Emerging Technologies

Digital Agriculture & Drones

The PoCRA quandary

Technology for Accelerating Development
Hyderabad – 27 February 2018
Project on Climate Resilient Agriculture (PoCRA) - Maharashtra

► 3000 drought affected villages in 8 districts in Marathwada
► 1000 drought affected villages in 6 districts in Vidarbha and Jalgaon district of Nashik Division.
► 850 salinity affected erosion prone villages in 3 districts in Vidarbha and one district from Nashik division (Jalgaon)
► 17.5 lakh families affected
► 4000+ crore INR funding (incl 600 MUSD from the World Bank)
<table>
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<th>PoCRA Digital Sub-systems</th>
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<td><strong>Watershed Management System</strong></td>
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<tr>
<td>1. Preparation of Micro-level Watershed plans</td>
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<td>2. Preparation of DPR and AAP</td>
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<td>3. Watershed development goods and works procurement</td>
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<td>4. Individual, community and entity (FPO/FPC etc.)</td>
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<td>5. Monitoring</td>
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<td>6. Dashboards</td>
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<td><strong>Climate Resilient Agriculture Extension Services System</strong></td>
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<td>2. Farmer Field Schools</td>
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<td>3. Trainings</td>
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<td>4. Extension services</td>
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<td>5. Dissemination of best practices</td>
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<td><strong>Farmer engagement and feedback system</strong></td>
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<td>3. F2G farmer feedback and rating</td>
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<td>4. Dashboards</td>
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<td>5. Grievance redressal</td>
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<td><strong>Monitoring and Evaluation system</strong></td>
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<td>4. Monitoring and evaluation of all activities of the project</td>
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<td><strong>Agribusiness and Value Chain Management System</strong></td>
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<td>5. Market intelligence and information</td>
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<td>6. Information on business opportunities, certification, cold storages etc.</td>
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<td>7. E-commerce platform</td>
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<td><strong>Weather advisory and warning system</strong></td>
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<td>6. Weather condition and prediction advisory</td>
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<td>7. Warnings</td>
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<td>8. Advisory related to crop production including cropping, knowledge on local environment, agriculture practices, costs of inputs etc.</td>
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<td><strong>Climate Risk Modelling</strong></td>
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<td>7. Advisory to adjust farm management strategies based on current and future weather conditions</td>
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<td>8. Advisory to optimize crop management strategy as per the weather and market conditions</td>
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<td><strong>Climate Disaster Management</strong></td>
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<td>8. Warning and timely advisory to mobilise resources and respond to emergencies</td>
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<td>9. Drought monitoring</td>
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<td>10. Flood, hail, unseasonal rain, pest monitoring</td>
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<td>11. Localised and fine-grained Impact assessments</td>
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Drones are already finding applications in agriculture

- **Crop Monitoring**
  - Provides a holistic view of crop’s growth
  - Precisely identify issues & target field scouting
  - Better planning and monitoring of improvements

- **Soil Assessment**
  - Extract soil characteristics such as temperature, moisture, slope, elevation
  - Accurate soil sampling and production of more suitable advisory on seed selection etc.

- **Plant emergence, population & Harvest**
  - Better understand plant emergence, population variance etc.
  - Identify crop models & help in precise agronomic practices
  - Better anticipate harvest quality and final yield

- **Crop protection and Fertility**
  - To identify the phases and health of crops during different stages
  - Enables right amount of application of inputs, reduce wastage, optimise crop health and production

- **Insurance**
  - Accurate reporting of events that could help mitigate economic loss such as crop health deterioration
  - Detailed digital record could help in carving out contingency plans

- **Irrigation and drainage**
  - Drones equipped with RGB and/or thermal infrared camera suit the planning and trouble shooting of irrigation systems
  - Manage resource usage and reduce waste across an operation
Drones for Input Application

DJI Agras MG-1 octocopter for spraying liquid pesticides, fertilizers and herbicides UAV (10 Ltrs)
INR 6 Lakhs approx

- **Dimension:** 1471mm x 1471mm x 482mm (arm unfolded, without propellers)
- **Standard Operating Payload:** 10 kg Max
- **Spray Speed:** 0.43 L/min (per nozzle, for water)
- **Spray Width:** 4 – 6 m (4 nozzles, 1.5 – 3 m above the crops)
- **Droplet Size** *(XR11001)*: 130~250 μm

*Battery & Charger not included*
Drones for Input Application

G15 Pesticide for spraying liquid pesticides, fertilizers and herbicides UAV (15 Ltrs)
₹ INR 8.2 Lakhs

- Capacity: 5-15 Ltrs
- Standard operating payload: 15KG
- Max spray speed: 0.43L/min (per nozzle for water)
- Spray width: 6-7M (4 nozzles, 1.5-3M above the crops)
- Area Cover: Upto 10 acre per hour
Drones for Mapping and Monitoring

PHANTOM 4 PRO ₹ INR 1 Lakh (Approx.)

- 6 camera navigation system
- Remote controller with built-in screen
- Infrared sensing system
  - FOV: 70° (Horizontal), ±10° (Vertical)
  - Gimbal: Pitch: -90° to +30°
  - Control Range: 7 KMs, Flight time 30 mins, Speed: 72 km/h
- Mobile App: DJI GO 4
- Live view frequency 2.4 GHz ISM, 5.8 GHz ISM, Live view Quality: 720P @ 30fps
- Camera Sensor: 1'' CMOS, Effective pixels: 20M
- Velocity range: ≤31 mph (50 kph) at 6.6 ft (2 m) above ground
So, where could we use drones in PoCRA?

1. Watershed Management System
2. Climate Resilient Agriculture Extension Services System
3. Farmer engagement and feedback system
4. Monitoring and Evaluation system
5. Agribusiness and Value Chain Management System
6. Weather advisory & warning system
7. Climate Risk Modelling
8. Climate Disaster Management
Drone Regulations – not yet conducive

Draft policy on operating drones and other remotely piloted aircraft systems in the country, released by Directorate General of Civil Aviation (DGCA) in Nov 2017.

► #1: Drones have been classified into five categories based on maximum take-off weight: nano (up to 250 gm), micro (251 gm to two kg), mini (2 kg to 25 kg), small (25 kg to 150 kg) and large (over 150 kg)

► #2: Nano drones won’t be required to have any security clearance for usage. Micro drones, which are 250 grams to 2 kgs, will have security clearance within 2 days.

► #3: Except for nano category and those operated by government security agencies, all other commercial categories of drones will be registered by the DGCA, which will issue it a Unique Identification Number

► #4: Mini and above categories will require Unmanned Aircraft Operator Permit while model aircraft up to 2 kg flown below 200 feet inside educational institution premises will not require a permit or identification number

► #5: Remote pilots of the drones will have to undergo requisite training, except in case of nano and micro categories

► #6: Except Nano Drones, all other types of drones will require different clearances from various departments. Air defence clearance is must, so that security authorities are aware of the route of the drone.

► #8: Various locations have restrictions on the use of drones in terms of ‘no-fly zones’ including strategic military and political locations

► #9: Govt. has said that strict privacy protection laws will be implemented, for using drones. The operator of drones cannot film or record anyone, without permission, and the route cannot be altered, once approved.
However, today, the challenges outweigh the benefits

**High cost:**

- Manufacturing is being done on a small scale and the fixed costs remain high.
- Unviable for a village entrepreneur to buy/rent one and use it for surveys/farm applications

**Low Imaging coverage and sophistication:**

- Unlike satellites drones can only image small areas at a time, and may be more expensive for repeated use per acre
- Image processing software for various crops is still a developing area. Drone applications in India need to focus more on these applications

**Regulatory uncertainty:**

- Policies unclear, current draft is still restrictive
- All but nano-drones need DGCA clearance and registration, as well as other departments
- Unmanned Aircraft Operator Permit required
- Defence clearance sometimes reqd.
- Route to be registered with defence

**Limited Range and scale:**

- Flying time of drones is restrictive (full-day flight still not easy, even for surveys), even for mini-drones
- Payloads and range of small/medium drones restrictive
- Autonomous drones still not permitted
So, we plan satellite-based systems, integrated with GIS to perform NDVI, weather, temperature, watershed-planning, etc.

1. **Normalized Differential Vegetation Index (NDVI) Analysis using Multispectral Satellites (LANDSAT 8, ISRO Bhuvan, Sentinel 2A)**

2. **Weather, Precipitation, Temperature**
   - (Sources: IMD, Skymet, Accuweather)

3. **Micro Watershed, Ground Water level Mapping using Satellites, Participative Plans**

   **Farmer’s view – mobile application**
   - (Source: Crop-in)

   **Farmer Database- Generate Plot/Crop Digital Score Card and Visual map on web portal**

   **NDVI Analysis**
   - (Satellite LANDSAT 8, Resolution: 200m)

   **Temperature Analysis**
   - (Source: Accuweather)

   **Ground Water Mapping using Bhuvan BHUJAL**
What is needed to accelerate drones in agriculture?

► Clarity on a Drone Policy - quickly
► Regulatory sandbox for experimentation/pilots
  ► Approvals for project areas for drone experimentation
  ► Empanelment / licenses of drone-start-ups
  ► Frameworks for monitoring / auditing of drone captured images
  ► Incentives for drone manufacturing start-ups (like STPI / SEZ)
► Potential private sector initiatives
  ► Drone as an agri service – per application, per acre
  ► Financing and leasing models to enable Village Level Entrepreneurs to rent / buy drones
  ► Training and experimentation with VLEs, Krishi Vigyan Kendras, Krishi Mitras, etc.

Other Ideas?
Thank you