Software for Farmers - FMIS

Area 4 – **Entrepreneurship in Farming**

Lesson – **Toolkit for Agripreneurs 4.0**

Sequence ID – **54**

Agrosap

SPARKLE

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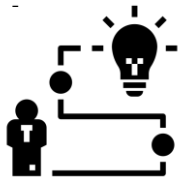

+12 years experience on PA hardware, sensors & development

DISCLAIMER

A4.L12.T4 Software for Farmers - FMIS

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Jorge Martinez Guanter , *Software for Farmers - FMIS*, © 2020 Author(s), CC BY-SA 4.0 International, DOI 10.36253/978-88-5518-044-3.56, in Marco Vieri (edited by), *SPARKLE - Entrepreneurship for Sustainable Precision Agriculture*, © 2020 Author(s), content CC BY-SA 4.0 International, metadata CC0 1.0 Universal, published by Firenze University Press, ISSN 2704-6095 (online), eISBN 978-88-5518-042-9, DOI 10.36253/978-88-5518-044-3

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New ICT Paradigm

Heterogeneity on biosystems

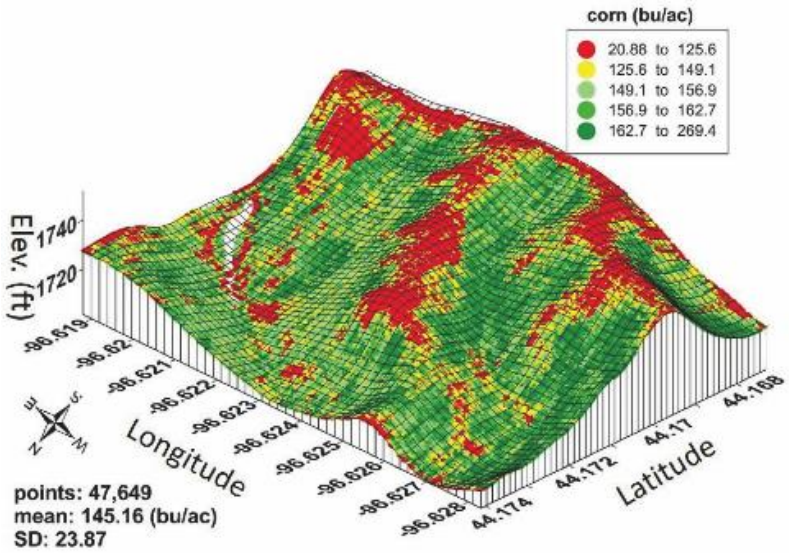
Soil & Crop as a continuum of **variability**

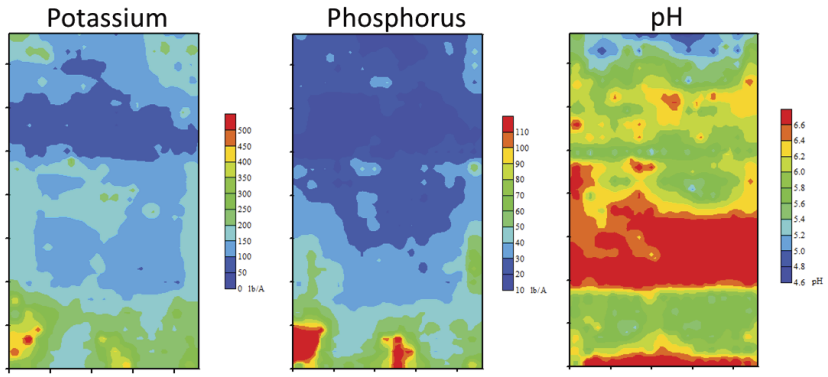
Advances in computing and electronics applied to agriculture

Amount of DATA

↓

Actuable Information





Images: Kitchen & Clay, PABasis (2018)

Register or management?

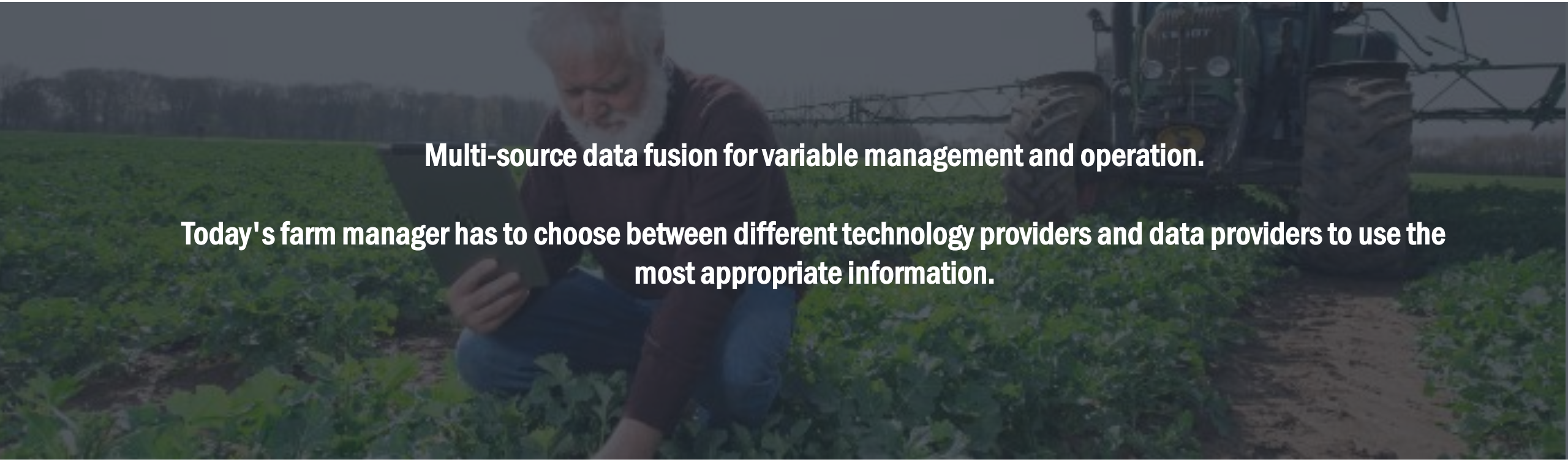
<No activity records>

Simple records (not digitized) of basic aspects

Complex systems that respond to communication and data needs between DBs to meet the needs of different actors.

The current situation:
too many unstructured and disaggregated data sources and that management systems can be too complex for users.

Register or management?



Multi-source data fusion for variable management and operation.

Today's farm manager has to choose between different technology providers and data providers to use the most appropriate information.

Processes incorporated in an FMIS

Data Collection

Sensors, maps, open data, real time, georeferenced...

Process & Computing

Data analysis, ML, BigData, edge computing

Data Storing

Local, in the cloud, open-data, blockchain

Spreading

User interfaces, multi-device

Sources for data collection: platforms

Proximal sensing

Sensors on mobile platforms

Remote sensing

UAVs, Satellites, Airplanes...

Static measurements

WSN measuring soil, crop & climate conditions.

Data streaming to Cloud and VRA control

Direct platform connectivity & standarization

Real-time data flow

Bi-directional information & fleet coordination

Measuring: sensing technology

GNSS: positioning, topography.

Visible: weed detection, guidance..

Multispectral: vegetation index, diseases

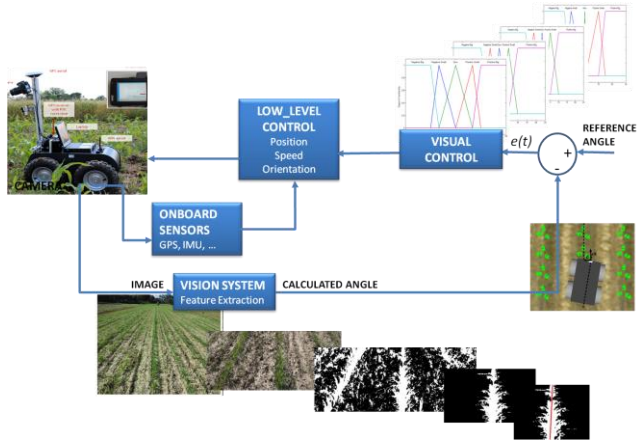
Distance (depth sensors, LiDAR): 3D crop modelling

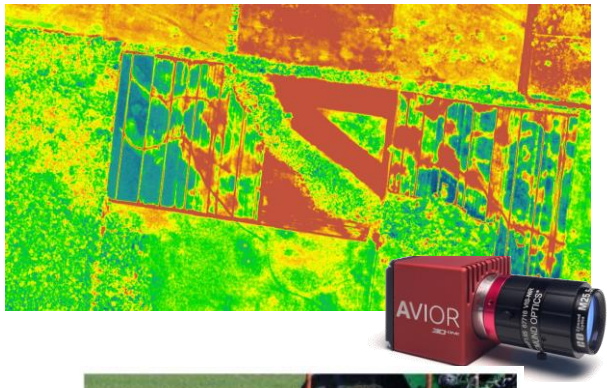
Electroconductivity: soil properties, sap rate,

Passive gamma ray: soil properties

Ground Penetration Radar: soil properties

Force, resistance and other sensors

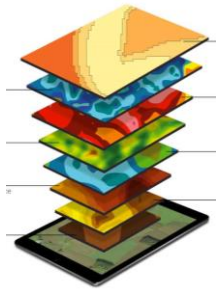




Modelling: data fusion

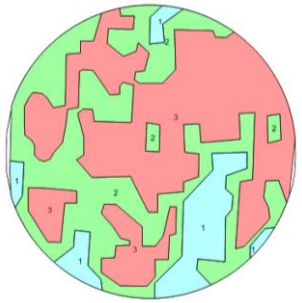
High-level architecture

Map based (offline)



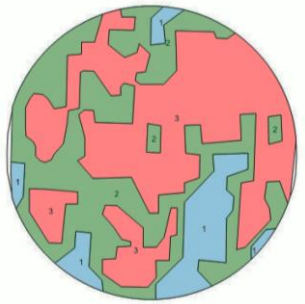
Normalization
Fuzzy Cognaitive maps
Machine Learning

Management zones

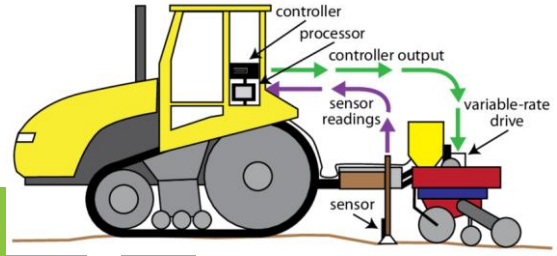


Agronomic Strategies:
Homogenize the c
Increase EUN
Increase yields...

Prescription maps



Sensor based (on the go)



RT Sensor readings

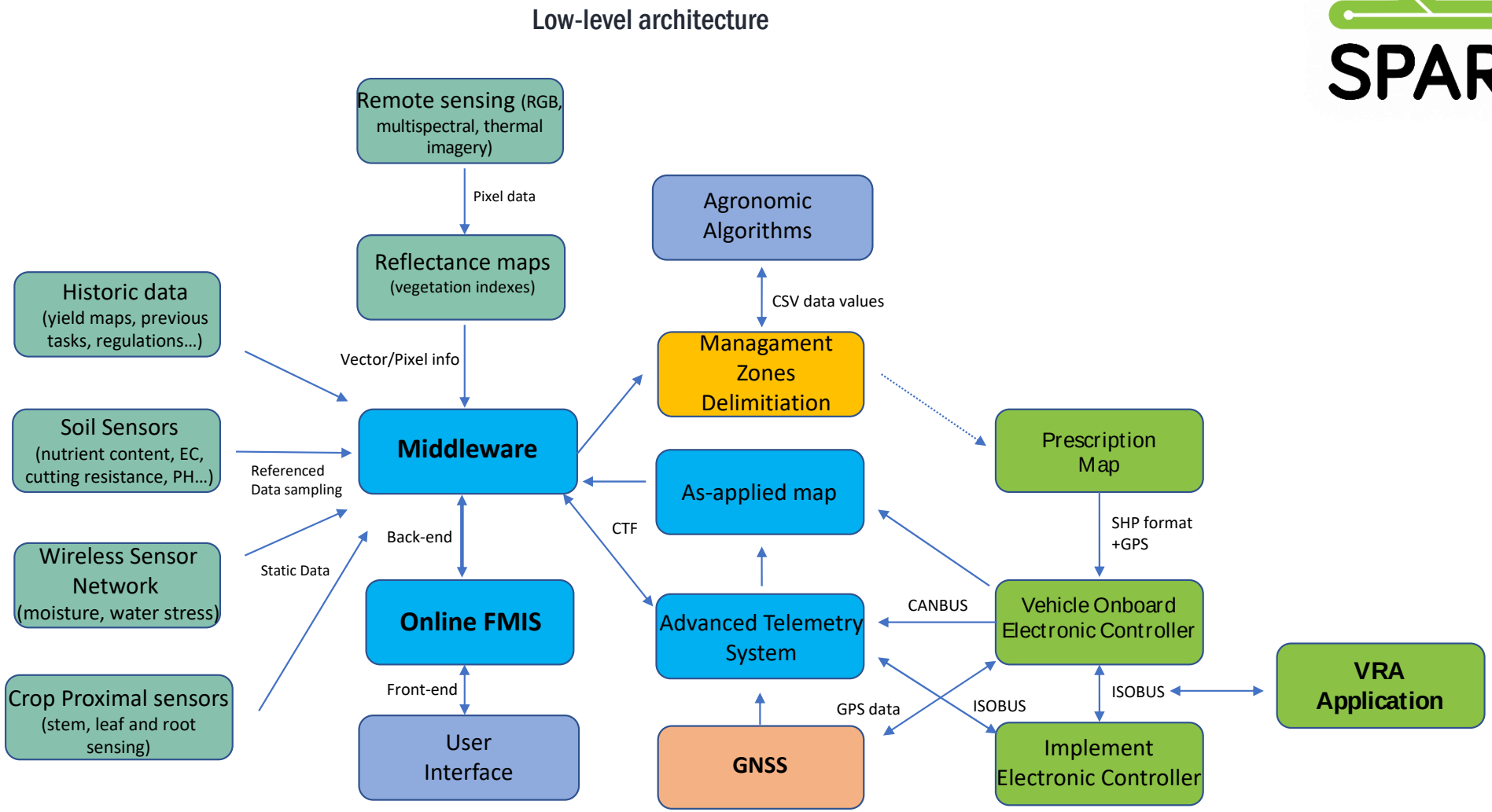
Mixed Alternative

Middleware

Rate calculation equation
(statistical/regression model)

Actuator / Implement

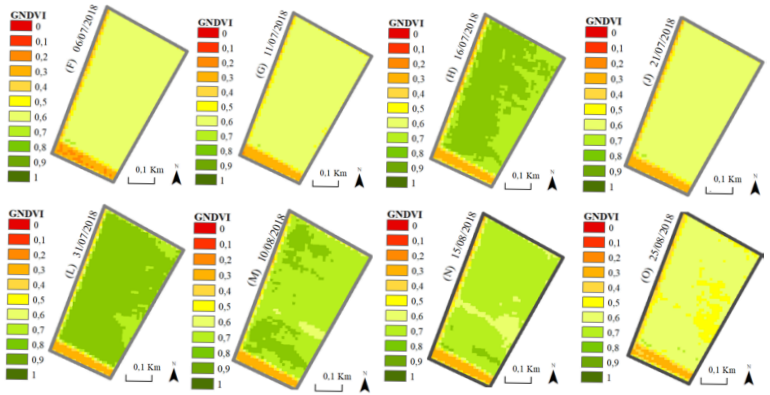
Modelling: data fusion

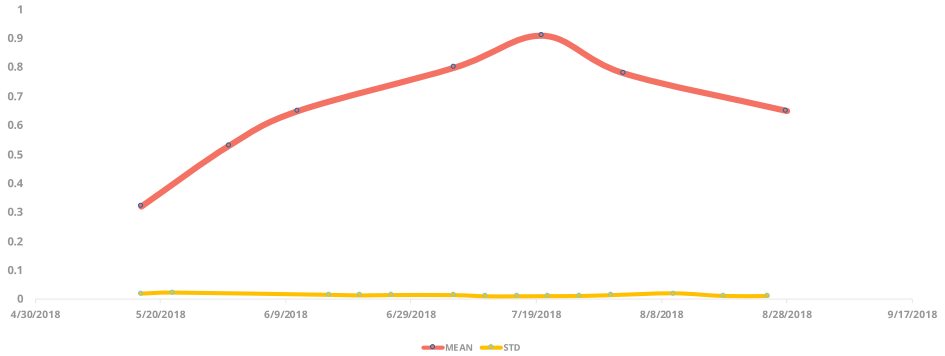


+ deal with unstructured data & local/national regulations

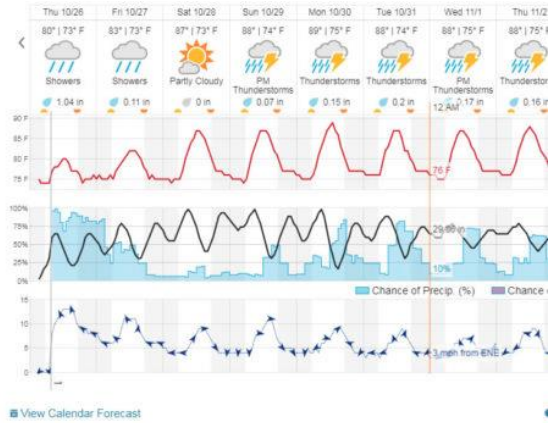
Modelling: data fusion

Temporal variability / in season / season to season





Include weather forecasts?



Precision irrigation
- Adjust irrigation to ET
- Minimize percolation
- Significant water savings

Precision application
- Pests & Disease prediction
- Crop response to application

FMIS User-centric approach

Specific farmer-oriented designs

Dedicated user interfaces

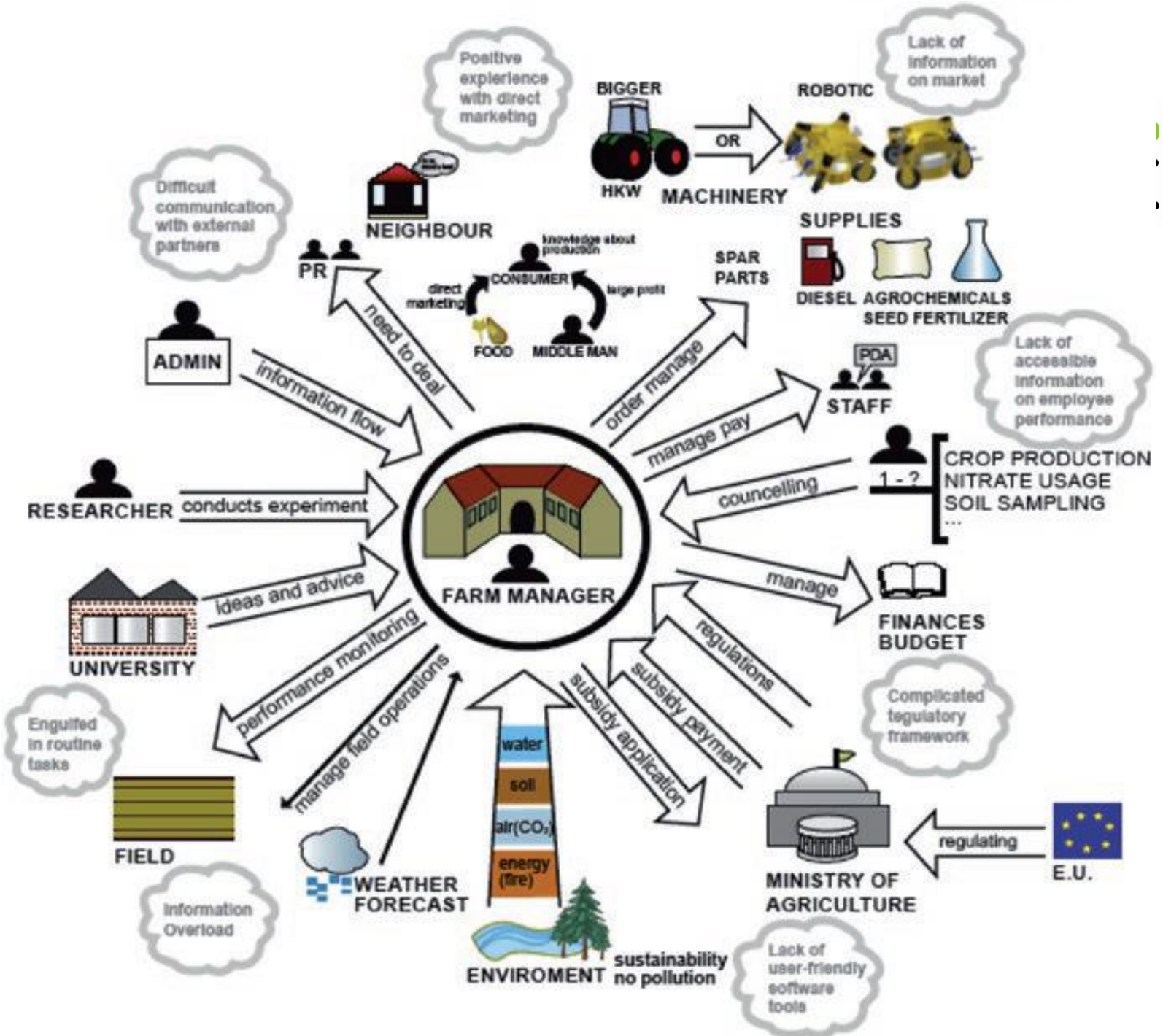
Automated data processing functions

Expert knowledge

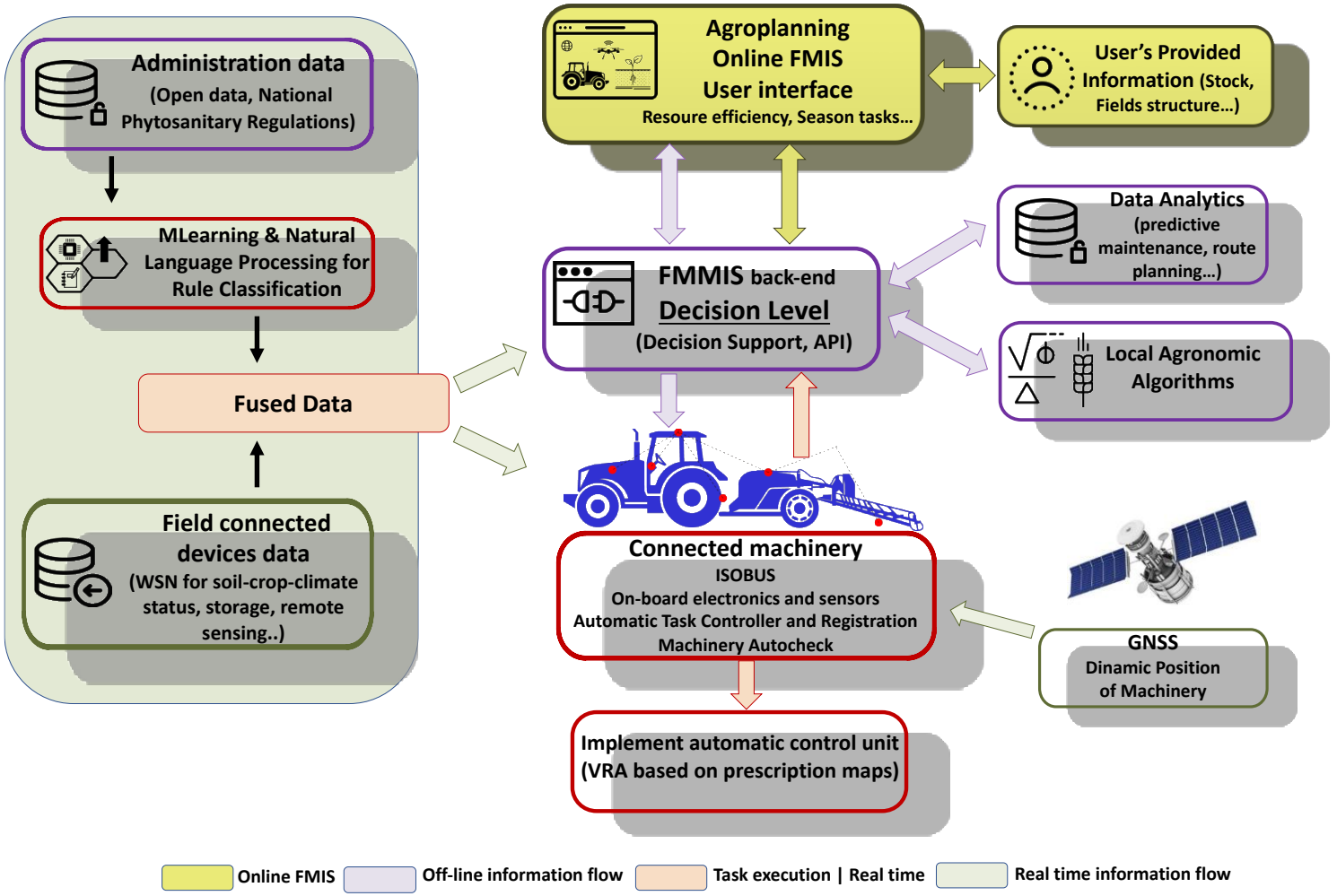
User preferences,

Standardized data communication

Scalability



FMIS
Farm machinery centric approach



Features of an FMIS

Management of field operations	Recording of farm activities to optimize crop production by planning activities and observing the actual execution of planned tasks. Preventive measures can be initiated based on the monitored data.
Best Practices	Tasks and production methods related to the application of good practices according to agricultural standards (e.g. organic standards, integrated crop management).
Accounting	Estimation of the cost of each agricultural activity, input-output calculations, cost of equipment, labour requirements per unit area. Expected and actual costs are also compared and included in the final assessment of the economic viability of the farm.
Inventory and Stock	Monitoring and management of all production materials, equipment, chemicals, fertilisers and planting and sowing materials. Quantities are adjusted according to the farmer's plans and customer orders.

Features of common FMIS

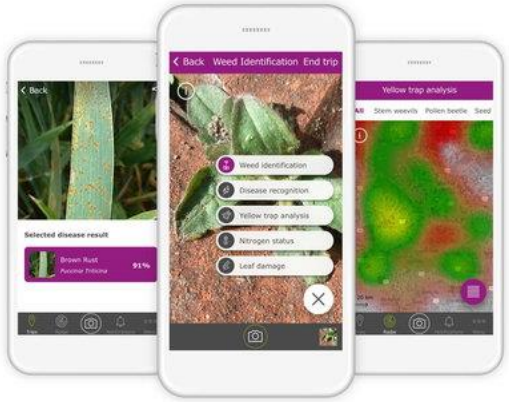
Traceability	Crop and products traceability, using an identification labeling system to control the product of each production section, including the use of inputs, employees and equipment, which can be easily archived for quick retrieval.
Reports	Creation of agricultural reports, such as planning and management, work progress, worksheets and instructions, order purchases, cost reports and plant information.
Site-Specific o VRA	Mapping of field characteristics, analysis of collected data, generation of input variables to optimize input and increase output. This is the Precision Farming Technologies component. It can be a separate or integrated software.
Sales	Order management, charges for services and online-sales.
Machinery monitoring	Management of orders, service charges and online sales. It includes details of equipment usage, average cost per hour of work or per unit area. Also includes fleet management and logistics.
Human resources management	Management of employees, availability of employees in time and space, management of work times, pay, qualifications, training, performance and experience..

Some examples of FMIS

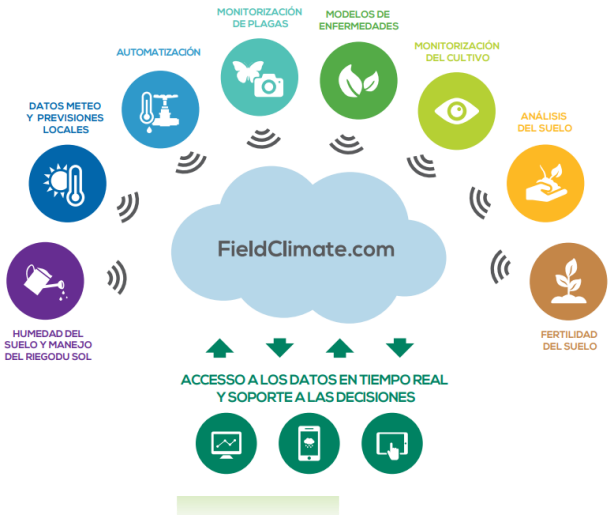
User (Data-centric)

Agroptima

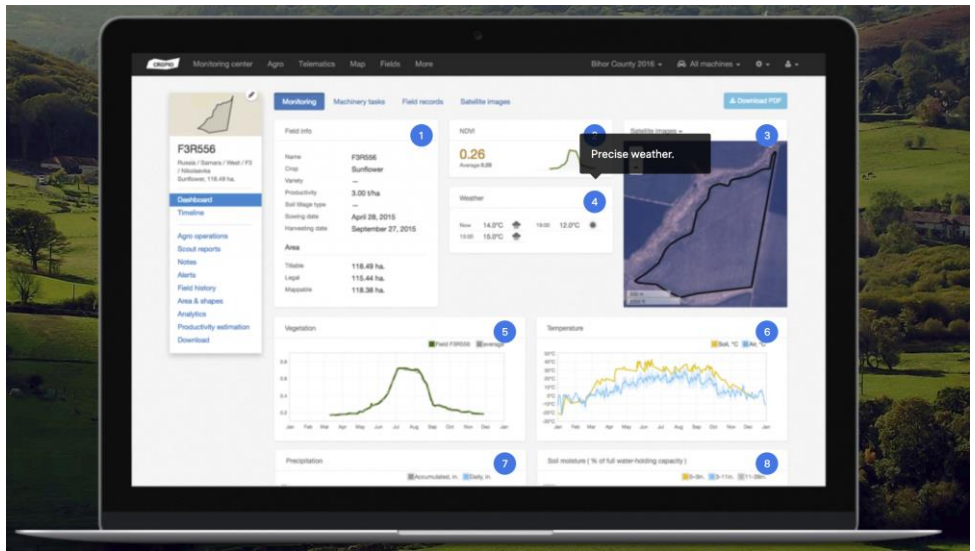
Xarvio



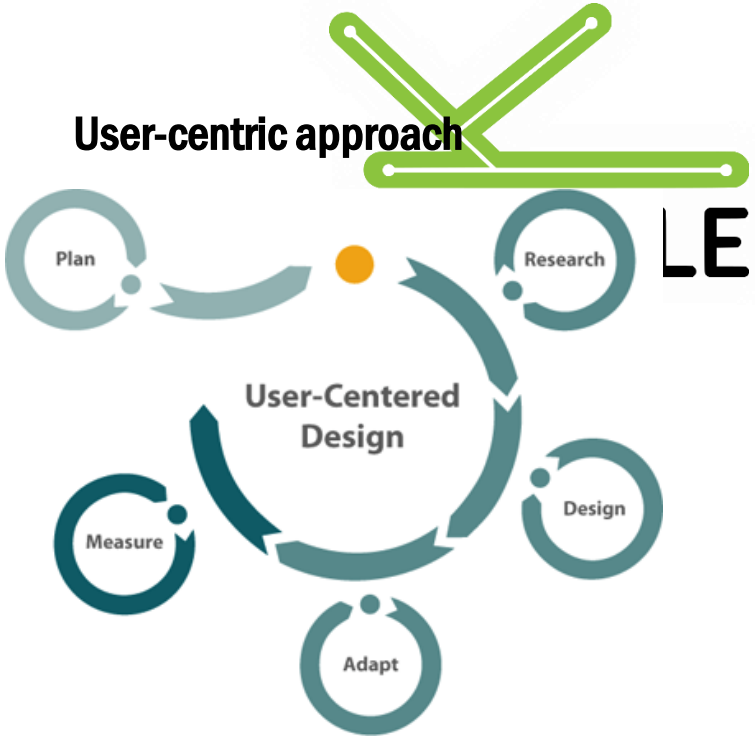
Field Climate from METOS



Cropio



User-centric approach



The user-centered approach implies that all decisions are made by focusing on the agricultural technician or producer through whom the decisions pass.
These systems should not be confused with automated systems that include some kind of Human-in-the-loop parameter, in which they take into account past decisions for future decisions.

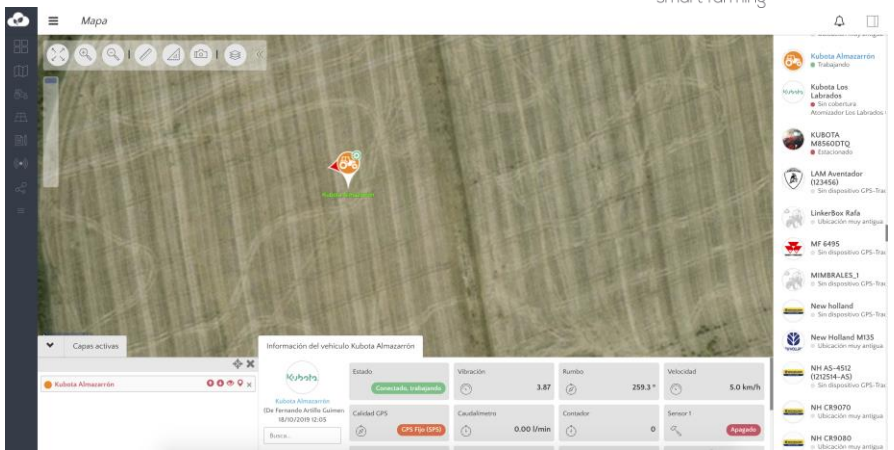
Some examples of FMIS

Tractor-centric approach

Trimble AgSoftware

MyJohnDeere FMMIS

Agroplanning



Machinery-centric approach

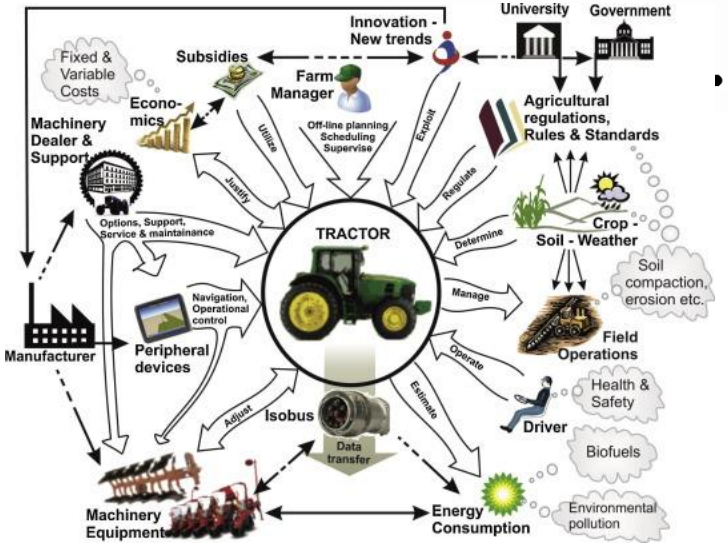


Image: Fountas et al (2015).

A tractor-centric approach involves putting the agricultural vehicle at the heart of the system, and understanding it as a data collection center in the field. The so-called Farm Machinery Management Information System seeks this and obtain real information with field platforms.