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CONTENTS

STRENGTHENING THE EUROPEAN FARMING AND FOOD CHAINS THROUGH THE INTERNET OF THINGS TECHNOLOGY

The Internet of Food and Farm 2020 (IoF2020) project aims to consolidate Europe's leading position in the Internet of Things (IoT)-technology applied to the agri-food sector. We develop an ecosystem consisting of farmers, food companies, policy-makers, technology providers, research institutes and end-users. The project aims to solve the European food and farming sectors' social challenges, maintain their competitiveness and increase their sustainability.

FOR MORE INFO:
IOF2020.EU

LEAN MULTI-ACTOR APPROACH

IoF2020 uses a lean multi-actor approach focusing on user acceptability, stakeholder engagement and the development of sustainable business models. IoF2020 aims to increase the economic viability and market share of developed technologies, while bringing end-users' and farmers' adoption of these technological solutions to the next stage.

THE STANDARDS

With an open ecosystem and collaboration space, the project relies on existing standards, as well as security and privacy platforms, applying these to the food production chains.

TOWARDS AN ECOSYSTEM

Led by the Wageningen University and Research (WUR), the 70+ members consortium includes partners from agriculture and ICT sectors, and uses open source technology provided by other initiatives (e.g. FIWARE). Together we build an innovation ecosystem in which technology is validated, knowledge is shared and innovative solutions are brought to market.

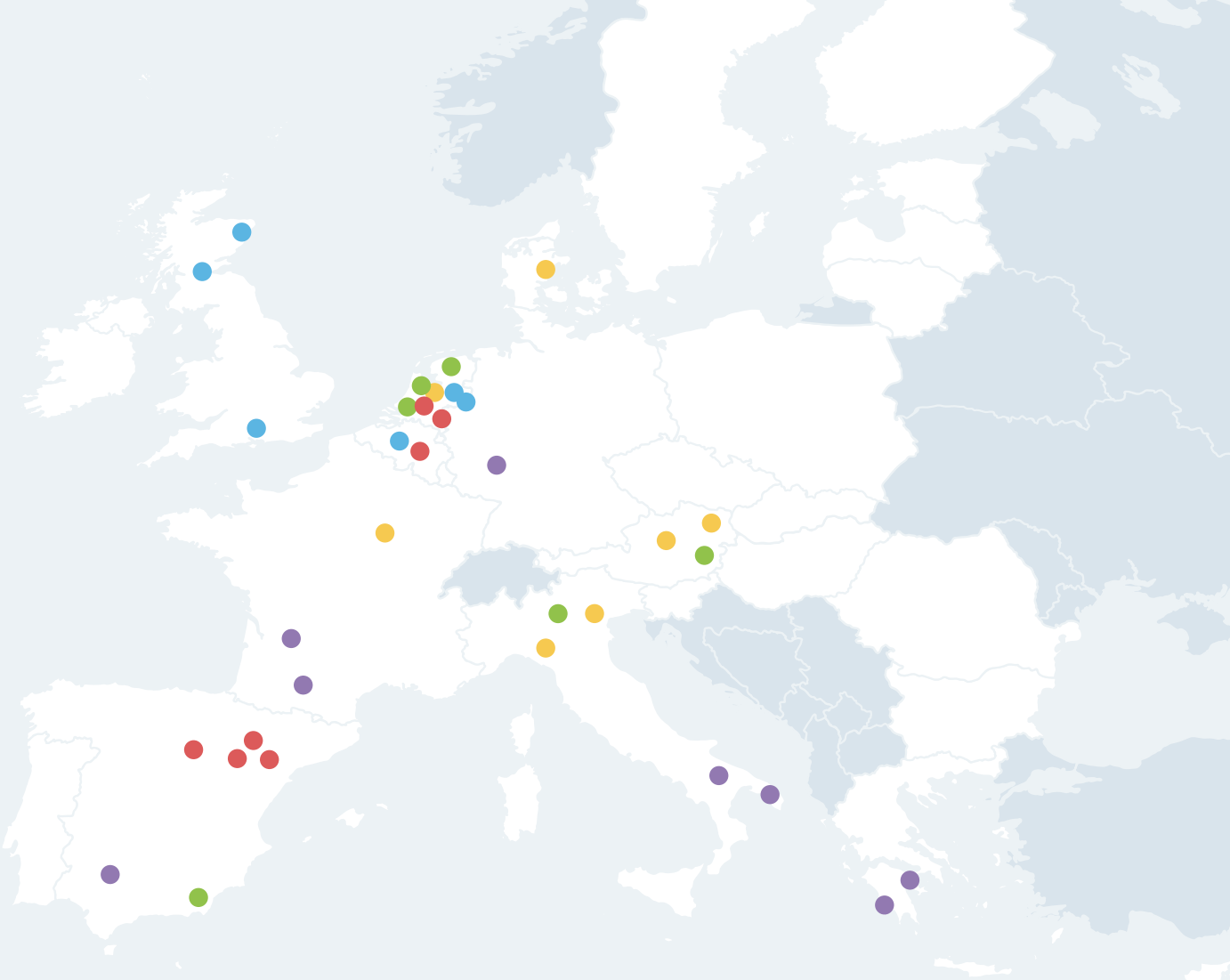
FOR MORE INFO:
IOF2020.EU

A FLYING START

5 TRIALS, 19 USE-CASES

The IoF2020-project is organized around 5 agriculture sectors: arable crops, dairy, fruits, vegetables and meat. Within each trial several use-cases (19 in total) demonstrate the value of IoT solutions for the European food and farming sectors.

FOR INTERACTIVE MAP:
IOF2020.EU/TRIALS



ARABLE DAIRY FRUITS VEGETABLES MEAT

THE IOF2020 OPEN CALL

€500k

Projects are eligible for costs from €300k up to €500k

5-6-2018

Open Call publication: June 5, 2018

30-9-2018

Deadline for application: September 30, 2018

1-1-2019

Start of new Use-Cases: January 1, 2019

THE IOF2020 OPEN CALL IN A NUTSHELL:

Aiming at increasing the scope and impact of IoF2020, it allows new use case teams to join the initiative and benefit from the growing network in the European farming and food sector. €5-6M are allocated to the funding of new Use-Cases. IoF2020 encourages highly impactful and market-ready IoT innovations validated and demonstrated, following the multi-actor approach in:

1- IOT USE-CASES IN NEW REGIONS

Eastern and northern part of Europe are less covered by the current IoF2020 use cases, new Use-Cases from these regions are welcomed.

2 - POST-FARM USE-CASES AND OTHER SECTORS

Extend the impact of IoF2020 is crucial. Use-Cases addressing complementary areas (e.g. logistics, processing, retail and in particular end-consumers) and subsectors (other crops, animals, etc.) are also encouraged.

THE INTERNET OF ARABLE FARMING

The arable trial focuses on wheat, soy bean and potato production and processing in Europe's different climate zones. It includes activities across the cropping cycle: e.g. with the help of IoT technologies data relevant to growing crops is gathered (e.g. soil condition, humidity and weather conditions). This trial also includes machine-to-machine communication. Overall, the use of IoT in arable farming can help to reduce pesticide, fertilizer and energy use, while increasing transparency and food safety.

FOR MORE INFO:
IOF2020.EU/TRIALS/ARABLE

1.1 WITHIN-FIELD MANAGEMENT ZONING

5/7
CURRENT TRL & TARGET TRL

4%
YIELD INCREASE

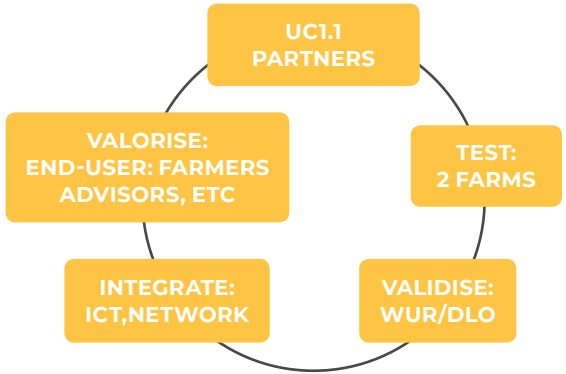
10%
RESOURCE USE EFFICIENCY

-15%
SOIL HERBICIDE USE

COUNTRIES

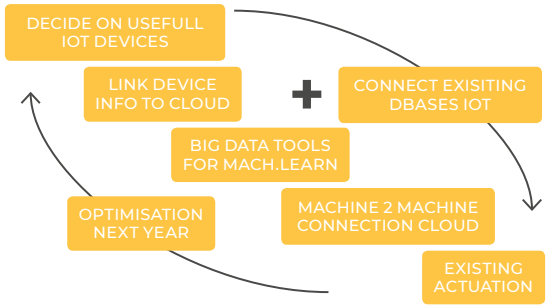
Arable farming faces increasing requirements and challenges when it comes to resource efficiency, environmental protection, transparency and chain optimization.
To address this challenge, this use case seeks to:

- Develop specific IoT devices for acquisition of soil, crop and climate data in production and storage of key arable and vegetable crops,
- Showcase the benefits of the broad IoT implementation at the farm level.



PARTNERS

HOW IT WORKS



Test, validate, integrate and valorize IoT in 4 demonstrators in commercial potato farms.

- Wireless connection of sensors to LoRa network,
- Yield prediction, compared with harvest yield sensing,
- Easy to use VRA maps from EM Soil Scan,
- Showcase state of play: tracking in bulk storage.

THE IMPACT

our Objectives

- Link Soil Sensor to data platforms and visualize data,
- Predict yield with Tipstar growth model, satellite data, Electro Magnetic (EM)-soil scan,
- Optimize the flow of EM-soil scan to VRA maps,
- Track and trace for bulk storage and potato quality sensing.

on Economy

- KPI: successful introduction of EM Soil advice product range.
- Optimum plant density, fertilization, soil herbicide use,
- Optimum product flow: user friendly ordering to smooth actuation,
- Organization of distribution, marketing and effectuation. The products will get clear positioning in competing market.

on environment

- Yield increase: + 4%,
- Resource use efficiency: + 10%,
- Soil herbicide use: -15%,
- Potato haulm killing herbicide use: - 30%,
- Nitrogen use: - 10%,
- Fungicide use: -10%,
- Energy use: - 15%.

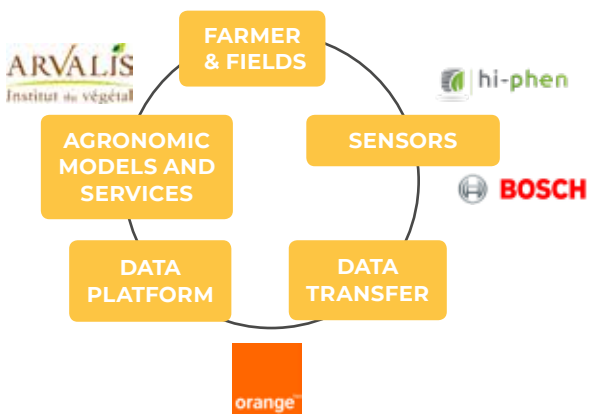
1.2 PRECISION CROP MANAGEMENT

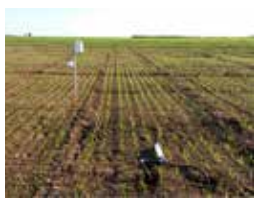
5/7
CURRENT TRL & TARGET TRL

50
MILLION EURO MARKET POTENTIAL

14
MILLION HA POTENTIAL AREA COVERED

The development of decision making tools and services is a priority to help farmers adopt better practices and optimize input management of their fields. Precise advice relies on accurate observations of crop status and growing environment. Existing services use climate data and satellite imagery that provide valuable information but has limitations. Improvement of these services requires a higher spatial and temporal resolutions that are now accessible by using ground based sensors.





COUNTRIES

PARTNERS

ARVALIS Institut du végétal

orange

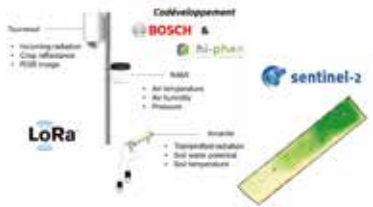
hi-phen

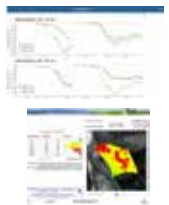
BOSCH

HOW IT WORKS

Satellite + IOT sensors are highly complementary. Combining both data sources offers a high temporal and spatial monitoring solution.

Integrated into Decision Support Tools they allow:
- Decision of irrigation based on soil sensors
- Nitrogen application maps from satellite + IOT sensors





The installed systems, provided by our subcontractors HIPHEN and BOSCH, are measuring simultaneously the vegetation growing status, main meteorological variables and the soil water potential. All data are transferred and made available on Orange data platform and combined with SENTINEL 2 satellite images. Data are integrated in ARVALIS agronomic models to provide accurate advices on crop management. Two topics are currently addressed: nitrogen and water management. Other applications are planned.

THE IMPACT

our Objectives

Nitrogen and irrigation for wheat, in a precision crop management approach. Nitrogen and Water are the two main limiting factors impacting wheat production. 30 systems will be deployed in Ile-de-France region to assess technical and economic values of the IoT technology.

on Economy

The potential of the French market for in-field nitrogen management is estimated at €50M, with 14 million ha potentially encompassed by the DST development. Such development could also apply to the European market. Regarding irrigation, acquiring a decision tool working in real time might lead to gains up to €20-€30 / ha.

other impact

IoT technologies will help farmers in their labour organization (time saving) and working environment. It will directly reduce the footprint of their activities through the optimization of their practices. It will also indirectly contribute to a better perception of agriculture by the society and consumers.

1.3 SOYA PROTEIN MANAGEMENT

4/5
CURRENT TRL & TARGET TRL

5%
IMPROVED YIELD AND QUALITY

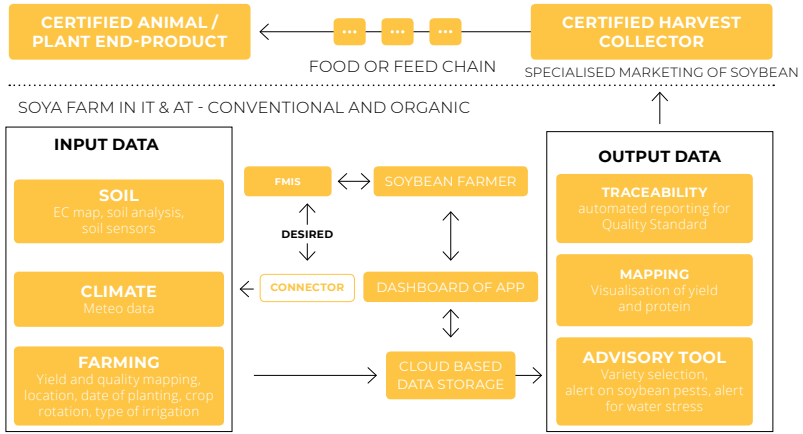
5%
IRRIGATION WATER EFFICIENCY

Soybeans are a major source of high-protein food and feed for livestock. At the moment the EU is highly dependent on imports from foreign soya producing countries. This is now changing and an increasing number of farmers is starting to produce soybeans as protein crop. IoT technology will connect various sources of data and information to advise producers and enable traceability for certified value-chain to improve the transparency of plant and animal food products.

COUNTRIES

PARTNERS

HOW IT WORKS



An application which supports farmers to grow high-quality soybeans and market them. The application contains an advisory tool and a basic traceability tool. The advisory tool will combine soil, climate and farming information from sensors and from third parties, both private and public. Furthermore, we seek to explore opportunities to create a web-based platform for soybean crop where all actors of the supply chain can find information and share knowledge.

THE IMPACT

our Objectives

- Higher protein yields (+5%) in soybean production by using the best available genetics and by making use of environmental and agronomic IoT data,
- Increase marketing possibilities and consumer trust into certified products.

on Economy

- Improved soybeans yield and quality (+5%),
- Enhanced transparency along the value chain of plant and animal-based food products to enable farmers and industry to obtain premiums.

On environment

- Increase consumers trust in food products by improved transparency (+5%),
- Enhance irrigation water efficiency (+5%) by an integration of soil moisture sensors.

1.4 FARM MACHINE INTEROPERABILITY

4/7

CURRENT TRL
& TARGET TRL

COUNTRIES

Every farmer wants his equipment to work seamlessly together, designed as one integrated system. Since farmers also want freedom of choice to select the best equipment for their needs, they expect equipment, machinery and software to work together in an interoperable way, regardless of the provider. Interoperability of IoT devices and machinery today is in its infancy. For the farmer, it is a challenge to make all devices work together in the digital space, as there are different platforms using vendor specific communication.

- UC 1.1 WITHIN-FIELD MANAGEMENT ZONING
- UC 1.2 PRECISION CROP MANAGEMENT
- UC 1.3 SOYA PROTEIN MANAGEMENT
- UC 2.1 GRAZING COW MONITOR
- UC 3.2 BIG WINE OPTIMIZATION
- UC 3.3 AUTOMATED OLIVE CHAIN
- UC 4.3 ADDED VALUE WEEDING DATA
- UC 4.4 ENHANCED QUALITY CERTIFICATION

UC 1.4 FARM MACHINE INTEROPERABILITY

The horizontal use-case on interoperability overarching the vertical production management oriented use-cases

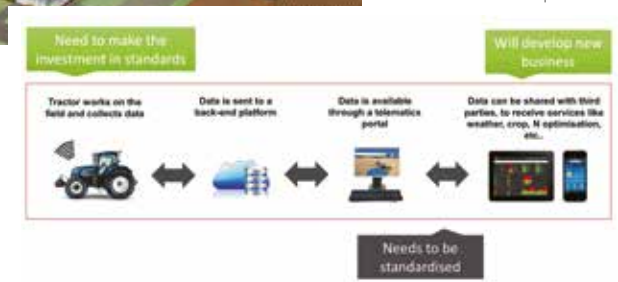
Farmers
Equipment Users
Data Consumers
Software Providers
Service Providers

PARTNERS

CNH INDUSTRIAL
AARHUS UNIVERSITY
kvernelanc group
AGRO INTELLIGENCE
365FarmNet
AGCO Your Agriculture Company
WAGENINGEN UNIVERSITY & RESEARCH

HOW IT WORKS

Plan of connected and interactive multiple electronic devices that are not fixed in one place.



Applying communication standards for optimized pairing and wireless communication between units in the IoMT in farming. Data transfer via standard communication definitions, enabling a single connection methodology. Enabling access to data and decision support through one interface. Service providers can add value to data based on a single API.

THE IMPACT

our Objectives

- Wireless connection of machine and sensor data,
- Demonstrate interoperability,
- Single API for integration of geospatial data,
- Share technical solution with the Standard Development Organisations.

other impact

- As UC 1.4 is a horizontal use-case, feeding into other use-cases, UC 1.4 is enhancing the KPIs from the other use-cases. Collaborating use- cases include UC 1.1 and UC 1.3

THE INTERNET OF DAIRY FARMING

The dairy trial explores the usefulness of collecting real-time sensor and GPS location data throughout the whole dairy chain–'from grass to glass', using neck collars or movement sensors for livestock. Use-cases range from monitoring the outdoor grazing of cows (from 'grass') to the application of machine learning technologies and cloud-based services (to 'glass'), making it possible to ensure the quality of the dairy chain remotely.

FOR MORE INFO:
IOF2020.EU/TRIALS/DAIRY

2.1 GRAZING COW MONITOR

6/8
CURRENT TRL & TARGET TRL

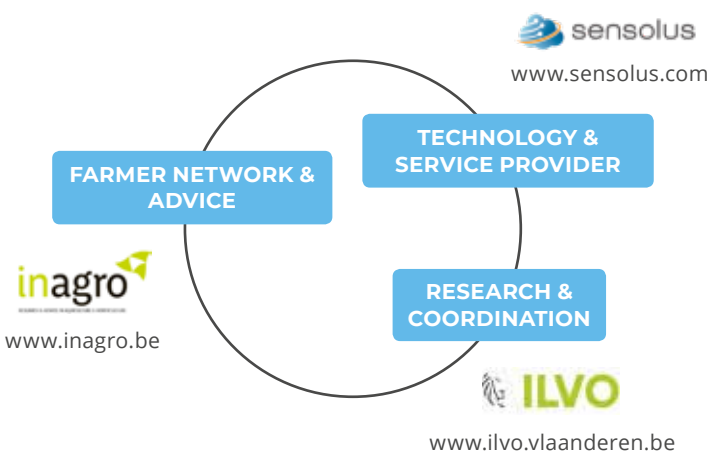
> 1,500
FARMERS ACROSS THE EU REACHED

-10%
FARMER LABOR TIME

COUNTRIES

The Grazing cow monitor digitally monitors cows' grazing time and provides an easy way to generate digital reports for legal controllers and dairy processors. This is important to verify pasturing for ammonia emission reduction and labels of 'milk from pasture'.

The system uses the STICKNTRACK low-power indoor-outdoor tracking service that combines the LPWAN SIGFOX network with BLE technology to track individual cows and measure their pasturing time. The system can also track extensively grazed livestock such as dairy cows, beef cattle, horses, sheep, and reindeer, but can also track wildlife.



PARTNERS

ILVO
sensolus
inagro

HOW IT WORKS

A STICKNTRACK GPS-tracker is attached to the collar of each tracked animal. Bluetooth Low Energy beacons are placed inside the dairy barn. Clear insights and digital reports on the location of every animal will be available in the management platform.

THE IMPACT

our Objectives
The grazing monitor will be tested at two dairy farms (100 dairy cows each) and demonstrated at five dairy farms in Belgium and the Netherlands.

on Economy
Eliminating manual record keeping will reduce farmer labor time by at least 10 %. Dairy processors can rely on digital reports, eliminating costly on-farm audits.

other impact
The technology will have 85 % accurate classification of inside/ outside animal presence. Trough dissemination activities over 1500 farmers and stakeholders will be reached EU-wide.

2.2 HAPPY COW

6/8
CURRENT TRL
& TARGET TRL

MITIGATION
OF MILK YIELD LOSSES

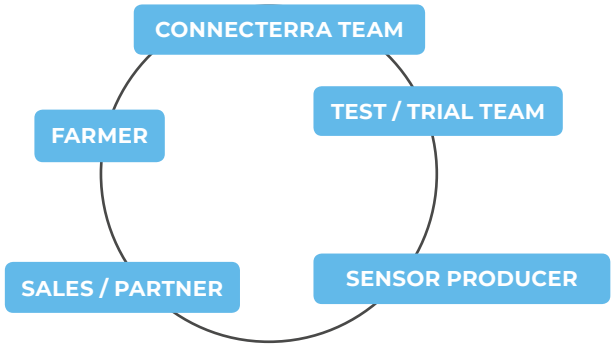
DECREASE
OF ANTIBIOTICS USE

BOOST
IN MILK PRODUCTION

COUNTRIES

A modern dairy farm is a dynamic and complex business. With increasing demands on animal health, environmental impact and margins being under pressure, improving farm management is vital for dairy farmers to stay in business.

Therefore, the Happy Cow project aims to use state-of-the-art technology and artificial intelligence to provide farmers with insights on the fertility and health of their cows. Besides these goals, IDA (the Intelligent Dairy Farmers Assistant) will also self-learn and give insights on calving and feed efficiency.



PARTNERS

Connecterra

WAGENINGEN UNIVERSITY & RESEARCH

ZLTO

veteffect

HOW IT WORKS

ACQUIRE Sensor devices

ANALYZE Machine Learning

ACT Cloud Apps

Cows wear a sensor that tracks their movements in 3 dimensions. From the data, a smart algorithm determines what behaviour the cow has expressed. All data is uploaded to "the cloud" where artificial intelligence is used to translate the data into insights. The insights are transmitted to the farmer via an app on his smartphone, offering suggestions on how to optimize the output of the farm.

THE IMPACT

our Objectives
To demonstrate that the approach of cloud computing and artificial intelligence works on farms.

IDA system is istalled on two farms where on each, 50 cows are equipped with sensors. Two additional farms are to follow in 2018.

on Economy
- A shorter calving interval; hence, higher milk production,
- Quicker treatment and severe disease prevention,
- Mitigation of milk yield losses and decrease of antibiotics use.

KPIs:
- Calving interval,
- 305-day milk production,
- Average number of days treated with antibiotics.

other impact
A lower usage of antibiotics reduces environmental impact and benefits the prevention of antimicrobial resistance.

2.3 HERDSMAN

5/8

CURRENT TRL & TARGET TRL

ANIMAL WELFARE

IMPROVED

PRODUCTION EFFICIENCY

INCREASED

ENGAGEMENT

GROWTH OF YOUNG FARMER ENGAGEMENT

This Use Case aims to implement, validate and showcase the use of real-time data primarily derived from a neck mounted collar together with other relevant data to create information of value to the dairy supply chain from 'grass to glass'. The impact will be more efficient use of resources and production of quality foods, combined with an enhanced animal health, welfare and environment implementation. The focus is on welfare and reproduction of cows through early warning systems and quality data that can be used for remote calibration and validation of sensors.

The platform has the potential to bring impact throughout the value chain. Integrated measurements of activity, feeding and rumination combined with other e.g. milk analysis gives a clear welfare indication. Information can be disseminated through the most appropriate channels to stakeholders providing services from on-farm to consumers; farming » processing » logistics » consumers. The information can also be used to optimise on-farm operations and provides consumers with provenance data on the products being purchased.

COUNTRIES

PARTNERS

University of Strathclyde Glasgow

HOW IT WORKS

- Multiple log-in capability so that members of the supply chain can remotely access to the information e.g. vets, fertility and health service,
- Visualisation of the key conditions of individual animals,
- Data accumulation either at an on-farm PC or the Cloud,
- Sensor fusion to enhance outputs,
- Low power wireless connectivity.

Clockwise from top left: Milking robot providing production, quality and health indicators, feed monitoring, collar sensors for monitoring behavior and health, view main barn at test site PARK

THE IMPACT

our Objectives

The integration and analysis of data from a number of measurement sources such as neck mounted accelerometer sensors, milk constituent sensors and feed to monitor animals and the production environment in order to generate actionable information and feedback that optimises welfare/ production.

on Economy

- Increased production efficiency (herd fertility),
- Improved animal welfare, early intervention on illness (automated intervention),
- Increased adoption of IoT in dairy,
- Growth of young farmer engagement.

other impact

- Environmental benefits through reduced production losses,
- Reduced greenhouse gas output per unit of product,
- Reduced use of veterinary intervention/ medication.

2.4 REMOTE MILK QUALITY

6/9

CURRENT TRL
& TARGET TRL

PROCESSING EFFICIENCY

IMPROVED

QUALITY & SAFETY

OF DAIRY PRODUCTS
INCREASED

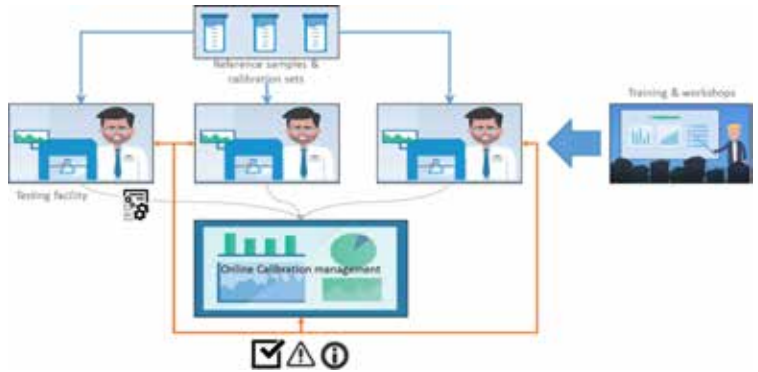
This Use Case has the following challenges:

- Maintain high safety, quality, sustainability and profitability in the dairy chain,
- Maintain reliable results from instrumental analyses (IR) for dairy processors and local testing laboratories,
- Maintain calibration and harmonization expertise within an organisation.

COUNTRIES

PARTNERS

HOW IT WORKS



- Training and workshops,
- Customized reference samples and calibration sets,
- Online Monitoring of calibration management, visualisation and alerts,
- Online and on-site maintenance services.

THE IMPACT

our Objectives

- High safety, quality and profitability in the dairy chain,
- Reliable instrumental analysis (IR) for dairy processors and local testing laboratories,
- Excellent maintenance, calibration and harmonization of test facilities within an organization,
- Qualified operators or QA/QC officers for maintenance and calibration tasks of advanced analytical instruments.

on Economy

Product quality, safety and processing efficiency. Financial gain is substantial when result of analysis are reliable and accurate. i.e. improvement of standardization of cheese milk can result in €100K profit per processing facility.

other impact

- Improved processing efficiency has direct positive impact on the environment,
- More product less waste,
- Higher quality dairy products at lower costs.

THE INTERNET OF FRUITS

The fruit trial aims to improve the use of IoT-technologies in the fruit supply chain, from growing to harvesting and processing. This trial will gather data on pre- and post-harvest losses to increase the yield and quality of fruits. In addition, IoT-technologies is used to ensure better traceability of fruit products in relation to the protected designation of origin. The use-cases include, among others, fresh table grapes, wine and olives, while addressing the challenges of automation in the fresh logistics.

FOR MORE INFO:
IOF2020.EU/TRIALS/FRUITS

3.1 FRESH TABLE GRAPES CHAIN

6/9

CURRENT TRL
& TARGET TRL

IRRIGATION & LABOR COSTS

REDUCED

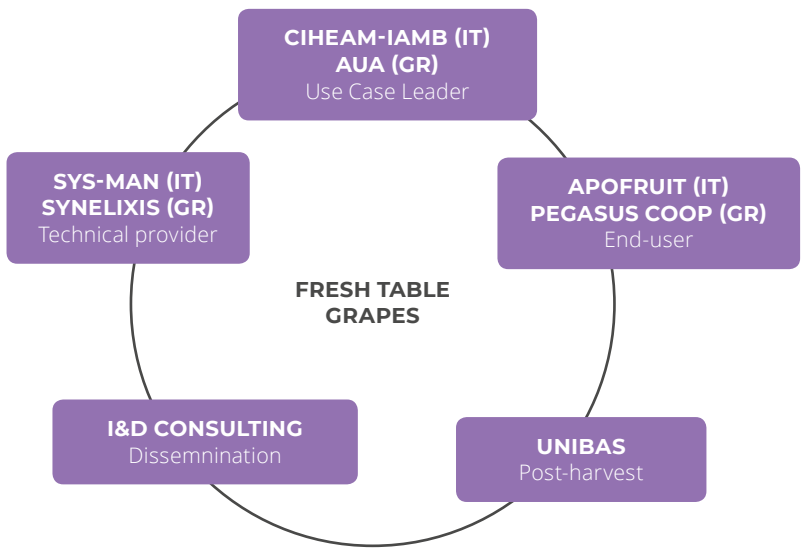
SHELF LIFE & QUALITY

INCREASED

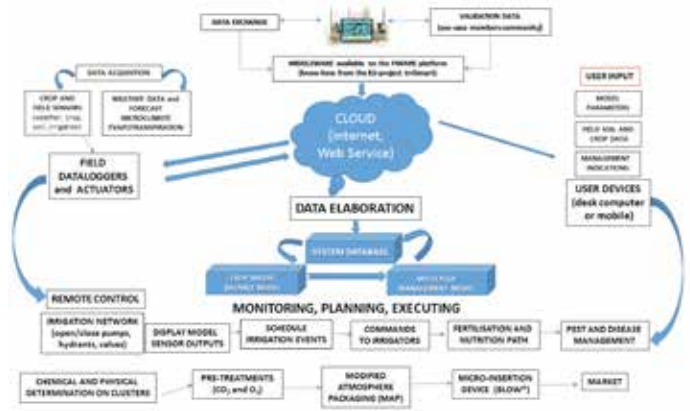
The challenge is to integrate existing technologies in table grapes (conventional and organic) value chain and deploy them from small scale to a larger scale. The implementation of IoT will produce economic benefits and positive environmental impacts due to better resource management (water, fuel and pesticide inputs).

COUNTRIES

PARTNERS



HOW IT WORKS



The solution provides detailed information on the major critical points of fresh table grape production: Irrigation, Table grapes managing, Pest management, Post-harvest. Installations are covering 10 ha in Italy and 5 ha in Greece, with more than 40 sensors installed in both countries and involving post-harvest techniques and two packing houses.

THE IMPACT

our Objectives

The goal of the Fresh Table Grapes is to test, develop and disseminate architectures, methodologies and strategies, for integrating heterogeneous IoT and Remote Sensing technologies on production and chain level into a coherent system, for a sustainable Fruit Sector.

on Economy

- Developing innovative business models for IOT managing of fresh table grapes "from fark to fork", more in specific:
- Reduction in irrigation costs,
- Reduction labor costs,
- Increased perceived quality,
- Increased price per unit,
- Increased shelf life duration.

other impact

Creation of an innovative ecosystem able to link farm activities with post-harvest quality with positive impact on the environment and on consumer's trust. Sensor introduction all along the value chain will improve the management and the quality of the finished product.

3.2 BIG WINE OPTIMIZATION

6/9

CURRENT TRL
& TARGET TRL

-20%

PESTICIDES &
FERTILIZERS COSTS

COUNTRIES

- Optimize the use of chemicals for plant protection through a precise identification of the moment and the product, as well as the exact needs for treatment in order to reduce environmental impacts, resource use and efficiently protect grape,
- Perform selective harvesting to reduce the inspection time and have accurate results,
- Avoid temperature and humidity issues thanks to winery monitoring, as they cause wine evaporation during summer times,
- Handle huge amount of data coming from 5 domains.

IoT technology allows to monitor weather, vine and key winery conditions in real time.

DENIS DUBOURDIEU DOMAINES
Winegrowing & Wine Producer.
END USER

PROCESS2WINE
Software developer specialised in tools for wineries and vineyards.
TECHNOLOGY PROVIDER

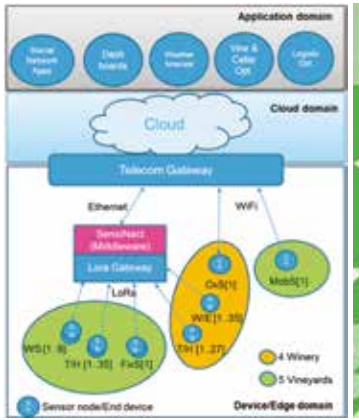
BORDEAUX INP - IMS LAB
Technical and scientific experts image analysis for vineyards.
TECHNOLOGY PROVIDER

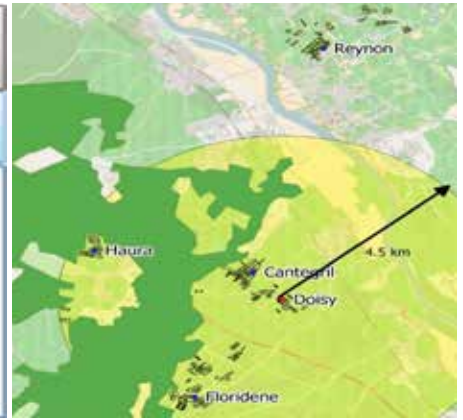
CEA-LETI
IoT Framework for Cloud and local data processing.
TECHNOLOGY PROVIDER

STMICROELECTRONICS
Provider of components for Smart nodes and Gateways solutions.
TECHNOLOGY PROVIDER

PARTNERS

HOW IT WORKS





IoT System based on a LoRa private network allowing:
- Data gathering in real time from both the vineyard (weather conditions, vine phenological stages) and the wineries (Temperature, Humidity, water and electricity consumption),
- Big data analysis,
- Decision-making at anytime and anywhere through specialized wine production applications running on mobile devices.

THE IMPACT

our Objectives

- Deploy 150 sensor nodes to gather data from 5 vineyards, covering 150 hectares and 4 cellars,
- Perform data analysis and facilitate decision making,
- Improve vine yield and wine production.

on Economy

- Reduced pesticides costs - 20%,
- Reduced fertilizers costs - 20%,
- Productivity gains (salaries and social charges),
- Increased annual savings due to accident prevention.

other impact

- Treatment frequency index,
- Cost reduction in phytosanitary measures and fertilizer use,
- Potable water use reduction in processing stage,
- Energy use reduction in processing stage,
- Reduction of GHG 600.

3.3 AUTOMATED OLIVE CHAIN

6/9

CURRENT TRL
& TARGET TRL

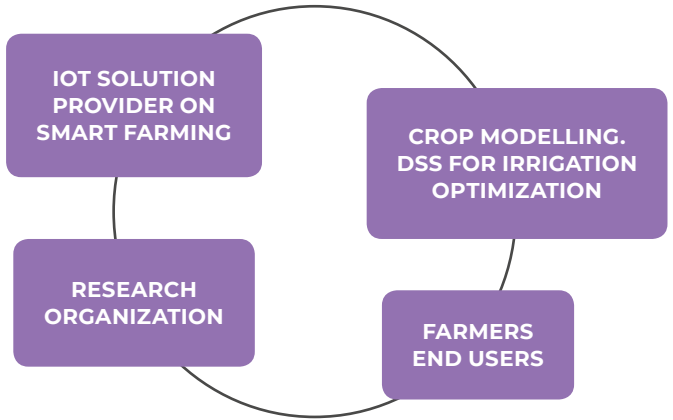
-20%

PESTICIDES &
FERTILIZERS COSTS

COUNTRIES

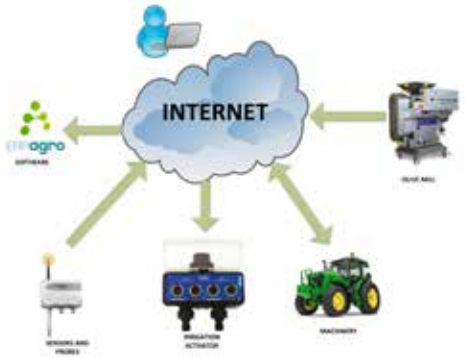
IoT technologies allow:

1. Automatically taking data from crops and post-harvest machines, in order to provide inputs for DSS (Decision Support Systems) models.
2. Optimizing resource consumption through the monitoring and controlling agricultural machinery.
3. Improving energy and water efficiency through the monitoring and controlling irrigation systems.
4. Calculating the water needs using agronomic models for optimized irrigation.
5. IoT-powered DSS that integrate crop monitoring, water needs calculation, automatic irrigation systems and agricultural machinery.



PARTNERS

HOW IT WORKS



Deployment of:

- Sensors and probes/supporting agronomic decisions,
- Remote actuators/irrigation process,
- Agricultural machinery/monitoring and controlling,
- Sensors in oil mills/monitoring and controlling key data,
- ERP Agro/data management from IoT platform,
- Agronomic models and algorithms for water needs and irrigation planning calculation.

THE IMPACT

our Objectives

- IoT boxes: soil sensors, probes, air and plants sensors (50 ha/ IoT box),
- Embedded ISOBUS data capture in harvesters and tractors,
- Fat and quality control using NIR sensors in olive mill,
- ERP solution for managing the process and the DSS,
- DSS modelling and algorithms for water needs and irrigation planning calculation.

on Economy

- Increase crop production,
- Reduce crop cost,
- Increase production quality,
- Crop per drop,
- Crop economic value per drop,
- Cost per drop.

other impact

- Lower residue levels in irrigation water,
- Lower residue levels in crop soil,
- Improved traceability.

3.4 INTELLIGENT FRUIT LOGISTICS

5/9
CURRENT TRL & TARGET TRL

> 10.000
MEASURED RENTAL TRIPS

> 1.000
TRANSPONDERS

COUNTRIES

Institut für angewandte Systemtechnik Bremen GmbH

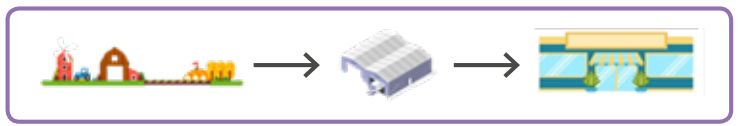
MIELOO & ALEXANDER

NXP

GS1 Germany

TECHNOLOGY & DEVELOPMENT ⟷ **STANDARDISATION & BUSINESS**

EUROPOOLSYSTEM



PARTNERS

Institut für angewandte Systemtechnik Bremen GmbH

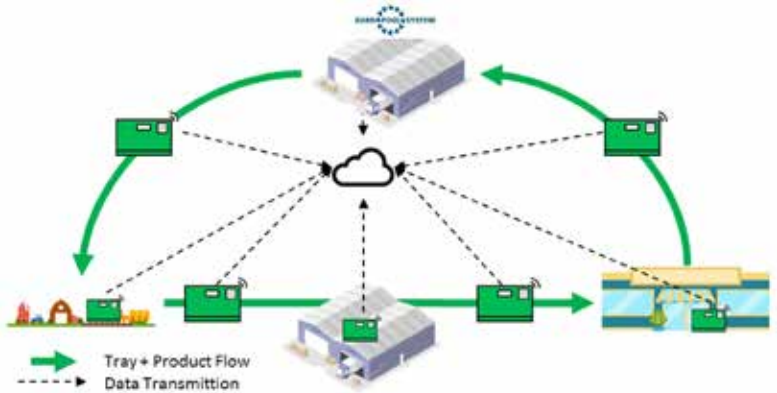
EUROPOOLSYSTEM

GS1 Germany

MIELOO & ALEXANDER

NXP

HOW IT WORKS



With this use case, we want to digitalize the tray by adding environmental sensors and communication technology to it. Data will be collected from the trays over the entire supply chain and stored on a cloud platform. With the help of a Smartphone Application, every member of the supply chain will have access to this cloud and data collected.

THE IMPACT

our Objectives
> 10.000 measured rental trips (with over) > 1.000 transponders including environmental sensors.

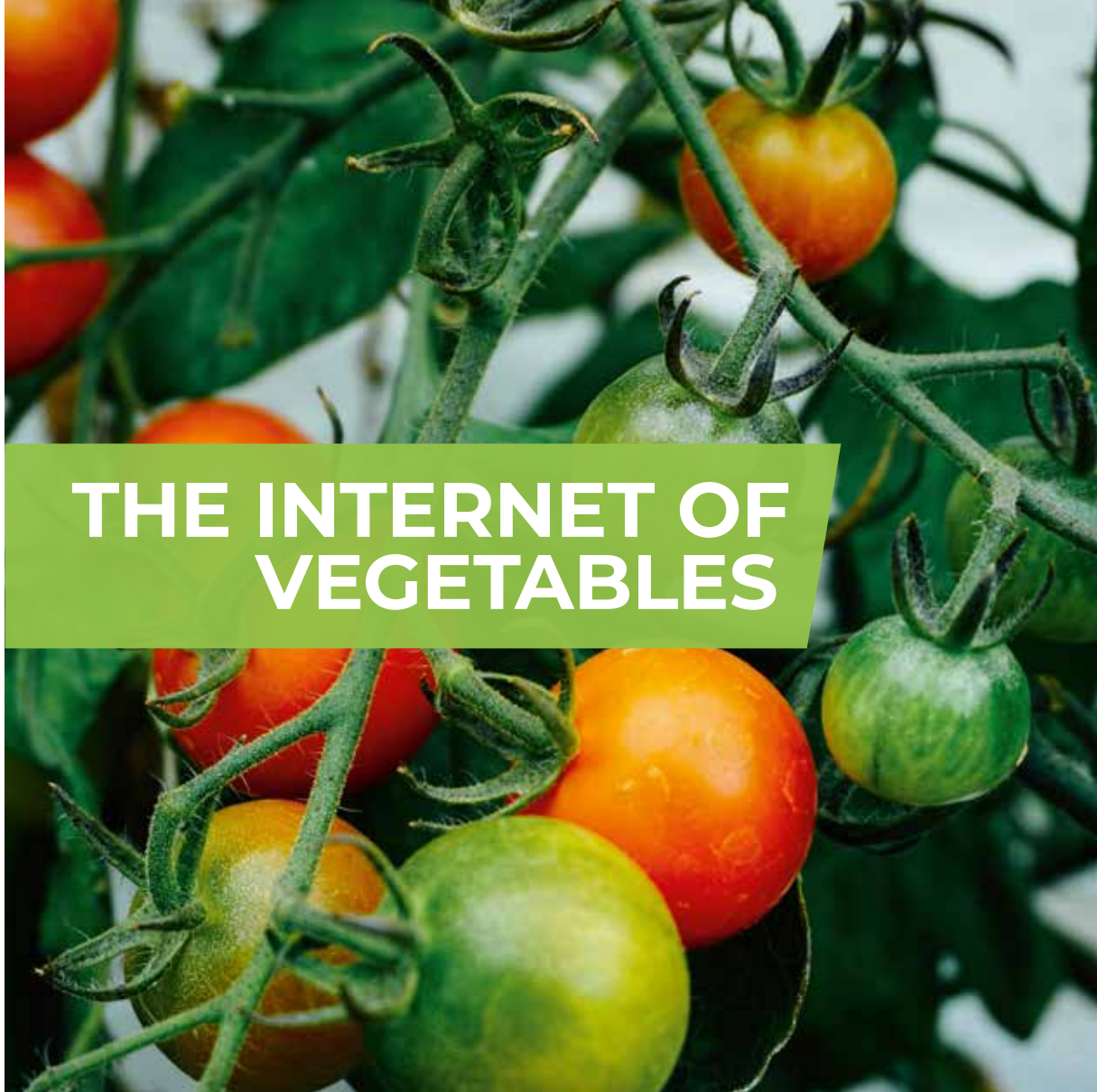
on Economy
- Optimized supply of pooling members with RTIs,
- Increased pool efficiency,
- Seamless tracking and tracing,
- Higher efficiency in quality management,
- Support in cases of theft or misuse.

other impact
- Reduction of food waste / better food quality,
- Reduction of CO_2 by better chain coordination,
- Possibilities for automation,
- Increased food safety,
- End-to-End visibility.

THE INTERNET OF VEGETABLES

The cultivation of vegetables can be done in different climate conditions, such as (fully) controlled indoor greenhouses with an artificial lighting system, semi-controlled greenhouses or non-regulated open-air cultivation. IoT-technologies can help to increase the efficiency of these production processes, e.g. water and nutrients consumption or the supply of artificial light. The vegetables trial aims to improve the quality and the productivity of lettuce and tomatoes in the controlled cultivation and weeding of the vegetables in organic production.

FOR MORE INFO:
IOF2020.EU/TRIALS/VEGETABLES



4.1 CITY FARMING LEAFY VEGETABLES

3/7

CURRENT TRL & TARGET TRL

SHELF LIFE

EXCELLENT SHELF LIFE AT AN ACCEPTABLE COST

LIGHTING

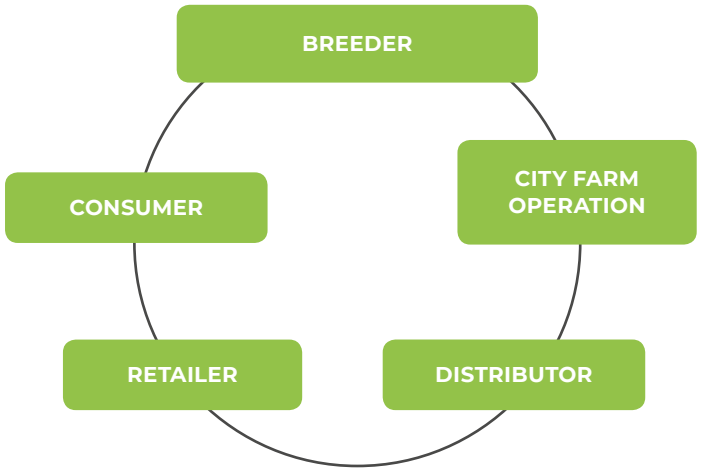
PROVIDE AN OPTIMAL SOLUTION

SENSORS

TO PROVIDE PROCESS FEEDBACK

COUNTRIES

Growing sufficient food of high quality for a growing population is becoming a challenge. There is a lack of arable land and a shortage of qualified growers. New and sustainable methods for producing food of high quality in a controlled environment with limited human intervention are required. City farming (a.k.a. vertical farming) is such a method that is gaining momentum.



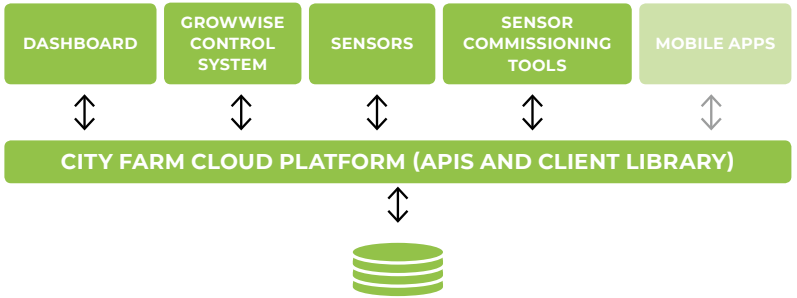
City farming is an innovation in food production that benefits all actors in the value chain.

PARTNERS

PHILIPS Lighting

StaayFoodGroup

HOW IT WORKS



- A data platform that enables storage and retrieval of data via web APIs and a client library.
- Sensors that measure relevant plant properties.
- A system for dynamically controlling the lighting (level and spectrum) for optimum plant growth.
- Cloud applications such as dashboards and tools (e.g. for commissioning sensors)

THE IMPACT

our Objectives

It is an aim of this use-case to develop an IOT sensing and control solution for city farms to be able to continuously monitor, automate, and improve their operations. This solution includes:

- The development of a lighting control system,
- The deployment of suitable sensors to measure plant growth parameters (typically 100 sensors per 1000 m^2 of growing area),
- The development of a data platform.

on Economy

The outcome of this use case will be an improvement of the city farms' efficiency, as well as its adoption rate. Relevant KPIs in this respect are the production yield (kg/m^2/year) and shelf life and nitrate content of the produce (with lettuce as key crop)

other impact

Compared to crop growth in open field and in greenhouses, city farms use far less water and crop waste. Moreover, no pesticides are used.

4.2 CHAIN-INTEGRATED GREENHOUSE PRODUCTION

6/9
CURRENT TRL
& TARGET TRL

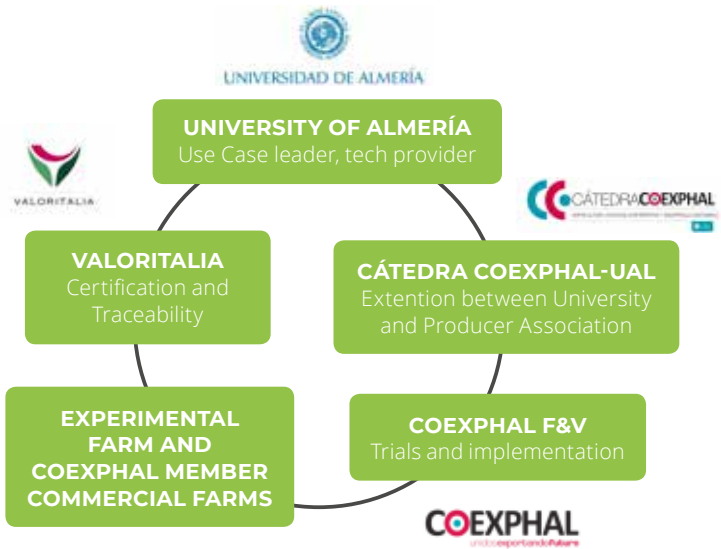
QUALITY
TRANSPARANCY
IN FOOD QUALITY

COST
& INPUT
REDUCED

COUNTRIES

The main challenge is to integrate an IoT solution for DSS in the value chain of greenhouse tomato-crops to ensure vegetable quality. That will happen through:

- Obtaining optimum ambient conditions during the whole chain, reducing inputs and increasing energy efficiency and avoiding/reducing the use of pesticides,
- Using technology and data sharing as essential tools in each of the phases based on transparency and process information.



PARTNERS

COEXPHAL

UNIVERSIDAD DE ALMERÍA

CÁTEDRA COEXPHAL

VALORITALIA

HOW IT WORKS

This IoT web-based DSS, developed using FIWARE, integrates information from sensors, field notebook, lab analysis and models. Information on production and management in the whole supply chain is available to end-users to help them taking decisions and to provide value added information related to crop growth and climate and irrigation setpoints to fulfill quality, sustainability and traceability objectives.

THE IMPACT

our Objectives
An IoT web-based Decision Support System (DSS) platform for greenhouse tomato supply chain focusing on water, energy and other inputs to achieve efficiency, transparency and safety.

on Economy
Greenhouse vegetable economic efficiencies based on:

- Increased production,
- Reduced costs and inputs,
- Reduced volatility of market and
- Added value of the product.

other impact

- Increasing system sustainability through water and energy efficiency, and through reducing the use of pesticides and underground water contamination,
- Providing transparency about food quality and process information to consumers.

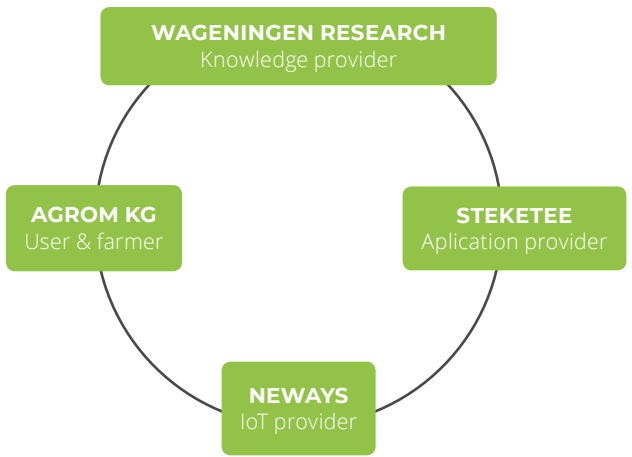
4.3 ADDED VALUE WEEDING DATA

5/8
CURRENT TRL
& TARGET TRL

+ 5%
PRODUCTION
CROP/M^2

- 5%
WORK TIME

Weeding is one of the most important and frequent activities in organic vegetable farming. Since a few years automated intra row weeding machines entered the market based on machine vision, to detect the crop and weeds. To get the (organic) production to a higher level, the farmer needs site specific information about his crop. Therefore, data on crop, field and weather need to be gathered. As the farmer needs to perform multiple tasks, the decision support for crop management needs to be user-friendly. By using IoT devices we can easily combine multiple data sources to support the grower.



COUNTRIES

PARTNERS

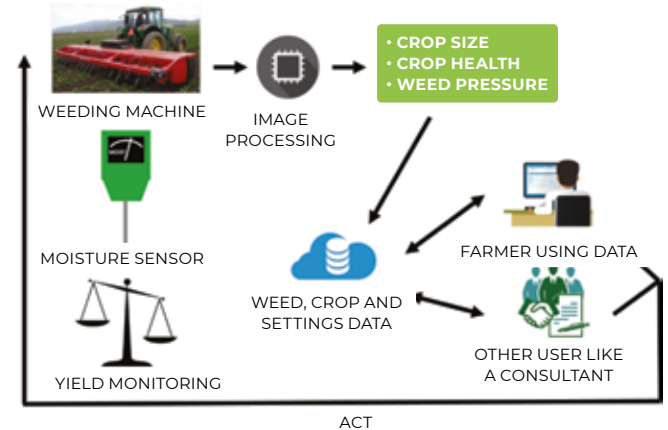
Steketee

WAGENINGEN UNIVERSITY & RESEARCH

AGROM

NEWAYS Technologies

HOW IT WORKS



The main component is the camera system in the Steketee machine, which will acquire the images that will be processed. The data gathered from the images will be supplemented with yield and field data.

THE IMPACT

our Objectives
Through improved crop and field monitoring, resulting in better field management we aim to reduce the labor required for organic crop production, while improving the yield.

on Economy
- Crop yield +5%,
- Sales turnover +5%.

other impact
- Work time -5%,
- Prediction uncertainty -10%.

4.4 ENHANCED QUALITY CERTIFICATION SYSTEM

5/9
CURRENT TRL & TARGET TRL

-90%
HUMAN ERROR

-5%
CERTIFICATION TIME

-50%
USE OF PAPER

To offer quality certification system improvement that will:

- Lead to a reduction of inspection/certification time/efforts and increased reliability,
- Limit redundancies (overlapping among certification schemes).

VALORITALIA
Certification company, private company

UNIVERSITY OF ALMERÍA
Research center and Technology provider

COEXPHAL
Technology user-Association of Producer Organisations

SUBCONTRACTOR
IoT provider

COUNTRIES

PARTNERS

VALORITALIA

COEXPHAL

UNIVERSIDAD DE ALMERÍA

uqido

HOW IT WORKS

VAT 1

VAT 2

VAT 3

VAT CONTENT
- HACCP data
- Winery log-book
- Field log-book
- Sensor Data
- Pesticide analysis

- Date
- Equipment used
- Type of cleaning
- Frequency
- Operator

- Name of the PDO
- Year of Production
- Amount tored
- Other storage vats
- *History*

- Temperature
- Level
- Colour
- Density
- Torbidity

- The auditor reaches the winery location thanks to GPS data and knows where the wine is located in the cellar,
- The producer can couple his expertise in chemical data analysis with data from sensors for better control over the fermentation and aging processes,
- Wine enthusiasts and specialists can discover the production process and access real time data by using virtual reality.

THE IMPACT

our Objectives
Implement the enhanced certification system in at least 2 wineries using augmented reality and virtual reality.

on Economy
- Certification time (-5%),
- Certification cost (-5%),
- Travel and consumable cost (-10%),
- Brand value (+10%).

other impact
- Human error (-90%),
- Auditor satisfaction (+10%),
- Producer satisfaction (+10%),
- Use of paper (-50%),
- Trust in quality products (+50%),
- Auditor performance (+15%).

THE INTERNET OF MEAT

The meat trial aims to improve the meat production chain's value through the application of IoT-technologies. The use-cases include the management and optimization of pork production by on-farm sensors and slaughterhouse data. In addition, it will attest the role of IoT-technologies in poultry chain management, and communicate about meat transparency and traceability.

FOR MORE INFO:
IOF2020.EU/TRIALS/MEAT

5.1 PIG FARM MANAGEMENT

5/7
CURRENT TRL & TARGET TRL

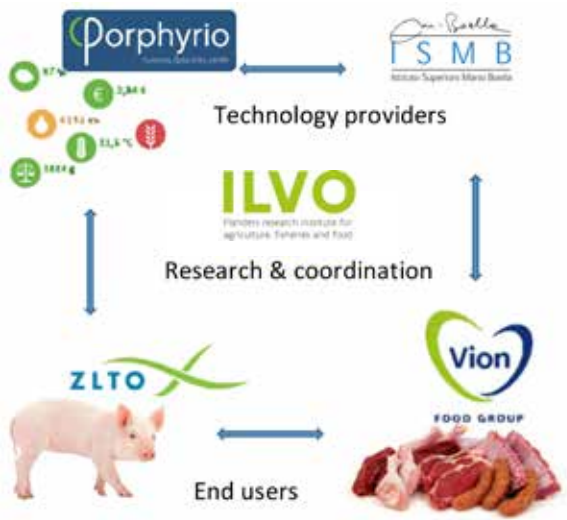
> 2.000
PIG RECORDS

- 10%
PIG MORTALITY

+ 10%
FEED EFFICIENCY

COUNTRIES

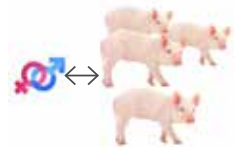
The pig sector is facing challenges of high costs, difficult economic situation and increasing pressure concerning welfare and greenhouse gas emissions. This use-case will work on combining data across the value chain in order to provide the pig farmers with crucial information to effectively steer their management to reduce health problems and boar taint, increase productivity, etc. This information is currently lacking, fragmented or collected only post-hoc.



PARTNERS

HOW IT WORKS

GENETICS → PIG FARMER → SLAUGHTER HOUSE → MEAT PROCESSOR → RETAIL → CONSUMER



- Climate
- Feed
- Water
- Weight
- ...

- Production
- Boar taint

Survey;
Need for info?

- Dashboard with analytics, early warnings and predictions based on on-farm sensors and chain level data,
- State-of-the-art sensors and warning systems for individual pig monitoring,
- IoT data platform and adaptors for several devices at the pilot sites,
- Compatibility with UC 5.3 Meat transparency and traceability.

THE IMPACT

our Objectives
- 5 farms (incl. 1 organic),
- heterogeneous data streams,
- over 2000 pig records,
- IoT data platform,
- early warning systems,
- boar taint presence reports,
- chain, group and individual level data.

on Economy
- Decrease health problems -10%,
- Reduce boar taint -20%,
- Increase average daily gain + 50g/day,
- Increased feed efficiency +10%.

other impact
- Reduce pig mortality -10%,
- 500 Consumers participating in survey,
- 5 Farmers attached to system,
- 5 Technology/data providers attached.

5.2 POULTRY CHAIN MANAGEMENT

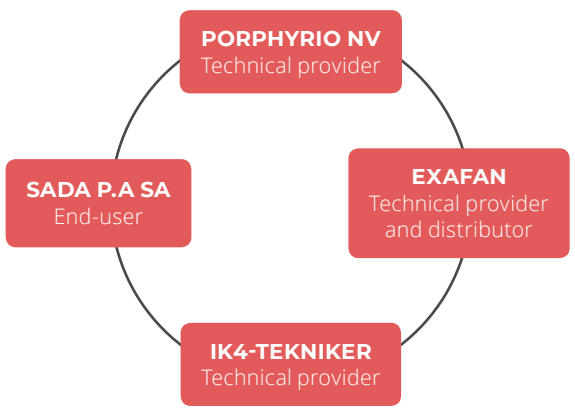
5/9
CURRENT TRL & TARGET TRL

130
MULTIMAGNITUDE SENSORS

4
FARMS

Three critical points define the efficiency and product quality of the poultry meat, starting from the broiler farm to the processing plant. In each step, IoT technology brings value, and moreover, linkage between these steps adds a second level of value.

- Farm level: Monitor and optimize growing process to achieve a uniform and precisely measured slaughter weight,
- Logistics: Monitor and optimize broiler handling and transport to reduce impacts on the poultry and increase comfort levels,
- Processing plant: Optimize slaughtering and improve rendability and product-market fit, with information from all stages.



COUNTRIES

PARTNERS

HOW IT WORKS

The data sources provide inputs for both Farm and Chain securized cloud-based Platforms (mainly in FIWARE components) leading to Early Warning System, Birds Manipulation Assistant, Environmental Assistant, Production Management DSS and Data Visualization to assist poultry meat production chain.

THE IMPACT

our Objectives
- 4 farms: 80 environmental and weight sensors,
- 5 environmental sensors for trucks,
- 5 smart watches: monitor bird manipulation on load and unload,
- Farm and Chain Platforms.

on Economy
- Flock´s average weight and uniformity improvement: +10%,
- Death reduction in production and transport: - 10%,
- Class A birds increase: 20%,

other impact
- Decrease feed waste: 10%,
- Decrease antibiotics use: 15%,
- Improve animal welfare (improve physical conditions and decrease birds' death): 15% less treatments.

5.3 MEAT TRANSPARENCY AND TRACEABILITY

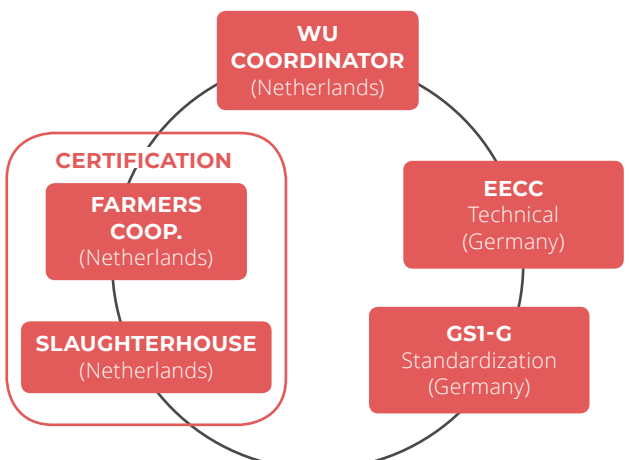
3-5
CURRENT TRL

6-7
TARGET TRL

>50%
REDUCTION INSPECTION COSTS

SHARE
DATA OF PORK QUALITY WITH SUPPLY CHAIN

The production chain around meat is complex: data about the quality and provenance of meat products must be made available securely to different stakeholders, with different levels of granularity. The main challenge is how to enhance transparency and traceability of meat based on a well-known transparency standard taking into consideration the diverse needs of stakeholders.

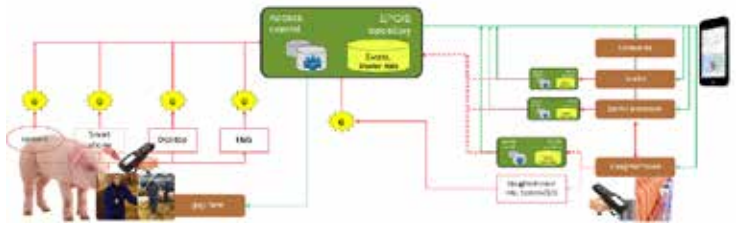


COUNTRIES

PARTNERS

A Dutch sustainable pork cooperative consisting of farmers and a slaughterhouse

HOW IT WORKS



Description: We provide a digital transparency system based on the well-recognized EPCIS standard. This free and open standard enables value chain partners to share information about the movement and status of products as they travel through the value chain. Our system answers key questions about WHAT, WHERE, WHEN and WHY to meet business, consumer and regulatory demands. This includes information about the animal's life cycle (from birth to slaughter) and the life cycle of the resulting meat products after slaughter. When necessary information about breeding and feed could be included. In relation to certification schemes, this means that certifiers can access data in real-time and supply actors can get timely feedback.

THE IMPACT

our Objectives
To support meat quality certification schemes by enabling the use of real-time data for targeted inspection, thereby increasing the quality of inspections and at the same time reducing inspection costs as well as increasing transparency on meat quality welfare.

on Economy
Significantly reduce inspection cost (>50%).

other impact
Significantly increase inspection quality and transparency.

KEY FACTS:

- Funding Scheme: Horizon 2020, Industrial Leadership, IOT-01-2016
- Contribution of the European Union: € 30 million
- Total costs: € 35 million
- Duration: 4 years, 2017-2020
- Consortium: 70+ partners
- 5 trials: arable crops, vegetables, fruits, meat and dairy
- 19 use-cases
- € 5-6 million open call in 2018

FOR MORE INFO:
IOF2020.EU

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