Brochure

# ICT-AGRI-FOOD HORIZON PROJECT

*Highlights of projects funded by the ICT-AGRI FOOD ERA-NET (2019-2024)*

https://ictagrifood.eu/

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# WELCOME TO ICT-AGRI

At ICT-AGRI-FOOD ERA-NET, we are committed to driving innovation and advancing knowledge through funding innovative European research and supporting our community with complementing activities. Our diverse portfolio of projects spans multiple disciplines, each aimed at addressing pressing challenges and unlocking new possibilities. This brochure offers a glimpse into the exciting and impactful work our researchers are leading, showcasing their dedication to excellence and their contributions to both scientific and societal progress. Explore the projects, learn about their objectives, and discover how we are shaping the future of agri-food systems.

Johannes Pfeifer , PhD
Coordinator of ICT-AGRI-FOOD

With a focus on digital technologies and data-driven solutions for the agri-food sector, and ultimately to make the sector more sustainable, resilient, equitable and transparent, the ERA-NET Cofund ICT-AGRI-FOOD has been dedicated to noticeably strengthening the European Research Area by aligning and pooling resources from regional, national, and European research programs to fund innovative and interdisciplinary research and development projects. With our multi-actor approach we aim to enable stakeholders along the entire agri-food value chain to create synergies and to collaborate.

ICT-AGRI-FOOD operates at the intersection of information and communication technologies (ICT), agriculture, and food systems, and is co-funded by the European Commission under the Horizon 2020 framework programme. Through four successful calls, 42 transnational and interdisciplinary projects have been funded, each working towards enhancing cooperation and creating synergies among stakeholders across the agri-food value chain. These projects leverage advanced digital tools to address the challenges faced by both conventional and organic farming, while accounting for diverse European climates and production conditions

Building on the successes of its predecessors, ICT-AGRI and ICT-AGRI 2, ICT-AGRI-FOOD broadens its scope beyond agriculture and seeks synergies along the value chain. It recognizes that agriculture is part of a larger food system, interconnected with upstream and downstream processes, as well as a diverse group of stakeholders. From farmers and industries to consumers and authorities, the initiative aims to foster collaboration across all sectors, driving innovation that can transform the entire food value chain.

In this brochure, we present a selection of projects funded through ICT-AGRI-FOOD's calls from 2019 and 2024, showcasing a variety of impactful research efforts. These projects explore urgent topics such as circularity, diversity, and technology adoption, providing valuable insights and setting the stage for future research within the Horizon Europe partnerships.

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# CONTENTS

# About ICT-AGRI FOOD

## Vision

The vision for the ERA-NET Cofund ICT-AGRI-FOOD is to bring together actors from across the entire agri-food systems including primary producers (comprising both conventional and organic), advisors, SMEs, food processors, food retailers, consumers and the public sector (e.g. ministries, policy makers and regulatory bodies) with researchers in a multi-actor approach, to enable digital technology solutions for a transition towards sustainable and resilient agri-food systems.

## Story

Since 2009, ERA-NET ICT-AGRI has been driving the development and implementation of new technologies for competitive, sustainable, and environmentally friendly agriculture. By pooling fragmented resources, it enhances the efficiency and effectiveness of European research in precision farming, ICT, and robotics.

**Key Objectives:**

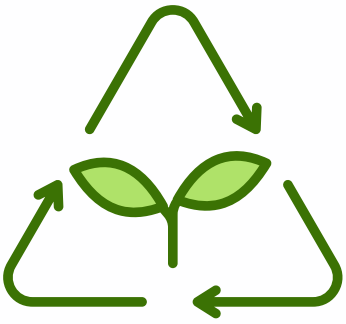
- Mapping existing research and future needs
- Developing transnational funding mechanisms
- Establishing strategic research agendas and networks

**ICT-AGRI Milestones:**

- ICT-AGRI-1 (2009-2014): 18 partners across 20 countries, launching 3 calls and funding 24 projects on precision farming tools.
- ICT-AGRI-2 (2014-2019): 23 partners across 17 countries, expanding collaboration within Horizon 2020, EIP-AGRI, and other ERA-NETs to promote eco-efficient and competitive agriculture.
- ICT-AGRI-FOOD (2019-2025): 37 partners across 24 countries, launched 4 calls and funding and co-funding on 42 projects to promote digitilisation of agriculture and food system.

With digital innovations transforming the agri-food sector, ICT-AGRI SRIA continues to shape the future of smart farming by advancing ICT and robotics adoption in agriculture.

## Impact



The ICT-AGRI-FOOD project has successfully strengthened coordination between national and EU funding, ensuring better resource allocation in ICT-enabled agri-food systems. By pooling resources, partner countries committed up to €20.96M, reducing research duplication and enhancing the impact of transnational collaboration. The project has also fostered partnerships with the European Space Agency to advance AI, machine learning, and space-based solutions for agriculture.

Through engagement with other ERA-NETs and the International Bioeconomy Forum, ICT-AGRI-FOOD has laid the groundwork for sustained collaboration and funding beyond the project's duration. Its contributions to sustainability include reducing the environmental footprint of agriculture by minimising resource inputs, waste, and emissions. Digital technologies funded through the project have empowered consumers with greater transparency and data-driven decision-making in the food system.

By integrating effectively with major digital platforms, the project has facilitated new business models and strengthened the adoption of ICT solutions in agriculture. The results of ICT-AGRI-FOOD mark a significant step toward a more resilient, efficient, and sustainable digital transformation of the agri-food sector.

# Knowledge Incubator

## A Hub for Digital Innovation in Agri-Food

The ICT-AGRI-FOOD Knowledge Incubator (KI) is a virtual space designed to bridge the gap between research and industry, facilitating the transition from scientific advancements to real-world innovations in the agri-food sector.

Developed within the ERA-NET ICT-AGRI-FOOD initiative, the incubator provides a structured environment where researchers, companies, and stakeholders can connect, share expertise, and collaborate to accelerate digital transformation in agriculture and food systems.

At its core, the KI serves as an interactive repository, where innovations are not only archived but actively discussed and refined through community engagement. Researchers and technology developers can upload their solutions, categorized into three main domains:

- **ICT** Domain: Innovations related to big data, artificial intelligence, robotics, remote sensing, and digital platforms for smart farming.
- **Agri** Domain: Solutions addressing sustainable production, resource efficiency, soil and water management, animal welfare, and climate adaptation.
- **Food** Domain: Innovations improving food chain management, reduction of waste, traceability, safety, and sustainable food processing.

A validation process ensures the quality and credibility of externally submitted innovations, reinforcing the platform's reliability.

Since its launch, the Knowledge Incubator has evolved through a series of strategic activities. A co-design process involving researchers and funders shaped its structure, while targeted workshops and seminars have guided users in describing and sharing their innovations. Notable milestones include its presentation at the Final Seminar of the 2019 Cofund Call in Warsaw (January 2024) and efforts to expand participation beyond the ICT-AGRI-FOOD community, ensuring a diverse and inclusive ecosystem.

The impact of the KI extends beyond mere knowledge sharing. By fostering cross-sector collaboration, enhancing innovation visibility, and supporting the adoption of digital solutions, it contributes to the broader European strategy for digitalization in agriculture. Moving forward, the platform aims to strengthen user engagement, refine its notification and matchmaking systems, and publish a comprehensive report on innovation uptake within the ICT-AGRI-FOOD action.

The great challenge ahead is to ensure that this platform becomes a valuable and distinctive resource compared to other existing initiatives. This means not only expanding its content and usability but also ensuring that it continues to grow in relevance, attracting high-quality contributions and active participation from stakeholders across the agri-food and ICT sectors.

In a rapidly evolving agri-food landscape, the ICT-AGRI-FOOD Knowledge Incubator stands as a catalyst for innovation, ensuring that research-driven digital solutions effectively reach and benefit the industry, policymakers, and society at large.

2019 COFUNDED CALL

# Integrated ICT and Automation for Sustainable Agricultural Production

The first transnational joint call for research projects within the framework of ICT-AGRI-FOOD aimed at the selection of projects that will significantly contribute to enable digital technology solutions for a transition towards more sustainable and resilient agri-food systems. The research projects are consistent with the scope of this call and with the national/organisational thematic priorities of the countries/regions involved in the projects.

Research projects investigated, developed and tested digital solutions for the rising demand for food, competition for land and other natural resources from other biomass uses, globalisation, and threats from animal or plant diseases, environmental and climatic changes, public health considerations and economic constraints.

| **NINETEEN PROJECTS WERE FUNDED IN THIS CALL** | | |
|---|---|---|
| **Title** | **Acronym** | **Countries** |
| Advanced Digital Solutions for Professional Food and Nutrition Catering Services | ADCATER | IL, RO, DE, IT |
| A Data-Driven Platform for Site-Specific Fertigation | ADDFerti | BE, GR, TR, CH |
| Multimodal Sensing for Individual Plant Phenotyping in Agriculture Robotics | ANTONIO | GR, IT, DE, CH |
| Understanding and Anticipating Mechanisms of Honeybee Colony Mortality with Connected Beehives | BeeConnected | FR, DE, GR |
| Fast and INtuitive Data Retrieval | FINDR | DE, NL, PL |
| A Smart-Sensing AI-driven Platform for Scalable, Low-Cost Hydroponic Units | GOHYDRO | GR, DK, RO, DE |
| Innovative ICT Tools for Targeted Monitoring and Sustainable Management of the Brown Marmorated Stink Bug and Other Pests | HALY.ID | BE, DE, HU |

# 2019 COFUNDED CALL

| Title | Acronym | Countries |
|---|---|---|
| Integrated Model and Digital Platform for Harvest Prediction of Canned Peaches | IMPPeach | GR, DE, NL |
| Enhancing Environmental Sustainability of Livestock Farms by Removing Barriers for Adoption of ICT Technologies | LivestockSense | HU, EE, AT, IL, PL, DK, SE |
| Multiscale Sensing For Disease Monitoring In Vineyard Production | MERIAVINO | FR, RO, GR |
| Unlocking Data-Driven Innovation for Improving Productivity and Data Sharing in Mushroom Value Chain | MUSHNOMICS | RO, DK, HU, IE |
| sPectraL Tools and Digitalization for the Development of SustAinable Structured Food with PlaNt Proteins | PLAN P | FR, DK, GR |
| Potential of Selective Harvest Based on Mycotoxins Content Assessment in Cereal Crops | POSHMyCo | BE, GR, SE, LT, ES |
| Sunburn and Heat Prediction in Canopies for Evolving a Warning Tech Solution | SHEET | DE, IT, HU |
| Implementation of Soil Compaction Risk Assessment System – End-User's Evaluation of Potentials and Barriers | SoCoRisk | DK, IT, CH, NO, SE |
| Agrifood Quality Estimation Using Spectral Techniques | SPECTROFOOD | GR, IE, DE, BE |
| Releasing the Potential of ICT for Sustainable Milk and Beef Cattle Value Chains | SustainIT | EE, FI, SE, DE |
| An ICT-Based Real-Time Advisory Tool to Minimise Tail Biting in Fattening Pigs | TailBiteAdvice | BE, IE, DK |
| aUtomaTed Open PrecIsion fArming Platform | UTOPIA | NL, TR, BE |

# Advanced Digital Solutions for Professional Food and Nutrition Catering Services (ADCATER)

**Coordinator:**
Itzik Levy - FoodproFix ltd

**Collaborating Institutions:**
Avraham Mordoch - FoodproFix ltd, (Israel)

Masha Niv Hebrew - University of Jerusalem, (Israel)

Razvan Stoica - Inside Media Communication LTD, IMC, (Romania)

Marina Kolesnik - Fraunhofer-Gesellschaft FIT, (Germany)

Umberto Nanni - University of Rome, (Italy)


**Project Number**

**Project Dates**
**01/05/2021 - 30/04/2023**

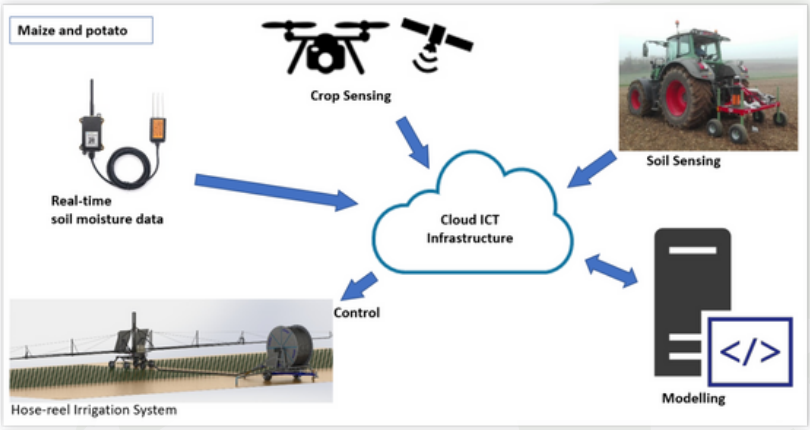
## Impacts

ADCATER project aims to assist healthcare professionals, particularly nutritionists, in quantifying and regulating patients' food intake through a digital meal tracking solution. This enables effective management of both short and long-term follow-up care by building ad hoc meal plans tailored to reduce healthcare complications.

The outcome of this project was presented in an article titled – 'Advancing Nutritional Care for Hospitalized Patients 2 through the ADCATER Solution'. In this article, the project present the primary outcome of this multidisciplinary project: a cloud-based, artificial intelligence-powered automated reporting solution. This solution seamlessly integrates computer vision techniques for tracking patient food consumption via image segmentation with ontology-based data management and business intelligence practices for informed proactive decision-making.

The generated reports provide insights that enable healthcare institutions and nutritionists to address any discrepancies and raise awareness of excessive or inadequate energy and macronutrient intake. The solution also enables prediction of potential issues related to decreased food consumption through historical data analysis, which is critical for dietary follow-up, particularly in preventing unintentional weight loss in long-term care settings.

# A Data-Driven Platform for Site-Specific Fertigation (ADDFerti)




**Coordinator:**
Abdul Mouazen - Ghent University, (Belgium)

**Collaborating Institutions:**
Dimitrios Moshou - Aristotle University Thessaloniki (AUTH), (Greece)

Yücel Tekin - Bursa Uludag University (BUÜ), (Turkey)

Ralf Bill - Rostock University (RU), (Germany)

Jürgen Reinhard - Quantis (QUA), (Switzerland)

Dilara Hişim - Sezer Inc. (Sezer), (Turkey)

## Impacts

The aim of the ADDFerti project is to design and develop a fully-automated ICT-based data driven platform for variable rate fertigation (VRFI). The project addresses challenges such as rising food demand, water scarcity, and climate change.

From the outset, ADDFerti team dedicated themselves to create an advanced fertigation system that combined cutting-edge soil sensing technologies with a hose-reel fertigation setup, ICT infrastructure, algorithms and decision support tools. The field trials for the project were on key crops like maize (e.g., in Turkey Pilot) and potatoes (in Belgium and Germany Pilots).

ADDFerti team has successfully modified a mid-size commercially available Sezer HIS machine for the implementation of VRFI, so as 4 independent section control for irrigation and 4 independent section control for fertilization were developed and successfully tested under indoor and field conditions. The team created a decision support system (DSS) to automatically process input data (soil scanning data, live soil moisture data, weather data) and calculate fertigation application maps in the cloud. A Neural Network was included into the DSS, to predict water for irrigation.

The results were remarkable. The outcome of this is that farmers saw significant increases in crop yields while simultaneously reduction in the use of fertilizer and water.

**Project Number**

**Project Dates**
**01/03/2021 - 28/02/2024**

# Multimodal sensing for individual plANT phenOtyping iN agrIculture robOtics (ANTONIO)

**Coordinator:**
Vasileios Fragos - AUTH-Laboratory for Alternative Energy Sources in Agriculture (AUTH-AESA), (Greece)

**Collaborating Institutions:**
Giulio Reina - Politecnico di Bari, (Italy)

Annalisa Milella - STIIMA, National Research Council of (Italy)

Stefan Rilling - Fraunhofer IAIS, (Germany)

Peter Froelich - AgriCircle, (Switzerland)


**Project Number**

**Project Dates**
**01/03/2021 - 28/02/2023**

## Impacts

ANTONIO aimed to streamline and enhance the utilization of crop protection products and related inputs through the implementation of precision agriculture techniques and automation.

This objective was accomplished by integrating sensors and leveraging their fusion within an innovative interoperability network, coupled with artificial intelligence. The resulting data was presented in user-friendly maps accessible through web services and mobile transforms, empowering farmers to efficiently manage the application of plant protection products and inputs in indoor crops.

Remarkable milestone involved the deployment and testing of advanced sensors on drones and vehicles. The initial dataset has been succesfully transmitted to a web service for display. ANTONIO collaborations with international projects and companies ensure the ongoing development and exploitation of these technologies.

# Understanding and Anticipating Mechanisms of Honey Bee Colony Mortality with Connected Beehives (BeeConnected)


**Coordinator:**
Fabrice Requier - UMR EGCE; IRD, CNRS, Univ. Paris-Saclay, (France)

**Collaborating Institutions:**
Ingolf Steffan-Dewenter - University of Würzburg - Department of Animal Ecology and Tropical Biology, (Germany)

Fani Hatjina - Hellenic Agricultural Organization DEMETER - Dept. of Apiculture, (Greece)

## Impacts

BeeConnected aims to use ICT to monitor beehives during winter and understand the mechanisms underlying winter mortality risk of honeybee colonies. The goal is to identify early-warning indicators that could help beekeepers limit colony losses and related economic deficits.

The project successfully monitored 135 beehives at 27 study sites across France, Germany, and Greece, collected 40 million data points on colony conditions, and developed a machine learning-based predictive system for mortality risk assessment.

BeeConnected also developed a new ICT device, the connected frames, a 3D multi-sensor monitoring system designed to track the internal temperature of colonies at multiple locations within the swarm. This device allows real-time estimation and tracking of colony size, including during the critical winter season.

Additionally, sound-recording devices were developed and installed in 14 beehives across the three countries to detect abnormal sounds as early warning indicators of colony collapse.

The project engaged 538 beekeepers in a survey, providing valuable insights into the current state of precision apiculture systems (PAS). The results show that beekeepers have a positive outlook on P.A.S., provided they become more inclusive, non-invasive, and cost-effective.

Project findings were disseminated through scientific publications, conferences, and web platforms.

**Project Number**

**Project Dates**
**01/02/2021 - 31/01/2024**

# Fast and Intuitive Data Retrieval for Earth Observation (FINDR)

**Coordinator:**
Jonah Vincke - Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI, (Germany)

**Collaborating Institutions:**
Daniel Spengler and Daniel Scheffler - Helmholtz Center Potsdam German Research Center for Geosciences, (Germany)

Henk Pelgrum - eLEAF (ELE), the (Netherlands)

Lukasz Dutka - ACK Cyfronet AGH, (Poland)


**Project Number**

**Project Dates**
**01/02/2021 - 31/07/2023**

## Impacts

The Fast and Intuitive Data Retrieval for Earth Observation (FINDR) project aimed to create a possibility for a rapid and comprehensive overview of available Earth Observation (EO) data from major satellite image providers. Furthermore, any available EO data from different providers are homogenized and converted into files optimized for Value Adding Service Providers (VASP). Thus, the overall goal was to facilitate a more efficient value chain in the agricultural and food industry.

FINDR addressed the following objectives:

- Creation of a comprehensive and transparent overview of available data from all major existing EO systems enabling faster and better-informed decisions
- Provision of accurate near-future forecasts on data availability to timely react to and mitigate potential coverage gaps by use of alternative data sources
- Obstacle-free integration of EO data from different sources to spatio-temporally complement existing and future information products.
- Implementation of a scalable processing infrastructure for distributed data infrastructures enhanced by caching optimization for large-scale data

Although FINDR experienced technical issues such as EO data source availability, scaling of cluster resources and data handling in Onedata, delayed the integration of the FINDR platform as well as the integration of FINDR in eLEAF's company owned service (FieldLook). Nonetheless, FINDR became operational and was used by eLEAF to generate information for their farmers in post-perspective.

# A Smart-Sensing AI-driven Platform for Scalable, Low-cost Hydroponic Units (GOHYDRO)

**Coordinator:**
Panagiotis Zervas - SCiO, (Greece)

**Collaborating Institutions:**
Bhim Bahadur Ghaley, University of Copenhagen, (Denmark)

Oliviu Matei - Holisun SRL, (Romania)

Niklas Galler - Nr21 Design, (Germany)

Eleni Makarona - Institute of Nanoscience and Nanotechnology, National Centre for Scientific Research "Demokritos", (Greece)

Teodor Rusu, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, (Romania)

## Impacts

The GOHYDRO project focuses on optimizing hydroponic cultivation to produce the best possible products, even with low-cost, consumer-grade equipment. It aims to address the global challenge of producing more food sustainably while minimizing environmental impact by utilizing hydroponics, a method that requires no arable land and reduces water usage, making it ideal for urban settings.

**Project Number**

**Project Dates**
**01/03/2021 - 28/2/2023**

GOHYDRO's goal is to develop a cost-efficient smart-sensing ICT platform that monitors the health and nutrient content of hydroponically cultivated microgreens to optimize the cultivation process. The project strives to create an affordable, AI-driven platform that serves as an easy-to-use e-agronomist, providing growers with the tools to fine-tune and optimize hydroponic production.

The project carried out preliminary research to establish the scientific foundation for optimizing microgreens production. Based on these findings, the team developed the GOHYDRO Multi-modal Sensor Kit (MMSK), which uses 3D-printing technologies to monitor plant health and nutrient content. These kits were delivered to the project's partners, who followed comprehensive experimental protocols to collect and process data through the GOHYDRO platform.

The platform integrates various computational modules for data collection, validation, and preprocessing, with AI components that power predictive models for yield and quality optimization. These models were implemented using neural network architectures to ensure high accuracy while maintaining generalization capacity.

Additionally, the project developed the GOHYDRO application, allowing users to register, monitor, and manage their hydroponic systems. The app provides real-time data on cultivations and offers guidelines and optimization advice to improve crop production.

Finally, the project conducted a comprehensive market analysis and created a detailed business plan for the GOHYDRO platform, preparing it for commercialization and future growth.

# Halyomorpha Halys Identification: Innovative ICT Tools for Targeted Monitoring and Sustainable Management of the Brown Marmorated Stink Bug and Other Pests (HALY.ID)

**Coordinator:**
Cristina Pinotti - Università degli Studi di Perugia, (Italy)

**Collaborating Institutions:**
Lara Maistrello - Università degli Studi di Modena e Reggio Emilia, (Italy)

Lars Wolf - Technische Universität Braunschweig, (Germany)

Dimitrios Zormpas - Tyndall National Institute, University College Cork, (Ireland)

Panagiotis Sarigiannidis - University of Western Macedonia, (Greece)

Dan Popescu - University POLITENICA of Bucharest, (Romania)

Peter Offermans - OnePlanet Research Center/imec, (the Netherlands)

**Project Number**

**Project Dates**
**01/02/2021 - 31/01/2024**

HALY.ID
HALYomorpha halys IDentification

## Impacts

The HalyID project focuses on developing advanced methodologies for monitoring and managing the Brown Marmorated Stink Bug (BMSB), an invasive agricultural pest that causes significant damage to fruits and seeds, often rendering them unmarketable. Accurate detection and monitoring are crucial for guiding effective pest control measures.

The project employs cutting-edge technologies, including neural networks and various camera systems—drone-mounted RGB cameras, sticky trap cameras, and stationary cameras—to detect and quantify BMSB populations. These methods also evaluate pheromone effectiveness and provide consistent, reliable monitoring data.

Environmental conditions, such as humidity and temperature, are recorded using sensor networks to create epidemiological models that predict BMSB infestations. To ensure data transparency and trust among stakeholders, the project utilises a blockchain-based logbook for secure and tamper-proof data storage.

Additionally, HalyID introduces non-destructive post-harvest techniques, such as Short Wave Infrared (SWIR) imaging, to detect hidden fruit damage, enhancing product quality and marketability.

By integrating these methodologies, the HalyID project offers innovative solutions to mitigate the impact of BMSB, supporting sustainable agriculture and improving consumer confidence in agricultural products.

# Integrated Model and Platform for Harvest Prediction of Canned Peaches (IMPPeach)

**Coordinator:**
Vangelis Vassiliadis - Agrostis SA, (Greece)

**Collaborating Institutions:**
Florian Schlenz - Geocledian GmbH, (Germany)
Javier Durante - Sigrow BV, (The Netherlands)

Christos Stergiou - ALMME SA, (Greece)

Dionissios Kalivas - Agricultural University of Athens, (Greece)

IMPPeach

Harvest prediction for canned peaches

## Impacts

The IMPPeach project aims to improve the accuracy of yield and harvest date predictions for canned peach cultivations, optimizing production planning for canning facilities. Accurate predictions address challenges posed by fluctuating harvest dates, fruit sizes, and yields caused by variations in weather, farming practices, and market dynamics. By enhancing prediction accuracy, the project benefits canning businesses and smallholder farmers, increasing efficiency, market share, and profit margins.

Focusing on peach orchards in Imathia, Greece, the project integrates data from historical records, remote sensing (RS), climatic data, IoT sensors, and field scouting. These datasets are used to train AI/ML models for predicting harvest dates and quantities. Predictions are incorporated into a Farm Management Information System (FMIS), connected to Material Requirements Planning (MRP) software, enabling seamless data exchange between farmers and canning facilities.

The project also evaluates the scalability of its methodologies to other crops and regions, supported by industry partnerships and global stakeholders. Dissemination and exploitation plans ensure broad adoption and maximize the impact of project outcomes.

The expected social impact includes higher incomes for farmers, more stable jobs in factories, and improved living standards. In developing countries, this translates to better education and healthcare access. Strong collaboration with farmers, processors, and stakeholders further fosters outreach and ensures the project's sustainability.

IMPPeach demonstrates the potential to revolutionize production planning in the fruit canning industry while promoting economic and social sustainability for all stakeholders involved.

**Project Number**

**Project Dates**
**01/02/2021 - 31/07/2023**

# Enhancing Environmental Sustainability of Livestock Farms by Removing Barriers for Adopting ICT Technologies (LivestockSense)

**Coordinator:**
Eugen Kokin - Estonian University of Life Science, (Estonia)

**Collaborating Institutions:**
Thomas Neubauer - SBA Research, (Austria)

Ildiko Edit Tikasz - NARIC Research Institute of Agricultural Economics, (Hungary)

Uri Marchaim - MIGAL Galilee Research Institute, (Israel)

Sebastian Opaliński - Wroclaw University of Environmental and Life Sciences, (Poland)

Claus Aage Grøn Sørensen - Aarhus University, Department of Engineering, (Denmark)

Thomas Bjerre - Innvite ApS, (Denmark)

Stefan Gunnarsson - Swedish University of Agricultural Sciences, (Sweden)

**Project Number**

**Project Dates**
**01/04/2021 - 31/03/2023**

## Impacts

The LivestockSense project aims to enhance the economic and environmental viability of livestock farms through advanced information and communication technologies (ICT) and address social barriers to technology adoption.

By equipping farms across five European regions with Precision Livestock Farming (PLF) tools, the project investigates farmers' attitudes toward these technologies, identifying obstacles to adoption. It engages stakeholders, including technology developers and policymakers, to explore future expectations and provide recommendations for overcoming barriers.

ICT tools are crucial for achieving the EU's climate neutrality goals under the Green Deal. However, adoption in animal husbandry remains limited due to socio-economic and cultural challenges and a lack of understanding about ICT benefits.

LivestockSense addresses these issues by documenting farmers' information needs, assessing decision-making processes, and supporting adaptation through workshops, mentoring, and an open API web platform. The project also highlights the economic and environmental benefits of PLF, fostering sustainable and inclusive animal production systems.

# Multiscale Sensing for Disease Monitoring in Vineyard Production (MERIAVINO)

**Coordinator:**
Adel Hafiane - INSA Centre Val de Loire, (France)

**Collaborating Institutions:**
Mihaela Hnatiuc - Constanta Maritime University, (Romania)

Victoria Artem - SCDVV Murfatlar, (Romania)

Emmanouil Oikonomou - University of West Attica, (Greece)

Guillaume Delanoue - IFV, (France)

Laurent Garriga - ATOS, (France)


## Impacts

The MERIAVINO project focused on advancing vine plant monitoring through a multiscale sensing and data analysis approach. By leveraging IoT devices, drones with multispectral and hyperspectral imaging, and satellite-based remote sensing, the project aimed to collect comprehensive data from vineyards across different continents.

**Project Number**

**Project Dates**
**01/02/2021 - 31/01/2024**

This approach aimed to enhance the understanding of how environmental factors impact vine growth and health, with close collaboration with end-users and viticulture specialists to ensure realistic agronomic practices.

Key achievements include:
Standardized Agronomic Protocol: A unified protocol was developed to assess vineyard parameters consistently across participant countries. This standardization ensured uniform data collection and analysis of vine growth, environmental factors, diseases, and yield, which was essential for validating the AI models created during the project.

Environmental Data Acquisition: IoT devices were installed in vineyards in Romania and France to measure environmental parameters like temperature, humidity, soil moisture, and air quality. Custom-designed, low-cost IoT systems were later deployed in Greece and Romania using LoRaWan network protocol and Fog and Cloud computing.

Imaging Systems: Drone-based multispectral imaging was used to capture high-resolution images weekly during the vine growth period in France. A visualization tool highlighted areas of interest, helping agronomists track growth patterns and evaluate management practices. Satellite-based imagery was combined with weather data to develop a new machine learning algorithm for predicting downy mildew outbreaks.

Data Security and Storage: A semantic-rich database was created to enhance data interoperability and security. This structured database allowed for meaningful connections between data points and ensured the protection of transmitted information against cyber threats.

In summary, the MERIAVINO project successfully utilized a multiscale approach and cutting-edge technologies for vineyard monitoring. The integration of IoT, remote sensing, AI, and advanced data security opened new possibilities for smart farming. However, more efforts are needed to harmonize these diverse technological advancements and increase the project's Technology Readiness Level (TRL).

# Unlocking Data-Driven Innovation for Improving Productivity and Data Sharing in Mushroom Value Chain (MUSHNOMICS)

**Coordinator:**
Rudolf Erdei - Holisun SRL, (Romania)

**Collaborating Institutions:**
Bhim Bahadur Ghaley - Department of Plant and Environmental Sciences, University of Copenhagen, (Denmark)

Adrienn Somosne Nagy - Pilze-Nagy Ltd, (Hungary)

Dimitrios Argyropoulos - University College Dublin, (Ireland)

**Project Number**

**Project Dates**
**01/02/2021 - 31/01/2024**

## Impacts

The MUSHNOMICS project aims to revolutionize mushroom production through dynamic, data-driven analytics to optimize yield, reduce costs, and enhance economic viability. By integrating IoT devices, AI algorithms, and ICT platforms, it ensures real-time data collection and analytics across the mushroom value chain, from production to valorisation of by-products like spent mushroom substrate. Trials in commercial settings will refine best practices and develop sustainable business models, including retrofitted production modules for year-round urban farming.

MUSHNOMICS emphasizes stakeholder collaboration, engaging farmers, researchers, policymakers, and consumers through a digital platform for knowledge exchange and decision-making. It supports food security by offering a sustainable protein alternative with a low environmental footprint.

By addressing socio-economic barriers, it promotes innovation, job creation, and rural development. With a focus on health and sustainability, MUSHNOMICS contributes to the EU Green Deal's goals, ensuring long-term accessibility of results and fostering a resilient agri-food sector.

# SPectraL Tools and Digitalisation for the Development of SustAinable Structured Food with PlaNt Proteins (PLAN P)

**Coordinator:**
Jonathan Thévenot - ADRIA, (France)

**Collaborating Institutions:**
Klavs Martin Sørensen & Søren Balling Engelsen - Department of Food Science (KU-FOOD), University of Copenhagen, (Denmark)

Panagiotis Zervas & Pythagoras Karampiperis - SCiO Private Company, (Greece)

Hugues Tariel - Diafir, (France)

## Impacts

The PLAN P project aims to accelerate the development of innovative food products, such as emulsions and mousses, by integrating plant-based protein ingredients and leveraging spectral analysis with artificial intelligence algorithms to predict and optimize product texture.

**Project Number**

**Project Dates**
**01/01/2021 - 31/12/2023**

Its objectives include diversifying protein sources through the incorporation of various plant-based ingredients, developing a methodology for selecting optimal protein ingredients for specific applications like emulsions and foams, creating predictive models for product texture acceptability using machine learning and spectral data, and establishing IT infrastructure and sensor prototypes to enhance data processing and production accuracy.

The project has had a significant impact by promoting the use of plant-based proteins in food product development, improving the understanding of the relationship between process variables and product texture, and developing predictive tools that streamline product design and manufacturing processes. These advancements have practical applications for the food industry, including improved efficiency in emulsion and foam production.

The outputs of the project include a database of 26 plant-based protein ingredients that were characterized and clustered for optimal use in emulsions and foams, 384 experimental matrices that were developed, characterized, and evaluated to create diverse microstructures and textures, and machine learning algorithms that achieved 90% accuracy in predicting the texture acceptability of finished products.

Additionally, the project developed a data processing platform and sensor prototypes, which were tested under manufacturing conditions and achieved 80% accuracy in texture prediction. The findings also confirmed that process and mixing variables have a greater impact on texture than the properties of the plant proteins used, offering valuable insights for more efficient product design strategies.

# Potential of Selective Harvest Based on Mycotoxins Content Assessment in Cereal Crops (POSHMyCo)

**Coordinator:**
Abdul Mouazen - Gent University (UGent), (Belgium)

**Collaborating Institutions:**
Dimitrios Moshou - Aristotle University Thessaloniki, (Greece)

Assem Abu Hatab - Swedish University of Agricultural Sciences,, (Sweden)

Egidijus Šarauskis - Vytautas Magnus University, (Lithuania)

Salvador Correa Rosa - Soluciones Agrícolas de Precisión S.L., (Spain)

Manuel Pérez-Ruiz - Universtity of Sevilla, (Spain)

POSHMyCo
SMART FARMING FOR HEALTHIER CEREALS

**Project Number**

**Project Dates**
**01/03/2021 - 28/02/2024**

## Impacts

POSHMyCo aims to reduce mycotoxin contamination in wheat and barley grains by using smart farming technologies. The project will develop a system to forecast and detect the spatial distribution of Fusarium Head Blight (FHB), a primary cause of mycotoxin contamination. It will recommend site-specific spraying of Fusarium fungicide (PSSS) combined with selective harvest, reducing contamination risks and improving food safety.

The selective harvest will sort grains into three categories—healthy, slightly/moderately contaminated, and contaminated—allowing them to be used for human food, animal feed, and bioenergy, respectively. This approach enhances farm profitability by maximizing yield price while minimizing health risks. The PSSS also reduces environmental impact by decreasing agrochemical use.

The project will integrate sensors, modelling, and control technologies, providing farmers with actionable data through a user-friendly platform. Ultimately, POSHMyCo aims to improve food safety, reduce environmental footprint, and support sustainable farming practices.

# Sunburn and HEat Prediction in Canopies for Evolving a Warning Tech Solution (SHEET)

**Coordinator:**
Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), (Germany)

**Collaborating Institutions:**
László Baranyai - Hungarian University of Agriculture and Life Sciences / Magyar Agrár- és Élettudományi Egyetem (MATE), Hungary, (Budapest)

Brunella Morandi - Department of Agricultural and Food Sciences (UNIBO), Bologna, (Italy)

Jan Kasten - macio GmbH (MACIO), Kiel, (Germany)

Marco Zibordi - HK Horticultural Knowledge srl (HK), Bologna, (Italy)

## Impacts

SHEET aimed to tackle the challenges in fruit production caused by global warming, specifically the increased risk of sunburn and heat damage in subtropical and temperate regions. These issues have led to reduced product quality, significant yield losses, and post-harvest losses, contributing to food waste along the supply chain.

The objective of SHEET was to develop and validate methods to assess and mitigate these risks in commercial fruit production.

Coordinated by ATB, the project's technical sub-project focused on estimating fruit temperatures within the tree canopy. One of the key challenges was accurately localizing fruit in varying light conditions and assigning precise temperature data to the fruit surface. This was achieved by combining 3D point cloud analysis from georeferenced LiDAR with thermal imaging, allowing for automated recording of fruit temperatures during heatwaves.

Field trials were ran on apples and grapes, providing input for a risk model developed by MATE. This model used thermodynamic and AI approaches to predict sunburn damage, which was then integrated into a mobile app by CloudFlight. The app allows farmers to compare calculated damage with actual symptoms in the orchard, with data stored for further analysis at ATB.

Dissemination of the results included research articles, conference presentations, workshops for farmers and researchers, and open access software. Key outputs included methods to analyse fruit surface temperature distribution using remote sensing, the validation of a risk model for sunburn damage, and the development of a mobile app prototype to assist farmers in managing heat stress risks in fruit production.

**Project Number**

**Project Dates**
**01/02/2021 - 31/01/2024**

# Implementation of Soil Compaction Risk Assessment System – End-User's Evaluation of Potentials and Barriers (SoCoRisk)

**Coordinator:**
Mathieu Lamandé - Aarhus University, (Denmark)

**Collaborating Institutions:**
Francesco Morari - University of Padua, (Italy)

Matthias Stettler - Agrifood Technology, (Switzerland)

Trond Børresen - Norwegian University of Life Sciences, (Norway)

Christian Hansen - SAGRO, (Denmark)

Thomas Keller - Swedish University of Agricultural Sciences, (Sweden)

Truls O.T. Hansen - Norwegian Agricultural Extension Service, (Norway)


**Project Number**

**Project Dates**
**01/03/2021 - 28/02/2024**

## Impacts

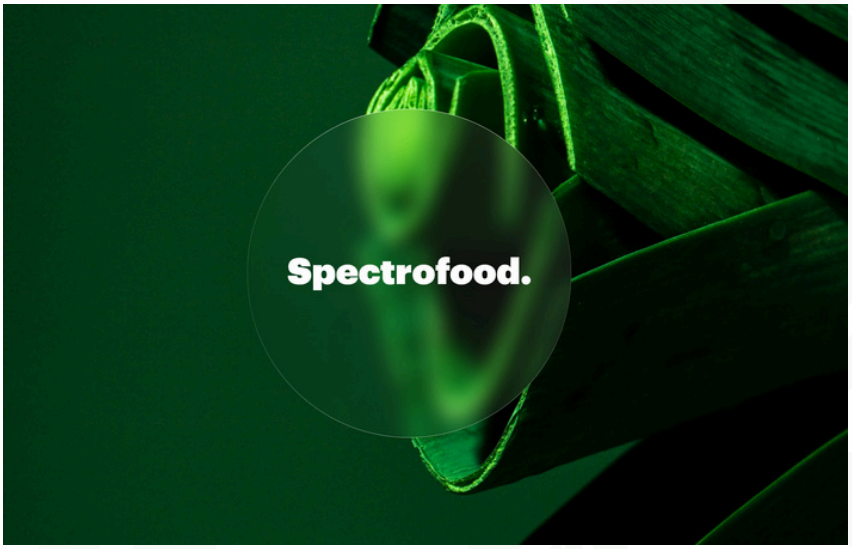
The project, "SoCoRisk," aimed to tackle the issue of soil compaction caused by modern agricultural machinery, particularly the increasing weight of equipment, which leads to persistent subsoil compaction. This type of compaction disrupts critical soil ecosystem services, such as flood control and agricultural production, resulting in both ecological and economic damage to farmers and society.

The objective of the project was to integrate the use of Terranimo®, a decision support tool for preventing soil compaction, into farmers' strategic planning processes. The project adopted a transdisciplinary approach, bringing together soil scientists, agronomists, social scientists, farmers, contractors, advisors, and policymakers from five European countries—Norway, Sweden, Denmark, Switzerland, and Italy.

Throughout the course of the project, barriers and potentials for using Terranimo® were identified across a north-south gradient in Europe and among various farming systems. Based on these findings, new methods were developed for presenting the tool's outputs to farmers, such as farm-scale maps of compaction risk. Recommendations were also made for expanding the use of Terranimo® in countries outside of the project consortium. The immediate impact of SoCoRisk was an enhanced understanding of soil compaction risks, which allowed farmers to make better-informed decisions about field operations, machinery use, and crop rotations. In the longer term, the project contributed to more sustainable farming practices, with better alignment between crop rotations, machinery, and site-specific conditions, as well as the design of more soil-friendly machinery.

The main output of SoCoRisk was an improved adoption of Terranimo® by farmers, which has helped reduce the risk of soil compaction. The project's social impact was also significant, benefiting farmers, contractors, and machinery manufacturers economically while reducing environmental issues such as erosion, nutrient leaching, flood risks, and greenhouse gas emissions. Overall, the project has contributed to the broader goal of protecting soil as a non-renewable resource, supporting ongoing EU and national efforts to promote sustainable soil management and agricultural practices.

# Information Agrifood Quality Estimation using Hyperspectral Techniques (SPECTROFOOD)




**Coordinator:**
Spyros Fountas - Agricultural University of Athens, (Greece)

**Collaborating Institutions:**
Manuela Zude-Sasse - Leibniz Institute for Agricultural Engineering and Bioeconomy, (Germany)

Jonathan Van Beek - ILVO, Flanders Research Institute for Agriculture, Fisheries and Food, (Belgium)

Dimitrios Argyropoulos - University College Dublin, (Ireland)

## Impacts

SPECTROFOOD aims to tackle food insecurity and reduce food waste by developing digital technology solutions for the agri-food value chain. By combining innovative Hyperspectral Imaging Systems (HIS), Artificial Intelligence (AI), and data analytics, the project seeks to optimize food quality assessment and production inputs.

SPECTROFOOD will demonstrate its solutions across four use cases focused on high-value crops: apples, broccoli, leek, and mushrooms. Current food quality inspection methods are often destructive, labour-intensive, and costly, with limited accuracy and efficiency.

This project will offer non-destructive, rapid, and precise techniques to monitor product quality at various stages of the supply chain, from production to consumer.

Key activities include using HIS to collect quality-related data, deploying AI algorithms for quality indices, and creating a digital platform to track product traceability and suggest improvements for both pre- and post-harvest treatments. The goal is to promote sustainable practices and reduce food waste while ensuring high-quality production.

**Project Number**

**Project Dates**
**01/01/2021 - 01/01/2024**

# Releasing the Potential of ICT for Sustainable Milk and Beef Cattle Value Chains (SustainIT)

**Coordinator:**
Spyros Fountas - Agricultural University of Athens, (Greece)

**Collaborating Institutions:**
Manuela Zude-Sasse - Leibniz Institute for Agricultural Engineering and Bioeconomy, (Germany)

Jonathan Van Beek - ILVO, Flanders Research Institute for Agriculture, Fisheries and Food, (Belgium)

Dimitrios Argyropoulos - University College Dublin, (Ireland)

**Project Number**

**Project Dates**
**01/12/2020 - 30/11/2023**

## Impacts

The SustainIT project focuses on leveraging ICT solutions to enhance sustainability in milk and beef cattle value chains. The widespread adoption of ICT in agri-food systems faces challenges, including business model integration, technological readiness, and limited stakeholder awareness. SustainIT addresses these gaps by developing innovative digital tools that improve efficiency, data sharing, and decision-making across the value chain. The project engages multiple stakeholders, including researchers, industry partners, and policymakers, fostering a collaborative ecosystem to drive digital transformation in livestock farming.

SustainIT has contributed significantly to digitalising the dairy and beef cattle industries. Through its Living Lab approach, the project facilitated co-learning among stakeholders, leading to enhanced knowledge sharing and innovation. The introduction of ICT-based monitoring tools has improved animal health and welfare management while optimising resource use. Additionally, the project's research outputs have influenced policy recommendations, supporting data standardisation and accessibility for farmers and industry actors.

The project has resulted in improved data management through the development of digital platforms for collecting and analysing cattle health and welfare data. ICT-based tools have enhanced decision-making by enabling better resource allocation and farm management strategies. It has also strengthened stakeholder collaboration, fostering multi-actor engagement to ensure the real-world applicability of its solutions. Its findings have influenced policy discussions on ICT adoption in agriculture, helping shape future regulations and best practices. Furthermore, the integration of ICT into farming operations has contributed to more efficient and environmentally friendly agricultural practices.

# An ICT-Based Real-Time Advisory Tool to Minimise Tail Biting in Fattening Pigs (TAILBITEADVICE)

**Coordinator:**
Tomas Norton, Mona Lilian Vestbjerg Larsen and Dong Liu - KU Leuven, (Belgium)

**Collaborating Institutions:**
Lene Juul Pedersen, Mona Lilian Vestbjerg Larsen - Aarhus University, (Denmark)

Keelin O'Driscoll, Laura Doyle - Teagasc, (Ireland)

## Impacts

Tail biting is a significant welfare, economic, and ethical issue in pig farming, exacerbated by stressors like boredom, poor feed availability, and suboptimal environments. This project aims to develop a data-driven decision-support tool to help farmers reduce tail biting incidents, focusing on behaviour-based variables monitored remotely during production. Despite 77% of EU farms docking tails to mitigate this issue, tail biting prevalence remains high. Current monitoring methods, such as abattoir-level detection, provide limited opportunities for on-farm intervention.

Key objectives include optimizing detection algorithms, understanding risk factor relationships, testing the tool in commercial settings, and developing guidelines for implementation.

The project promises substantial benefits, including improved animal welfare, reduced carcass waste and antibiotic use, and support for non-docking policies in the EU. The tool will also aid consultants and inspectors in welfare audits, enable farmers to benchmark practices, and help retailers enhance labelling and production standards.

**Project Number**

**Project Dates**
**01/02/2021 - 31/01/2024**

# AUtomaTed Open PrecIsion FArming Platform (UTOPIA)

**Coordinator:**
Dennis Kooijman - Intelligent Autonomous Mobility Center (I-AM Center), (The Netherlands)

**Collaborating Institutions:**
Sinan Öncü, Bogazici University, (Istanbul)

Steve Vanlanduit, University of Antwerp, (Belgium)

Haris Ahmad Khan, Wageningen University & Research, (The Netherlands)

Ivo W. Wieling, Aqitec Projects BV, (The Netherlands)

**Project Number**

**Project Dates**
**01/03/2021 - 01/07/2023**

## Impacts

The UTOPIA project aimed to develop an open smart farming framework that enables farmers to store precision agriculture data in the cloud and access it through a user interface. This framework allows farmers to implement precision farming with minimal time and cost investment by integrating mapping, planning, and measurement technologies. The project, developed with input from vineyard and seaweed farmers, equipment manufacturers, and robotics companies, will be made publicly available on GitHub under an open-source license once the related paper is published and project approval is received.

Despite challenges like a 2.5-year delay and economic constraints, the project successfully achieved its core objective, with the framework tested and demonstrated in the field. While direct validation of time savings was not completed, feedback from farmers suggested the framework's potential to reduce personnel needs in seaweed farming through operational efficiencies.

The framework was built to integrate with the widely used Robotics Operating System 2 (ROS 2) and the NGSI-LD data model, enhancing compatibility with other agri-tech innovations. Field tests showed that the framework could accurately map trees and calculate yield per tree, as well as measure the surface area of underwater seaweed. It also addressed localization challenges during motion, even with RTK-GPS.

Looking ahead, the open-source framework is poised for broader adoption. Discussions with start-ups are underway, and one partner plans to commercialize a ready-to-use version for existing manufacturers. Open-sourcing ensures UTOPIA's continued growth and adoption in the agri-tech sector.

2021 JOINT CALL

# Enhancing Circularity between Crop and Livestock Farming Systems

The aim of the 2021 Joint Call is to enhance circularity between crop and livestock farming systems, focusing on climate change mitigation and adaptation, through a joint transnational funding initiative for agricultural greenhouse gas (GHG) research. This initiative is coordinated by the four ERA-NETs: SusAn, FACCE ERA-GAS, ICT-AGRI-FOOD, and SusCrop.

| **SEVEN PROJECTS WERE FUNDED IN THIS CALL** | | |
|---|---|---|
| **Title** | **Acronym** | **Countries** |
| Strategies for circular agriculture to reduce GHG emissions within and between farming systems across an agro-ecological gradient | CircAgric-GHG | **NO**, KE, ES, IE, DE, IT, ZA, UK |
| Connecting sustainable agroecosystems and farming with circular bioeconomy and new technologies | ConnectFarms | **IT**, BG, LT, EE, ES, PL, TR |
| Multi-criteria assessment, decision support and management tools for sustainable circular mixed farming systems for dairy production | DairyMix | **DE**, IE, IT, PL, FR, NO, BE, AR |
| Integrated crop-ruminant livestock systems as a strategy to increase nutrient circularity and promote sustainability in the context of climate change | INTEGRITY | **AR**, ES, FI, UK, NZ, PE, UY, FR, IE |
| Mitigation and adaptation through better biomass cycling in crop livestock systems of north and western Europe | MI BICYCLE | **NL**, DK, UK, FR |
| Balancing production and environment | PROENV | **DK**, NO, ES, IT |
| Back to the Future: reintegrating land and livestock for greenhouse gas mitigation and circularity | ReLive | **IE**, FR, NL, DE, ES, FI, PL, EE, NZ, CL |
| Synergies in integrated systems: Improving resource use efficiency while mitigating GHG emissions through well-informed decisions about circularity | SENSE | **UK**, NL, DE, IT, BR, AR, UY |
| Solutions for GHGs emissions mitigation for the mixed farming systems across different European climates | Solution4Farming | **RO**, PL, ES, FI |

# Strategies for Circular Agriculture to Reduce Ghg Emissions within and between Farming Systems across an Agro-Ecological Gradient (CIRCAGRIC-GHG)

**Coordinator:**
Dr. Vibeke Lind - Norwegian Institute of Bioeconomy Research, NIBIO, (Norway)

**Collaborating Institutions:**
The International Livestock Research Institute, ILRI, (Kenya)

Basque Centre For Climate Change, BC3, (Spain)

National University of Ireland (NUI), Galway - Agriculture and Food Development Authority, Teagasc, (Ireland)

Karlsruhe Institute of technology, KIT, (Germany)
University of Milan, UNIMI, (Italy)

University of Pretoria, UP, (South Africa)

Bangor University, BU, (United Kingdom)

University of Oslo, UO (Norway)


**Project Number**

**Project Dates**
**01/03/2022 - 28/02/2025**

## Impacts

The overall objective of CircAgric-GHG is to enhance circularity within and between farm typologies across an agro-ecological gradient. The project includes farms located in the arctic climate in Norway, via the oceanic climate of UK and Ireland, continental climate of Germany, Mediterranean climate of Spain and Italy to the tropics in Kenya and the dry and temperate climate of South Africa.

Solutions are achieved by combining efforts of internationally recognised scientists and stakeholders. Satellite, drone remote sensing and flux-towers are used to measure livestock and soil emissions and produce state-of-the-art environmental modelling.

Farm typologies serve as a baseline to evaluate existing circular practices. High-resolution modelling of resource cycling and greenhouse gas (GHG) emissions at farm and landscape level are undertaken, using process- and farm models. Promising practices to enhance circularity have been proposed across typologies and agro-ecological zones such as:

1) use of bakery by-products for animal feeding (Italy)
2) sowing legume-rich species in Mediterranean pastures (Spain)
3) seasonal grazing in alpine pastures (Italy)
4) solid-liquid separation of slurry (UK)
5) anaerobic digestion of manure (Germany)
6) use of grass-clover swards (Norway)

Life cycle analyses (LCA) are applied to integrate modelling outputs into environmental footprints of food production, developing a novel framework for future projects. Farm-scale modelling also inform a marginal abatement cost curve, and a decision support tool, enabling robust comparison of reducing GHG efficacy of specific circular practices.

# Connecting Sustainable Agroecosystems and Farming with Circular Bioeconomy and New Technologies (CONNECTFARMS)

**Coordinator:**
Consorzio Interuniversitario Nazionale per le Scienze Ambientali, (Italy)

**Collaborating Institutions:**
Agricultural University – Plovdiv, (Bulgaria)

Lithuanian Research Centre for Agriculture and Forestry (Lithuania)

University of Tartu (Estonia)
CIEMAT – NEIKER (Spain)

Warsaw University of Life Sciences (Poland)

Niğde Ömer Halisdemir University (Turkey)

University of Milano - Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (Italy)

## Impacts

The project ConnectFarms is addressing circularlty in farming systems across 7 different countries. In Spain, Turkey, Poland, Bulgaria, Italy and Lithuania field trials have been carried out using intercropping, crop rotations, amendments (biochar, compost) produced circularly from residues of agrifood chains, evaluating the performances of plants and soil health.

Microbial consortia have been used for fertilization and a method developed for tracing their presence in the rhizosphere. Precision tools, remote sensing and sensors have been deployed. Greenhouse experiments have tested soils and amendments in common conditions with specific barley genotypes. Barley genotypes with reduced leaf chlorophyll content or with high beta-glucan content have been utilized in view of animal nutrition. Poultry and sheep have been raised with biochar as a tool for decreasing emissions of greenhouse gases.

All results are currently under evaluation to estimate the sustainability of the agroecological solutions applied by partners. The aim is to assess sustainable food production systems to implement resilient agricultural practices, increasing productivity and production and, at the same time, reinforcing adaptability to climate change and environmental conditions.

Partners have produced eight scientific publications in journals, and contributed book chapters. The project results have been disseminated in conferences and exhibitions. Engagement of stakeholders and general public has been pursued by all partners in the respective countries.

**Project Number**

**Project Dates**
**01/12/2021 - 30/11/2024**

# Multi-Criteria Assessment, Decision Support and Management Tools for Sustainable Circular Mixed Farming Systems for Dairy Production (DAIRYMIX)

**Coordinator:**
Leibniz Institute for Agricultural Engineering and Bioeconomy, ATB, (Germany)

**Collaborating Institutions:**
University College Dublin - Agriculture and Food Development Authority, Teagasc (Ireland)

University of Milan (Italy)
University of Zielona Góra (Poland)

French National Research Institute for Agriculture, Food and the Environment, INRAE (France)

Norwegian Institute of Bioeconomy Research - Ruralis Institute for Rural and Regional Research (Norway)

Flanders Research Institute for agriculture, fisheries and food, ILVO (Belgium)

Instituto Nacional de Tecnología Agropecuaria (Argentina)


**Project Number**

**Project Dates**
**01/03/2022 - 28/02/2025**

## Impacts

The DairyMix project develops sustainable solutions for circular mixed farming systems for dairy production, addressing environmental, economic, and social challenges. By advancing nutrient recycling, carbon sequestration, and reducing reliance on external inputs such as mineral fertilizers and concentrate feeds, DairyMix aims to greenhouse gas (GHG) mitigation and reduction of nutrient losses.

Through a systems approach, DairyMix integrates data collection from European and Latin American case studies, advanced modeling, and precision farming technologies, such as the OTICE barn monitoring system, supporting tailored solutions for regional agricultural challenges. Multi-criteria assessments consider environmental, economic, and social indicators, identifying trade-offs and synergies to guide informed decision-making. The project emphasizes the critical role of agro-ecosystem services and nature-based solutions, such as agroforestry, in developing sustainable farming systems for dairy production.

DairyMix addresses global agricultural challenges by promoting biodiversity, maintaining rural ecosystems, and aligning with the UN's Sustainable Development Goals. Key outcomes include scenarios for improved nutrient circularity, enhanced farm resilience and increased protein self-sufficiency through the integration of protein crops, grasslands, agroforestry into dairy systems. The MilKey/DairyMix online platform will display these scenarios, facilitating knowledge sharing and decision support, fostering stakeholder awareness of sustainable dairy practices and the integrated assessment of economic, environmental and social sustainability.

# Integrated Crop-Ruminant Livestock Systems as a Strategy to Increase Nutrient Circularity and Promote Sustainability in the Context of Climate Change (INTEGRITY)


**Coordinator:**
National Institute of Agricultural Technology, Argentina)

**Collaborating Institutions:**
Agencia Estatal Consejo Superior de Investigaciones Cientificas (Spain)

Natural Resources Institute Finland, Luke (Finland)

Agri-Food and Biosciences Institute - Queens University Belfast (United Kingdom)

AgResearch (New Zealand)
Universidad Nacional Agraria La Molina (Peru)

National Agricultural Research Institute of Uruguay, INIA (Uruguay)

French National Research Institute for Agriculture, Food and Environment, INRAE (France)

IRELAND: Agriculture and Food Development Authority, Teagasc (Ireland))

## Impacts

This project aims to evaluate alternative management of mixed crop-ruminant livestock systems to enhance nutrient circularity, production efficiency, and reduce C footprint in diverse agro-climatic regions to enhance sustainability. The proposed activities within this project are organized in five Work Packages (WP).

**Project Number**

**Project Dates**
**01/03/2022 - 28/02/2025**

Through system research to on-field experiment WP1 investigates different management practices at diverse agricultural systems. WP2 evaluates the increasing inclusion of agro-industry by-products in ruminants feeding programs. WP3 explores integration alternatives through LCA analysis, participatory co-innovation, potential technology adoption assessment, and digital twins. WP4 involves actions to promote engagement with local stakeholders, training, communication, and dissemination. And WP5 includes activities for project coordination.

This project has generated novel information suggesting alternatives to optimize on-farm resource use efficiency, self-sufficiency, reduce competition with human-edible food, maximize productivity, and sustainability with an emphasis on GHG abatement of diverse mixed crop-ruminant livestock systems. A set of circularity and economic, environmental, and social sustainability indicators evaluated with stakeholders have been proposed for decision support tools. The design of digital twins of farms based on combining sensor data and modeling has been generated to help the decision-making process of stakeholders on the production chain of different mixed production systems.

A website of this project (https://integrity-agrisystems.com/) share briefs of observed results and publications of locally contextualized technical recommendation and training for successful implementation of integrated crop-ruminant livestock production systems

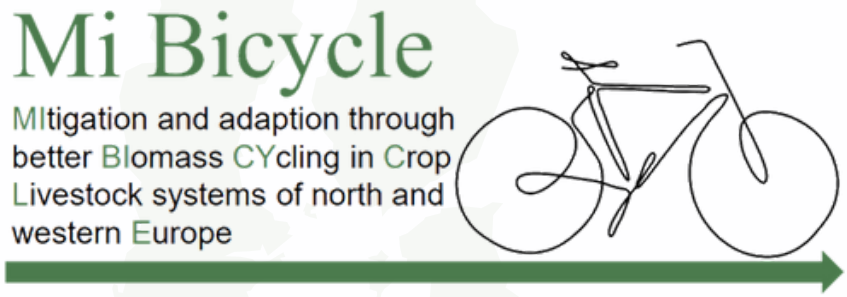
# Mitigation and Adaptation through Better Biomass Cycling in Crop Livestock Systems of North and Western Europe (MI BICYCLE)

**Coordinator:**
National Institute of Agricultural Technology, (Argentina)

**Collaborating Institutions:**
Aarhus University, AU (Denmark)

Scotland's Rural College, SRUC (United Kingdom)

French National Research Institute for Agriculture, Food and Environment, INRAE - Ariege Chamber of Agriculture (France)




**Project Number**

**Project Dates**
**01/03/2022 - 28/02/2025**

## Impacts

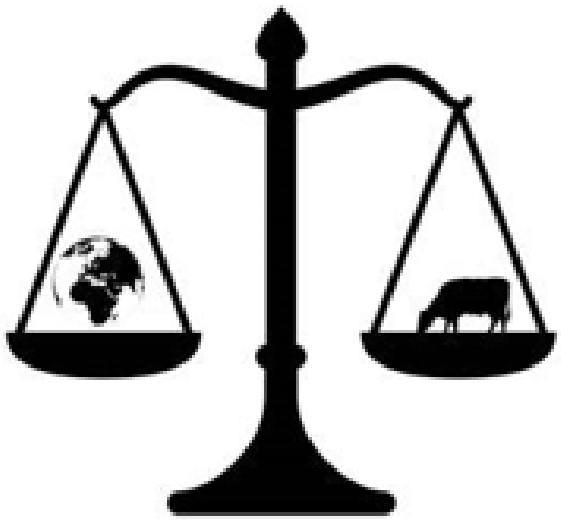
The MI BICYCLE project investigates possibilities for enhanced circularity, aiming to improve utilization and exchange of biomass between crop and livestock farms. We focus especially on so-called co-products, for instance crop residues, manure, cover crops and green waste. Over the last decades, agriculture in Europe has become more specialised which brings the advantage of economies of scale, but hinders optimal use of biomass.

We hypothesize that better co-product utilisation across crop and livestock farms will be beneficial for nutrient cycling, greenhouse gas emissions, soil carbon sequestration and productivity, leading to climate change mitigation and to more sustainable systems. We use different research approaches and make maximum use of our four case study regions, i.e. 1) Drenthe province (the Netherlands); 2) Limfjord catchment (Denmark); 3) Fife (Scotland); 4) Ariège region (France). First, we developed a model to assess performance on nutrient cycling, greenhouse gas emissions, carbon sequestration and productivity at farm and regional levels.

For example, we assessed which utilization option of manure has most environmental benefits: using it directly as crop fertilizer or anaerobically digesting it first to produce biogas for energy and digestate which can then be used as fertilizer. Second, we developed a so-called serious game. This game can be played by students or others, as if they are the decision makers in a region that have to decide upon the use of co-products. We tested it with students in an MSc course.

Finally, we developed a number of concise videos about project outcomes for different stakeholders.

# Balancing Production and Environment (PROENV)



**Coordinator:**
Aarhus University, (Denmark)

**Collaborating Institutions:**
Norwegian Centre for Organic Agriculture, NORSØK - Norwegian Institute of Bioeconomy Research, NIBIO (Norway)

Institute of Agrifood Research and Technology, IRTA (Spain)

University of Milano - Università Cattolica del Sacro Cuore, UCSC (Italy)

**Project Number**

**Project Dates**
**01/04/2022 - 01/03/2025**

## Impacts

The PROENV (balancing PROduction and ENVironment) project addressed the challenges faced by European agriculture in achieving a balance between food production and environmental impact. The project adopted an interdisciplinary approach, combining theoretical and practical components to develop innovative solutions.

The practical component involved investigating measures to reduce nitrogen (N) losses and greenhouse gas emissions (GHG) from at field, farm level and landscape levels in Denmark, Italy, Norway and Spain. At field level, either by looking at different types of cover crops and/or fertilization strategies in cropping systems. At farm level, through livestock feeding strategies for milk and meat production. While for the landscape level, a N distribution tool has been developed where the distribution of manure over a landscape can be optimized. This tool shows that there is a big potential for reducing GHG from diverse agricultural European regions when the distribution is optimized.

The theoretical component focused on balancing production and ecosystem services, where we explored current production practices and scenarios at the abovementioned levels and systems, employing Life cycle analysis (LCA) and modelling platforms for sustainability assessment. Moreover, we have gathered perspectives from farmers' organizations and government regulators in Italy, Spain and Norway, through conducted workshops with a specific focus on barriers and opportunities in achieving sustainable manure handling. This framework will help policymakers determine the most suitable approach for a given region.

By integrating theoretical and practical aspects, the PROENV project successfully advanced sustainable agriculture by implementing solutions that addressed economic, environmental, and biodiversity concerns.

# Back to the Future: Reintegrating Land and Livestock for Greenhouse Gas Mitigation and Circularity (RELIVE)

**Coordinator:**
University College Dublin, (Ireland)

**Collaborating Institutions:**
National Research Institute for Agriculture, Food and the Environment, INRAE (France)

Wageningen University, WUR (Netherlands)

Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences (Germany)

Universidad de Extremadura (Spain)

Avoin association (Finland)

Institute of Agrophysics, Polish Academy of Science (Poland)

University of Tartu (Estonia)

AgResearch (New Zealand)

University of Chile (Chile)

Teagasc - Agriculture and Food Development Authority (Ireland)


**Project Number**

**Project Dates**
**01/03/2022 - 28/02/2025**

## Impacts

The ReLive project explores the sustainable reintegration of livestock and crop systems to promote a circular agricultural economy, enhancing resource recycling and reducing waste. This approach could improve biodiversity, soil health, and reduce dependency on synthetic fertilizers. However, challenges include potential increases in greenhouse gas (GHG) emissions, environmental pollution from organic manure, land degradation, and economic barriers for farmers. ReLive examines strategies like alternative livestock diets to reduce methane emissions, improved manure management, agroforestry, and decision support tools for sustainable farming practices.

Initial findings highlight variations in soil methane absorption, emission reduction from manure management, and the economic impacts of farming practices. Modelling tools, like a farm-wide GHG calculator, and data collection from surveys and remote sensing are being developed to inform sustainability strategies. ReLive emphasizes practical dissemination of results to policymakers, stakeholders, and farmers, ensuring viable business models and effective implementation for long-term sustainability in agriculture.

# Synergies in Integrated Systems: Improving Resource Use Efficiency while Mitigating GHG Emissions through Well-Informed Decisions about Circularity (SENSE)

**Coordinator:**
The James Hutton Institute (JHI), (United Kingdom)

**Collaborating Institutions:**
Centre for Ecology and Hydrology (CEH) and-University of Bristol (United Kingdom)

Stichting Wageningen Research (the Netherlands)

University of Hohenheim (UHOH) and Demeter e.V. (Germany)

Consiglio per la ricerca in agricoltura e l'analisi dell'economia agrarian (Italy)

Brazilian Agricultural Research Corporation (Embrapa) (Brazil)

National Institute of Agropecuarian Technology (Argentina)

Instituto Nacional de Investigación Agropecuaria (Uruguay)

## Impacts

The SENSE project aims to evaluate and enhance circularity in crop-livestock-forestry integrated systems in Europe and South America. Over the past three years, SENSE partners gathered annually to review and discuss progress in the project. The first annual meeting took place in Brazil (hosted by Embrapa), the second annual meeting took place in the Netherlands (hosted by Wageningen University & Research), the third annual meeting took place in Germany (hosted by University of Hohenheim) and the final annual meeting will be held in Scotland (hosted by The James Hutton Institute – project coordination). During these annual meetings, SENSE partners had the opportunity to visit the case studies of the project and interact with farmers and farm managers to learn more about their motivations, experiences and challenges related to circularity in integrated systems. Those insights were crucial to fine-tune the outputs of the project.

Throughout the duration of the project, several outputs were developed, including technical briefs and videos from the case studies of the project as well as conference abstracts, short communications and peer-reviewed articles which can all be accessed and downloaded from the website of the project: https://sense-eranet.hutton.ac.uk/. As the project comes to its conclusion, policy briefs and several peer-reviewed articles are currently under preparation. These final outputs are mostly related to the results from circularity and ecological indicators as well as from the performance and use of the DNDC model to estimate GHG emissions and SOC changes using data from soil sensors and management practices from selected case studies.

**Project Number**

**Project Dates**
**01/03/2022 - 28/02/2025**

# Solutions for GHGs Emissions Mitigation for the Mixed Farming Systems across Different European Climates (SOLUTION4FARMING)

**Coordinator:**
Dr Mihaela Balanescu, Beia Consult International, (Romania)

**Collaborating Institutions:**
Wroclaw University of Science and Technology (Poland)

Universidad Politécnica de Cartagena (Spain)

Kajaani University of Applied Sciences (Finland)

University of Agricultural Sciences and Veterinary Medicine of Bucharest (Romania)

**Project Number**

**Project Dates**
**01/12/2021 - 30/11/2024**

## Impacts

Solution4Farming (S4F) is an ambitious initiative that addresses the dual challenge of reducing greenhouse gas (GHG) emissions and increasing circularity in mixed farming systems across Europe. By integrating innovative technologies and sustainable management practices, S4F optimizes the synergy between crop and livestock production while mitigating environmental impacts.

The project focuses on:

- Designing tailored solutions to improve circularity in farming systems in different climatic regions.
- Developing ICT tools to support decision-making and reduce greenhouse gas emissions.
- Testing and validating advanced technologies and practices using Life Cycle Analysis (LCA).

Implemented through pilots in Romania, Spain, Poland and Finland, S4F is exploring GHG reduction strategies in mixed farming, improving regional synergies between crop and livestock systems, and evaluating novel circular solutions in real-world settings.

Expected outcomes include innovative fertilizers, ammonia-adsorbing technologies, and a decision support system (DSS) to support sustainable farming practices. These innovations are expected to significantly reduce greenhouse gas emissions, improve resource efficiency, and increase the resilience of agricultural systems.

The project's impact goes beyond environmental benefits, promoting economic sustainability and helping European farmers transition to more environmentally friendly practices. By demonstrating scalable, region-specific solutions, S4F is leading the way to a more sustainable and climate-resilient future for agriculture.

2022 JOINT CALL

# MORE TRANSPARENT AGRI-FOOD SYSTEMS FOR CONSUMERS AND OTHER STAKEHOLDERS ALONG THE FOOD VALUE CHAIN BASED ON ICT TECHNOLOGIES

The aim of the 2022 Joint Call is to enhance transparency, sustainability, and efficiency in food systems through digital innovation. It seeks to integrate smart farming, precision agriculture, and digital traceability to improve supply chains from farm to fork. The call promotes multi-actor collaboration, ensuring that farmers, businesses, policymakers, and consumers benefit from efficient and trustworthy food systems. It also aims to support sustainable food production, reduce waste, and improve decision-making through data-driven approaches.

| **SEVEN PROJECTS WERE FUNDED IN THIS CALL** | | |
|---|---|---|
| **Title** | **Acronym** | **Countries** |
| From vineyard to bottle – trace sustainable practices in wine-growing under full transparency | Oenotrace | **DE** IE IT RO DK |
| Development of a practical data management system with embedded sensors for improved environmental management and transparency of dairy farming | ET4D | **DE** HU DK EE IL PL TR FI |
| Proposing a Satellite Controlled Incentive System for Sustainable Sugar Beet Production | SCI for Sustainable Sugar | **EE** TR IL |
| Giving Smell sense To Agricultural Robotics | STAR | **IT** IL DE |
| Artificial Intelligence application for Farming | APP4FARM | **IT** DE IE |
| Transparency and sustainability in the potato processing chain from F2F through innovative data sharing | SusPot | **BE** TR PL |
| Trustable and Sustainable Open Platform for Smart Honey Value Chains | Top4HoneyChains | **TR** PL AR LV |

# From Vineyard to Bottle – Trace Sustainable Practices in Wine-Growing under Full Transparency (OENOTRACE)

**Coordinator:**
Prof. Dr. Dimitrios S. Paraforos, Hochschule Geisenheim University, HGU, (Germany)

**Collaborating Institutions:**
University College Dublin, UCD, Ireland

Consiglio Nazionale Delle Ricerche, CNR IBE, Italy

BEIA Consult International, BEIA, Romania

Department of Agroecology, AU, Denmark

Deutscher Weinbauverband e.V., DWV, Germany

EXA Computing GmbH, EXA, Germany

**Project Number**

**Project Duration**
**01/06/2023 - 31/05/2026**

## Abstract

There is a growing need to strengthen the competitiveness of European wine producers, while at the same time the environmental impact of wine production is significant. Meanwhile, consumers are demanding more transparency on the environmental performance of high-value food products and are willing to pay for ecosystem services. Oenotrace aims to use digital tools and advanced algorithms to automatically track sustainable practices in viticulture with full transparency.

In conjunction with environmental models, water and GHG footprints will be defined at the field level, and a machine data processing and analysis pipeline will help quantify the amounts of inputs used, such as pesticides and diesel. A data platform will integrate all data streams and algorithms to finally provide information on the sustainability of primary production via a web front-end that can be accessed by different stakeholders. Oenotrace will provide winegrowers with new ICT-based means to improve their operational and environmental performance, while satisfying consumer demand for greater insight into production and potentially generating higher revenues.

The Oenotrace consortium is strongly committed to the development of networked digital solutions that will contribute to meeting consumer demand for a more traceable and transparent wine value chain. This will also allow the transfer of knowledge and the education of consumers towards more sustainable behaviors, increasing their trust in the information provided about the origin of the wine, its agricultural practices and winemaking processes, its transport and storage conditions, its carbon footprint and the environmental impacts associated with all stages of the value chain.

# Development of a Practical Data Management System with Embedded Sensors for Improved Environmental Management and Transparency of Dairy Farming (ET4D)

**Coordinator:**
Dr. Sabrina Hempel - Leibniz Institute for Agricultural Engineering and Bioeconomy, ATB, Germany

**Collaborating Institutions:**
AgHiTech Ltd, AgHiTech, Hungary

Innvite ApS, INNVITE, Denmark
Estonian University of Life Sciences, EMU, Estonia

MIGAL Galilee Technology Center, MIGAL, Israel

University of Zielona Góra, UZ, Poland

TOKAT GAZİOSMANPAŞA UNIVERSITY, TOGU, Turkey

AKI Agrárközgazdasági Intézet Nonprofit Kft./ The Institute of Agricultural Economics Nonprofit Kft., AKI., Hungary

University of Oulu, Centre for Wireless Communications - Networks and Systems, UOULU, Finland

Wroclaw University of Environmental and Life Sciences, UPWr, Poland

Department of Engineering, AU, Denmark

## Abstract

ET4D is an ambitious EU-supported project with partners from eight countries: Germany, Hungary, Denmark, Estonia, Poland, Finland, Turkey and Israel.

The aim of ET4D is to:

- Validate and expand the reporting frame of a data management system (DMS) with embedded sensors for on-farm use to collect and process data from dairy barns;
- Demonstrate the system's applicability in real word application by deploying it in commercial farms in different countries with different climatological and socio-economic boundary conditions;
- Identify information requirements of different interest groups and demonstrate the potential added value of the information sharing for the farmer and other interest groups.

This will be achieved by collecting on-farm environmental data and feed it to an online DMS. To this end, dependable wireless connectivity will be implemented on-farm. Data will be processed regarding the information needs of different target groups, where the latter will be determined based on social diagnosis in the project. A web app will permit farmers and other interest groups to obtain reports tailored to their respective information needs.

**Project Number**

**Project Duration**
**01/10/2023 - 31/04/2026**

# Proposing a Satellite Controlled Incentive System for Sustainable Sugar Beet Production (SCI for Sustainable Sugar)

**Coordinator:**
Emre Tunali & Akif Durdu-
Agrovisio OÜ, Agrovisio, Estonia

**Collaborating Institutions:**
Ege University Faculty of Agriculture, Turkey

Rivulis Irrigation Ltd, Rivulis, Israel

Kayseri Seker Fabrikasi A.S., KSF, Turkey


**Project Number**

**Project Duration**
**17/04/2023 - 03/03/2026**

## Abstract

The project proposes a Satellite-Controlled Incentive System (SCI) to enhance sugar beet production efficiency by integrating satellite monitoring with a reward-based system. Sustainable sugar beet production requires balancing yield and root quality while minimising environmental impact. Excessive fertilisation and irrigation not only threaten soil fertility and water resources but also reduce sugar extraction efficiency due to increased alpha-amino nitrogen content. Current monitoring methods rely on costly and labour-intensive field sampling and laboratory analysis, offering no chance for mid-season intervention.

This project aims to improve sugar yield and extraction quality by providing farmers with fertilisation and irrigation guidelines linked to incentive scores. By integrating satellite control into the incentive system, farmers will be encouraged to follow best practices that enhance both productivity and sustainability. A mobile app will facilitate real-time monitoring and communication, ensuring ease of adoption. The project targets a 20% reduction in water usage and a 25% decrease in fertiliser application, resulting in significant cost savings. Additionally, AI-driven modelling will improve production forecasting, enabling better planning for sugar factories.

Beyond improving efficiency, the project will drive long-term adoption of digital farming tools, helping farmers transition to more sustainable practices. By offering financial incentives, it mitigates the risks associated with changing agricultural habits while ensuring environmental protection. The initiative will contribute to maintaining soil fertility, protecting water resources, and fostering greater awareness of precision agriculture technologies among farmers.

# Giving Smell Sense to Agricultural Robotics (STAR)


**Coordinator:**
Prof. Reina - Politecnico di Bari, POLIBA, Italy

**Collaborating Institutions:**
Todos Technologies Ltd, Todos, Israel

Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, FRA, Germany

## Abstract

The ability to single out healthy fruits/plants from those with problems and to selectively start the harvesting or apply a remedy without wasting resources or contaminating the environment is critical for precision farming. Project STAR develops a unifying framework to combine different sensor modalities that include standard (e.g., RGB-D cameras) with novel sensors (e.g., gas sensors), methods for creating accurate maps to facilitate operations on a narrow scale with a smaller environment footprint, artificial intelligence algorithms for data processing and decision support, and applications to make relevant information easily visible to the farmer.

The overall goal of STAR project is the development and implementation of multi-sensor systems and sensor processing algorithms to enable agri-robots to perform fruit freshness level monitoring and reduce food waste throughout the supply chain, and precision agriculture tasks, such as precise local application of pesticides/fertilizers and yield estimation. The envisaged idea is based on an integrated sensor network, including mobile gas sensors mounted on board of ground robots. Information coming from the fixed sensing devices will flag “attention spots” in the crop for further local investigation by the robotic platform.

**Project Number**

**Project Duration**
**05/2023 - 05/2026**

# Artificial Intelligence Application for Farming (APP4FARM)

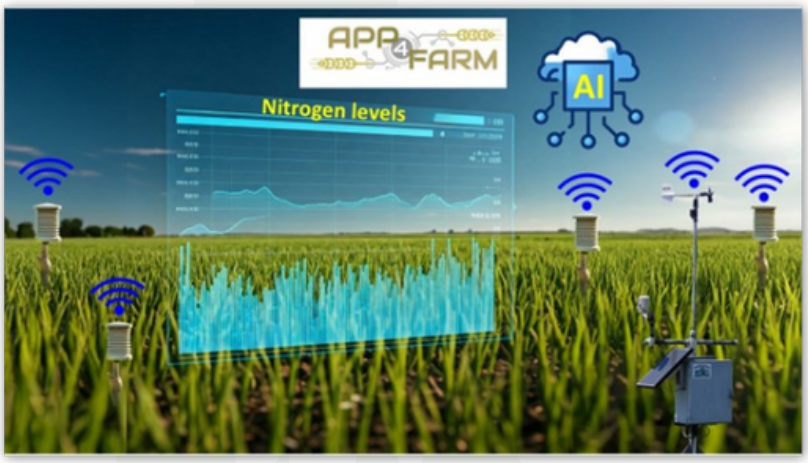
**Coordinator:**
Prof. Carnevale - University of Brescia, UNIBS, Italy

**Collaborating Institutions:**
Consiglio Nazionale delle Ricerche, CNR-IBBR, Italy

German Research Centre for Geosciences, GFZ, Germany

University of Florence, UNIFI, Italy

Munster Technological University, MTU, Ireland




**Project Number**

**Project Duration**
**04/2023 - 03/2026**

## Abstract

Nitrogen is the primary nutrient, critical for the productivity of agricultural ecosystems. Hence, large changes in the availability of nitrogen can lead to severe alterations of the nitrogen cycle in terrestrial ecosystems. Currently, the N surplus is estimated as the difference between input and output.

To understand the losses, the emission related to single farming systems and climatic zones need to be accurately measured and integrated in a Decision Support System (DSS) to design better N management strategies aiming at achieving agronomic objectives (farm income, high crop and animal productivity) and environmental objectives (minimal N losses), simultaneously.

APP4FARM is a European research project aiming to develop agri-food systems enabled by interconnected digital technologies, that are more transparent to consumers, farmers and other stakeholders along the agri-food value chain. Specifically, APP4FARM will create;

- A Decision Support System with a dashboard giving the farmer up-to-date information on nitrogen emission levels
- A tailored Sensoring System to monitor environment and soil health, including nitrogen-related microbial activity
- Machine Learning/Artificial Intelligence forecasting models

The project is the starting point of the digitalization of agriculture sectors, aiming to ensure:

- Publicly available monitoring data, ensuring transparency of the supply chain from the very beginning
- The data will provide the basis for a "green labelling" project, leading to more traceable, sustainable and healthy food
- Limitation of greenhouse gases (N20) and nitrogen oxides (NOx) emissions
- Limitation of the atmospheric concentration of ozone (O3) and aerosols (PM10/PM2.5)
- Data transparency

# Transparency and Sustainability in the Potato Processing Chain from F2F through Innovative Data Sharing (SUSPOT)


**Coordinator:**
Steven De Cuyper - Agristo, Belgium

**Collaborating Institutions:**
AVR, Flanders Research Institute for Agriculture, Fisheries and Food, ILVO, Belgium

Scientific and Technological Research Council of Turkey, TUBITAK, Turkey

Poznan Supercomputing and Networking Center, PSNC, Poland

## Abstract

The SusPot project aims to enhance transparency and sustainability in the potato value chain, from farm to fork, by utilizing cutting-edge data-sharing technologies. This European-scale initiative addresses the increasing demand from consumers and retailers for specific sustainability data, moving beyond general statistics to provide actionable, product-specific insights. Through systemic innovation and collaboration among stakeholders, SusPot promotes data-driven decision-making to optimize processes and improve traceability across the chain.

SusPot's outcomes are expected to set new benchmarks in sustainability for the agri-food industry. By delivering transparency and fostering trust among consumers, farmers, and stakeholders, the project ensures a future-proof potato processing chain that addresses environmental challenges while maintaining economic viability.

**Project Number**

**Project Duration**
**05/2023 - 05/2026**

# Trustable and Sustainable Open Platform for Smart Honey Value Chains (TOP4HONEYCHAINS)

**Coordinator:**
Mehmet Nafiz Aydin - Kadir Has Üniversitesi, KHAS, Türkiye

**Collaborating Institutions:**
Işik University, ISIKUN, Turkey

Apiculture Research Institute, ARI, Turkey

University of Economics in Katowice, UEKat, Poland

Instituto Nacional de Tecnologia Agropecuaria, INTA, Argentina

Nexco S.A, NEXCOSA, Argentina

Cooperativa Agropecuaria Y Apicola Norte Grande Limitada, CNORTEGRANDE, Argentina

Alimentos Naturales Natural Foods S. A., ALIMENTOS, Argentina

Latvia University of Life Sciences and Technologies, LBTU, Latvia


**Project Number**

**Project Duration**
**05/2023 - 05/2026**

## Abstract

The TOP4HoneyChains project aims to create a transparent and sustainable digital platform for smart honey value chains in Türkiye and Argentina, addressing global challenges such as honey fraud, climate change, and market pressures. This open data platform will enhance traceability and transparency, enabling stakeholders like beekeepers, cooperatives, and consumers to access and share critical information, such as honey quality tests and production practices.

The project addresses challenges identified in surveys, where beekeepers struggled with marketing and pricing, and consumers sought trustworthy honey sources. TOP4HoneyChains will design innovative digital ecosystems and employ state-of-the-art technologies like dynamic data collection, semantic integration, and scalable microservices.

Expected impacts include improved sustainability for beekeepers, consumer confidence in honey quality, and the promotion of youth and women in beekeeping. By fostering transnational collaboration, the project showcases a model for transparent food systems, contributing to environmental, economic, and societal progress globally.

2024 JOINT CALL

# Tackling Digitalisation for Sound Agriculture and Food Systems

The aim of the 2024 Joint Call is to address urgent global challenges in agricultural and food systems emphasizing the role of these systems in mitigating issues such as climate change, biodiversity loss and food security. To bring about the necessary transformation, the call advocates for closer involvement of policymakers and the use of digital technologies for communication and data-driven decision-making.Projects must have a clear European added value by being carried out on a transnational level.

| **SEVEN PROJECTS WERE FUNDED IN THIS CALL** | | |
|---|---|---|
| **Title** | **Acronym** | **Countries** |
| Consolidated virtual living lab platform for knowledge sharing and adaption in regenerative agriculture | CAGRILAB | IE, PL, FI |
| Empowering Sustainable Food Crop Breeding Through Smart Selection | AI-CROPBREED | TR, PL, RO |
| Empowering Agri-Food Sustainability: A Data-Driven Approach to Agrivoltaics Management | DIGI-GROW | DE, ES, FI, TR |
| A Comprehensive Digital Platform for Land Use Planning, Carbon Footprinting, and Decision Making in European Agriculture | HOLOSEU | IE, FI, EE, PL, TR, RO, DE |
| Development of tomato disease development risk warning system | HEALTHYTOMATO | LV, EE, TR |
| Integrating High-Resolution Sensors and AI Decision Tools for Enhancing Agricultural Efficiency | INSPIRE | DE, FI, IE, TR, PL |
| Sensor based Environmental Surveillance and Observation with Realtime data in Pig and Poultry houses | SENSOR-PP | BE, DE, HU |

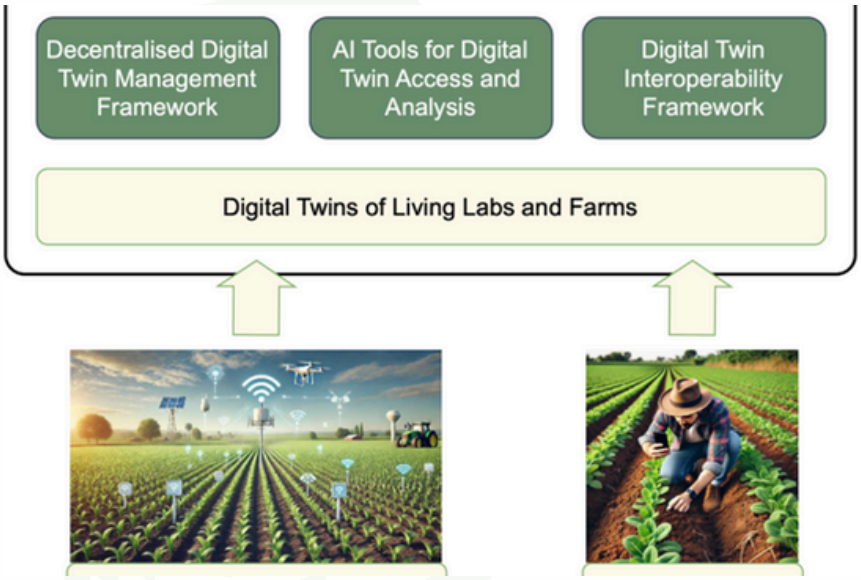
# Consolidated Virtual Living Lab Platform for Knowledge Sharing and Adaption in Regenerative Agriculture (CAgriLab)

**Coordinator:**
Dr Yuansong Qiao,
Technological University of the Shannon,
(Ireland)

**Collaborating Institutions:**
Dr Raul Palma,
Institute of Bioorganic Chemistry PAN, Poznan Supercomputing and Networking Centre, (Poland)

Dr Nathaniel Narra, Häme University of Applied Sciences, (Finland)

Mr Andrzej Słomczewski,
CGFP Sp. z o.o.,
(Poland)




**Project Number**

**Project Duration**
**36months**

## Abstract

By 2030, 100 soil health living labs (LLs) and lighthouses will be established, as per the mission “A Soil Deal for Europe”. Farmers worldwide also possess their own experiences in regenerative agriculture. These labs and farmers remain isolated, hindering the discovery, access, and replication of knowledge and best practices across labs and farmers.

Similarly, although there is a growing availability of data thanks to advances in IoT, AI and Big Data technologies, among others, data is usually available in different format and represented according to different data models hindering its interoperability and reusability. Additionally, regenerative agriculture practices and their effectiveness, such as intercropping and cover cropping, are location-specific due to variations in soil types, climate conditions, and ecological characteristics. This variability poses challenges in generalising or exporting practices without significant adaptations.

Approach:
To address these issues, the project will establish a consolidated virtual living lab using digital twin (DT), dataspace, blockchain, and AI technologies. The platform will enable real-time data sharing and collaboration among farmers and labs, facilitating the exchange of regenerative agriculture practices across diverse environments and generating farm-specific recommendations.

The key impacts of the project include:

- The platform will serve as a collaborative space for sharing insights and strategies, accelerating the adoption of regenerative practices - EUSO, SOILCRATES, and other living labs through SOILL and SOILL startup, individual farmers and open field research facilities associated with educational institutions.
- The platform will help farmers implement sustainable practices that are most effective for their specific conditions.
- The project will promote practices that restore soil health, increase beneficial biodiversity/abundance of beneficial soil microbes and fauna, and optimize resource utilization, ultimately contributing to monitoring of impacts of specific practices on ecosystem services.

# Empowering Sustainable Food Crop Breeding through Smart Selection (AI-CROPBREED)

**Coordinator:**
Prof. Dr. Meryem Ipek, Bursa Uludag University Agriculture, (Turkey)

**Collaborating Institutions:**
Prof.Dr. Meryem Ipek, Bursa Uludag University Agriculture, (Turkey)

Prof.Dr. Mehmet Süleyman Ünlütürk, Yasar University (YU), (Turkey)

Prof. Dr. Dariusz Grzebelus, University of Agriculture in Krakow, (Poland)

Dr Violeta Alexandra ION, University of Agronomic Sciences and Veterinary Medicine, (Romania)

**Project Number**
1234556

**Project Dates**
06/25 - 05/28

## Abstract

The development of crop varieties for sustainable food production heavily relies on selecting genotypes with desirable traits such as high yield and tolerance to biotic and abiotic stresses. However, traditional selection procedures in plant breeding are time-consuming, costly, and susceptible to environmental and genetic factors.

Leveraging modern digital and information technologies such as artificial intelligence (AI) and big data can support farmers in implementing these techniques, enhancing stakeholder awareness across the agri-food value chain.

The AI-CROPBREED project aims to harness the power of AI and image processing to develop sophisticated software capable of accurately estimating early bolting tendency in carrot (Daucus carota L.). By focusing on this specific trait, the project addresses critical challenges within agri-food systems, particularly those related to sustainability, resilience, and economic viability. Through a comprehensive approach, the project seeks to involve stakeholders at every stage of research and development, ensuring that the resulting software meets the diverse needs of the agricultural community.

The project conducts thorough analyses of the benefits and environmental risks linked to big data technologies in the agri-food sector, informing the development of practical advice and innovative solutions to balance their advantages and disadvantages. Ultimately, the AICROPBREED project aims to align stakeholders towards shared objectives, fostering collaboration and driving progress towards a more transparent, sustainable, and resilient food system. Through continuous iteration and refinement of methodologies, it seeks to enhance breeding practices while showcasing the potential of AI-driven innovations to revolutionize agriculture.

The AI-CROPBREED project's development of software for predicting early bolting in crops has vast potential applications, impact, and benefits. By enabling the selection of late bolting genotypes resistant to early flowering, it enhances crop resilience and resource efficiency, resulting in reliable harvests and cost savings. Overall, this technology supports sustainable agricultural practices, fostering environmental stewardship, enhancing livelihoods, and improving food security, signifying a substantial advancement in agricultural productivity, resilience, and sustainability through AI-driven innovation.

# Empowering Agri-Food Sustainability: A Data-Driven Approach to Agrivoltaics Management (DIGI-GROW)

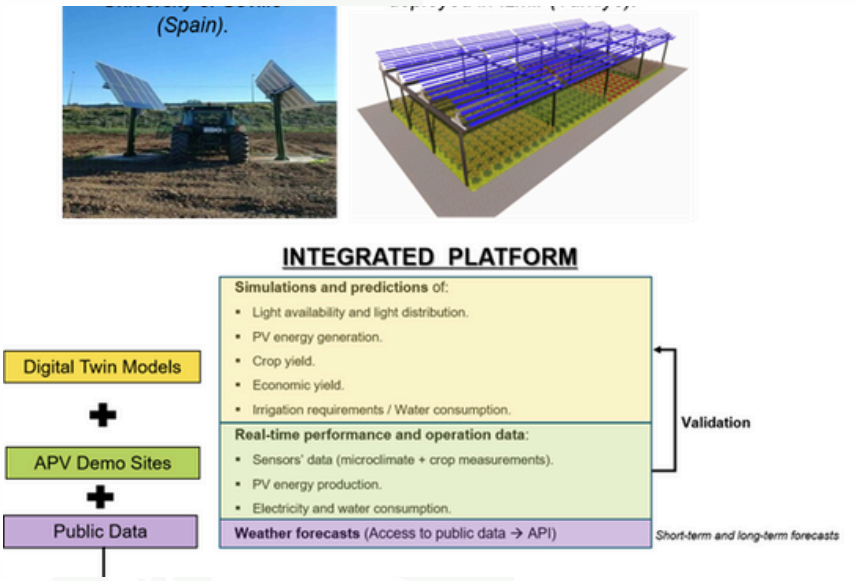
**Coordinator:**
Álvaro Fernández Solas, German Aerospace Center (DLR) – Institute of Solar Research, (Germany)

**Collaborating Institutions:**
German Aerospace Center (DLR) – Institute of Solar Research, (Germany)

Bettergy SL, (Spain)

Avoin Association, (Finland)

Ege University, (Turkey)




**Project Number**

**Project Dates**
02/25 - 01/28

## Abstract

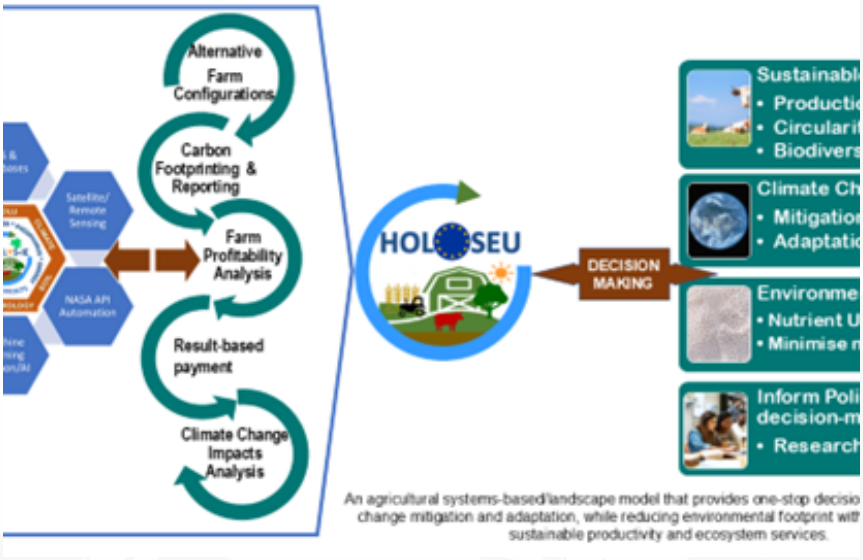
The DIGI-GROW project aims to develop an integrated platform for agrivoltaic (APV) systems. APV systems combine agricultural production and photovoltaic (PV) energy generation on the same piece of land. By doing so, these systems maximize land use efficiency, significantly increasing farmers' revenues while simultaneously contributing to the creation of a sustainable and resilient food system.

This dual-use of land reduces dependence on fossil fuels and decreases the need for irrigation, which directly addresses issues related to climate change and enhances food security.
The project will address the following specific objectives (SO):

- SO1. Integrate advanced digital tools in APV systems: The project will design and implement cutting-edge digital tools, such as simulation models and sensors, to optimize the dual management of agricultural and PV components within APV systems.
- SO2. Enhance land use efficiency: Through the development of customized models and software tools, the project aims to maximize land use efficiency by optimizing both crop production and energy generation.
- SO3. Increase farmers' profitability: By combining on-site measurements, historical data, and weather forecasts, the project aims to enhance the profitability of APV systems.
- SO4. Optimize resource use: The project intends to optimize energy and water consumption within APV systems by developing detailed simulation models and a web-based management application.
- SO5. Facilitate data-driven decisions: To enable farmers to make informed decisions, the project will develop a platform that provides real-time data access and sharing, tailored specifically to the needs of APV systems.
- SO6. Improve stakeholder communication within the food value chain: By implementing a data-sharing approach, the project will support the interconnected nature of APV systems and enhance collaboration across the food value chain.

The impact of the DIGI-GROW project will extend far beyond individual agricultural farms. The decision support systems (DSS) developed through this project can be applied not only to existing APV installations but also to any agricultural farm in Europe where an APV facility is planned to be deployed.

# A Comprehensive Digital Platform for Land Use Planning, Carbon Footprinting, and Decision Making in European Agriculture (HOLOSEU)




**Coordinator:**
Dr. Ibrahim Khalil, University College Dublin, (Ireland )

**Collaborating Institutions:**
Mr. Otso Valta, Avoin Ry (Finland)

Dr. Joel Kuusk, University of Tartu (Estonia)

Dr. Anna Walkiewicz, Polish Academy of Sciences, (Poland)

Prof. Tugrul Yakupoglu, Yozgat Bozok University (Turkey)

Dr. Ana Cornelia Butcaru, University of Agriculture and Veterinary Medicine (Romania)
Prof. Jan Paul Lindner, University of Augsburg (Germany)

Dr. Ariane Voglhuber-Slavinsky, Fraunhofer Institute for Systems and Innovation Research (Germany)

## Impact

The European Council's commitment to reducing GHG emissions by 80–95% by 2050 highlights the need for effective strategies in climate-resilient agriculture. However, current assessments face challenges due to high variability, technological limitations, and measurement issues.

**Project Number**

**Project Duration**
36 months

While modelling is promising, a comprehensive digital platform for landscape-based planning is crucial to ensure consistency in sustainable farming, future scenario projections and achieving socioeconomically viable sustainability goals like the UN SDGs and the EU Climate Action Plan.

The HOLOSEU project aims to develop an advanced decision-support tool for European agriculture, surpassing traditional digital platforms by integrating essential variables like soil and climate impacts. An evolution of the HOLOS-IE model, HOLOSEU incorporates new modules for agrobiodiversity and circularity to enable comprehensive scenario modelling across Europe. This robust platform integrates FAIR data from diverse sources - including soil, climate, drones, and satellites - using advanced programming, GIS, APIs, and statistical analysis to improve land use planning and decision-making.

HOLOS-IE V3.0, developed as an open-source component of HOLOSEU, features a dynamic soil and weather mapping tool and a user-friendly interface. Through real-time data access, living labs, and calibration, it aims to optimise resource use, enhance production economics, and support sustainable and competitive European agriculture. Key functionalities include GHG quantifications, carbon footprinting, and climate change simulation, offering actionable insights for stakeholders ranging from farmers to policymakers.

The project supports wide dissemination through software, training, publications, and workshops, promoting best practices, and potential carbon credits, and addressing social issues like gender equality. Collaboration with multidisciplinary European partners is central to HOLOSEU, ensuring model adaptability and scalability across diverse European agricultural scenarios.

# Development of Tomato Disease Development Risk Warning System (HEALTHYTOMATO)

**Coordinator:**
Dr. Viktorija Zagorska, Latvia University of Life Sciences and Technologies, (Latvia)

**Collaborating Institutions:**
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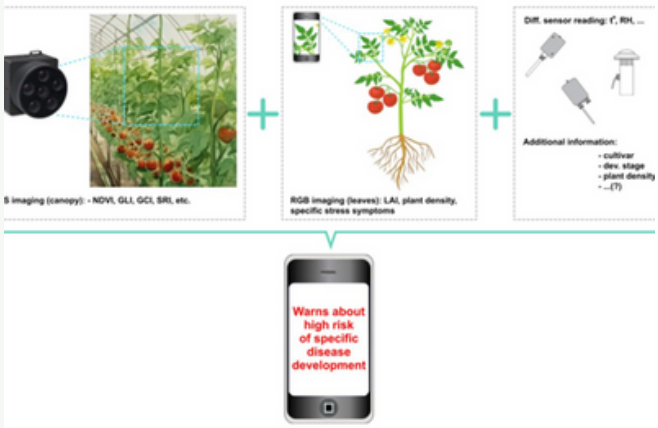



**Project Number**

**Project Dates**
02/25 - 01/28

## Abstract

Various diseases of greenhouse tomatoes reduce fruit yield and quality, which leads to serious economic losses globally. In large and well-equipped greenhouses, there are different solutions to avoid or minimize the spread of diseases, including environmental sensors and control options, plant vigor sensors, different visioning systems, decision support systems (DSS), etc. besides experienced agronomists are also available for quick, timely, and most effective procedures.

On the other hand, smaller and less-equipped greenhouses often have problems with both of the mentioned obstacles. It is not worth offering complicated and expensive solutions to small and medium-size tomato growers, because they do not have access to sufficient financial and human resources. The goal of this project is to develop a relatively inexpensive and effective solution to help growers reduce the potential risk of spread of diseases in small and medium-sized tomato greenhouses.

Greenhouse tomato disease risk warning and detection system includes a disease development risk evaluation model as well as a specific disease detection model. The development of the system will be based on the following regular and occasional data acquisition tools/sources:

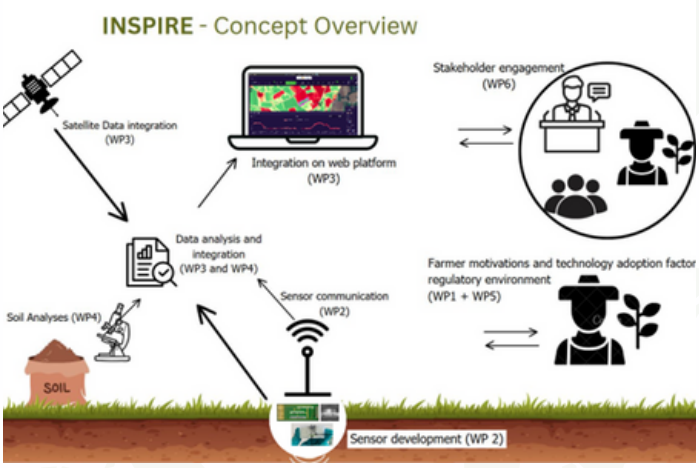
1. data acquisition from existing greenhouse sensors (mostly inside/outside temperature and air humidity)
2. data captured by MultiSpectral (MS) camera;
3. data captured by RGB camera (mobile phone)
4. additional information which added manually (cultivar, sizes of greenhouse, etc.).

The greenhouse tomato disease risk warning and detection system will use two separate models:

- one model to integrate and evaluate different data to conclude the level of specific disease spread/development risk,
- another model uses images of diseased plant leaves, to detect the specific disease if it occurs. Data for both model development will be collected in scientific and commercial greenhouses over a three-year period.

In a scientific greenhouse, inoculation of tomato plants with relevant diseases will be conducted, as well as modelling of suitable conditions for disease development to collect maximum data (e.g. images) of diseased plants. While in a commercial greenhouse, previously developed models will be evaluated and non-diseased measurements conducted - for leaf area index assessment, plant density on different levels assessment, etc.

# Integrating High-Resolution Sensors and AI Decision Tools for Enhancing Agricultural Efficiency (INSPIRE)

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University College Cork (Ireland)

MOVE ON Technology Inc. AgriTech Solutions (Turkey)

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## Abstract

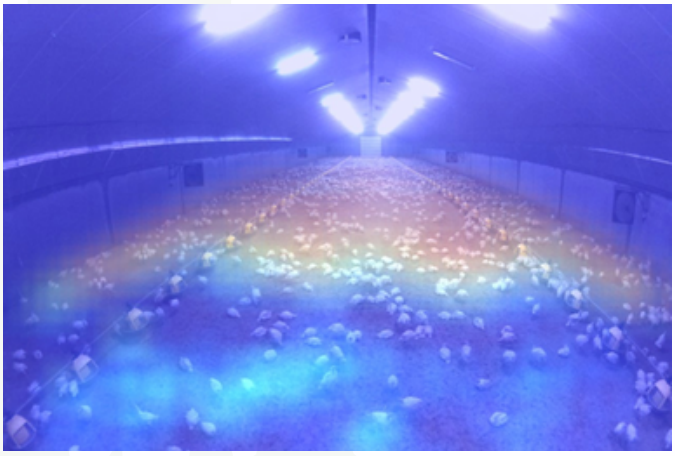
The main objective of INSPIRE is to improve nutrient use efficiency in agriculture by innovative technology capable of measuring nutrient contents in soils and incorporating this data into state-of-the-art decision support tools for farmers. This will be enabled by the development and deployment of novel nutrient sensors, which can be incorporated in agricultural soils and produce high-resolution data on current nutrient levels.

The project will explore the best ways to incorporate this data into a cloud-based decision support tool and the effectiveness of the derived fertilization strategies in terms of environmental and economic performance. Connected to this, the project will study farmers' willingness to accept novel technologies and data sharing among themselves and with other value chain stakeholders. Furthermore, training materials will be produced that help farmers understand preconditions, opportunities, and challenges of novel technologies such as AI in farming.

**Project Number**

**Project Dates**
02/25 - 01/28

# Sensor based ENvironmental Surveillance and Observation with Realtime Data in Pig and Poultry houses (SENSOR-PP)



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**Project Number**

**Project Dates**
02/25 - 01/28

## Abstract

Poultry and pig meat belongs to the most produced and consumed meat in the EU, being 13 million and 22,1 million of tons respectively in 2022. The production often occurs in some of the most intensive farming systems characterized by high stocking densities and indoor rearing conditions.

Despite a decrease in the number of farms over the last years, there has also been a tendency of an increase in the average livestock farm size and a need for more external employees. Simultaneously topics such as antibiotic consumption reduction, animal welfare and environmental impact are expected to be addressed. Automated monitoring systems of the environmental conditions and animal behavior linked with productivity data will be a key element to identify and correct suboptimal housing conditions. A lack of synergy between technology developers and producers/animal health experts has led to the availability of many sensors but a lack of predetermined target values and decision support systems allowing data-driven decision-making. Moreover, both internal (technical specificities of the installations, occupancy and age, etc.) and external factors (wind, rain, etc.) determine the final stable climate and therefore make it crucial to combine all of these data for correlation and causation analysis so actionable insights are generated.

Therefore, the SENSORS PP project aims to:

- Test and implement real-time negative pressure sensors applicable under stable conditions with a cloud-gateway connectivity
- Apply natural language processing to digitize stable cards (mortality, medication treatments, water and feed-uptake)
- Develop image analysis algorithms for pigs and poultry to allow automated analyses of animal activity, distribution and social behavior. These are early indicators of health or welfare issues.
- Grow the data-base of environmental parameters and behavioral indicators in pig and poultry houses under different ventilation conditions from farms with and without climate related health or productivity problems so the environmental target values and thresholds can be refined in relation with the varying conditions.
- Aggregate and process heterogeneous sensor data, external weather conditions and production parameters ingested into an IoT platform, enabling automated data analytics.
- Built an interactive visualization information platform as a decision support system and early warnings method for the users.

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