FEDER UNACOMA
Federazione Nazionale Costruttori Macchine per l'Agricoltura

Digital agriculture

Terms and Definitions

By AgriDigital

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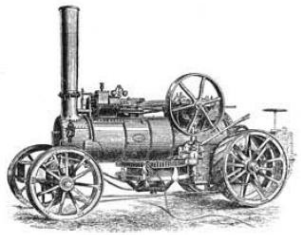
introduction

A bit of history

Agriculture 1.0
Mechanisation



STEAM ENGINE — **1676**

LOCOMOBILE — **1812**

Agriculture 2.0
Endothermic engine and electrification

2T AND 4T — **1891**

ELECTRICAL SYSTEM — **1930**

Agriculture 3.0
Electronics and Software (Precision Agriculture)

ISOBUS — **1990**

GPS — **2000**

Agriculture 4.0
ICT + IOT

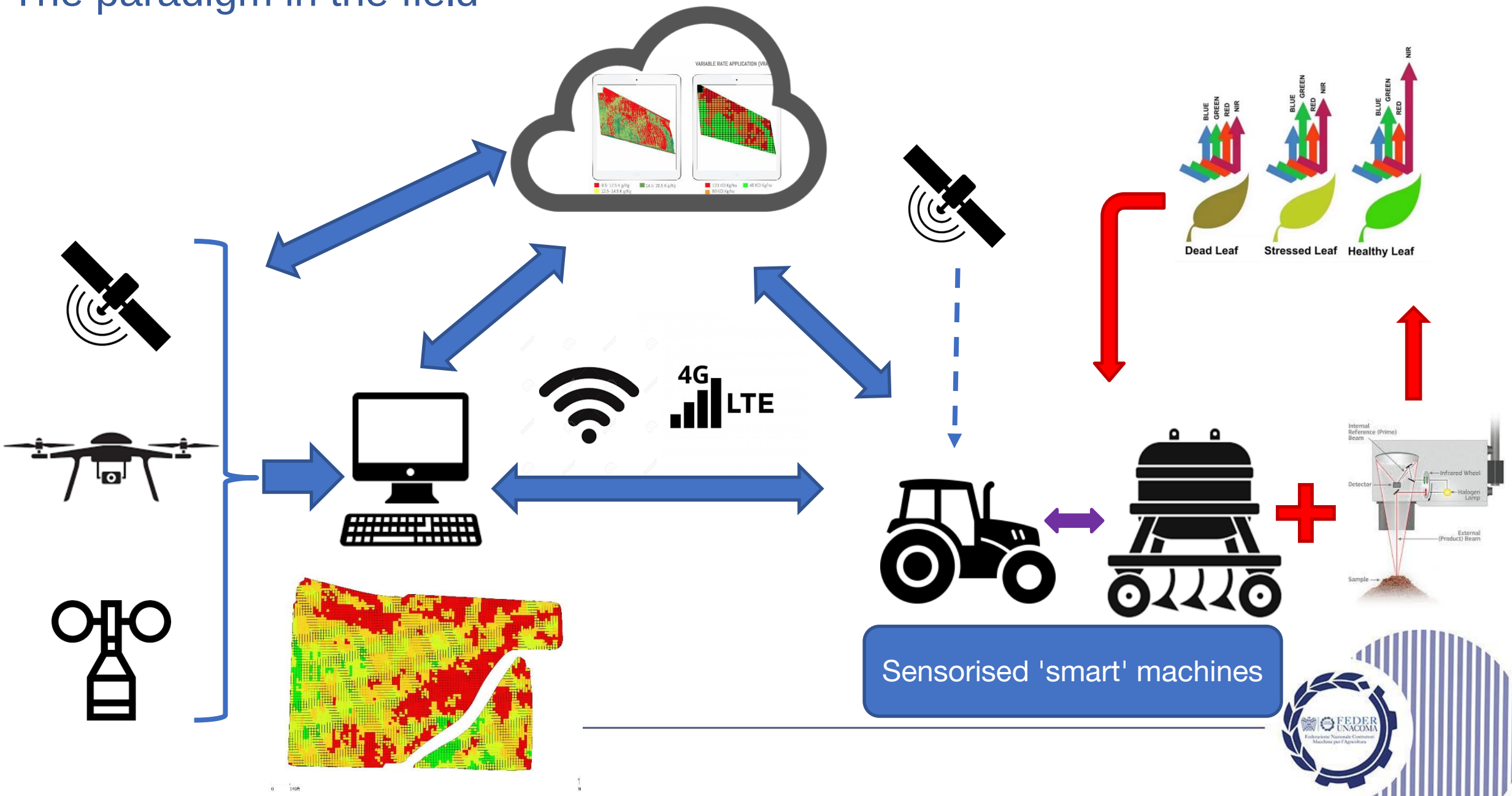
Wi-Fi - 4G — **2015**

CLOUD AND SMART FARMING — **2020**

Agriculture 5.0?
Robots and AI

Autonomous machines, AI, swarms of robots, etc. — **2025 ...**

The paradigm in the field



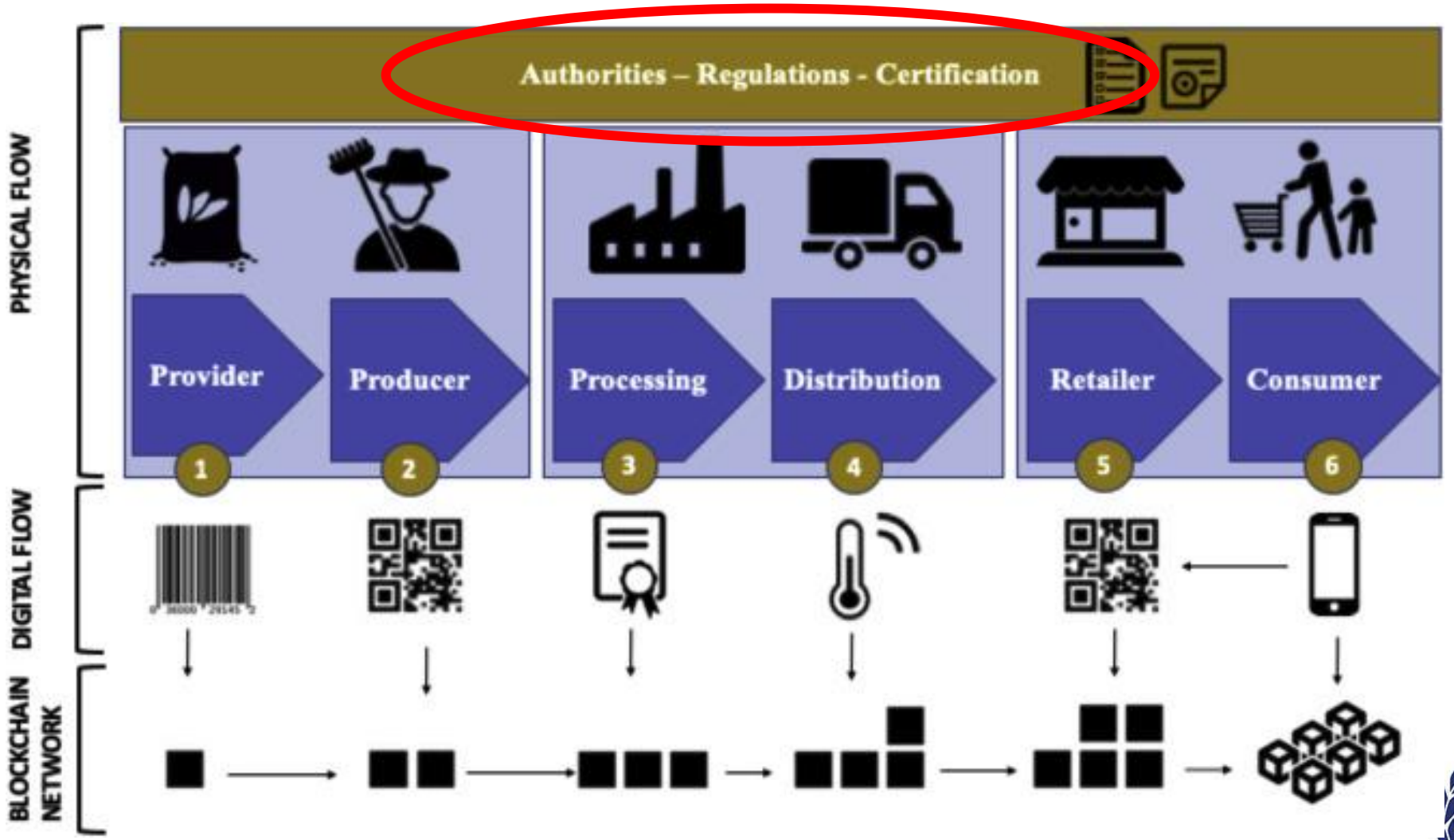
The digital farm

It is part of a supply chain context and is itself the aggregation of several closely related activities

AGRICULTURE VALUE CHAIN	Pre-production	Production	Processing	Distribution	Retail
PRIMARY STAKEHOLDERS	• Seed suppliers • Fertilizer suppliers • Irrigation businesses	• Farmers • Associations • Cooperatives	• Mills • Food processing companies • Packaging companies	• Traders • Distribution companies	• Wholesalers • Retailers • Export companies

TRACEABILITY

Regulatory constraints



definitions

Basic definitions: AGRICULTURE

PRECISION AGRICULTURE

It is an integrated farm and tillage management strategy that makes use of modern tools and is aimed at the execution of agronomic interventions that take into account the actual cultivation needs and the biochemical and physical characteristics of the soil.

It is achieved through the integration of different sciences and technologies such as: Agronomy, Geology, Chemistry, FMIS*, ISOBUS, Assisted or Automatic Guidance Systems, VRA*, Automatic Section Control, GNSS*, etc.

It does NOT require remote connectivity of machines and systems to the cloud.

AGRICULTURE 4.0

Term derived from the European Digital Transition programme called Industry 4.0.

Its main requirement is the interconnection of machines and systems with cloud services and their integration in terms of information flow.

It is not about strategies but about technologies for connectivity and information transmission

SMART AGRICULTURE

"Smart" is a commonly used term for the ability of a system to use available information to offer increasingly targeted services.

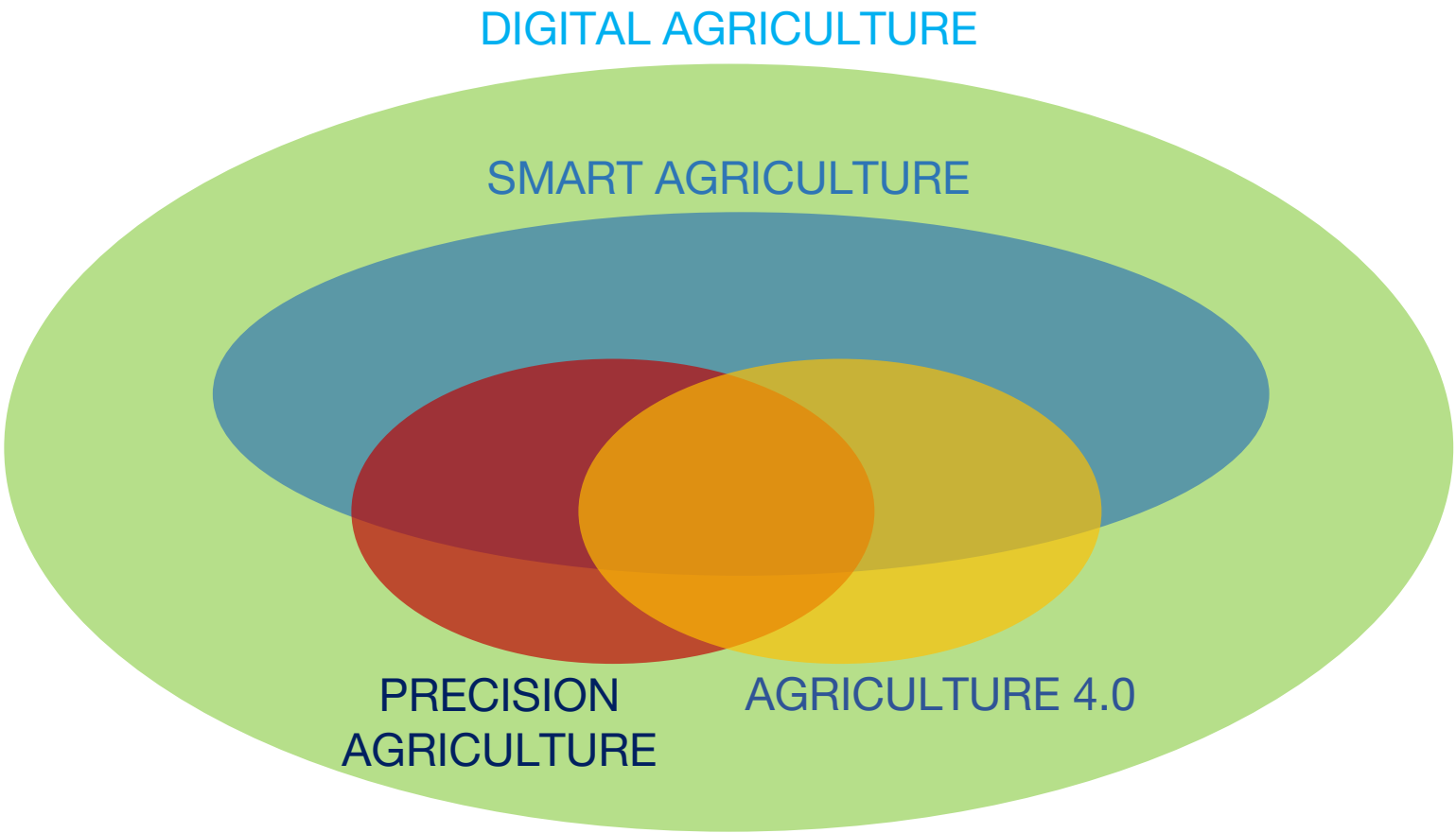
In the agricultural sphere, it therefore indicates a strategy capable of using large amounts of information to adapt and optimise - also in real time - every operation carried out on the farm or in the field.

DIGITAL AGRICULTURE

It is the term for the use of information in digital format and machines and systems capable of generating, processing and using such data.

* See *Acronyms*

Basic definitions: AGRICULTURE



Basic definitions: ISOBUS

ISOBUS

It is a technology defined by international standard ISO 11783 and based on CAN-BUS**, parts 1 to 14, used for the two-way transmission of information and commands between agricultural tractors and equipment. Both the physical communication infrastructure and the protocol (language) used are standardised.

It allows any equipment implementing ISOBUS technology to be controlled through a single terminal installed on the tractor.

AEF* has developed several technology-based functionalities to perform VRA, SC, automatic driving, etc.

ISO-XML

XML language* defined in ISO standard 11783 for exchanging mappings and processing tasks

* See *Acronyms*

** Serial fieldbus communication technology developed by Robert Bosch GmbH developed to connect electronic control systems (ECUs) in mobile vehicles

Basic definitions: DRIVING

ASSISTED MANUAL DRIVING

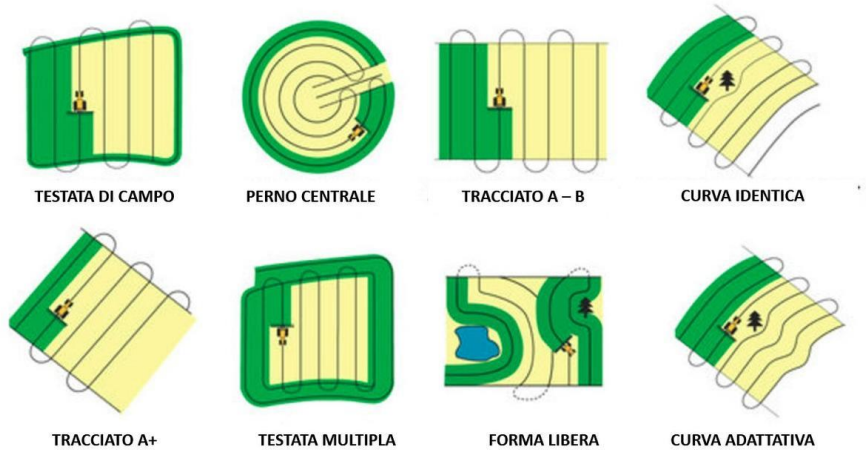
A system that, using GNSS position information* ** provides the operator with indications on the direction corrections to be made in order to correctly follow a set of pre-set driving trajectories

AUTOMATIC DRIVING

It is an evolution of manual assisted driving whereby steering actions are performed automatically thanks to on-board actuating systems.

It does, however, require the presence of an operator in the cabin who is in charge of safety decisions.

It is one of the enabling technologies for Precision Agriculture



SELF-DRIVING

Ability of a machine to drive fully autonomously even without on-board supervision (e.g. agricultural robots). It can be based on trajectories or these can be evaluated by an AI*.

It involves the use of highly accurate GNSS*, as well as perception systems to detect surroundings, obstacles and to implement safety functions.

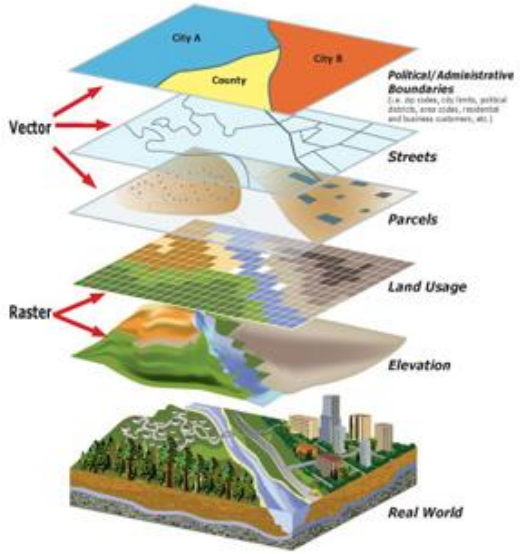
* See Acronyms

**Not to be confused with GPS

Basic definitions: MAPS

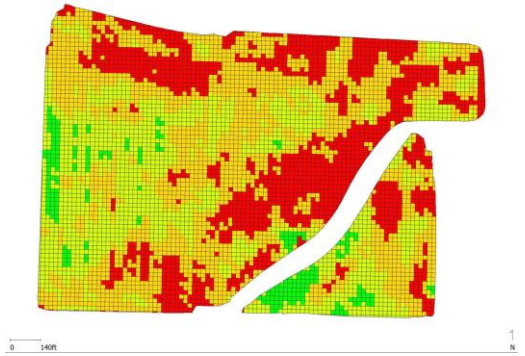
PRESCRIPTION MAP

Prescription maps are derived from the agronomic analysis (regardless of the way in which it is carried out), are generated with FMIS* software and are then used to carry out VRA* type work in order to optimise treatments. Each area of the field, with its own characteristics, is assigned specific treatment methods and quantities.



APPLICATION MAP

Application Maps are the result of processing performed using Prescription Maps and contain georeferenced information about the actual way in which operations were performed.



* See *Acronyms*

acronyms

ACRONYMS

AEF: Agricultura Industry Electronic Foundation - non-profit association that develops guidelines to ensure the interoperability of agricultural machinery and systems (i.e. ISOBUS)

VRA: Variable Rate Application - Management of variable rate treatments, based on prescription maps or real-time agronomic analyses

SC: Section Control - automatic control of implement sections to avoid overlapping treatments

GNSS: Global Navigation Satellite System - General term describing any constellation of satellites capable of providing position, navigation and time information (PNT)

- GPS: Global Positioning System - US satellite constellation (worldwide coverage)
- GLONASS: Russian Satellite Constellation (Worldwide Coverage)
- GALILEO: European Satellite Constellation (Worldwide Coverage)
- BEIDOU: Chinese Satellite Constellation (Regional Coverage)

PNT: Position Navigation and Timing - Information managed by GNSS systems

RTK: Real Time Kinematic - Error correction technology for positioning systems via a fixed reference station

VRS: Virtual Reference Station - Error correction technology that uses a network of references that do not have to be physically owned by the user

ISOBUS (see Definitions)

- UT: Universtal Terminal - functionality for controlling and managing ISOBUS equipment via a single display on the tractor
- TC-Bas: Task Controller Basic - ISOBUS functionality for processing totals
- TC-Geo: Georeferenced Task Controller - ISOBUS functionality for VRA management
- TC-SC: Task Controller Section Control - ISOBUS functionality for automatic section control
- AUX-N: Auxiliary controls New - ISOBUS input system (joystick or buttons) configurable for quick access to implement control functions
- TIM: Tractor Implement Management - ISOBUS functionality by which an implement can control the speed, steering, PTO, linkage and auxiliaries of a tractor

XML: Extensible Markup Language - a language for creating structured and typed documents and data in digital format

* See *Acronyms*

FINAL CLARIFICATIONS

The requirements for 4.0 machines and solutions and how to meet them

Goods in the first group **must have all of the** following **five characteristics**:

- Control by CNC (Computer Numerical Control) and/or PLC (Programmable Logic Controller);
  - Translation: they must have an electronic control system
- Interconnection to factory computer systems with remote loading of instructions and/or part programs;
  - Translation: they must have wireless connectivity (3G, 4G, LTE, ...) to remotely send and receive a range of information and data useful for operations, security, maintenance, etc.
- Automated integration with the factory logistics system or supply network and/or other machines in the production cycle;
  - Translation: I must be able to manage via the cloud and related applications the data of all machines involved in field operations, in an integrated and interoperable manner (see AEF)
- Simple and intuitive human-machine interfaces;
  - Translation: there must be a control system (typically a display) that allows simple and immediate management of the machine's functions
- Compliance with the latest occupational safety, health and hygiene standards.
  - Translation: safety standards (DM, MR, Harmonised Standards and other applicable directives)

The requirements for 4.0 machines and solutions and how to meet them

At the same time, they must be equipped with **at least two** of the following additional features to make them similar or integrable to cyber-physical systems:

1. Remote maintenance and/or remote diagnostics and/or remote control systems;
   - Translation: ability to monitor parameters remotely and intervene if necessary by sending settings or commands
1. Continuous monitoring of working conditions and process parameters using appropriate sensor sets and adaptability to process drifts;
   - Translation: monitor how the machine is working and send prescription maps or work settings (Precision / Smart Farming)
2. ~~Integration characteristics of the physical machine and/or plant with modelling and/or simulation of its behaviour in the process (cyber-physical system).~~
   - Not applicable

Tangible and intangible assets

Tangible assets (Annex A group 1 point 11, L. 232/2016 et seq.): Capital assets whose operation is controlled by computerised systems or managed through appropriate sensors and drives:

- robots, collaborative robots and multi-robot systems
- machines, including drive and operating machines, tools and devices for loading and unloading, handling, weighing and automatic sorting of workpieces, automated lifting and handling devices, AGVs and flexible conveying and handling systems, and/or equipped with workpiece recognition (e.g. RFID, vision and mechatronic systems)

Tangible and intangible assets

Intangible assets (Annex B, L. 232/2016 et seq.): Intangible assets (software, systems and system integration, platforms and applications) related to investments in "Industry 4.0" tangible assets

- software, systems, platforms and applications for the design and re-engineering of production systems that take into account material and information flows, software, systems
- decision support platforms and applications that can interpret data analysed from the field and visualise specific actions to line operators to improve product quality and production system efficiency
- software, systems, platforms and applications for production management and coordination with high integration features of service activities, such as factory logistics and maintenance
- software, systems, platforms and applications for monitoring and controlling the working conditions of machines and production systems interfaced with factory information systems and/or cloud solutions
- software, systems, platforms and applications capable of communicating and sharing data and information both with each other and with the surrounding environment and actors (Industrial Internet of Things) thanks to a network of interconnected intelligent sensors

Tangible and intangible assets

...more

- software, systems, platforms and applications for industrial analytics dedicated to the treatment and processing of big data from IoT sensors applied in the industrial environment (Data Analytics & Visualisation, Simulation and Forecasting)
- ...

In general, this includes Farm Management Information System type software, resource and logistics management, data management from sensors and agricultural IOT systems, fleet management, decision support systems

COMMON INTERPRETATION ERRORS

Tractor: 'I have automatic driving, so I meet the requirements'

- Automatic/semi-automatic driving alone is not enough, GPS connection is not connectivity. The tractor must have a system for remote data connectivity with the ability to remotely send status information and receive settings, warnings or driving trajectories

Tool: 'I have ISOBUS, so I meet the requirements'

- ISOBUS is only a means that can allow me, provided I implement the Task Controller functionality, to exploit a connectivity system already present on the tractor

Cloud: 'I have my own cloud, so I meet the requirements'

- This may be true if the customer has all the machines from the same manufacturer, if not, unless open or standardised systems are used, the requirement for integration with factory logistics systems would be lost.

Common misinterpretation errors

Connectivity: 'I can use my mobile phone as a *modem*'.

- Although initially prohibited, a 2021 Revenue Agency circular clarified that mobile phones can be used as modems for on-board electronics in order to meet the connectivity requirement

"Stupid" machines: 'I can do one-way connectivity'

- Machines with simple and well-defined functionalities can implement connectivity in a one-way manner for telemetry, positioning, diagnosis only, without the possibility of receiving remote settings or prescriptions. **HOWEVER**, the recognition of an asset as a simple machine is subject to interpretation, so it is recommended that the requirements are always met in full.

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THANK YOU FOR YOUR ATTENTION

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