardo Arjona, Chairman			
Country:	Spain	Implementation in Germany, Portugal, Spain, Peru, Argentina, Brazil, Morocco		
Website:	https://www.ec2ce.com/en			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

We develop predictive models for production, pest evolution and crop quality, and decision making and optimization tools based on those models. The solutions is available for different sectors like olive oil, berries, veggies, etc. The technology has been developed by our company and is focusing on machine learning and its applications. Impact:

1. Improve productivity
2. Optimize the use of water and fertilizer
3. Diminish the use of pesticides
4. Support the commercial strategy of the farmer.

An unique mathematical technology capable to deliver predictive solutions to different stages throughout the supply chain of agribusinesses. Our technology learns from the past to predict the future in order to increase your profit. We mathematically analyse your data, together with open databases, and develop reliable predictive tools tailored to your needs.

- We help you make better decisions to increase the productivity of your crop by anticipating information on harvest yield, pests evolution and other variables.
- Anticipate key information to increase the sustainability of your crop, optimizing resources and processes such as fertirrigation and pest management.
- Match the supply chain to expected production and demand, increasing efficiency and profitability.

Technology applied:

Web platforms (forums, communities, e-governance); Robotics (agrobots, driverless tractors); Digital communication (telephone, messenger, email); Satellite Imagery; Sensors; Software

6.7 FARMING.SOFTWARE, AUSTRIA

XYLEM TECHNOLOGIES	**farming.software**			
Applicant:	**XYLEM Technologies** Dr. Thomas Neubauer, CEO			
Country:	Austria	Implementation in Austria		
Website:	https://www.xylem-technologies.com/en			
App:	https://farming.software			
	**Delivery model:**	Free and fee; Regular service; Part of advisory service	**Stage:**	Market adoption/ Validation stage

Practice description:

Farming.software is addressing climate change and variability challenges by giving stakeholders a solution for implementing mitigation and adaptation options to ensure sustainable, climate-smart, low-risk and resilient, economically and socially viable agriculture. farming.software is a ground-breaking software solution that meets the increasing requirements for the decarbonization of our society and the demand for organic food. The software solution, which is unique to date, integrates data from a multitude of sources, including, satellites, drones, soil sensors, weather sensors, robots, traditional machinery, etc. It enables farmers and decision-makers in agriculture to (semi-)automatically analyse the data and support the decision-making process.

farming.software provides its users with standardized software modules with defined applications. In addition, individual requirements and cost-effective way, individual requirements and scenarios can be can be implemented. It is not your business or company that has to adapt to the software, but rather the software adapts itself individually to your requirements and ensures that your processes are optimally supported. The solution does not take decisions from its users, but structures the multitude of data available today, in order to provide a sound basis for quick and efficient decision-making. In doing so, the software helps it's users to identify the effects of agricultural measures - with their numerous interdependencies and interactions - and to optimize them. For example, farming.software is the first solution on the market that allows to interactively plan optimal crop rotations. It takes into account the crops to be grown, the corresponding acreage and allocation on the farm over multiple time periods (e.g. seasons, year) and a defined chronological sequence of growing crops of the same species on the same land. farming.software was designed specifically for smallholder farmers and their specific needs.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

6.8 FARMOO, PORTUGAL

AGROOP	**Farmoo**			
Applicant:	**Agroop** Bruno Fonseca, CEO & Founder			
Country:	Portugal	Implementation in Portugal, Spain, Morocco, Angola, Paraguay, Brazil, Australia		
Website:	https://www.agroop.net			
	**Delivery model:**	Free and fee; One-time sell; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

Since 2014 Agroop has been continuously developing a technological solution to tackle three main agricultural challenges, namely, inefficient irrigation, inefficient production and risk factors management such as pest, diseases and fungi attacks. At this point our core value proposition is focused on water management, since we believe water scarcity is one of the biggest and more transversal challenges that the farming sector is currently facing. For us water management is the ideal entering point, but gradually we are adding new features to open more value propositions, providing a more holistic solution.

Farmoo is a multiplatform software that is using 4 different data sources to generate value added insight that in turn will help our customers (farmers) to:

1. Better irrigate their crops;
2. Prevent risk factors, such as pests, diseases and fungi;
3. Improve their yield;

Using the 4 data sources referred on the previous answer, namely IoT devices, satellite imagery, weather forecast and users inputs we are crossing data, running algorithms and therefore, building meaningful insights that are and will provide added value within the 3 mentioned value propositions. The platform is innovative since is one of the few we know in the World capable of integrating these 4 data sources under one roof. Our technology, namely the IoT devices were made to be more scalable since they require lower maintenance and support and therefore are more affordable and more suitable also for smallholder farmers. Basically, we are aiming to reach a more democratic solution. Our end goal is to target smallholder farmers, however, t reach the business sustainability as soon as possible we are currently targeting, mainly, medium and large farmers since they represent bigger revenue tickets.

Technology applied:

Smartphones (features, apps); Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

6.9 IGNITIA'S DIGITAL WEATHER INTELLIGENCE FOR THE TROPICS, SWEDEN

	Ignitia's Digital Weather Intelligence for the Tropics			
Applicant:	**Ignitia** Andrew Lala, Chief Sustainability and Growth Officer			
Country:	Sweden	Implementation in Sweden		
Website:	https://www.ignitia.se			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Sweden-based Ignitia AB has developed the world's first weather intelligence platform designed specifically for tropical belt agriculture. Ignitia uses remote sensing, machine learning, and scalable distribution channels to reach farmers and agribusinesses with weather forecasts and insights that drive sustainable agricultural practices. Ignitia's unique forecasts are enabling farmers in the tropical belt to reduce weather related risks and allowing agribusiness and other supply chain stakeholders to leverage highly accurate, hyper local weather data to optimize the food system from crop input use to post-harvest handling.

While alternative weather information exists, it's either inaccurate in the tropics, non-specific to a farmer's location, fails to be distributed efficiently, or presents information in a non-actionable way to farmers. Ignitia started from scratch to understand the physics governing tropical weather patterns and built a more reliable forecast, that outperforms by far any existing forecasts on the market in accuracy, including IBMs weather forecast. Our supercomputer cluster in Stockholm generates these forecasts, which are distributed to farmers in the tropics either as an SMS message, through agribusinesses accessing an online dashboard, or via an API for an existing app or program of a customer.

Ignitia currently serves more than 1.3 million active subscribers across West Africa, maintaining a 97% customer retention rate. Most other weather forecasts are free to end users, Ignitia has proven a successful business model in charging small amounts for superior forecast messages with flexible subscriptions (daily, weekly, monthly). Additionally, most of our subscriptions are linked to our partnerships with the region's largest Mobile Network Operators. By allowing the farmers to pay for the low-cost messages throughout the season with mobile phone credit (rather than all at once in the beginning), we eliminate the need to create a unique payment method and reduce the prohibitive savings requirements necessary for a large one-time purchase.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Broadcasting (TV, radio, online, SMS); Artificial Intelligence (Machine / deep learning)

6.10 INCREASED EFFICIENCY OF PEST CONTROL SPRAYING IN VITICULTURE USING HIGH-RESOLUTION FORECASTS FROM LOCAL AUTOMATED WEATHER SENSORS DATA, PORTUGAL

SOGRAPE	**Increased efficiency of pest control spraying in viticulture using high-resolution forecasts from local automated weather sensors data**			
Applicant:	**SOGRAPE VINHOS SA** ANTÓNIO GRAÇA, HEAD OF RESEARCH & DEVELOPMENT			
Country:	Portugal	Implementation in Portugal, Spain		
Website:	https://www.sogrape.com/home#intro			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Before the practice was implemented, heavy rain episodes (> 10 mm / day) following spraying events would washout plant protection products (PPP) leading to environmental pollution, crop loss and increased costs from repeated spraying. Generic national or regional based weather forecasts would not have necessary resolution for accurate planning of spraying timing, most especially in rugged mountainous areas. Introduction of autonomous weather sensors in vineyards (recording data every 15 minutes) allowed for forecast models using real data from the farm site on top of regional and national data. Modelling provided forecasts at a resolution allowing for vineyard-specific spraying planning to be made. To our knowledge, this was the first time, such a situation was deployed in practice for viticulture in both flat and mountainous environments. ICTs allowed for fast recovery of data and timely production and delivery of high-resolution, at both spatial and chronological scales, forecasts for farmers and farm managers.

The main innovation resided in increasing the spatial and chronological resolutions (a technical innovation in terms of climate service) of farmer-available forecasts and in ensuring validation and reliability of weather data, usually a major factor affecting forecast value and trustworthiness. A user-tailored web platform for data restitution, visualization and analysis provided an innovative interface between users and providers of the climate service. Sustainability was enhanced by the improved forecasts allowing for limiting the cost and environment runoff of protection products from unanticipated weather events. To date, the system has been up scaled and is in use by several farmer organizations and is supplying the same level of service for more than 500 farmers in Portugal and Spain. It is better to have an organization (association) or interface company to cluster groups of farmers, helping achieve critical mass and economies of scale.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email)

6.11 INFORMATION AND EARLY WARNING SYSTEM FOR INTEGRATED PLANT PROTECTION, REPUBLIC OF MOLDOVA

<table>
<tr><td> 
</td><td colspan="4">Information and early warning system for Integrated plant protection</td></tr>
<tr><td>Applicant:</td><td colspan="4">Institute of Genetics, Plant physiology and Protection
Todiras Vladimir, Researcher</td></tr>
<tr><td>Country:</td><td>Republic of Moldova</td><td colspan="3">Implementation in National level, Republic of Moldova</td></tr>
<tr><td>Website:</td><td colspan="4">http://eco-con.net</td></tr>
<tr><td>App:</td><td colspan="4">http://eco-con.net/DSS.htm</td></tr>
<tr><td></td><td>Delivery model:</td><td>Fully free to use</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Main objectives of the use case: Improved development planning processes and enhanced capacities for Integrated plant protection (IPP) at various levels; enhanced collaboration and co-ordination between the key national institutions; greater participation of stakeholders in decision making processes on evaluation, prevention and IPP; public awareness concerning IPP, the agrometeorological forecasts improving the expertise in using agrometeorological data extended to communities and farms level. The solution is based on two software modules:
- OptimClass software is a decision support system for temporal and spatial phenological changes influenced by annual variation of temperature, precipitation etc.
- BioClass is a GIS tool designed to solve multiple-criteria classification and optimization problems.
We present a new classification system which is based on combining fuzzy logic and level set methods. The aim of BioClass is to introduce advances in Multi-objective Decision Making for real world problems. In BioClass we joined the advantages of rough sets, crisp level sets and fuzzy sets methods to improve classification processes. Preference-Ordered Fuzzy Sets approach provide the degree to which two classes are related to each other. Preference-Ordered Fuzzy Sets approach is an extension of fuzzy set theory for Multi Criteria Decision Analysis and Evolutionary Optimization. In BioClass the representation of a fuzzy subset is described in terms of its crisp level sets. An essential part of forming membership functions is the input space partitioning.

Membership measures the degree of similarity of an element to the Class OptimClass software is an Interactive System for Multi-criteria Decision Making and Evolutionary Optimization. The aim of OptimClass is to introduce advances in Multi-objective Decision Making and Evolutionary Optimization for real-world problems. The practical approach of OptimClass software is making full use of your own skills and know-how. OptimClass uses a new approach based on the concept of fuzzy logic and level sets Preference-Ordered Fuzzy Sets (POFS). The Response function as degree of satisfaction and Membership function as the expression of fuzziness for decision making and optimization problems is introduced.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Software solutions (programs and packages)</td></tr>
</table>

6.12 IoT FOR SMART FARMING AND TREATMENT AND WATER MANAGEMENT, ITALY

netsens	**IoT for smart farming and treatment and water management**			
Applicant:	**NETSENS SrL** Gianfranco Manes, President, R&D and business development			
Country:	Italy	Implementation in Austria, Croatia, Germany, Greece, Hungary, Israel, Italy, Malta, Poland, Romania, Sweden, Australia, China, South Africa		
Website:	https://www.netsens.it			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

With more than 2000 units already installed worldwide, Netsens enjoys a strong position in the agrometeorology marketplace. Particularly in Italy, in the field of viticulture, we count most of the recognized wine farmers. Netsens' products cover two areas critical to digital Agriculture paradigm, namely integrated pest management enabling chemical treatments reduction, and smart irrigation management enabling water saving and optimum plant growth environment.

The IoT AgriSense/VineSense solution provides an ideal tool to fulfil the needs of smallholders for taking advantage of the digital agriculture technology, as they barely can afford the investment and maintenance cost of an individually owned equipment. Once a single weather station is installed in the area, it can be equipped with a IoT transceiver and becomes the gateway to Internet of a IoT network made of individual wireless unit that can be installed in the properties of the smallholders around, covering an area, up to 50.000 acres where several tens of wireless unit can be installed, basically one or two for each smallholder. Locally specific sensors like soil moisture, RHT and leaf wetness are installed at small scale on each wireless node, while sensors providing information at a larger scale -rainfall, wind direction intensity and solar radiation- are installed at weather station or at suitable location.

By merging the data gathered by the individual wireless units with the data gathered by the large-scale sensors and grouping all of them properly, they make individually available to the users and exhibit the same effectiveness of data collected by a traditional weather station with consistent advantage in investment and cost. Moreover, user can share their own information and coordinate actions, thus establishing a much more effective community in facing pest infection.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email)

6.13 METEOBOT, BULGARIA

meteobot™	**Meteobot**			
Applicant:	**Prointegra Ltd.** Radostin Kondov, Sales and Marketing Manager			
Country:	Bulgaria	Implementation in Austria, Bulgaria, Cyprus, Czech Republic, France, Germany, Greece, Hungary, Italy, Lithuania, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Spain, Switzerland, Rep.of North Macedonia, Russian Federation, Tajikistan, Turkey, Ukraine, Paraguay, Chile, Nigeria, South Africa, Mauritius		
Website:	https://meteobot.com			
App:	https://play.google.com/store/apps/details?id=biz.prointegra.meteobot https://apps.apple.com/app/meteobot/id1266582375			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Meteobot is state-of-the-art product which use a simple and cost-effective way to get meteorological data seamlessly transmitted from the fields to the smart device in users' hands. It combines data from the fields, orchards or vineyards with a reliable hardware and an intelligent software to help farmers make data-driven decisions in order to determine the best time to plant, spray, fertilize, irrigate and harvest. By the assembling of the weather stations are used only high-quality components from established suppliers of sensors. The products have proven EU origin and unique unrivalled level of value for money targeted at the needs of even the smallest farmers.

The weather stations give local information about unlimited historical data, real time weather data and 10-days weather forecast via cloud server and Meteobot mobile app for Android and iOS. Meteobot app securely stores the data from all weather stations, for an unlimited period of time. Thus, there are no gaps or omissions – as compared to manual records keeping on paper. The mobile application is with intuitive user interface and provides farmers with information from their weather stations organized in graphs and tables. There are calculated such important agronomic indicators as temperature sums (growing degree days), cumulative rainfall sums since beginning of growing season or seeding, evapotranspiration, dew point, etc.

With the help of Meteobot app the farmers could set up important alarms and notifications for frost conditions, soil freezing, average daily air temperature above or under certain value, intensive rain, soil moisture level (drought alert) etc. Meteobot weather stations are very affordable products for each farmer - from the largest to the smallest, for cereal producers, for fruit and vine growers, for greenhouses etc. The retail prices are several times lower than competing equivalent products with a similar configuration of sensors.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

6.14 METEOTREK, UKRAINE

	METEOTREK			
Applicant:	**Meteotrek, LLC** Vadym Kochevykh, CEO			
Country:	Ukraine	Implementation in Ukraine		
Website:	https://www.meteotrek.ua			
	**Delivery model:**	One-time sale; Regular maintenance	**Stage:**	Proven/ Scale-up stage

Practice description:

Our solution helps farmers receive accurate information about the current state of the weather at the place of installation of weather stations, effectively plan technological operations depending on the short-term weather forecast, quickly respond to sudden changes in weather conditions, use irrigation systems in the most optimal and efficient way, depending on the soil condition, receive online alerts about possible fire risks. As a result, farmers reduce the cost of processing fields and increase yields from each hectare, tree and bush.

We have developed a product line of weather stations that fix various parameters depending on stations' configuration - air temperature and humidity, atmospheric pressure, wind speed and direction, leaf moisture, precipitation, temperature and soil moisture at several levels. All our stations are self-powered (solar panel or built-in battery) and can be installed at any location. Stations are equipped with a GSM modem (or optionally - data transmission via LoRa) for online data transmission to the server. Data is fixed every 15 minutes and transmitted to the server 1 time per hour. When alarm events occur, the station sends an immediate message. All data collected by the weather station since its installation is available in software.

Users can view data from their fields or gardens when installing several stations in 1 field, or for each weather station separately - current data, historical data and short-term (5-day) weather forecast for each location. The system also contains stations with public access - if the customer is ready to provide data from the station to other users, he receives a 50% discount on the subscription, and other users have the opportunity to subscribe to the data from needed location for a paid subscription, without purchasing their own weather station.

Technology applied:

Computers (Desktops, Laptops & Tablets); Smartphones (Features and Apps); Web platforms (Forums, communities, regulatory framework); Sensors (Weather, Geolocation, Livestock); Internet of Things (IoT) (M2M, WiFi, local area networks); Broadband Internet (Mobile, Satellite, Cable); Cloud technologies (Storage and processing of large amounts of data); Artificial Intelligence (Machine / Deep Learning); Communication (Phone, messenger, email); Software (Apps and packages)

6.15 SENCROP: PRECISION AG-WEATHER SOLUTIONS, FRANCE

Sencrop	**Sencrop: Precision ag-weather solutions**			
Applicant:	**Sencrop** Jeanne Longueville, Marketing Coordinator			
Country:	France	Implementation in Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, Netherlands, Portugal, Romania, Spain, Sweden, Switzerland, Ukraine, United Kingdom, South Africa, Mauritius		
Website:	https://sencrop.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Sencrop develops and implements connected, accessible, and collaborative solutions based on agro-weather data collection in order to make precision agricultural monitoring technology available to everyone. Sencrop strives to develop more accurate, efficient, and environmentally responsible agricultural techniques and practices for widespread implementation. Easy to install and connected to a friendly application designed for farmers and winegrowers, Sencrop's rain gauges, anemometers and wetness sensors allow professionals to instantly access their plots' ultra-local weather data, anywhere and 24 hours a day. The data is transmitted by a 0G signal.Users can, in real time, access their data, personalize alerts to position an intervention at the best time, and intervene in the event of diseases or frost. The accumulations can be calculated in order to position a treatment after a rain, or to predict phenological states thanks to the accumulations of degree days and cold hours. Weather data collection: usage of in-field sensors for ultra local weather data, collected every 5 minutes.

- Raincrop comes equipped with a dual-trough swivel system to measure cumulative rainfall accurately. Three temperature and humidity sensors are combined to deliver more reliable weather data and prevent measurements from drifting over time.
- Windcrop: independent sensor to ensure stable free readings, provides wind average speed and gusts.
- Leafcrop: simulates a real leaf to be placed at the heart of the foliage, leaf humidity, temperature and air, and measures the leaf humidity rate.
- Data transmission: the Rain and Leaf sensors transmit data every 15 minutes and the wind sensor, every 20 minutes.
- Data restitution to the farmer, in the Sencrop application

Today, Sencrop is the first in its field in Europe: more than 15,000 farmers and winegrowers already use this solution, within family farms or cooperatives. The latter provide quality service to their communities through the creation of private interconnected networks, which allow access to different devices with a subscription to the app. With giving real-time data on their fields, farmers don't need to travel in their fields to access conditions, and reduce their travel.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

6.16 VIPS, NORWAY

	VIPS			
Applicant:	**NIBIO** Berit Nordskog, Research Scientist/Project leader of VIPS			
Country:	Norway	Implementation in Bosnia and Herzegovina, Norway, Sweden, Part of FAOs mobile app for Fall armyworm (FAMEWS)		
Website:	https://www.nibio.no			
App:	https://www.vips-landbruk.no/			
	**Delivery model:**	Free and fee; Open source, community approach	**Stage:**	Proven/ Scale-up stage

Practice description:

VIPS is an Open Source technology platform for prognosis, monitoring and decision support for integrated pest management in agricultural crops. The VIPS system, originally developed to meet the needs of Norwegian agriculture, is designed with flexibility in mind, aiming to create new and improved tools for better implementation of integrated pest management at an international scale. VIPSweb is an online tool for integrated pest management, particularly addressing two IPM principles; i) Tools for monitoring and ii) Threshold values as basis for decision making.

The service includes pest risk models and early warning of relevance for the most important pests and diseases of Norwegian agriculture, targeting crops such as cereals, apples and field vegetables. Observations of pests and diseases are reported to the system by agricultural advisors, addressing both inputs to models and reports on pest and disease observations. The VIPSweb allows for local adaptations, including multi language support, incorporation of models and other services. This opens for easy customization for international use. Alternatively, model output views can be incorporated in existing web sites or distributed on smart phones or tablets. The overall architecture and design of the VIPS platform is developed to allow for international collaboration. Data from most online weather stations, public weather data networks and weather forecasts can be used, allowing pest and disease models to be tested and validated under local conditions, with multiple sources of input data. Observations of pests and diseases can be easily reported and visualized in online maps.

We aim to initiate international research collaboration to create new and improved tools for better implementation of integrated pest management. As part of the combat against Fall Armyworm in Africa, elements from VIPS has been implemented in the FAMEWS mobile app. Current outputs include facilitation of access to weather data through the FAMEWS app.Since 2014, VIPS has been an element of several international projects related to development of integrated pest management tools in Europe, Asia and Africa, including collaboration with organizations such as FAO and IITA.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Software solutions (programs and packages)

7. CATEGORY 7 – FOOD LOSS AND WASTE / FOOD SAFETY AND TRACEABILITY

7.1 FARMER EXPERT, TURKEY

	Farmer Expert			
Applicant:	**Farmer Expert** Abdula Davudov, COO			
Country:	Turkey	Implementation in Turkey.		
Website:	https://www.farmerexpert.com/en			
	**Delivery model:**	Fully free to use; Regular service; Part of advisory service	**Stage:**	Proven/ Scale-up stage

Practice description:

We have decided to provide an access point for farmers, customers and third parties together, where everyone sees everything, prices, farmer location and other multiple features. In addition we are currently integrating sms companies for farmer messaging, opening up a chat section for all farmers to communicate togethers, adding a brokerage section where customers will purchase from farmers in advance, additionally requesting price matching if this service is desired. Therefore our goal was to enable all technologies for farmers for free, where this system would be global.

Our platform allows all farmers to register for free (there is absolutely no fees for farmers for using the platform too), where they provide all data relevant to their field (or a number of fields). Platform includes agronomists, customers, payment system, logistics and additional features to integrate within the process of seed to customer. We provide farmers the access to everything they need to grow the best produce providing traceability for customers, and currently adding (ugly fruit section, and factories to collect was from farmers). This platform is blockchain based, has multiple API connections including satellite imagery company.

We are the only platform that provides all features for farmers mentioned above in the market, furthermore all farmers globally can use it, and registration is available for everyone. We are the service provider integrating all companies in the AG Tech together, therefore providing and all in one service. Sustainability is a major goal, as farmers add agronomists, which fertilisers were used, lab results of produce, their location, and excess production will also be available for users in the platform. We are the only company in Turkey who signed an agreement with UN Technology bank for ldc's , therefore this platform will be implemented to Uganda as a pilot country through UN.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Remote sensing (satellites, planes, drones); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Blockchain (transactions)

7.2 AI POWERED, FULLY AUTOMATED FOOD WASTE MONITOR, NETHERLANDS

Orbisk zero food waste	**AI powered, fully automated food waste monitor**			
Applicant:	**Orbisk** Olaf van der Veen, CEO			
Country:	Netherlands	Implementation in Netherlands		
Website:	https://www.orbisk.com			
	Delivery model:	Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

Food is lost in a variety of places across the value chain, of which the hospitality sector is of significant impact (15%), altogether amounting to close to 200 million tons annually. For an average-sized restaurant, this status quo of daily loss will easily result in (far) over 10 tons of food lost annually, worth well over €50.000, with huge environmental consequences (38.000 kg CO2eq, 36M liters of water use). There is little data on this food loss, as it has been practically impossible to grasp food waste streams, as it presents itself throughout the production process, in dozens of instances daily. Currently, capturing this stream requires strenuous, labour intensive and disciplined registration processes, of which most fail due to lack of engagement by floor staff. Lack of this information on the other hand, hinders the ability to act.

Orbisk has developed and introduced the world's first fully automated food waste monitor. By outfitting the (organic) waste bin in restaurants with the Orbisk monitoring equipment (a weighing scale and a intelligent camera unit), we enable absolute effortless registration of what food is going to waste, on a very detailed level. This way, food loss and waste can be nipped in the bud: before even considering re-appropriating or recycling efforts, or increasing efficient production to keep up with demand, we will prevent food waste from happening in the first place thus increasing efficiency and sustainability at the same time.

By outfitting the (organic) waste bin in restaurants with the Orbisk monitoring equipment (a weighing scale and a intelligent camera unit) and then interpretation by means of AI image recognition technology, we enable absolute frictionless registration of what food is going to waste, on a very detailed level (1000 ingredient classes). Moreover, by including the context of the waste action - such as the food being thrown away from a pan, a cutting board or a plate - we can identify in what part of the food providing process the food was lost. This information can then be used to recognize, address and optimize the inefficiencies in the restaurant process.

Technology applied:

Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

7.3 AUTOMATED OLIVE CHAIN, SPAIN

AUTOMATED OLIVE CHAIN	**Automated Olive Chain**			
Applicant:	**Grupo Hispatec Informatica Empresarial S.A.** Rafael Angel Ferrer Martinez, R&D Manager			
Country:	Spain	Implementation in Greece, Spain		
Website:	https://www.hispatec.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage
Practice description:				
The EU is the largest producer (accounting for almost three quarters) and consumer (accounting for almost two thirds) of olive oil in the world. However, increasing competition from other countries and the rapid decline in olive plantations caused by the bacterium Xylella fastidiosa puts the olive sector under pressure. As a response, this use case explored how technologies can help alleviate the pressure and boost resource use efficiency. To validate their solution under different environmental conditions the project relied on four test farms in Greece alongside seven in Spain. Regardless of the location, the overall focus of the use case lied on a more sustainable way of farming while dealing with climate adaptation. This included traceability for the entire olive chain, providing information on irrigation for end-users and olive farm advisory boards along with monitoring and controlling the olive oil extractability and quality. IoT devices installed on the fields and Olive Mills. Using ETL (Extraction, transformation and Load) processes, all the data are gathered in a cloud-based solution. Using Artificial Intelligence and Big Data, several agronomic models are deployed in order to calculate the best practices for irrigation, oil quality and oil extractability, linking all the data for assuring traceability. Using agronomic models, the system calculates the best practices for optimizing water and energy consumption, two of the most important impacts in environmental sustainability. The solution is built in cloud-based solutions, therefore, smallholder farmers can access using the web applications.				
Technology applied:				
Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)				

7.4 BIOSENS MYCO, UKRAINE

	BIOsens Myco			
Applicant:	**BIOsens** Andrii Karpiuk, CEO			
Country:	Ukraine	Implementation in Poland, Ukraine		
Website:	https://sens.bio			
	**Delivery model:**	Regular service; Part of advisory service	**Stage:**	Market adoption/ Validation stage

Practice description:

Mycotoxins are toxic compounds naturally produced by certain types of moulds. Mycotoxins are a significant food safety concern in the agriculture – 25% of global food supply is affected by mycotoxins, while annual losses of food amounts reach 1 bn tons. While mycotoxins can occur at any point of the value chain, market players do not have an ability to check mycotoxins containment rapidly on-site and get accurate reliable quantitative results to prevent future losses.

To help industry players to maintain the required consistently high level of quality and safety of food and feed, BIOsens developed a portable and rapid precise mycotoxins detection device. It is the Mycotoxin Prediction Tool. From the farm to the fork, BIOsens helps clients to reduce the risk of mycotoxins contamination and avoid associated losses. Its unique and proprietary solution is the first to provide an automated way to prepare samples of plants (e.g. corn, wheat) and analyse them on content of mycotoxins within 21 minutes. A breakthrough in device architecture allowed to automate sample preparation, conduct tests on-site with laboratory accuracy and to reduce the time required for analysis by dozens of times in a comparison to laboratory tests. As testing using the BIOsens can be conducted even by non-professionals, it allows market players to easily perform the test by themselves and avoid using costly laboratory services. Moreover, BIOsens AI-based software solution can predict mycotoxin contamination areas, so agriculture market players (e.g. farmers) can prevent crop contamination.

Technically, BIOsens solution consists of two components: a unique hardware solution – portable electromechanical device of 40x25x15cm size with disposable cartridges with reagents and a developed software solution – mobile app and web platform to securely store data, analyze it and make predictions powered by AI algorithms. The device provides both qualitative (whether the product contains mycotoxins or not) and quantitative (how much of mycotoxins is in the product) analysis.

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Software solutions (programs and packages)

7.5 BLOCKCHAIN FOR BEER TRACEABILITY, ITALY

	Blockchain for beer traceability			
Applicant:	**Posti** Marco Pizzuto, junior program officier			
Country:	Italy	Implementation in Italy		
Website:	http://posti.world			
App:	https://nastro-azzurro.web.app			
	**Delivery model:**	One-time sell	**Stage:**	Market adoption/ Validation stage

Practice description:

Our practice consists in the complete traceability of all parts of the beer production chain, from the cultivation of barley to the bottling and marketing of the finished product. During the traceability process the information are gathered manually and automatically and transcribed in an opensource blockchain platform in order to enhance transparency and guaranty an efficient communication to the receiving customer. During the traceability process we go across different phases: 1. Assessment: at first the objectives, the actors, the times and the process are defined. 2. Products: in this phase the raw materials used, the products and the recipes are defined. We begin to study the production chain by going into the details of each single phase. 3. data model: once the relevant information of the process to be traced has been defined, the data acquisition model is established. 4. Content Creation/Storytelling: in this phase the acquired contents are processed. 5. Customer Experience: the delivery channels are identified (QR code, notification, etc.). 6. Marketing & Communication: This is probably the most important phase. The key messages are defined for the different targets, the launch strategies and the final customer is supported in the positioning of the new product traced.

Our traceability system is a win-win solution for all the actors involved in supply chain (not only for brewers) to achieve the following goals:

- To communicate, in an innovative way, the quality of the product and the virtuous supply chain.
- Enhance the link with the territory and guarantee the value of Italianness.
- Offer the consumer guarantee and immediate access to data traced in blockchain.
- Telling the value of sustainability with clear, legible, less codified information.
- Witness an innovative and avant-garde vision: in this case Peroni tells of a transparent supply chain before competitors.

This technology can also be applied in other agricultural contexts and for any agri-food product. Our beer traceability project has been implemented since January 2020. We started our pilot project with the premium line of “Nastro Azzurro Mais Nostrano” and now the company (Birra Peroni) decided to implement our traceability system based on blockchain on the all brands included different kind of beer.

Technology applied:

Smartphones (features, apps); Blockchain (transactions); Augmented reality, Gamification

7.6 CHEMOMETRIC BRAIN, SPAIN

CHEMOMETRIC BRAIN	**Chemometric Brain**			
Applicant:	**Chemometric Brain** Geoff Carss, Chief Growth Officer			
Country:	Spain	Implementation in Belgium, Netherlands, Spain, Colombia, Mexico, India, Qatar		
Website:	https://www.chemometricbrain.io			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Testing agricultural products is time consuming and costly - so doesn't happen. We provide a cloud-based software solution where a user can take a simple Near Infrared scan of any product (wheat, corn, oil etc) and analyse it to confirm its composition in line with a standard and then optimise where the product can be sold. A digital certificate can be shared between supplier and customer. The analysis is carried using a number of techniques including AI/Machine Learning and Qualitative Analysis.

The technology was developed over 6 years in a food company who needed to significantly improve controls over raw materials and finished products around the world - in a way which was cheap, fast and easy to use. Developed by 2 PhD's and some research institutes (such as CRA-W in Belgium) the solution is in use in a number of countries around the world. Research continues on a number of subjects such as the identification of the geographic origin or a product such as Olive Oil, potential replacement of wheat tests such as the Farinograph tests amongst others.

Our solution enables field-based testing with a very high degree of accuracy. A farmer, grain processor or feed merchant etc. can get a much better understanding of their product and, ideally, get a higher price depending on the products functionality. Users can test a sample in 2 - 3 seconds so testing can happen much more frequently and rapidly in the location of the product - no sending samples to a lab. This is a highly innovative solution which uses a digital 'fingerprint' for any product - solid, powder, liquid, gel etc and potentially identify any adulteration or non-conformity with a standard. This data can be shared in a blockchain solution as significantly increase the traceability as the data from Chemometric Brain will describe the ACTUAL composition of a product at a physical/chemical comparison level. Farmers etc. can publish the data to a customer and a customer can check the product on receipt to confirm it has the composition as described.

Technology applied:

Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

7.7 DaPoPE, Belgium

	**DaPoPE**			
Applicant:	**AVR** Koen Uyttenhove, IOT manager			
Country:	Belgium	Implementation in Belgium, Netherlands, Poland		
Website:	https://www.avr.be/en			
	Delivery model:	Regular service	**Stage:**	Market adoption/ Validation stage

Practice description:

With this innovative solution, developed by a consortium of partners in Europe, we are connecting the farmer and the processing industry in terms of data exchange, using soil mapping, growth models and harvesting data to optimise traceability in potato processing. This use case opens data flows between stakeholders in the supply chain. The information and caliber measurements are gathered throughout the entire season through sensors mounted onto machinery, in addition to soil mapping performed by drones or satellites. Leveraging it enables potato processing companies to optimise logistics to ensure the continuous quality of their activities. Besides the technological components applied, this use case also addresses the growing demand for traceability among consumers in terms of food safety as well as quality.

High-end AI driven image recognition systems give insights into the width/length of the harvested potatoes in realtime (while harvesting). This information is linked to the correct field and farmer. By doing so the food industry has a unique view where to find which kind of potatoes for a certain order to have to make for the retail e.g. In this project we have combined this with overall yield measurement and prediction models (done with drone flights during the growing season). In this development we have used 2G/3G/4G telematics devices integrated on the harvesting machines. These units are transferring in real time the data analysed by the camera/AI system determining the width and length of the potatoes passing through the machine. Data is visualised into a fully cloud base application based upon Microsoft Azure IOT technology (platform as a service components were used). The ML/AI model has been trained by using images of potatoes. We think this development/solution is essential to achieve sustainable agriculture and e.g. less food waste. 'The correct potatoes on the right time on the right place'! This is possible with this solution. This solution can be used for all kind of farmers.

Technology applied:

Remote sensing (satellites, planes, drones); Internet of Things (IoT) (M2M, WiFi, networks); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages)

7.8 DIGITAL SUPPLY CHAIN MANAGEMENT, KAZAKHSTAN

openforis COLLECT MOBILE	**Digital Supply Chain Management**			
Applicant:	**The Dairy Union of Kazakhstan** Saule Zhankina, Deputy Director			
Country:	Kazakhstan	Implementation in Kazakhstan, Kyrgyzstan		
Website:	https://kazsut.com			
	**Delivery model:**	Fully free to use; Open source, community approach; Free and Open Source	**Stage:**	Market adoption/ Validation stage

Practice description:

We foster the use of a free mobile app called Collect Mobile to digitalize our suppliers of raw milk. Dairy factories in Kazakhstan buy milk from hundreds of small farms and having this digital solution saves time for supply chain management and allows dairies to provide better support to small farmers. With support from the FAO and EBRD, we developed standard reports using Power BI to analyze the data. This is helpful to improve food safety parameters and milk and plan milk procurement quantities. Factories use free and open-source mobile app - Open Foris Collect Mobile. It was developed by the FAO Forestry originally to monitor forests. The FAO/EBRD dairy project expanded the scope of use of this app and introduced it in our dairy sector. It was a very good idea.

Milk procurement staff of factories once or twice a year visit each farmer and milk collection center and collected various data using Android smartphones or tablets. Questions cover key quantitative parameters, management practices and factors affecting food safety of milk. Over 100 questions. Numerators send data to the administrator using WhatsApp. At the factory's office, data is managed and visualized using MS Power BI tool. These reports help dairy factories understand the reasons of the underperformance of farmers, understand their growth potential and spot issues negatively affecting milk safety. We believe the innovation consists in bringing the tool (Collect Mobile) from forestry to agribusiness and in trying to establish a direct dialogue with our farmers, by-passing the middlemen (milk traders). Thanks to the survey, developed by the FAO experts, dairies' staff holds a direct dialogue with small farmers and this will lead to relations of trust and mutual understanding.

We believe only trust and responsible behavior from both sides of the value chain can result in inclusiveness and competitiveness of the industry as a whole. We also have a Smart Milk portal where we centralize all the knowledge for the dairy value chain, and smallholders especially. We have video-lessons, manuals, animations, and posters. All in one place and electronic. Visit us here: https://smartsut.com/

Technology applied:

Smartphones (features, apps); Sensors (weather, GPS tagging, livestock); Cloud (data storage and computing, Big data); Software solutions (programs and packages); BI

7.9 FARMY AG, SWITZERLAND

<table>
<tr><td>  </td><td colspan="4">Farmy AG</td></tr>
<tr><td>Applicant:</td><td colspan="4">Farmy AG
Tobias Schubert, Co-CEO & Co-Founder</td></tr>
<tr><td>Country:</td><td>Switzerland</td><td colspan="3">Implementation in Switzerland</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.farmy.ch</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Regular service</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Farmy.ch is an online market place for sustainable grocery shopping in Switzerland, offering more than 12000 products from more than 1000 producers. The disruptive aspect: It is NOT an inventory, but a cross-docking business model, meaning that we do not hold any inventory for perishable items at all, but all products are being produced, harvested or baked at the same day. Then they are sent to our hubs in Zurich or Lausanne, where they are being packed and then sent to the client at the same day. Like this we work 100% without any food waste and thus reduce CO2 exhaustions.

By running this cross docking business model we eliminate food waste to by 100% (at our part of the supply chain). In addition we support especially small and medium sized local food producers, by offering them an additional revenue channel: online. Those producers have great products, but often face severe pressure by big supermarket chains and also do not know how to set up an online shop or it is not worth it, as they only have a small assortment. Also the commercial conditions are fairer with us, as we source directly from them and do not have any wholesaler in between. Like this we help them to increase revenues and to survive. Farmy at the end is an IT and logistics company. All processes along the whole supply chain are supported by applications and IT tools, which are 100% in-house developed. E.g.: Pick & Pack App, Route Planning App, Customer Frontend Apps, Backend System, WMS, etc. We are using these tools to design all processes in an efficient manner and to be able to control the whole process flow. Like this we are able to grow in a scalable manner.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Broadband internet (mobile, satellite, cable)</td></tr>
</table>

7.10 IoTRAILER, BELGIUM

<table>
<tr><td>  </td><td colspan="4">IoTrailer</td></tr>
<tr><td>Applicant:</td><td colspan="4">Lambrecht trailers
Francis Verhelst, Technical Director</td></tr>
<tr><td>Country:</td><td>Belgium</td><td colspan="3">Implementation in Belgium</td></tr>
<tr><td>Website:</td><td colspan="4">https://lambrechttrailers.be</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>fee per delivery + small one-time installation cost</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">This proposal ‘IoTrailer’ aims at an Internet of Things (IoT) based innovative approach that can secure and authenticate transport of bulk goods in the agri-food chain both for animal feed and human food with a zero risk of contamination. Today animal feed or human food producers make enormous efforts in order to have safe and traceable processes for bulk truck loads right until they leave the production site. But for transport and delivery of the goods into the customer’s silos, no further control mechanism exists. Fail deliveries of bulk contents happen every day all across the agricultural value chain. These identification mistakes result in severe and costly consequences. If the incident is detected right away it implies the full emptying and cleaning of the silo as well as the replacement of the feed. Even worse is if the failed delivery stays undetected as that might result in animal illness, mortality or a delay of growth due to the wrong feed. In cases of organic feed this could lead to the withdrawal of the farms bio certification and severe loss in sales prices.

We developed a siloreader with wireless communication between the silo, the multi compartment and a central ’smart silo server’ centralising all delivery data - IoTrailer to guarantee that the farmer receive the right feed into the right silo. Not only the farmer will obtain more trust in his raw materials but also the end – consumer will have more trust in the origin of the food he daily consumes. IoTrailer reduces the risk of wrong deliveries of animal feed to practically zero which results in lower costs as well as possibly better rates for transport insurance. The solution promises a 99% secure delivery of bulk goods into the right silo and with full traceability across the whole delivery process. Furthermore, it adds more security to farmer as well as the credibility of food labels as all relevant stakeholders can receive insights to delivery data and the process in general gets more trustworthy than ever before. Farmers can introduce their silo's in our Smart Silo Server in order to secure and obtain all feed deliveries. The data from those feed deliveries will give the farmer information for his silomanagement.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Digital communication (telephone, messenger, email); Software solutions (programs and packages)</td></tr>
</table>

7.11 LOTA DIGITAL, PORTUGAL

<table>
<tr><td>  </td><td colspan="4">LOTA DIGITAL</td></tr>
<tr><td>Applicant:</td><td colspan="4">BITCLIQ TECHNOLOGIES, S.A.
Pedro Araújo Manuel, Founder & CEO</td></tr>
<tr><td>Country:</td><td>Portugal</td><td colspan="3">Implementation in Portugal</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.bitcliq.com/en/home-eng</td></tr>
<tr><td>  </td><td>Delivery model:</td><td>Free and fee</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">Lota Digital is a fresh fish e-marketplace powered by AI and Blockchain Technology, connecting fishing boats with buyers, enabling the first sale of fish after it is caught at sea. In addition to connecting fishermen with buyers, this platform also integrates logistic partners and allows end2end digital traceability, increasing the level of transparency and trust from the point of catch to the retail store. Lota Digital creates value for both parties with fishermen exercising greater control of fish pricing, while buyers, including fishmongers, supermarkets, restaurants and hotels, have guaranteed the best supply and quality level.

The B2B app operates a pay-as-you-go model, enabling fish to be sold upon capture at sea at the price the fisherman has requested, using blockchain to track it from the time of catch to delivery. For the buyer, the advantages include guaranteed quality and freshness from stringent, traditional quality control, combined with lot tracking by blockchain and an optimized buying process. The process is boosted further by an automated AI-powered search to find the best options available for the desired species up to a specified time limit. The marketplace also connects users with logistics partners, ensuring tailor-made packaging and transportation options. A Smart Label is placed on packaged fish, facilitating the traceability from catch to delivery using the data recorded on the Lota Digital platform.

Although the marketplace disrupts the entire trading process of small-scale fisheries, it maintains their traditional, non-industrial style of fishing while optimizing the commercial process. Lota Digital's technology combined with the artisan fishing style ensures adherence to the EU's Common Fisheries Policy and its sustainability requirements on the method of catch, the avoidance of waste and delivery to the most local markets. This is made possible because buyers can source fish caught as close as possible to the point of sale.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Robotics (agrobots, driverless tractors); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Blockchain (transactions)</td></tr>
</table>

7.12 NOVADA GARSA - E-CATALOG OF LATVIAN FOOD PRODUCERS AND PROCESSORS, LATVIA

	Novada Garsa - E-catalog of Latvian food producers and processors			
Applicant:	**Latvian Rural Advisory and Training Centre** Elina Ozola, Head of Rural Development Department			
Country:	Latvia	Implementation in Europe, Latvia, National		
Website:	http://new.llkc.lv/lv/latvian-rural-advisory-and-training-centre			
App:	https://www.novadagarsa.lv			
	Delivery model:	n/a	**Stage:**	Proven/ Scale-up stage

Practice description:

The E-catalog of Latvian food producers and processors (www.novadagarsa.lv), as a support program for local agricultural and fisheries producers, processors and home producers has the goal to encourage the development and co-operation of local producers by providing information, events and education as well as strengthen public interest in local food producers, growers and processors by promoting their involvement in promotion activities.

It is a B2C and B2B solution where consumers can find and sort food producers by location, quality scheme, product range and additional services. The catalog was created in 2019. At the beginning of 2020 when the global pandemic began, the number of users of the e-catalog increased rapidly, which confirms it's extremely important role in providing food access to the local population, the desire of the population to bypass large food chains. Currently, 778 producers are registered in the catalog, but this number is growing every day. During busiest months webpage receives in traffic almost 11 000 users who uses the platform. Main type of users:

- Food producers: facilitating market access as well as increase demand. For each profile, the system creates QR code that the producer can use as marketing and food traceability instrument: it can be exhibited, when the producer trades at a local market, which the customers could clarify, where products have been produced; it may be also on the product label, especially in cases when the producer himself does not market the product.
- B2C and B2B consumers: facilitating food traceability, as this is the only unique site where can be found safe and reliable producers involved in various food quality schemes - Organic certified, Global G.A.P., Integrated farming, home producer. The website has educational role too, in familiarizing local food producers and consumers with food quality schemes and requirements they provide. It is possible to find the closest supplier short food chains, and without business side as a bonus it reduces CO2 emissions.

Technology applied:

Web platforms (forums, communities, e-governance), Cloud (data storage and computing, Big data); Software solutions (programs and packages)

7.13 OLIO, UNITED KINGDOM

	**OLIO**			
Applicant:	**OLIO Exchange Limited** Tessa Clarke, Co-founder & CEO			
Country:	United Kingdom	Implementation in Ireland, Netherlands, Sweden, United Kingdom		
Website:	https://olioex.com			
	Delivery model:	Fully free to use	**Stage:**	Proven/ Scale-up stage

Practice description:

OLIO is a pioneering peer-2-peer app tackling the problem of food waste in the home & local community. Globally we estimate that households throw away well over $100 billion of food, with a devastating environmental effect due to the incredible amount of resources that go into the production of that food, and the GHG intensive supply chain it travels through. OLIO solves the problem of food waste in the home & local community by connecting users with each other, and volunteers with local businesses, so that surplus food can be given away, rather than thrown away. Users simply snap a photo of their spare food to add it to the app; neighbours then receive customised alerts letting them know something new has been added, they can request what they want and arrange pickup via private messaging within the app. The handover of the food takes place on the doorstep or in a public location, generally the same day.

Launched in 2016 in the UK OLIO now has over 2.7 million members, who have together saved 11 million portions of food; this has had the environmental impact equivalent to taking 33 million car miles off the road. Half of all the food added to the app is requested within 30 minutes, demonstrating what an effective hyper-local redistribution platform OLIO is. Whilst OLIO originated in the UK, already 25% of all activity is taking place outside of the UK, and food has been successfully shared in 54 countries so far. OLIO's growth both within the UK and beyond has been powered by over 60,000 people who have reached out to offer to help spread the word about OLIO (Ambassadors), and by 10,000 trained volunteers (Food Waste Heroes) who collect and redistribute unsold food from local businesses such as Tesco, Pret a Manger and Compass Catering.

OLIO is a for profit company that generates revenues by charging businesses for the service we provide to enable them to have zero food waste stores. We are a remote-first team of 40 employees, and have been funded by a combination of venture capital, impact investment, revenues and grants. Whilst OLIO's mission is to reduce food waste in the home through leveraging the power of digital technology, it also has several powerful secondary benefits which include tackling the problem of food poverty, and increasing social cohesion at a local community level.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance)

7.14 PROACTIVE AUDITING, NETHERLANDS

<table>
<tr><td>  </td><td colspan="4">Proactive auditing</td></tr>
<tr><td>Applicant:</td><td colspan="4">Wageningen University
Ayalew Kassahun, Dr.ir</td></tr>
<tr><td>Country:</td><td>Netherlands</td><td colspan="3">Implementation in Belgium, Greece, Netherlands</td></tr>
<tr><td>Website:</td><td colspan="4">https://www.wur.nl</td></tr>
<tr><td>App:</td><td colspan="4">https://iof.epcat.de/dashboard</td></tr>
<tr><td></td><td>Delivery model:</td><td>Regular service; Part of advisory service; Open source, community approach; Our solution has various aspects. Our design and data models are open source and free to use.</td><td>Stage:</td><td>Market adoption/ Validation stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">We developed a proactive auditing system for agri-food supply chains in collaboration with leading technology providers, standardization bodies, and innovative supply chain actors. Mainly, we used a standard transparency solution to enable auditing at any time. With our proactive auditing, we aim to realize the unfulfilled goals of auditing, which is avoiding food crises and scandals before they occur so that instead of focusing on punishment and sanctions after the damage we focus on avoiding them.

Our proactive auditing system is a two-layer system: a transparency system and auditing support dashboard. Therefore, our proactive auditing system provides by default a system for tracking and tracing products across the supply chain. It enables businesses, authorities, and consumers to participate and address their concerns. Above all, businesses will not need two separate systems, one for transparency and another for auditing. The underlying transparency system is based on GS1 global standards, which constitutes standards for identifying objects (packages, animals, barns, etc.), capturing data (such as using barcodes and RFID), sharing data (common data model, common API, and repository), and use (the applications that are built using identification, capture and share standards).

Our system is best described using the solution we provided for a pig and pork supply chain in the Netherlands. In the meat sector worldwide, there is a very strong demand for transparency and auditing. For instance, organic products and products with clear animal welfare labels (for example better-life in the Netherlands) are very popular. Our approach to proactive auditing is helping our pilot partners to transition from a once-in-year retrospective auditing to what they now refer to as real-time auditing. The auditing system provides information about animal welfare, the use of antibiotics, origin, energy use, loss and waste, and safety on a continuous basis.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Software solutions (programs and packages)</td></tr>
</table>

7.15 REAL-TIME DIGITAL FOOD SUPPLY CHAIN AUDITING, POWERED BY BLOCKCHAIN, FRANCE

<table>
<tr><td>  </td><td colspan="4">Real-time digital food supply chain auditing, powered by blockchain</td></tr>
<tr><td>Applicant:</td><td colspan="4">Connecting Food
Samantha Gadenne, Global Sales Director</td></tr>
<tr><td>Country:</td><td>France</td><td colspan="3">Implementation in several countries across Europe, and Southeast Asia</td></tr>
<tr><td>Website:</td><td colspan="4">https://connecting-food.com</td></tr>
<tr><td></td><td>Delivery model:</td><td>Regular service</td><td>Stage:</td><td>Proven/ Scale-up stage</td></tr>
<tr><td colspan="5">Practice description:</td></tr>
<tr><td colspan="5">The major of area of work includes supply chains for all food verticals. The technical innovation is the novel combination of blockchain plus smart modules such as LiveAudit, which permits real-time digital supply chain auditing to ensure data accuracy and identify supply chain problems as they occur. We provide end-to-end food chain traceability and to identify product non-compliance in real-time. We use a baseline technology of Hyperledger Fabric, combined with our proprietary smart modules (LiveAudit). The objective is three-fold:
- First, to provide end-to-end supply chain traceability to all food chain actors;
- Second, to leverage new technologies to help food chain actors identify issues and make decisions in real-time; and
- Third, to allow food chain actors to respond to the growing consumers demands for transparency in where their food comes from and how it is made.
This technology benefits actors across the food chain, from farmers and manufacturers to brands and retailers, and also increases transparency for consumers. Our partners include EIT Foods, Microsoft and CEA (French Alternative Energies and Atomic Energy Commission). Our technology was first deployed in 2018, and its adoption has been growing quickly ever since. This practice was born out of the experience of two people who had spent 40+ years working in the food industry, and who saw the challenges when it came to achieving traceability: fragmented supply chains, non-digitized systems, and non-compatible data in different formats.

It is important that many nations are implementing new legislation regarding the requirements for end-to-end traceability, and food actors need a safe and secure way to share their data and ensure it is accurate. In addition, most audits today occur with 6-12 month old data, whereas LiveAudit allows them to make decisions in real-time, improving supply chain efficiencies. We are the first to develop an additional smart layer of real-time digital auditing, combined with blockchain, to ensure data quality and to catch non-compliance in real-time. The solution helps actors across the food chain improve food safety and reduce food wastage.</td></tr>
<tr><td colspan="5">Technology applied:</td></tr>
<tr><td colspan="5">Blockchain (transactions); Software solutions (programs and packages)</td></tr>
</table>

7.16 SENSONOMIC YIELD SYSTEMS, NORWAY

sensonomic	**Sensonomic yield systems**			
Applicant:	**Sensonomic** Anders Gundersen, CEO			
Country:	Norway	Implementation in Portugal, Spain, Senegal; Ghana; Burkina Faso; Uganda; Malaysia; Fiji		
Website:	https://sensonomic.com			
	**Delivery model:**	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

We solve an efficiency problem in agricultural systems that is how do we do the right activities, at the right location, and at the right time. Through data fusion of spatial and temporal data we improve the value capture of the crucial first mile in agriculture - both from industrial scale systems and smaller cooperative systems. Through our solutions clients can achieve 30 % higher profits, without increasing any inputs. The systems approach to agriculture is not new, and has long been practiced by agronomists, agroecologists, and agroeconomists. However, a comprehensive software-based approach is new, and with our unique capabilities we can adapt the software to work across crops and geographies.

The technology we use for data input are divided into two categories: Temporal: Historical production data, including significant events such as drought, pests, adverse weather events, etc.; Historical input data, where available; Sensor data. Spatial: Weather prognosis; Digital elevation models; Optical satellite imagery; Sensor data. We combine these data into two separate but interconnected services: 1. Yield prediction 2. Logistics optimisation (harvest + transport).

We increase output without having to increase inputs. This significantly increases the sales value of the produce, and is proven to work for different agricultural production systems. Our technology is adaptive, and allows for out-of-sample events. In the face of climate change this becomes even more relevant. Our results: First instance prototyped 2017. Implemented with commercial clients in Spain and Portugal 2020. First measured KPIs: 33 % saved time on data analytics; 50 % on data input. We are expanding into economically significant crops on all continents, starting with olives, citrus and wine grapes in Europe. We consider a commercial software platform for 5 crops in 20+ countries a decent medium term objective - paired with KPIs to measure outcome objectively.

Technology applied:

Remote sensing (satellites, planes, drones); Sensors (weather, GPS tagging, livestock); Artificial Intelligence (Machine / deep learning); Software solutions (programs and packages); Simulation software

7.17 THE WORLD'S FIRST FOOD-AS-A-SERVICE PLATFORM, SPAIN

Blendhub	**The world's first food-as-a-service platform**			
Applicant:	**Blendhub** Henrik Stamm Kristensen, Founder			
Country:	Spain	Implementation in Spain, India, Mexico, Colombia, Thailand		
Website:	https://www.blendhub.com			
	**Delivery model:**	Open source, community approach; Food-as-a-service / platform	**Stage:**	Proven/ Scale-up stage

Practice description:

Blendhub's solution is a collaborative platform-based business model to offer food-as-a-service. We have built a localised production model, closer to raw materials and final consumers, through a network of production hubs, portable factories that are developed and installed according to a unique replication model designed by Blendhub, which are transported in a 40-foot container and are operational anywhere in the world within six months, near the raw material sources and near the final consumer, optimizing logistics. By implementing this multi-localised food production model, we are streamlining global supply chains, making them more efficient and more environmentally friendly, producing cheaper, faster and safer, and thus making food accessible to more people in more places.

The key to efficiency lies in this replicable circular model that can be implemented anywhere in the world, and we have succesfully implemented this model in 5 countries: Spain, India, Mexico, Colombia and Thailand. Blendhub is the result of five agro-technological companies founded by Henrik Stamm Kristensen, a Dane based in Spain and linked throughout his career to the agri-food sector. Blendhub started its activity in the production of ingredients and food powders for the food industry but the company has evolved from a food company to a technology and services platform for the food industry. Working with food powders and implementing a multi-localised and more efficient production model enables us to better tackle the issue of food waste.

In 2011 Blendhub patented and implemented its first PPB (Portable Powder Blending) in India aiming at localizing food production closer to raw materials and final consumers, thus streamlining supply chains. The company has also developed a cloud-based software suite that enables online quality control of food production and supply chain monitoring. Each PPB or production hub ensures cloud-based quality control and global traceability using this proprietary technology.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Broadcasting (TV, radio, online, SMS); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages); Blockchain (transactions)

7.18 WENDA PLATFORM, ITALY

	**Wenda Platform**			
Applicant:	**Wenda srl** Mattia Nanetti, Co-founder/COO-CMO			
Country:	Italy	Implementation in Czech Republic, France, Hungary, Italy, Portugal, Romania, Spain, Switzerland, Hong Kong		
Website:	https://wenda-it.com/en			
	Delivery model:	Regular service	**Stage:**	Proven/ Scale-up stage

Practice description:

Food supply chain actors struggle to manage paperworks, data sheets, cold chain softwares, compliance tools. Many people are poisoned by food each year. Food loss and waste, safety, traceability are urgent issues, impossible challenges to face without connecting all the Food supply chain links and governing the millions of data points generated by tracking tools. Wenda is the universal and collaborative Platform that allows you to easily manage, analyze and share temperature and track & trace data from production to consumer, supporting the most common tracking devices and monitoring systems.

The Platform collects, analyzes and automatically shares Food supply chain data, automatically integrating with measuring equipment, data loggers and management, logistics and quality softwares already in use. This way, it delivers support for decisions and statistics about temperature and track & trace data to all the protagonists of each specific supply chain. With Wenda, Food chain players can:

- Track data at every stage of the supply chain, reducing Food Waste and improving Food Safety and freshness;
- Decide intelligently based on organized, clean and unified data, simplifying, automating the management of quality, logistics and supply chain data and alerts;
- Collaborate in the supply chain, sharing selected information with clients, suppliers and collaborators to increase transparency, traceability and the connection with the protagonists of the chain.

The Wenda Platform supports numerous measurement devices, data loggers, management, logistics and quality software, even those already in use. You can take advantage of its benefits through its Modules or via API technology.

Technology applied:

Smartphones (features, apps); Web platforms (forums, communities, e-governance); Sensors (weather, GPS tagging, livestock); Internet of Things (IoT) (M2M, WiFi, networks); Broadband internet (mobile, satellite, cable); Cloud (data storage and computing, Big data); Artificial Intelligence (Machine / deep learning); Digital communication (telephone, messenger, email); Software solutions (programs and packages)

APPENDIXES

3. APPENDIX I - ELIGIBLE COUNTRIES

Europe			**Central Asia (CIS)**
Albania Andorra Austria Belgium Bosnia and Herzegovina Bulgaria Croatia Cyprus Czech Republic Denmark Estonia Finland France Georgia German	Greece Hungary Iceland Ireland Israel Italy Latvia Liechtenstein Lithuania Luxembourg Malta Moldova Monaco Montenegro Netherlands Norway	Poland Portugal Romania San Marino Serbia Slovakia Slovenia Spain Sweden Switzerland Rep. of North Macedonia Turkey Ukraine United Kingdom Vatican	Armenia Azerbaijan Belarus Kazakhstan Kyrgyzstan Russian Federation Tajikistan Turkmenistan Uzbekistan

4. APPENDIX II - CALL QUESTIONNAIRE TEMPLATE

*(*are mandatory fields)*

1) Personal Information	
***Name of the practice/solution:**	
Organization:	**Organization Website:**
***Country:**	***Email:**
***Name of the person submitting the application:**	**Title/Role of the person submitting the application:**
Gender: Female Male I prefer not to say	***Are you above the age of 18?** Yes No *Note: Only individuals over the age of 18 may submit a practice.*
***Are you or is a member of your team a former employee of ITU or holding any kind of relations to ITU?** Yes No *Note: Employees or persons related to ITU are excluded from participating in the call for good practices.*	

1) Good Practice Information

***Which is/are the main challenge(s) that your practice/solution aims to address?** (*Please, select maximum two*)

1. Regulatory Frameworks/ Enhanced market access/ Financial services and insurance
2. Capacity Development and Empowerment
3. Agriculture innovations systems and Sustainable farming
4. Disaster risk management and Early warning systems
5. Food loss and waste / Food safety and traceability

***Provide a brief description of your practice, highlighting the agricultural challenge(s) your solution has proven to address** *(max 3000 characters)*:

***Technology in use** *(please, select more than one if appropriate):*

Smartphones (features, apps)
Web platforms (forums, communities, e-governance)
Remote sensing (satellites, planes, drones)
Sensors (weather, GPS tagging, livestock)
Robotics (agrobots, driverless tractors)
Internet of Things (IoT) (M2M, WiFi, networks)
Broadband internet (mobile, satellite, cable)
Broadcasting (TV, radio, online, SMS)
Cloud (data storage and computing, Big data)
Artificial Intelligence (Machine / deep learning)
Digital communication (telephone, messenger, email)
Software solutions (programs and packages)
Blockchain (transactions)

Others_____

***Please, describe the technology developed or adopted, and how it is applied** *(max 3000 characters)*:

***How does your practice/solution contribute to addressing the agriculture challenge(s) innovatively and sustainably?**

Please, highlight elements of innovation and sustainability *(max 3000 characters):*

***Does your practice/solution target smallholder farmers?** Yes No

If yes, please, describe *(max 2000 characters)*:

***Who is your practice/solution targeted for?** *(max 2000 characters)*

Is your practice/solution developed in partnership with other entities? Yes No

If yes, please, describe *(max 2000 characters)**:***

***Where has your practice/solution been implemented?** *(possible multiple selection)*

Albania	Czech Republic	Italy	Norway	Russian Federation
Andorra	Denmark	Kazakhstan	Poland	Tajikistan
Armenia	Estonia	Kyrgyzstan	Portugal	Turkey
Austria	Finland	Latvia	Romania	Turkmenistan
Azerbaijan	France	Liechtenstein	San Marino	Ukraine
Belarus	Georgia	Lithuania	Serbia	United Kingdom
Belgium	Germany	Luxembourg	Slovakia	Uzbekistan
Bosnia and Herzegovina	Greece	Malta	Slovenia	Vatican
Bulgaria	Hungary	Moldova	Spain	Others: _____
Croatia	Iceland	Monaco	Sweden	
Cyprus	Ireland	Montenegro	Switzerland	
	Israel	Netherlands	Rep.of North Macedonia	

***How would you describe the maturity of your practice/solution?** *(Please, select only one)*

Early stages/ Ideation stage

Market adoption/ Validation stage

Proven/ Scale-up stage

***How long has your practice/solution been implemented for?**

Please, highlight results and accomplishments. *(max 3000 characters)*

***Please, select the option that best describes the delivery model behind the practice/solution.**

Fully free to use Free and fee One-time sell Regular service Part of advisory service

Open source, community approach Other:

***Please, provide link(s) to your application or a demo of it, and/or material describing your practice/solution, or provide attachment(s)** *(max 1000 characters, Attachment is not mandatory)*

Please, provide a link to or describe user stories or feedback gathered from the field.

(max 1000 characters)

Which challenges did you encounter when implementing the practice/solution?

(max 2000 characters)

What are your plans for the future and medium-term objectives?

(max 2000 characters)

Is there anything else you would like us to know?

(max 2000 characters)

***How did you hear about this Call?**

FAO/ITU Social Media

FAO/ITU Websites, Newsletter

Others' Websites, Newsletter

Others' Social Media

I was contacted by FAO/ITU

I was recommended to apply by a person/organization

Others:

***All solutions entered into this competition will be submitted for consideration to the World Summit of the Information Society (WSIS) Prizes 2021. Would you like your project to be entered in the next edition of the WSIS Prizes contest?**

If so, you will be contacted for additional information once the next edition of the contest is launched.

Yes No

Terms

Applicants are required to maintain ethical conduct and may be subject to disqualification – If applicable, please note that participants must comply with the intellectual property rights of applications and technologies used in the submitted good practice. Employees, or persons related to ITU are excluded from participating in the call for good practices.

All submissions will be automatically considered for:

- ITU Stocktaking Report on e-agriculture,
- Digital Excellence in Agriculture Report,
- Promotional video focusing on nominated good practices,
- Social media campaign
- Awards ceremony highlighting the outstanding achievements of the nominated good practices.
- World Summit of the Information Society (WSIS) Prizes 2021 (More information at: wsis.org/prizes).

All relevant information can be accessed via the Digital Excellence in Agriculture and Central Asia dedicated website.

Please ensure that you have thoroughly read and understood the directions and conditions for participation. Only those proposals will be accepted, which are fully completed and submitted within the deadline – no later than 11 January 2021, 23:59 (CET).

*** Submit / I certify that**

I understand the terms and conditions, and hereby submit the above-mentioned practice for consideration to the Call for Good Practice in the field of Digital Excellence in Agriculture in Europe and Central Asia (type full name to sign)

Date

Signature (type full name to sign)

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