ROBOTICS IN AGRICULTURE:

A RISING MARKET WITH HUGE CHALLENGES

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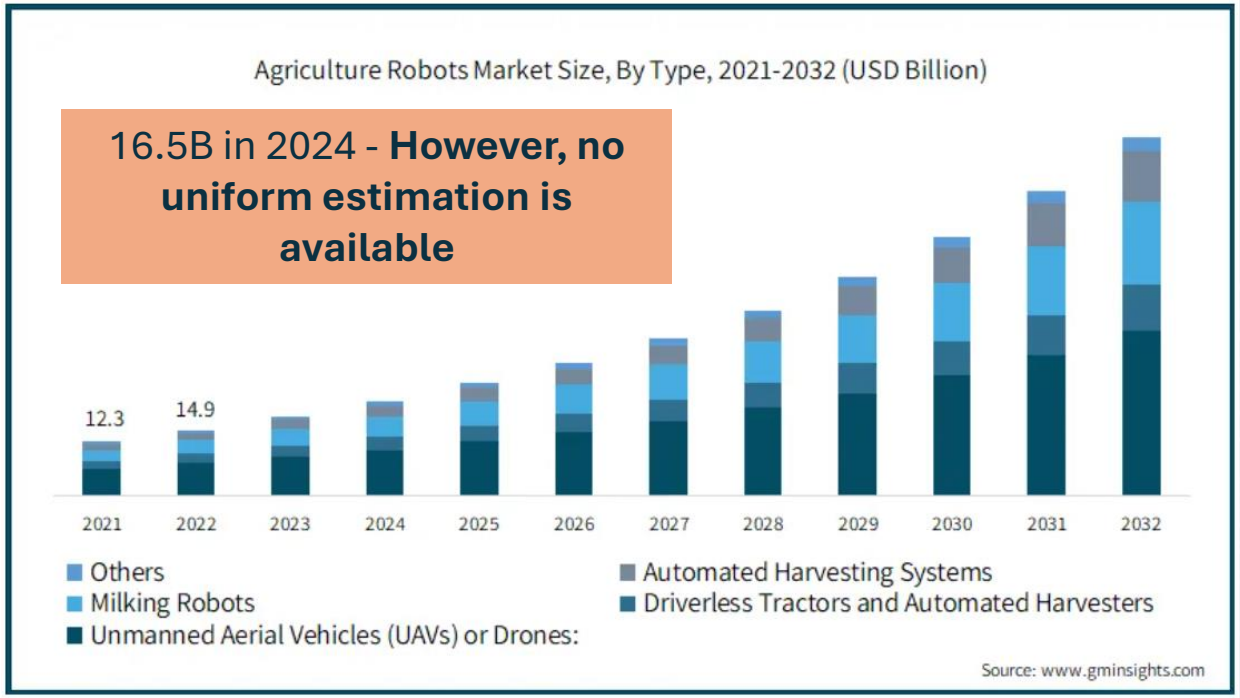
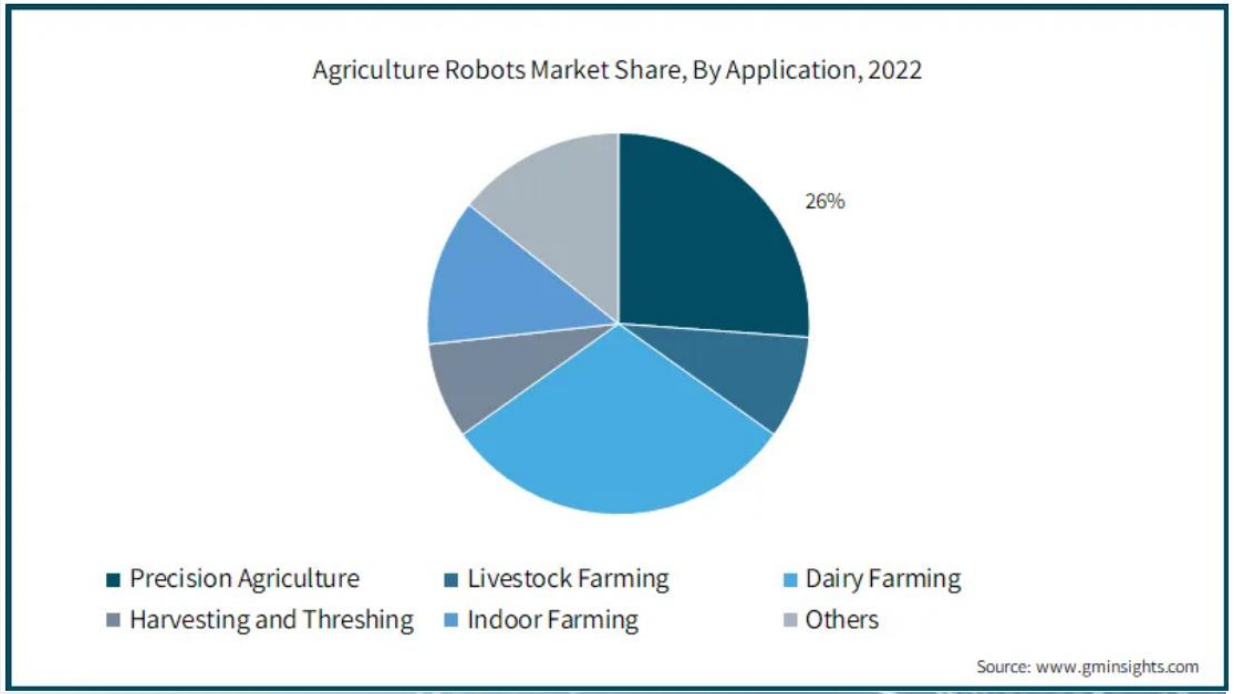
A RISING MARKET



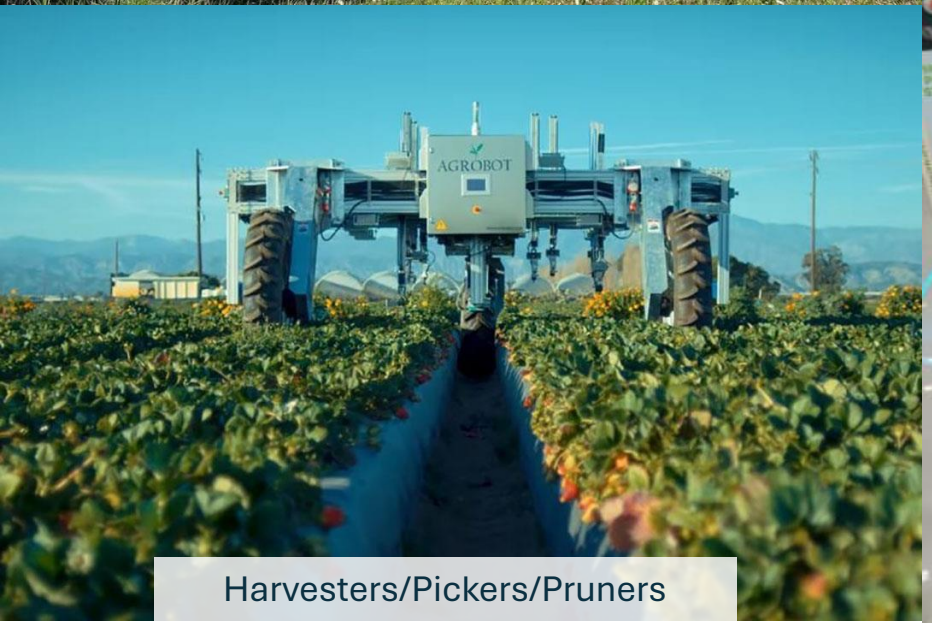


What is robotics in Ag?

Small multitool carrier

High-power multitool carrier

Weeding machines



Harvesters/Pickers/Pruners

Crop protection

Monitoring

Why Ag Robotics is growing so fast?

- Lack of labor / High labor costs
- Automation of repetitive tasks
  - Better precision
  - Higher safety and better health
- Higher productivity with less inputs
- Sustainability (environmental, economical, societal)
- Higher controllability of operations
- …

Handbraking to adoption

- **High entry cost**: ROI is a question mark
- **Fragmentation** of Italian Farms: difficult to scale solutions
- **Performance** lower than standard machines
- Lack of **digital awareness**/skills | Complex interfaces
- Inhomogeneous digital **infrastructure**
- **Regulatory framework** unclear

The EU NLF – Impact on the Industry

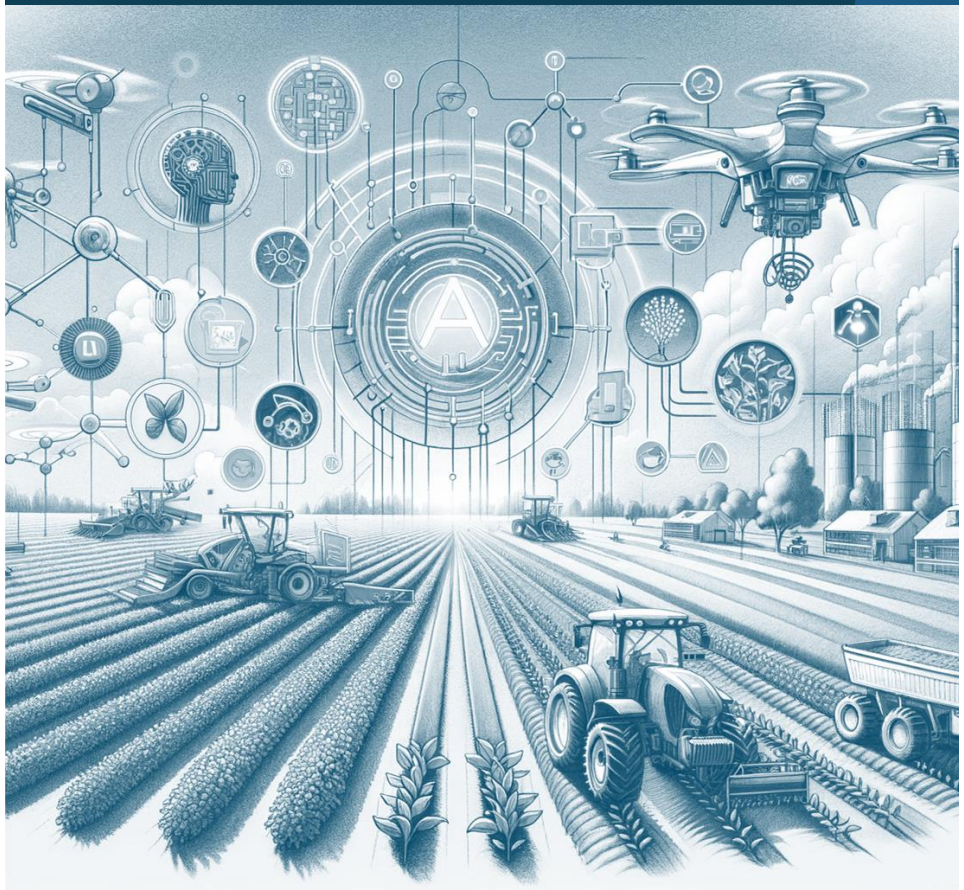
EU New Legislative Framework applicable to Ag Robotics (1)

- **Artificial Intelligence Act EU-2024:1689:**
  - Sets rules for the development, deployment, and use of AI to ensure safety, transparency, and trust while fostering innovation.
  - **The definition of AI is way too broad and includes almost any type of software**
  - It classifies AI systems by risk: high-risk AI faces strict compliance and third-party assessment if required by the main safety regulation for the product
  - A risk management system shall be established throughout the entire life-cycle of a product
- **Machinery Regulation EU-2023:1230:**
  - Sets minimum safety requirements for machinery
  - **“Safety component” now explicitly covers software (including AI). They are the base of Ag Robots**
  - **In case of “high-risk machinery product” (including machinery or safety components based on AI and capable of self-evolving behaviour) shall be verified by a notified body**
  - For self-evolving behaviours, risk assessment shall cover potential hazards generated by these behaviours

EU New Legislative Framework applicable to Ag Robotics (2)

- **Cyber Resilience Act EU-2024:2847:**
  - Sets cybersecurity requirements for digital products and connected devices to ensure greater protection against cyber threats throughout their lifecycle
  - **To improve safety by protecting Data**
  - It has a **big impact on manufacturers** as it requires that a product is put on the market "**secure by design**" and free from known vulnerabilities
- **Data Act EU-2023:2854**
  - Sets rules on **who can access and use Data**
  - For our industry, it governs access, sharing, and use of data generated by machines and connected devices
  - From one hand, **farmers can control on how and who can access data** and the possibility to seamlessly switch service providers
  - However, **companies and manufacturers shall implement all the requirements** – base on their role in the data chain - in order to guarantee data sharing and their portability by **adopting standards**

AI in EU NLF: a very brief picture



- **Definition (AI Act, Article 6):**
  - **An AI system is high-risk if:**
    1. **It is a safety component of a regulated product (e.g., machinery, medical device), and**
    2. **product, is required to undergo a third-party conformity assessment**
- **In agriculture: High-risk AI likely includes:**
  - **Autonomous navigation & collision avoidance systems**
  - **Automated pesticide dosing or spraying**
  - Safety-critical self-evolving DSSs influencing human decisions on hazardous materials
  - …
- **Providers must implement:**
  - Documented risk and vulnerability management system
  - Data quality and traceability controls
  - Human oversight functions
  - Post-market monitoring and reporting
  - …

EU NLF effect

Common Headaches and Their Causes

Migraines

Self-evolving / Adaptive AI

How to deal with the safety of a machine that can evolve after deployment

Tension-Type Headache

Homologation vs Self-Certification

Autonomous tractor? Autonomous tool carrier? Autonomous machinery? Agricultural robot?
What to do?

Cluster Headache

Regulations Overlaps

AI Act vs MR
MR vs CRA
Data Act playing in the same team of CRA, AI Act, etc.

AI Act and Machinery Regulation

- **Conflict zones are not just on a technical level:**
  - **Conformity routes:** The AI Act foresees *AI-specific assessment*, while MR follows *product-level CE conformity* and validation via notified bodies if required
    → The same product faces dual obligations with different approaches
  - **Responsibility confusion:** Who certifies the AI model—the machinery manufacturer or AI software provider if different?
  - **Adaptive systems:** The MR's "fixed conformity" model doesn't fit systems that evolve post-market.
  - **On data:** Are data used for training part of the validation?
- **Key insight:** The EU is drafting *implementation guidance and standards* to bridge these frameworks, **but there is still a long way to go and timelines are not aligned**

Other areas of uncertainty: Safety vs Security

- **Traditional view:**
  - *Safety* = preventing harm from accidental failure.
  - *Security* = protecting against intentional attacks.
- **Now:** boundaries blur.
  - Connected agricultural systems → more attack surfaces (telemetry, cloud links, OTA updates).
  - A single cybersecurity failure can compromise **physical safety**.
  - The **Cyber Resilience Act** makes *cybersecurity an intrinsic part of product safety*:
    - Secure design, encryption, authentication.
    - Patch management and vulnerability handling.
    - Security documentation as part of technical file.
  - This concept is very strong for AI based machinery or safety components.
- **Industry implication:** Safety and cybersecurity teams must be strictly integrated

What about “Autonomous Tractors”

- **A controversial topic**
- What was decided so far:
  - **Homologation for the tractor**
  - **CE marking for Autonomous capability**
- **Questions**
  - Where is/ What is the interface?
  - How to clearly isolate the autonomous guidance system
- **And on the road?**

Autonomous tractors and smart machines

- **Now-a-days:**
  - autonomous tool carriers pull “dumb” implements
  - “autonomous guidance” tractor could pull “smart implement”
- **In the next years:**
  - **Autonomous machines should work in a integrated way with smart implement in order to guarantee state of the art performance and sustainability**
- **What is needed to meet that:**
  - Automated smart operations using standard technologies
    - ISOBUS with Task Controller, TIM or WIC)
  - Distributed perception system and a related legal environment
    - Agricultural Industry Electronic Foundation is working on this topic

Multi-branded farm environments are the EU standard

- **Why interoperability matters:**
  - **Robots use AI and AI quality depends on large, consistent, high quality, annotated datasets**.
  - Agriculture data is **heterogeneous**: machines, sensors, weather stations, soil analyses, and FMIS platforms.
  - Lack of interoperability = **Technological Lock-In**
  - **Liability by interoperability**
  - **Standardization is one of the main requirements set by Data Act**
- **Current initiatives:**
  - **ISOBUS** (ISO 11783-1..14): first major step towards interoperability od machine data, guaranteed by AEF Certification
  - **AEF Autonomy**
  - **CEMA PT4 (Agricultural Robotics) and PT11 (Artificial Intelligence)**
  - **AgGateway ADAPT:** Common data models and conversion framework for field operations data.
  - **AEF AgIN:** Standardized interface for smart machinery interoperability.
  - **ISO TC347:** Standardized Data Models in Agrifood
  - …

To conclude...

Agricultural Robotics is how “Future-Present”

But we should solve some “youth” issues:

- **Farmers:**
  - Lower costs
  - Financial incentives
  - Evidence of benefit
  - Ease of use
  - Access to training
  - Avoid Lock-In situation
- **Manufacturers**
  - Clarify regulatory framework
  - Standard processes for Safety assessment and validation

Grazie!! …for your attention

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