Smart Agricultural Machinery - Technologies and Solutions *(Indian Perspective)*

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Indian Agriculture

- **Agriculture 1.0 - manual labour with traditional tools (around 1900)**
- **Agriculture 2.0 - manual, animal, power tiller and tractor operated tools, implements and machinery - helped farmers to produce more with less effort (1920 - 2010)**
- **Agriculture 3.0 - precision agriculture (PA) with "5R" (2010 - 2015)**
- **Agriculture 4.0 - Digital farming or Smart farming (2016 - 2025)**
  - **Internet of Things: Collecting information**
  - **Big Data: Analysis of massive data**
  - **Robotics and Artificial Intelligence (AI)**

Trend in Farm Mechanization in India

Cost effective solutions that drive down input costs and minimize cost of ownership but more importantly reduce drudgery of workers.

- **Drive down cost of ownership and reduce downtime**
  - **Custom hiring or contract farming**
  - **After sale service and support**
  - **Logistic management tools**
- **Smart farm mechanization**
  - **Gender neutral farm implements and machinery**
  - **Whole tractor/system efficiency improvement**
  - **Supervised autonomy – push a button and it works**
  - **Full autonomy – long term**

Mechanization 4.0

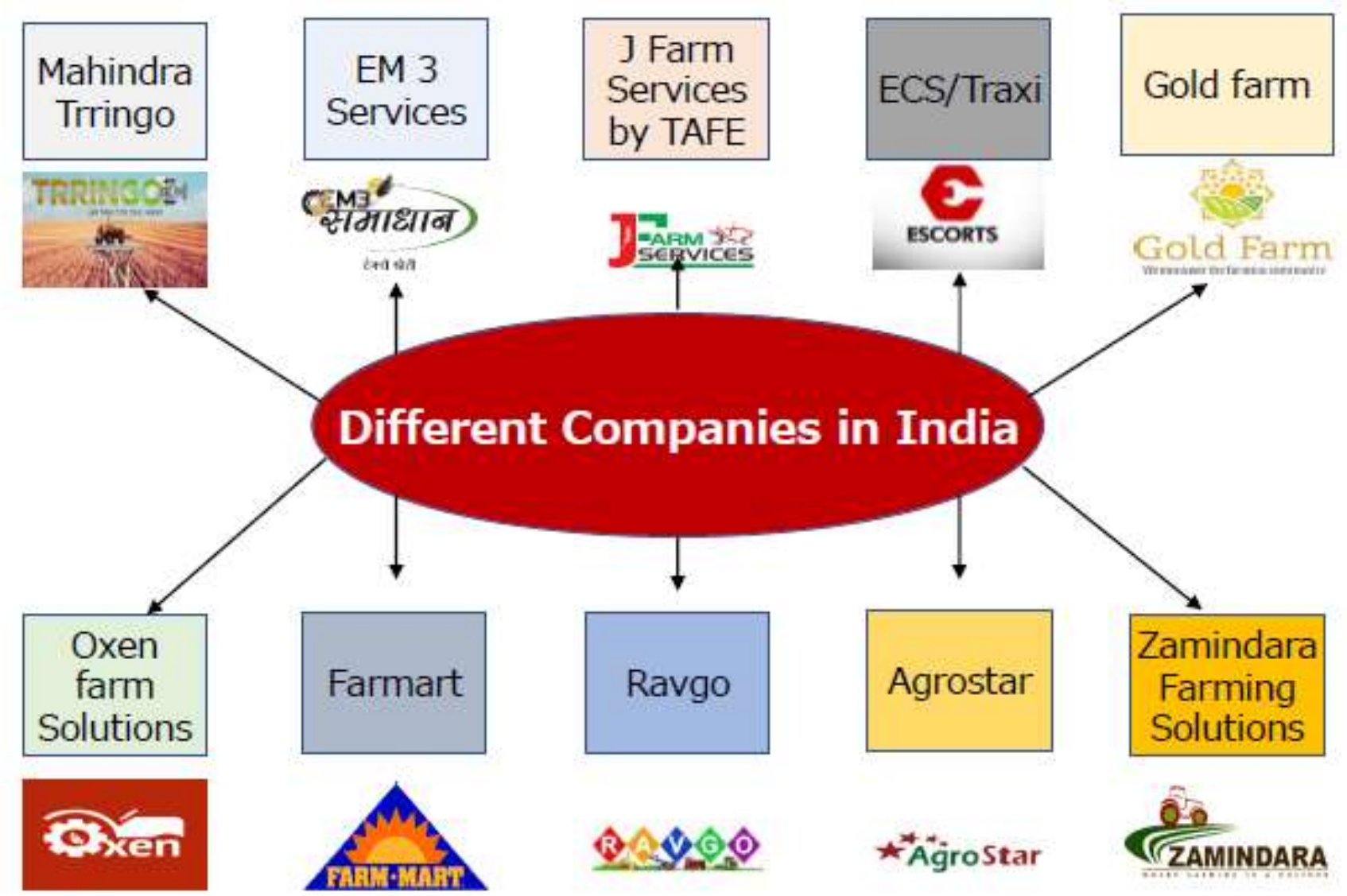
AgriTech themes are based on

- Farming as a service (FAAS) – app based farmer to farmer aggregation platform
- Big data – collection of data to help farmers take smart decisions
- IoT – GPS, sensors, automated hardware, robotics etc.
- AI – weeding, spraying and harvesting can be AI enabled – accuracy and higher productivity

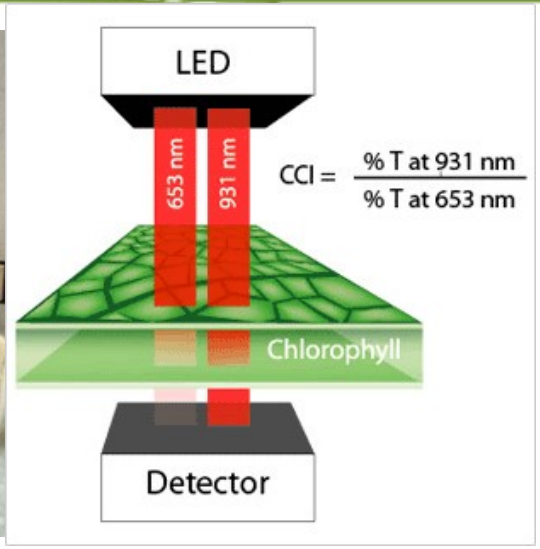
Smart Farming Techniques

- **Data collection or field mapping** (sensor technology, GPS and GIS)
- **Data saving** (cloud-based, shareable for wider area analytics)
- **Tracking and monitoring** (technique might require cameras, drones, tags, etc.)
- **Predictive analytics** (Analytic software)
- **Warehousing** (solar-powered refrigerators)
- **Labor work** (automation, drones, and robotics are helpful)
- **Energy saving** (smart system to cut down energy consumption)

OEM & Startup Companies in Rental/CHC Business



Crop Health Monitoring



SPAD meter (2 licensee)

Hand-held device for disease identification

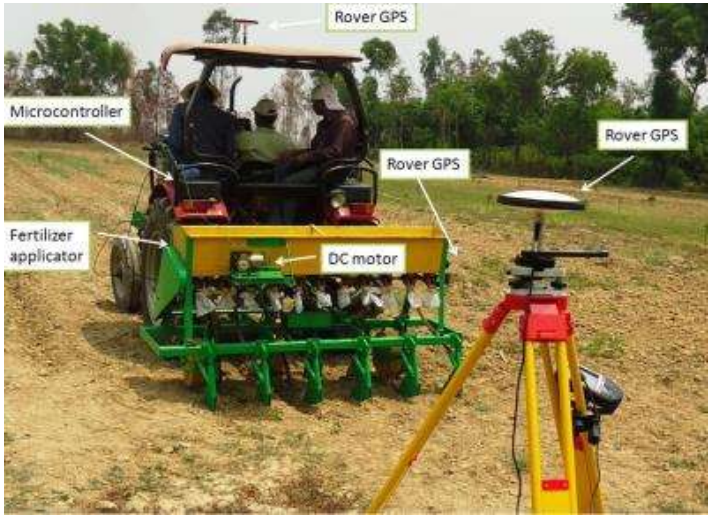
Uniform rate spraying system

Ultrasonic sensor based sprayer

Seeding, Planting and Fertilizer Applications

Ground speed sensor based seed cum fertilizer drill

Palletized rice seeder

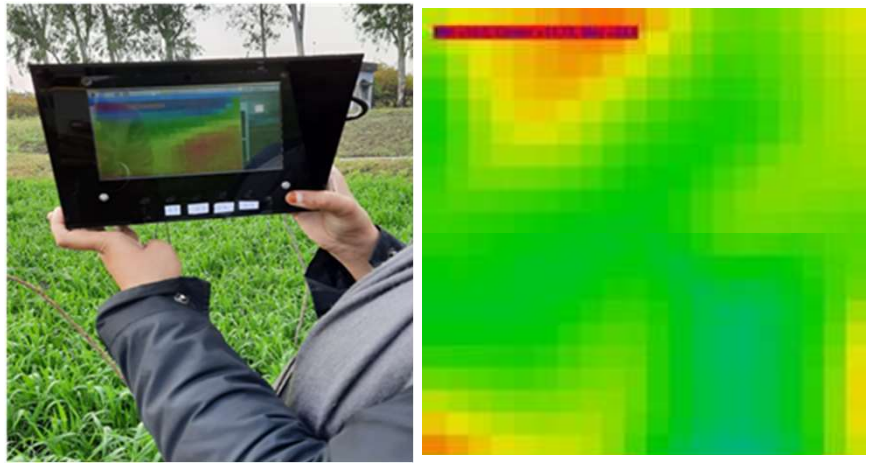


GPS based variable rate fertilizer applicator

Robotic vegetable transplanter

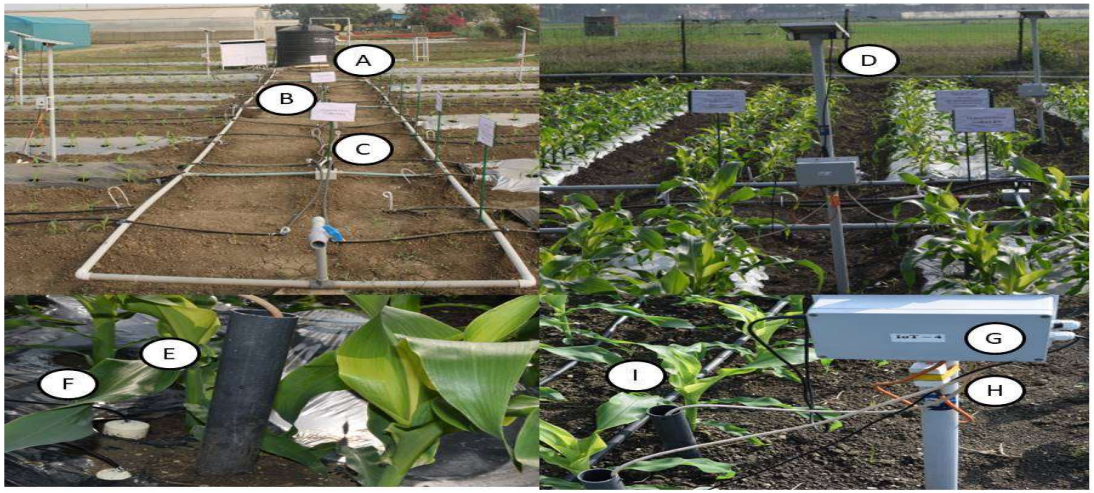
Enhanced Water Use Efficiency

Automatic irrigation system for rice



Water stress indices using thermal imaging

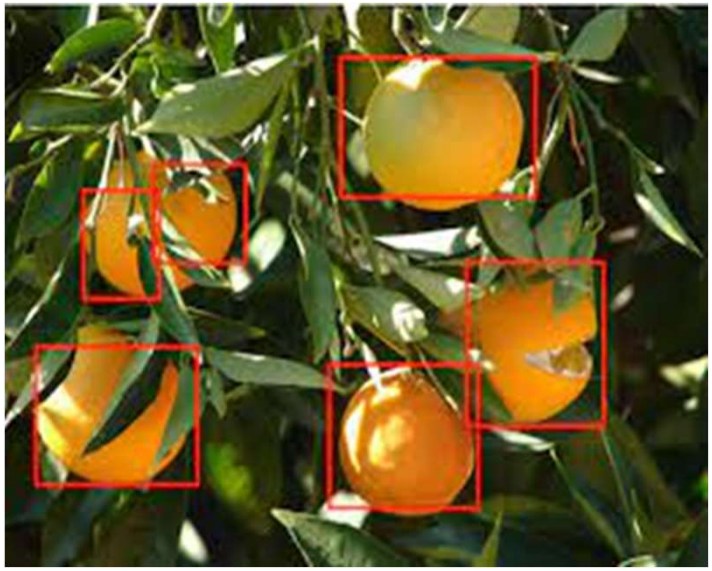
Controlled level puddling (one licensee)



IoT based drip irrigation system

Harvesting

Yield mapping and monitoring



Yield estimation using DL

Robotic harvesting of apples

Remote Control Machinery/Power Units

Remote control power tiller

Unmanned rice transplanter

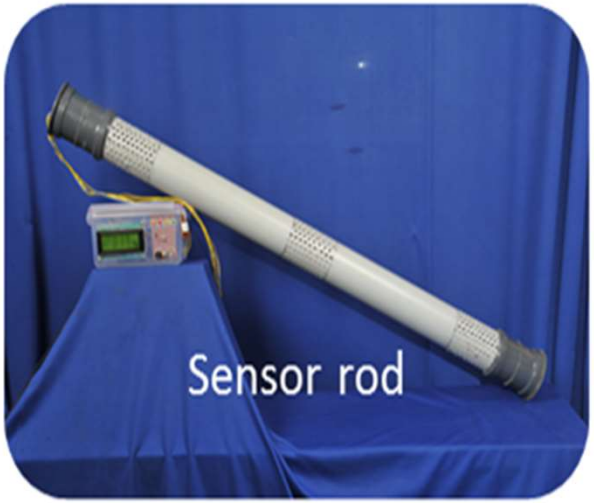
Real time monitoring system

Autonomous tractor

Automation in Post-harvest Agriculture

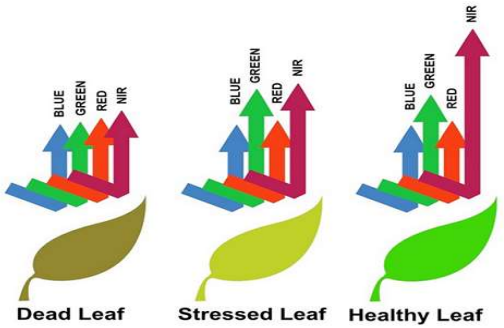
Automated packing line for horticultural produces

Radiography set up

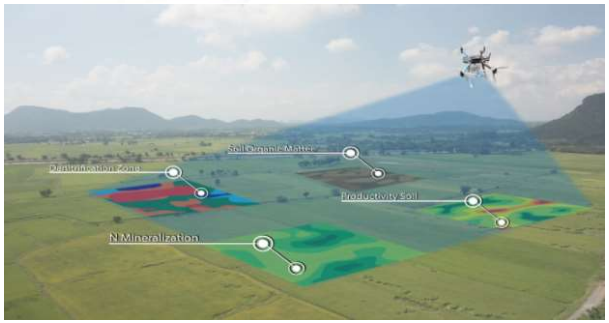


Sensor for food-grains storage monitoring

Drones in Agriculture

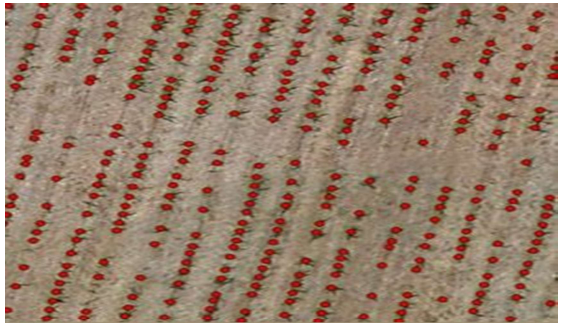


Crop Health Scouting/Monitoring

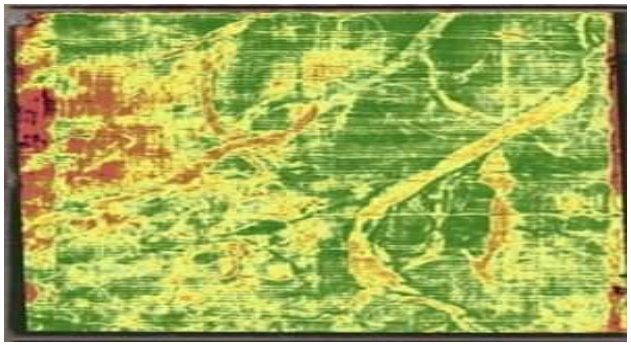


Monitoring Field Conditions

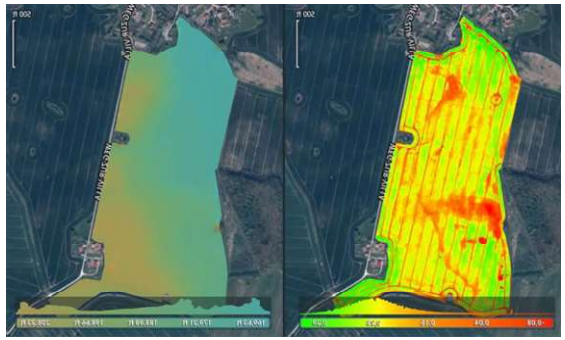
Spray Application



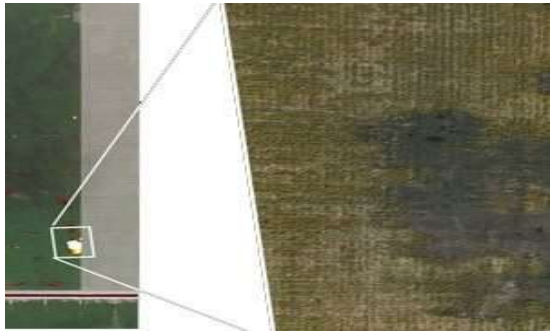
Crop Counting



Crop Yield Potential

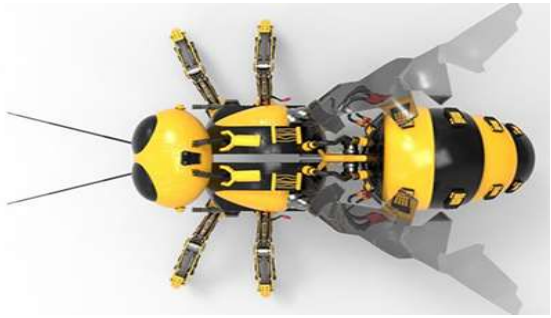


Irrigation Monitoring and Planning



Leak Detection

Security



Drone Pollination

https://www.croptracker.com/blog/drone-technology-in-agriculture.html

Benefits of Smart Agriculture

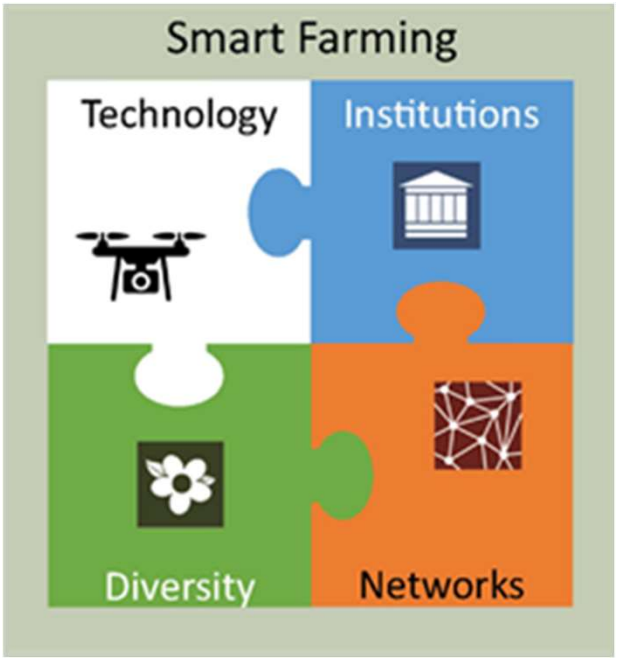
- **Improve machinery**: high-quality and energy efficient machinery
- **Precise data**: predictions or actions based on accurate data
- **Environmental friendly**: minimize pesticide use, enhance water use efficiency, manage waste efficiency
- **Efficient management and cost-effective**: management costs can be reduced or allocated to maintain the technology
- **Low risk**: predict any disaster that might happen to the farm whether it is viral diseases or climate change

Lessons Learned and Recommendations

- Numerous opportunities for adoption of Smart farm machinery are for:
  - increasing productivity
  - reducing cost of production
  - improving inputs application and utilization efficiencies and
  - reducing environmental pollution and soil degradation.
- Farmers are not presently equipped to adopt smart agriculture technologies - need support from Government and private sector at initial stage.

Lessons Learned and Recommendations

- Need to be selective in adoption of precision farming in India
- Reliability of equipment/technology and effective coordination - Vital
- In future, agriculture will be dominated by precision and cloud data with cost effective technologies like smart tractors, unmanned aerial vehicles and wireless technology.



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