

ICT-AGRI-FOOD COFUND



The ERA-NET ICT-AGRI-FOOD launched in 2019, the cofunded call "Transnational, collaborative, inter-/transdisciplinary research projects on ICT-enabled agri-food systems" for transnational research projects. The network consists of 28 funding bodies from 22 countries, 3 European regions and the European Commission.

ICT-ENABLED AGRI-FOOD SYSTEMS

The ERA-NET Cofund ICT-AGRI-FOOD strengthen the transnational coordination of research programmes and ensure better cooperation and use of resources in the area of digital agri-food research, development and innovation. The scope of this co-funded call covers the entire value added chain of the agri-food sector from farm to fork and puts a special focus on the sustainability and transparency of the sector.

19 selected research projects investigate, develop and test 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.

TOPIC 1 - DATA-DRIVEN ICT PLATFORMS AND SOLUTIONS TO IMPROVE THE SUSTAINABILITY OF AGRIFOOD SYSTEMS

ADCATER

Advanced Digital Solutions for Professional Food and Nutrition Catering Service

ADCATER will develop advanced ICT technologies and integrate them into a Smart Food Catering Supply Chain platform that provides: economic efficiencies to growers and suppliers; personalized nutrition accuracy to diners/patrons, wholesalers and caterer; and verification of personal, organizational and global nutritional policies. This will be achieved by harnessing computer vision & deep learning technologies to identify and decode images of prepared food “plated before meal” and “left in plate after meal”, applying advanced analytics to derive valuable information such as: served meal ingredients, the degree of adjustment and dietary gaps to the diner profile, batch traceability data, effective and up-to-date nutritional supervision, food waste, and correlation between consumer consumption and health.

Keywords: Nutritional assessment, Food waste, ICT Food, Foodtech, Food image analysis, malnutrition indicators, Food Service chain traceability, Healthcare, Elderly house

ADDFerti

A data-driven platform for site-specific fertigation

ADDFerti aims to design and develop a fully-automated ICT-based data driven platform for VRFI. Given the increasing demands for water and food under global warming, one of the great challenges is how to increase food production by using less water for irrigation. Another issue is the homogeneous application of not only water but N, P and K by the majority of farmers in Europe and beyond. This results in over- and under-applications over different parts of the field, leading to poor yield and management of farm input, and negative environmental consequences, e.g., N and P leaching, or water scarcity. The solution would be adopting variable-rate fertigation (VERI), to apply the right rate at the right time, and place using advanced sensing, modelling and control technology.

Keywords: Fertigation, ICT, Proximal soil sensing, Variable rate, Data fusion, Management zones

ANTONIO

Multimodal sensing for individual pLANT phenOtyping iN agriculture robOtics

ANTONIO develops and implements advanced perception systems based on multi-sensor platforms and sensor processing algorithms to enable agricultural vehicles to perform plant phenotyping and precision agriculture tasks, such as precise local application of pesticides. The envisaged idea is based on an integrated sensor network, including mobile sensors mounted onboard of robotic vehicles and drones, stationary sensors deployed in the field, and smart insect traps. Information coming from the fixed sensing devices as well as robots and drones will flag “attention spots” in the crop for further local investigation by the robotic platforms. This approach will lead to precise detection of pests and weeds/plants, and this narrow temporal and spatial scale of detection ability can treat the specific site instead of the entire crop or field.

Keywords: Precision agriculture, Field robotics, Crop sensing, Sensors fusion, UAV, Situation awareness, Deep learning, Decision support system (DSS)

BeeConnected

Understanding and anticipating mechanisms of honeybee colony mortality with connected beehives

BeeConnected aims at understanding mechanisms underlying winter mortality risk of honeybee colonies and to identify early-warning indicators that could help beekeepers limiting colony losses and related economic deficits. We will combine our expertise in various scientific fields, including behavioural ecology, molecular biology, engineering, computer science, and modelling. In close collaboration with beekeepers, we will carry out a large-scale monitoring of beehives along combined gradients in climate (continental, temperate and Mediterranean) and landscape. The monitoring will combine traditional field observations with automated systems using multiple low-cost sensors to track the bee swarm in real time and in three dimensions inside the beehives. The final goal is to derivate decision-support tools for beekeepers to sustain their professional activity.

Keywords: Beekeeping, Early warning indicators, Honeybee colony loss, Mechanistic modelling, Multiple in-hive connected sensors

FINDR

Fast and Intuitive Data Retrieval for Earth Observation

FINDR's objective is to provide universal, transparent, and unifying access to Earth Observation (EO) data for sustainable and resilient food production. The project will implement an ICT platform to enable faster and better-informed decisions by making existing EO data sources directly comparable and inter-compatible. This is reached by the implementation of data-finding, data-forecasting, and data homogenization algorithms, leveraging the technological advantages of cloud computing, big data, and machine learning. The overall vision is to unlock many of the most immediate potential benefits, like more efficient use of water in irrigated agriculture, optimized fertilizer use, automated irrigation management, that are still waiting for their adoption on large scales by the food producers.

Keywords: Earth Observation, Satellite Imagery Access, AgriTech, Remote Sensing, Data Homogenization, FINDR, Access Forecasting, ICT

GOHYDRO

A smart-sensing AI-driven platform for scalable, low-cost hydroponic units

GOHYDRO aspires to culminate in the production of a platform that will be a shifting paradigm of how AI-driven technological innovation can become an affordable, accessible-by-all tool applicable to all forms of urban farming. In a nutshell, the proposal aims at creating a form of an easy-to-use e-agronomist which will assist any grower to fine-tune and optimize her hydroponic production. Within this framework, GOHYDRO aims at developing a cost-efficient smart-sensing ICT platform capable of monitoring the crops' health and nutrient content of hydroponically cultivated microgreens in order to optimize the cultivation process and allow the harvest of the best possible products. Hydroponics has emerged as one such solution, as it requires no arable land, reduces the usage of clean water and can be used in any urban setting.

Keywords: Microgreens, Urban farming, Smart sensors, Data-driven platform, Hydroponic units, Machine learning

HALY.ID

HALYomorpha halys IDentification: Innovative ICT tools for targeted monitoring and sustainable management of the brown marmorated stink bug and other pests

HALY.ID aims to replace the current monitoring of the brown marmorated stink bug (*Halyomorpha halys*) by non-reliable traps with an autonomous monitoring system based on new emerging technologies like drones, computer vision and IoT devices. The brown marmorated stink bug (*Halyomorpha halys*), an invasive Asian species, in 2019 has already reached 28 European countries, causing damages for millions of euros. The final goal is to collect images of the most dangerous pests in our countries (*H. Halys*, *Psila rosae*) with vision chips carried by unmanned vehicles, mined via machine learning on the edge-devices, in order to direct interventions. We also intend to exploit hyperspectral vision for detecting pest damages non-visible in the marketable fruits. By logging this information and making it available across the value chain to provide transparency and quality assurance toward the consumer.

Keywords: Pest Monitoring, Algorithms for Unmanned aerial vehicles, Internet of Things, Wireless Sensors Networks, Machine learning techniques, NIR-Hyperspectral imaging, Ultrasound, microwave/THz imaging, vision chips

IMPPEach

Integrated Model and Platform for Harvest Prediction of Canned Peaches

IMPPEach develops a digital platform for the harvest prediction for canned fruits, powered by a predictive model based on Machine Learning, Remote Sensing and IoT. The platform will provide remote sensing (satellite) data of the orchards and corresponding vegetation indexes to derive parameters like plant vitality and other phenological parameters. It provides also climatic, soil conditions, cultivation and fruit data (e.g. irrigation, size, growth rate) by an IoT sensor network and manual field scouting. This data feeds into a prediction model for harvest dates and yields based on the data analysis by AI/ML algorithms and into a distributed FMIS that integrates all collected data, supports data exchange between farmers and the fruit canning business and integrates the predictions with the MRP process.

Keywords: Harvest and Yield prediction, Canning Peach, EO data, Spatial Analysis, Geodatabase, Machine Learning, IoT

MERIAVINO

Multiscale Sensing for Disease Monitoring in Vineyard Production

MERIAVINO project advocates a multidisciplinary approach, which is based on several scientific fields to address the problem of disease and yield estimation in vineyard. The proposed methodology consists of inter-combining and implementing IoT, remote sensing and big data with a multi-scale approach in order to interconnect the vineyard parcels, as well as to develop a non-invasive, eco-friendly and low-cost technology for vine disease detection/warning. In order to reduce economic loss of both quantity and quality, and the environmental impact, various sensors, data fusion techniques and artificial intelligence and machine learning methods are combined along with the development of re-printable sensors for effective vineyard monitoring. The project results are then analysed and geo-visualised on compatible MobApp for end-users for decision-making and early prevention.

Keywords: Vineyard monitoring, Remote sensing, IoT, Artificial Intelligence, Cybersecurity

MUSHNOMICS

Unlocking data-driven innovation for improving productivity and data sharing in mushroom value chain

MUSHNOMICS aims to demonstrate the feasibility of dynamic data-driven analytics for multidomain mushroom production environments in order to optimize yield, lower costs and improve the economic viability of this agrifood sector. The project will develop ICT technologies for use in the agrifood domain exclusively focusing on mushroom value chain, combining smart sensors, AI, Deep Learning and Big Data analytics. The multi-factor, multi-discipline MUSHNOMICS team will lead to the development of ICT platform in the mushroom value chain, which will be demonstrated at TRL7 for post-project exploitation by the SMEs. The project team constitutes has a wide geographical spread with partners from Ireland, Denmark, Romania and Hungary.

Keywords: Smart sensors, ICT platform, Artificial intelligence, Big data analysis, IoT enabled mushroom production

PLAN P

sPectraL tools and digitalisation for the development of sustAinable structured food with plaNt Proteins

PLAN P develops a digital solution for the conception and production of sustainable food based on plant proteins. Data linked to the external and internal quality of the dispersed systems such as emulsions and foams will be acquired by hyperspectral analysis, an efficient and non-invasive technology. Instead of using Deep Neural Networks in regards of AI, the project will use a multi-model approach, where a set of components, each using different machine learning methodologies, will be trained and evaluated. The development of sensors will ensure online a quality diet with reduced waste. The multidisciplinary approach of the partnership will ensure the transfer of the innovations to companies.

Keywords: Plant proteins, Spectral analysis, Sensor, Artificial Intelligence, Online quality, Digital factory, Sustainability structured food

POSHMyCo

Potential of selective harvest based on mycotoxins content assessment in cereal crops

POSHMyCo developed a system to evaluate the spatial distribution of mycotoxin contamination by Fusarium. Recommendation will be made for selective harvest and preventive site-specific spraying of fusarium fungicide aiming at reducing the risk of mycotoxin contamination in wheat and barley grains, which is expected to maximize the yield price, while minimize the risk to human health and livestock. Fusarium species are the main cause of trichothecene type B contamination in cereals. Mycotoxins are considered to have a significant impact on food and feed safety. Currently, producers do not have a validated methodology to determine toxin contamination levels before harvesting the grain.

Keywords: Fusarium, Mycotoxin, Hyperspectral sensor, Selective harvest, Site-specific spraying, Data fusion

SHEET

Sunburn and HEat prediction in canopies for Evolving a warning Tech solution

SHEET aims to analyse the apparent temperature distribution at the fruit surface employing terrestrial remote sensing with automated conveyor in apple, sweet cherry, and grapes. Furthermore, the project wants to validate the findings on fruit damage considering the peak and duration of radiation and temperature degrees and develops a prototype of a warning IoT solution to inform growers on the risk of damage. The varying training systems of woody plants and efficacy of physical protection measures based on shielding effects have an effect on the heat distribution in the canopies and crop damage in varying climate conditions. Time series analysis of fruit temperature in heat periods due to global warming are needed.

Keywords: Fruit, global warming, heat damage, mobile App, postharvest, remote sensing, storage

SPECTROFOOD

Information Agrifood quality estimation using hyperspectral techniques

SPECTROFOOD aims to enhance the monitoring of fruits and vegetables quality, with advanced monitoring, using hyperspectral imaging in both pre- and post-harvest stages. This will identify links at temporal and spatial relations between production practices and quality characteristics in post-harvest and storage. The collected data and generated relations will be stored in a user-friendly and interactive platform, which will be created to present the monitoring data at the different supply-chain stages. Four use-cases have been identified in four countries to monitor leeks, mushrooms, sweet cherries and apples, as well as broccoli. The specific needs to be monitored will be identified with close cooperation with the relevant stakeholders.

Keywords: Spectral monitoring, Pre-harvest, Post-harvest, Agri-food supply chain, Fruits, Vegetables, Spectral imaging, Data platform

TailBiteAdvice

An ICT-based real-time advisory tool to minimise tail biting in fattening pigs

TailBiteAdvice aims to research, develop and demonstrate an on-farm advisory tool for assisting the farmer in the reduction of tail biting by combining multiple remote detection algorithms for both tail biting and several adjustment parameters including enrichment engagement, aggression, feeding and drinking behaviour, and climate. Further, the project aims to identify and discuss opportunities and barriers to the implementation of this in combination with previously developed abattoir tool (TailCam® developed by DMRI) for automatic detection of tail lesions and tail length by including multiple actors across nationalities. Combined, the two tools will create a data driven ICT-based approach to provide the farmer and other stakeholders with knowledge on how to prevent tail biting and as a result, lower the need for tail docking.

Keywords: Precision bitingLivestock Farming, Domesticated pig, Animal behaviour, Computer vision, Tail biting

TOPIC 2 - IDENTIFY AND ADDRESS BARRIERS FOR ADOPTION OF ICT TECHNOLOGIES IN THE AGRI-FOOD SYSTEMS

LivestockSense

Enhancing environmental sustainability of livestock farms by removing barriers for adopting ICT technologies

LivestockSense aims to draw farmer's attention to the importance of environmentally friendly animal housing, especially air quality and its impact on health, welfare and productivity of livestock. In relation to sociological research, the project wants to understand the real causes of resistance to precision livestock farming (PLF) systems, i.e. exploring the attitude of farmers to PLF systems, their requirements for the operation of these systems and the provision of information, and their knowledge of the decision-making roles ICT technologies, can play on farms. Demonstrate the role of PLF systems can play in delivering economic and environmental benefits through building a data-driven ICT tool.

Keywords: ICT tools, Social science and adoption, stakeholder's involvement, Technology implementation, Learning database, Animal welfare, Environmental benefits

SoCoRisk

Implementation of soil compaction risk assessment system - end-user's evaluation of potentials and barriers

SoCoRisk aims to generalize the use of the decision support tool for prevention of soil compaction called Terranimo. Therefore, the project will identify and address potentials and barriers of using the decision support tool in Europe through a transdisciplinary approach with the involvement of soil scientists, agronomists, and social scientists. End-users will have a central role in the project: 4 to 5 farms will be chosen as case studies in each the five taking part countries (Norway, Sweden, Denmark, Switzerland, Italy). Soil quality is threatened due to traffic with modern agricultural machinery. Compaction of the subsoil is effectively persistent. Soil ecosystem services related to protection of the environment are significantly affected by subsoil compaction.

Keywords: Soil compaction, Decision support tool, Stakeholder involvement, Living labs, Transdisciplinarity

SustainIT

Releasing the potential of ICT for sustainable milk and beef cattle value chains

SustainIT aims to identify institutional, economic and social barriers of widespread adoption of ICT, and develop conceptual governance, innovation ecosystems and business models for releasing the full potential of ICT in milk and beef cattle value chains. The project uses action research methods in the living lab setting to co-design the study frameworks and survey questions, test validity of the propositions, develop conceptual solutions. Living labs will include ICT developers, technology providers, farmers, processing industry, retailers, consumers, policy makers, researchers, and innovation brokers. The SustainIT project involves five partners from Estonia, Finland, Sweden and Germany.

Keywords: Adoption of ICT, Animal health and welfare, Data, Dairy and beef value chains, Sustainable business models, Living labs, Co-creation, ICT innovation ecosystem, Governance