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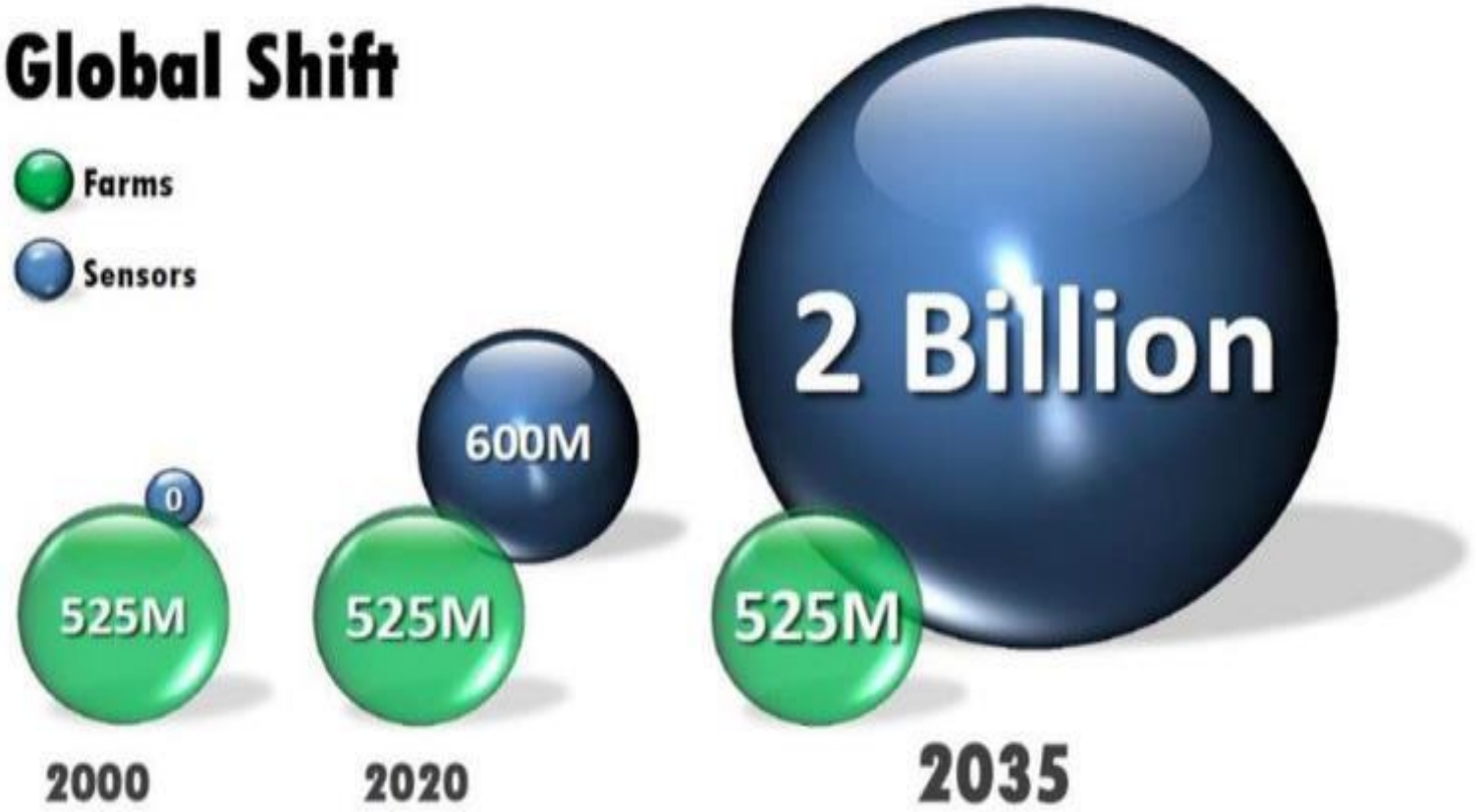
Mainstreaming digital farming for a Climate Smart Agriculture in Europe

Harnessing Research and Innovation for FOOD 2030

Brussels, 16 October 2017

Volume of sensors in agriculture



Data Need per Plant

0.5 kB/corn plant/year

2250 acres per 2 GB thumb drive

- Amazon charges $0.36/GB/yr for storage.
- Raw data storage cost approaches $300/yr for 5,000 ac farm with 10 years of data

Defining attributes for

- Leaf
- Ear
- Stalk
- Tassle
- Root Mass

0.85 kB/plant/yr

Growing Conditions

Crop + Soil + Weather + Irrigation

Image courtesy of Corn and Soybean Digest / Mitchell Farms

Precision Ag Data Generation - Today

Source: http://bit.ly/1KUVVoR

Image Data Need per Plant

Image Data Generation – Future

- 24 bits per pixel
- 2.0 cm/pixel
- 5 overflights/season
- 4.6 kB/plant of image data

Source: http://bit.ly/1KUVVoR

Solutions

New Crop Varieties

Smart Crop Protection

Precision Agriculture

Internet of Things

Remote Sensing

Big Data Analytics

Not an Easy task for the farming community

81% of the Danish and 78% of the US famers preferred to store the data themselves.

88% of the US famers preferred not to store the data in a shared Internet-based database explaining the reluctance of software vendors to push in this direction, which further emphasize the importance of farm data ownership.

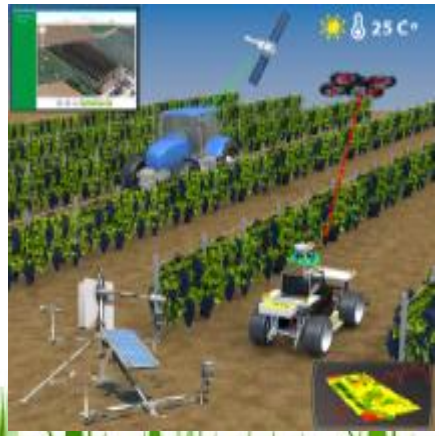
(Fountas et al., 2005. Precision Agriculture 6, 121-141)

SMART-AKIS PROJECT Info

- **TITLE:** European Agricultural Knowledge and Innovation Systems (AKIS) towards innovation-driven research in Smart Farming Technology.

THIS PROJECT HAS RECEIVED FUNDING FROM THE **EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME** UNDER GRANT AGREEMENT N. 696294

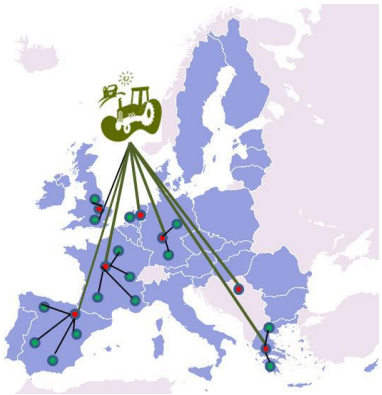
- **FOCUS:** Smart Farming technologies: Application of ICT into Agriculture, leading to a Third Green Revolution:
  - ✓ Information Management systems.
  - ✓ Precision Agriculture.
  - ✓ Automation & Robots.



SMART-AKIS APPROACH

- **APPROACH:** Involvement of a wide range of actors of the Agricultural Knowledge and Innovation Systems (AKIS) following a "MULTI-ACTOR" approach:
  - ✓ Farmers,
  - ✓ Research,
  - ✓ Industry
  - ✓ Extension Services / Consultants / Advisors.

- **PARTNERSHIP:** 13 partners from Belgium, France, Germany, Greece, Netherlands, Serbia, Spain and UK, representing research, farmer community, advisory/extension services and the agricultural equipment industry.



SMART AKIS PARTNERS:

WHY SMART FARMING?

- Response to the global food challenge of feeding more than 9 billion people in 2050.

- Sustainability (resource efficiency) and competitiveness (increased yield) challenges of the European agricultural sector, lagging on Smart Farming adoption.

- Technological, social, regulatory and economic factors hinder the widespread adoption of Smart Farming in EU.

APPROACH

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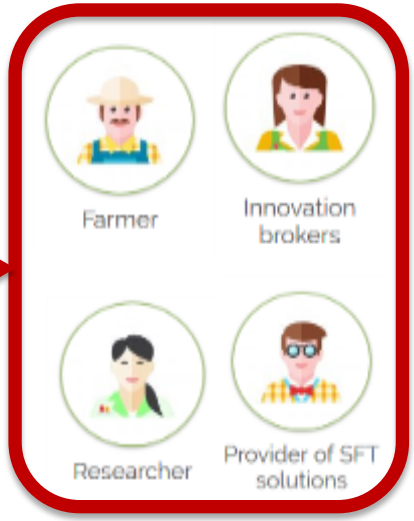
Smart Farming Thematic Network

RESEARCH
Assessment of farmers' needs

KNOWLEDGE
Inventory of SFT

INNOVATION
Multiactor networking: Innovation Workshops in 7 countries and 2 International Worlshops for new projects

SMART FARMING PLATFORM



POLICY
Policy recommendations and dissemination

SERVICES & OUTPUTS

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RESEARCH:

- Reports on needs of farmers from France, Germany, Greece, Netherlands, Serbia, Spain and UK.
- Report on factors hindering the adoption of Smart Farming in Europe.

KNOWLEDGE:

- +1500 SFT solutions, projects and papers compiled and assessed.

INNOVATION:

- 7 Innovation Hubs in France, Germany, Greece, Netherlands, Serbia, Spain and UK have hold Innovation Workshops for generation of innovation and market uptake projects.

SMART FARMING PLATFORM:

- Searchable database of +1500 SFTs.
- Assessment tool for best technology selection.
- Message board for actors networking.

POLICY:

- 1 EU & 7 national policy recommendations reports.

ONLINE SURVEY created for MAPPING Smart Farming Technologies (SFTs): SMART FARMING PRODUCTS, PROJECTS & ARTICLES

- Tech category: Mapping, Variable Rate, Controlled traffic, Information management system & Robotics.
- Info: Specification of cropping systems, crop & field operation. Description and dissemination materials.
- Benefits: Environmental, yield and work conditions benefits.

OPEN CALL to SFT providers (ag equipment machinery, SMEs, startups and spin-offs) and research community through CEMA, partners channels and Social media.

SMART FARMING PLATFORM as the main entry point for:

- Online survey available all along the project.
- SFTs compiled in tech database available from Jan. 2017 onwards.
- Users will be able to assess the SFTs according to innovation & interest.

Data entries:

- A total of >1250 entries in the platform
- 800 scientific articles (from 13.000 initially screened)
- 210 research projects
- 240 commercial products

KNOWLEDGE Snapshots

- Alliances with consultants for better penetration and adoption. Smart farming as a service an emergent business model that might fit farmers' needs.
- Further adoption of SFT might demand innovation in terms of lower costs, size of equipment, interoperability and usability
- Many instances report an increase in revenue and reduction in labour time
- Research projects mainly focus on crop and soil scouting of crops
- Product SFTs require more ha's compared to research SFTs
- Adoption of commercial SFT fit for bigger farms, while research SFT are more prone to be used and experimented in smaller farms

RESEARCH 1: FARMERS NEEDS & INTERESTS ON SMART FARMING:

1. Challenges important for farmers to be addressed with SFTs
2. Perception of farmers of SFTs as able to overcome challenges.
3. Information sources on SFTs by farmers.

- 271 farmers interviewed following a survey of 129 questions.
- 48% of them considered as SFT adopters.

	France	Germany	Greece	Serbia	Spain	Netherlands	UK	Total
Arable	21	25	10	16	8	26	16	122
Orchards	0	0	27	10	0	9	0	46
Field veg	16	2	4	0	4	9	4	39
Vineyards	10	1	27	10	16	0	0	64
Total	47	28	68	36	28	44	20	271

RESEARCH Outcomes

- Main challenges: Crop disease reduction & soil conservation
- Perception: High doubts about the ability to SFT to solve problems.
- More valued sources of information: independent private advice, other farmers, and agri-tech providers. 67% of the farmers surveyed recently had sought out information on SFTs.
- Most useful SFTs: 1) robots for monotonous work processes (e.g. weeding, hoeing, harvesting), 2) real-time diagnostics via drones, satellite imagery, or smart phone sensors , 3) integration of various SFT, and 4) data for information and decision support.
- Areas of improvement of SFTs: information (e.g. turning data into useable information, reducing complexity in data presentation), cost and size.
- Innovation ideas: Building, adapting, and adjusting machinery to improve work processes.

Identify innovation cases across the Innovation Hubs

- Step 1: Identify innovation cases from project partners
- Step 2: Select cases from a multi-actor selection body

innovations have already reached a certain level of implementation and a number of users. Practice partners are keen to cooperate in the case study

- Step 3: Analysis and synthesis of the selected cases

plantix

- Plantix selected innovation case from Germany
- the user takes pictures of the damaged plants and in return receives information about the respective problem
- 150,000 registered users
- 10,000 pictures every day

INNOVATION: REGIONAL & CROSS-BORDER

REGIONAL INNOVATION

- Holding of 3 multi-actor Innovation Workshops in France, Germany, Greece, Netherlands, Serbia, Spain and UK.
- General Framework & Guidelines of Workshops agreed and dates planned.

Goals:

- Give feedback to the SFT solution providers.
- Provide inputs to researchers for the definition of commercialization strategies.
- Generate innovative uses for SFT solutions.
- Foster the development of new SFT solutions.

Expected outcomes: MULTI-ACTOR PROJECTS

Barriers for the adoption of SFT:

- As expected, differences were observed among more advanced countries (Netherlands, France, UK and Germany) and countries with SFT less widespread (Serbia and Greece).
- Main barriers mentioned were:
  - Cost-benefit is uncertain
  - Difficulties in using equipment and lack of "Plug&Play"
  - Lack of specific subsidies and access to funding
  - Lack of compatibility among equipment (old one), systems and data formats
  - Need for adaptation to local context (size, topography)
  - Lack of training and information, high speed of SFT development
  - Accurate data colection and reliability of data
  - Need for demonstrations on farm level (not at SFT level) and need for practical research
  - Data ownership

Incentives for the adoption of SFT

- Reduction of inputs
- Useful for complying with regulation (CC, fertilisers…)
- Easiness of data recording
- Reduces labour and monotonous tasks

Interest in adoption

- In all hubs, farmers were eager to adopt new technologies, being in general more hesitant about digital platforms' usefulness.
- Their interst strongly depends on their farm type
- Results from early adopters could help laggers to make right decision (guinea pig syndrom!)
- Need for "ground truthing" for more than 1 season: network for benchmarking and international cooperation

Potential new uses of SFT

- Combine data registration with governmental systems for regulation compliance
- Correlate crop imaging data with soil data
- Early disease detection
- Use info collected with crop sensors for crop protection and crops status documentation
- Use digital platforms info also for market relevanti info (aonymous publication of input prices…)

Interest in adoption

- In all hubs, farmers were eager to adopt new technologies, being in general more hesitant about digital platforms' usefulness.

Ideas for research (16 all from the UK!) – to demonstrate the interest!! :

- Do we know how farmer behaviour and practice will change when info on SFTs is more available?
- What are good ways to promote Knowledge Transfer?
- Should research be manufacturer/supplier led? Or research led? Or farmer instigated?
- Understand how to develop new business models and value chains by new types and uses of SFTs
- Find from farmers and growers what data is most useful for them and at what cost?
- Pass this information to SFT developers to help target (more) appropriate innovation
- How to detect problems (disease, weeds etc.) earlier
- The good experiences with e.g. Yara-N Sensor should encourage more on-machine-systems e.g. for blackgrass detection and immediate sprayer control that avoids separate imaging operation
- Determine impact on energy use [chemical fertiliser can be about 50% of all energy use in ag]

Ideas for research (all from the UK!) – to demonstrate the interest!! :

- Do different plant architectures, shapes, planting formats give better application results when e.g. using drones?
- Improve and/or focus the spectrum of cameras for more specific information
- Develop autonomous vehicles
- Help to commercialise technology (loans to developers and "early adopters")
- Interaction between researchers and government and minimising the funding gap for the good of the industry and getting SFT to the user
- Will support roles (agronomist, equipment service and supplier etc.) change? Or even disappear?
- Seems to be much SFT on the edge of breaking through but hasn't yet. Should there be research into finding out why it doesn't become fully commercial?

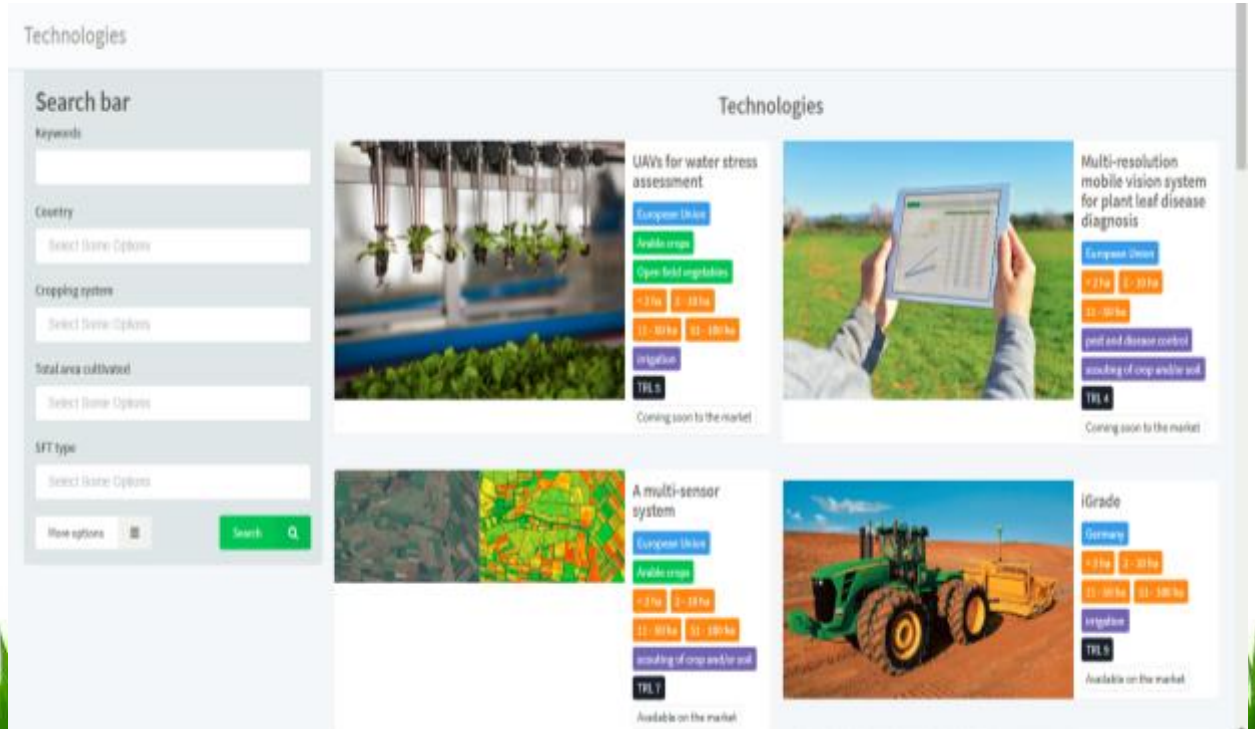
SMART FARMING PLATFORM

FREEE & OPEN ONLINE PLATFORM, main entry point for Smart AKIS SERVICES, embedded on webportal. Available from Feb. 2017 onwards.

Target Groups: Farmers, industry, researchers and advisers.

4 Services offered:

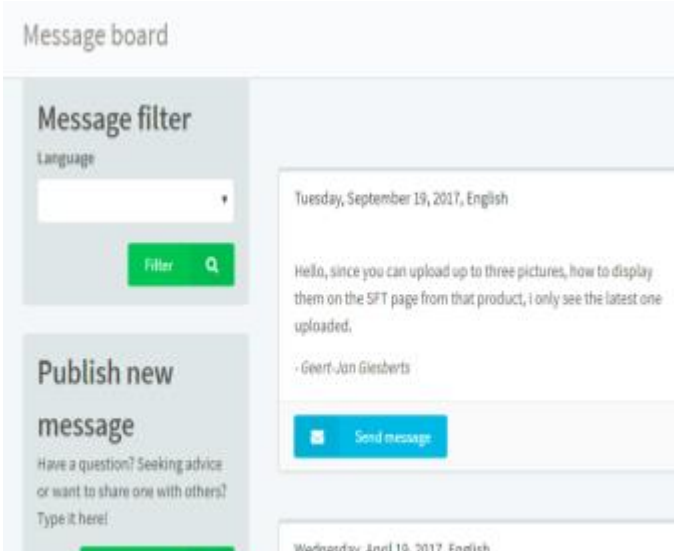
1. **TECH FEED: Online survey for SFT mapping**
2. **TECH BROWSE: Searchable SFTs database. Results on Technology Cards with SFT info, support materials ands benefits, open to users rating.**

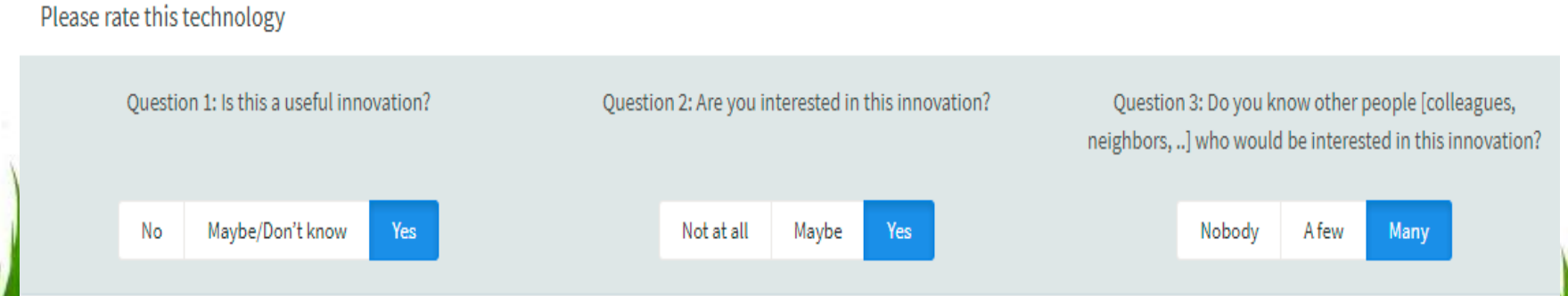


SMART FARMING PLATFORM

3. QUICK ASSESSMENT TOOL: Survey open to Farmers and Advisory Services that will proposes the most suitable SFTs following their needs, using a new algorithm.

4. MESSAGE BOARD: Open board for posts by registered users to be filtered by country, SFT and subject, open to be responded on the board or privately.

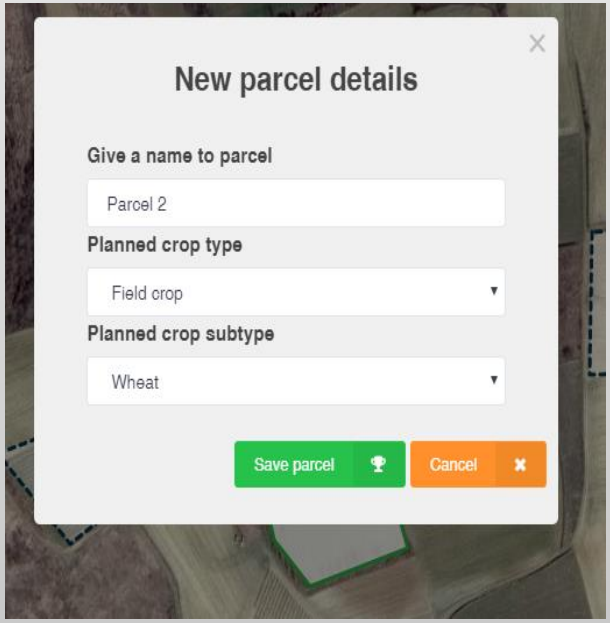




Farmers benefit from Smart-AKIS through AgriSens

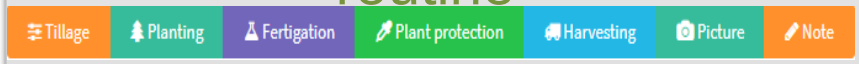
New user

Basic personal information
Basic parcel details

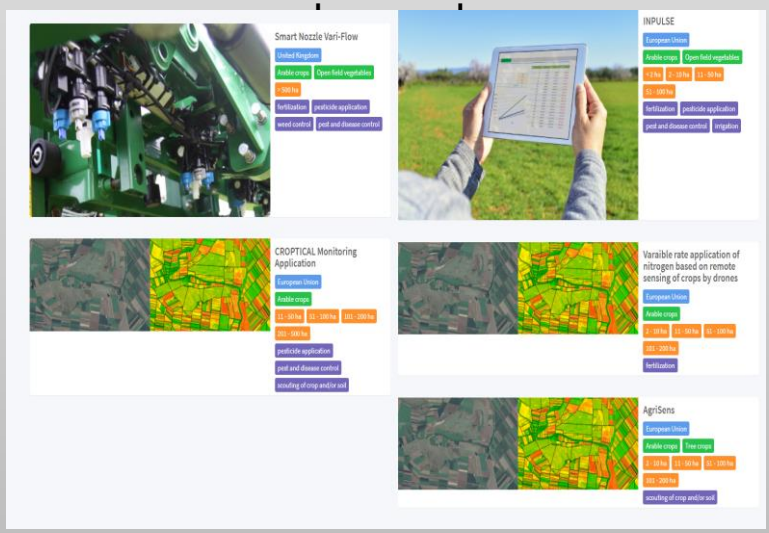


→ the platform automatically suggests relevant technologies

Already registered user updates farming routine



After inserting new farming practice, the system will in real-time process new inputs and suggest technologies that can



Success in first 2 weeks in Serbia

AgroSense

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- **Total registered users: 616**
- **Total number of App downloads: 483**

Multi-Actor lessons learned

- What is the main added-value and what are the main difficulties linked to the MAA during the implementation/ realisation phase of the project?

- MAA has transformed research projects within H2020 in comparison to FP7 projects

- The projects and the results are directly communicated with the end-users

- - Competition among commercial companies with similar products to come to the same table

Multi-Actor lessons learned

- Do the actors involved in the MAA projects adapt their attitude, role and skills by learning from one and other? (Changes and gaps between initial role and implementations activities?)

- Farmers were more open to discuss their problems and concerns regarding SFTs with the commercial vendors, while more actors were involved (agronomists, researchers, peer farmers)
- Commercial vendors tried to adapt their attitudes and be more pragmatic, when all actors were in the table
- Researchers tried to talk in practical terms and not superficial research outcomes, when commercial vendors and farmers were involved

Multi-Actor lessons learned

- Best practices & Bottlenecks (examples) solutions to connect H2020 with OGs? Added-value of connecting H2020 projects with other national, regional projects and networks (beyond OGs).

- EIP-AGRI Service point helped us identifying all OGs related to SFTs and we have contacted them regarding our project. Great!

- The problem is how the National/Regional projects get to know the results of TN or H2020 projects!. This is a bottleneck!.. No connection and communication, especially when project partners are not from the country or interest

Multi-Actor lessons learned

- How to better spread (accelerate the uptake of) end-user material produced by H2020 projects? How to ensure sustainability and easy access of H2020 end-user material on the long term? How to inter-connect and link end-user material coming from different projects?

- Practice Abstracts is a very good idea, as it will be easily accessed! However, they should be easily accessed by search engines (google, firefox, etc)
- Too many platforms and projects websites with so valuable information, but not interconnected!
- Projects should be funded to gather the generated knowledge, at least for the TN.

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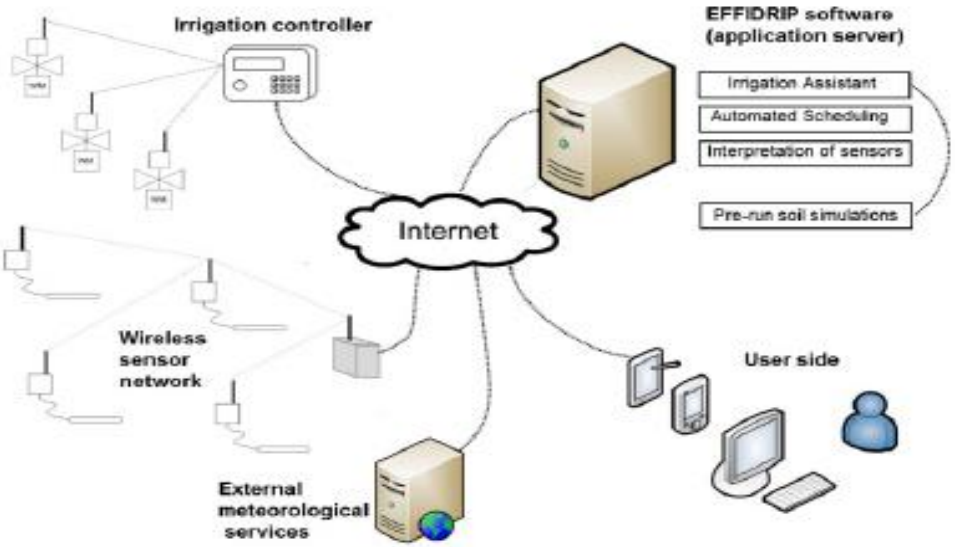
eip-agri
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 696294

Practice Abstract

EFFIDRIP system: "Enabling next generation commercial service-oriented, automatic irrigation management systems for high efficient use of water, fertilizers and energy in drip irrigated tree crops."



Title	EFFIDRIP system: "Enabling next generation commercial service-oriented, automatic irrigation management systems for high efficient use of water, fertilizers and energy in drip irrigated tree crops."
Title (native language)	
Category	• Farm Management Information System • Robot or smart machine
Short summary for practitioners (Practice abstract) in English)	EFFIDRIP is an ICT-based tool for supporting the management and supervision of irrigation and fertigation. In particular, it has been conceived for localized irrigation systems in tree crops although its use could be extended to further scenarios. Its overall objective is to offer a cost-effective tool that provides the end-users (farmers or technicians) effortless irrigation and fertilization management, as well as easy and reliable supervision of the state of the irrigation system. EFFIDRIP aims at relieving farmers from most of the tasks involved in acquiring data, re-scheduling, reprogramming and supervising the application of efficient irrigation.
Short summary for practitioners	
Website	http://effidrip.eu/
Audiovisual material	
Links to other websites	

Practice Abstract

Effects of this SFT

Productivity (crop yield per ha)	Some increase
Quality of product	Some increase
Revenue profit farm income	Some increase
Soil biodiversity	No effect
Biodiversity (other than soil)	No effect
Input costs	Some decrease
Variable costs	Some decrease
Post-harvest crop wastage	Some decrease
Energy use	Some decrease
CH4 (methane) emission	Some decrease
CO2 (carbon dioxide) emission	Some decrease

N2O (nitrous oxide) emission	Some decrease
NH3 (ammonia) emission	Some decrease
NO3 (nitrate) leaching	Some decrease
Fertilizer use	Some decrease
Pesticide use	Some decrease
Irrigation water use	Large decrease
Labor time	Some decrease
Stress or fatigue for farmer	Some decrease
Amount of heavy physical labour	Some decrease
Number and/or severity of personal injury accidents	No effect
Number and/or severity of accidents resulting in spills property damage incorrect application of fertiliser/pesticides etc.	Some decrease
Pesticide residue on product	No effect
Weed pressure	Some decrease
Pest pressure (insects etc.)	Some decrease
Disease pressure (bacterial fungal viral etc.)	Some decrease

Information related to how easy it is to start using the SFT

This SFT replaces a tool or technology that is currently used. The SFT is better than the current tool	strongly agree
The SFT can be used without making major changes to the existing system	agree
The SFT does not require significant learning before the farmer can use it	disagree
The SFT can be used in other useful ways than intended by the inventor	no opinion
The SFT has effects that can be directly observed by the farmer	agree
Using the SFT requires a large time investment by farmer	disagree
The SFT produces information that can be interpreted directly	agree

Thank you for your attention!

www.smart-akis.com

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