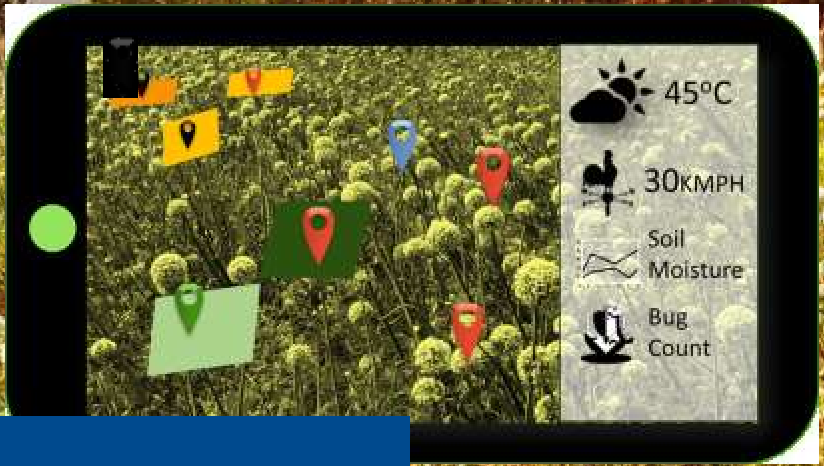
tcs50
Experience energy
TATA
CONSULTANCY
SERVICES


45°C
30KMPH
Soil Moisture
Bug Count

Business 4.0

Intelligent, Agile, Automated, and on the Cloud

Digital Farming Initiatives

An Introduction

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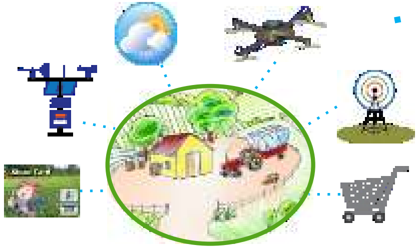
Contents

- Digital Farming Initiatives - Overview
- InteGra - Digital Farming Platform
- Cloud – Remote Sensing Analytics
- Intelligent Edge – IoT (Internet of Things)
- Analytics – Image Processing

Digital Farming Initiatives Overview

Digital Farming Initiatives - Mission

Improve Farmer Livelihoods via Technology and Partnerships



Smart Villages
(Climate and Market Smart)

Sustainable Ecosystems

The Digital Enterprise

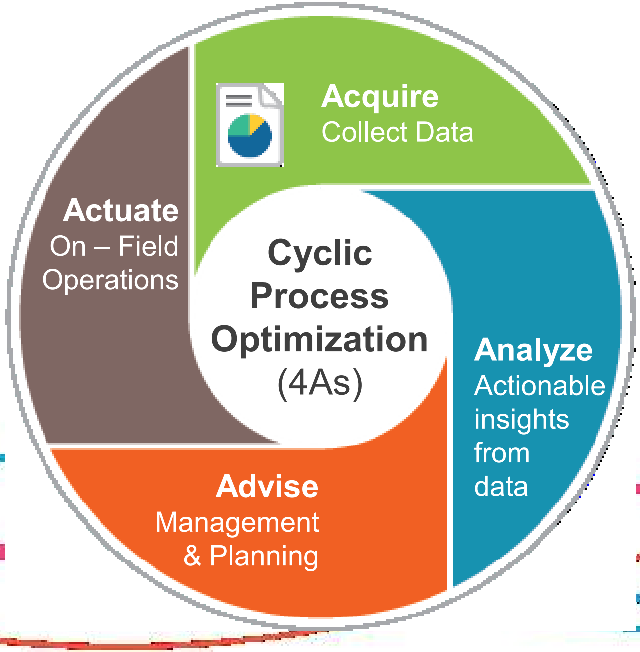
Mobility and Pervasive Computing, Cloud, Big Data, Artificial Intelligence & Robotics and Social Media

Digital 5 Forces + GIS +
Agri Knowledge Base

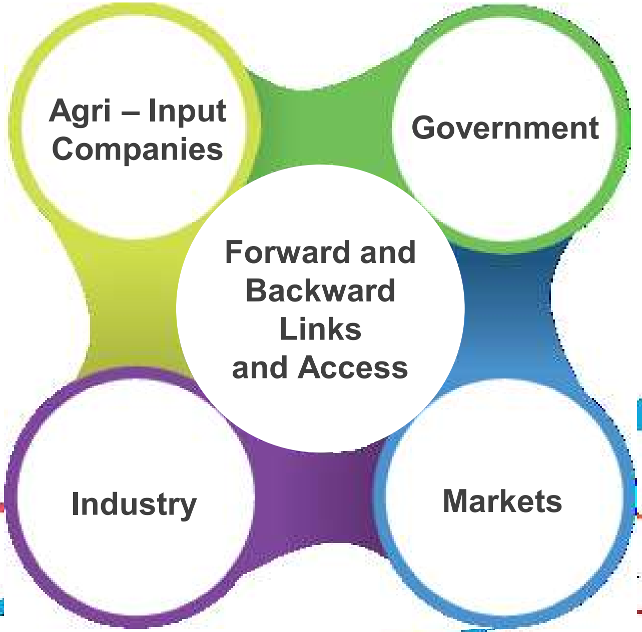
Digital Transformation

Digital Farming Initiatives - Objectives

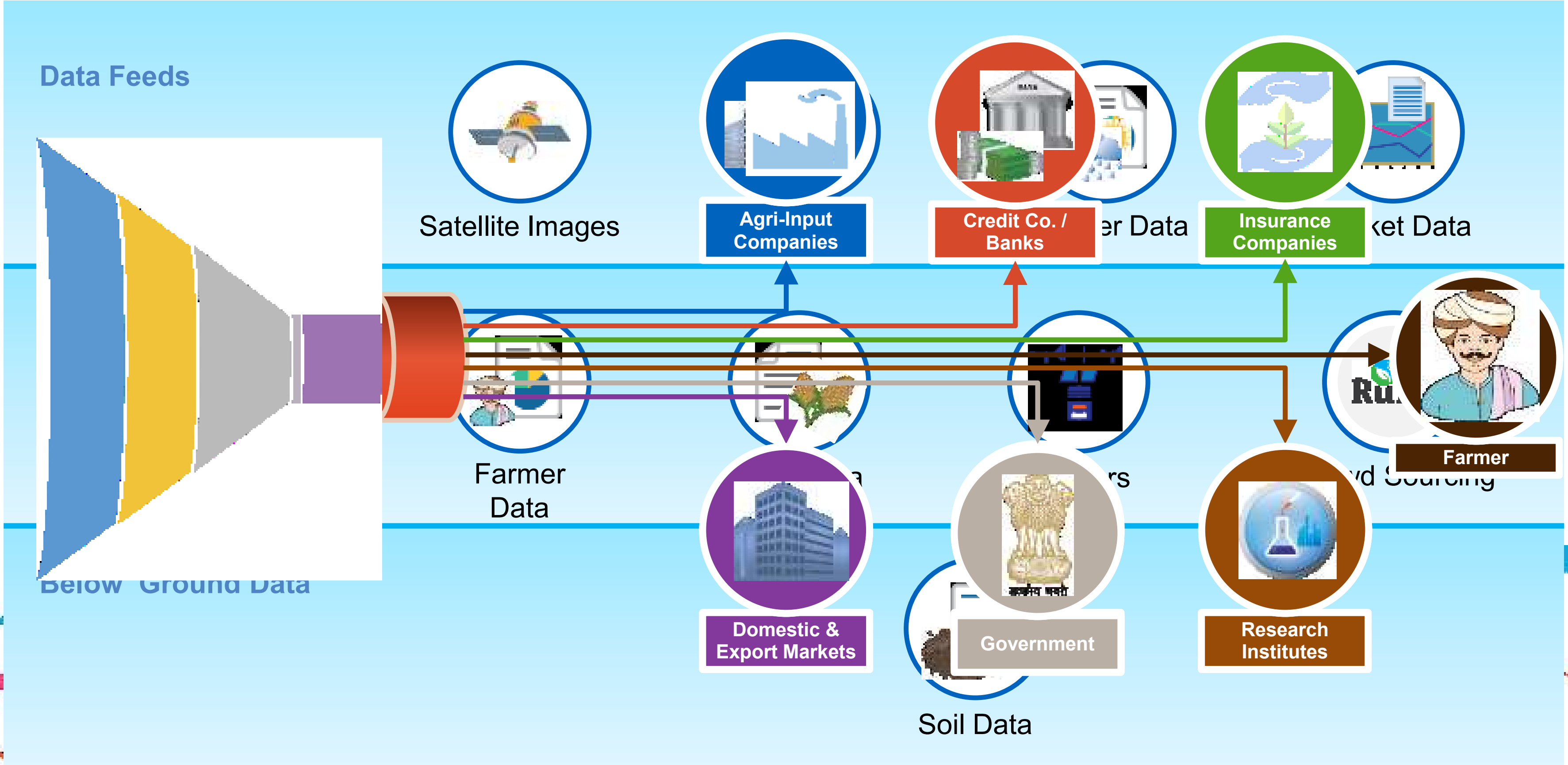
Improve Crop Production & Efficiency


Acquire
Collect Data
Analyze
Actionable insights from data
Advise
Management & Planning
Actuate
On – Field Operations
Cyclic Process Optimization (4As)

Establish Links Across Ecosystems


Agri – Input Companies
Government
Forward and Backward Links and Access
Industry
Markets

Data Driven Approach


Data Feeds
Satellite Images
Agri-Input Companies
Credit Co. / Banks
er Data
Insurance Companies
ket Data
Farmer Data
Domestic & Export Markets
Government
Research Institutes
Farmer
rs
vd Sourcing
Soil Data
Below Ground Data

Digital Farming Platform Overview

InteGra -Digital Farming Platform

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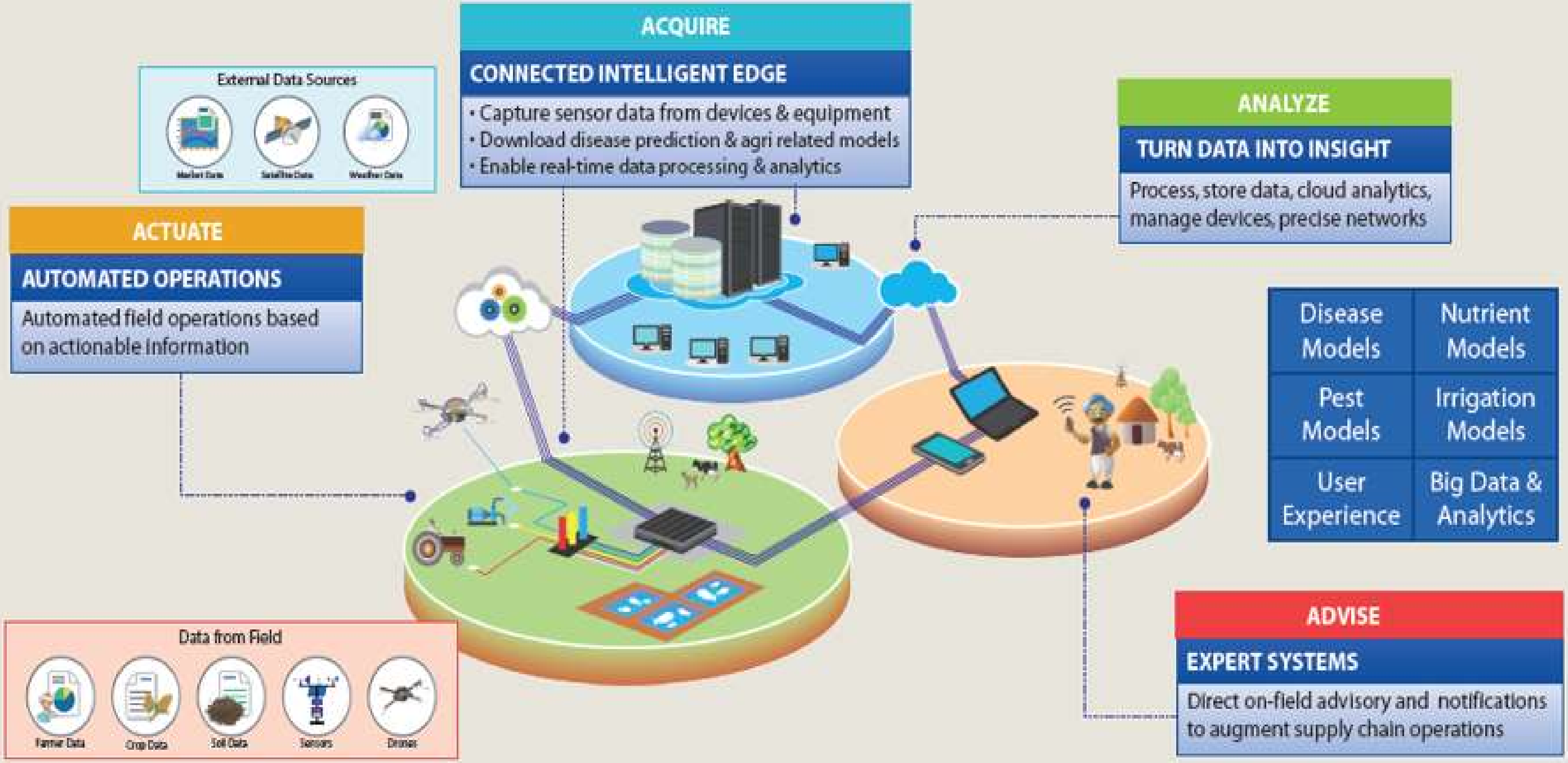

External Data Sources
Market Data
Satellite Data
Weather Data
Data from Field
Farmer Data
Crop Data
Soil Data
Sensors
Drones

ACQUIRE

CONNECTED INTELLIGENT EDGE

- Capture sensor data from devices & equipment
- Download disease prediction & agri related models
- Enable real-time data processing & analytics

ANALYZE

TURN DATA INTO INSIGHT

Process, store data, cloud analytics, manage devices, precise networks

ACTUATE

AUTOMATED OPERATIONS

Automated field operations based on actionable information

Disease Models	Nutrient Models
Pest Models	Irrigation Models
User Experience	Big Data & Analytics

ADVISE

EXPERT SYSTEMS

Direct on-field advisory and notifications to augment supply chain operations

DFI Focus Areas Driving Next Gen Agriculture

01

Cloud

Scale operations through Satellite, Drones data based Crop/Soil Assessment etc. on cloud

02

Intelligent Edge

Sensor Data acquisition layer and Low Cost IoT sensors for Micro Climatic Monitoring

03

AgriKnoB

Comprehensive Agriculture Knowledge base on all Crops providing contextual data

04

Data Analytics

Machine Learning based Crop specific decision science models, Pest/Disease predictions, Image Processing based on Edge/Cloud data

Cloud - Remote Sensing Analytics

agEYE Overview

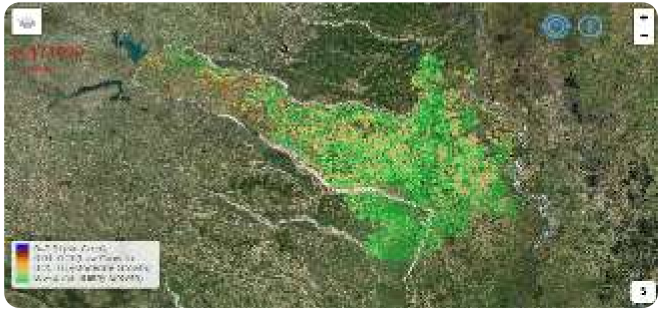
	Historical Condition	Current State	Future Projection*
Automatic Crop Acreage Estimation	🌍 📊 📈	🌍 📊 📈	🌍 📊 📈
Crop Health	🌍 📊 📈	🌍 📊 📈	🌍 📊 📈
Soil Moisture	🌍 📊 📈	🌍 📊 📈	🌍 📊 📈
Crop Yield			🌍 📊 📈
Disease and Pest Incidence	🌍 📈	🌍 📈	🌍 📈
Weather Projections	🌍 📊 📈	🌍 📊 📈	🌍 📊 📈
Credit Score for Farms	🌍	🌍 📊 📈	
Irrigation and Fertilizer Recommendation		🌍 📊 📈	🌍 📊 📈
Drought Status and Agricultural Water Usage	🌍 📊 📈	🌍 📊 📈	🌍 📊 📈

** Future projections available for at least up to 15 days.*

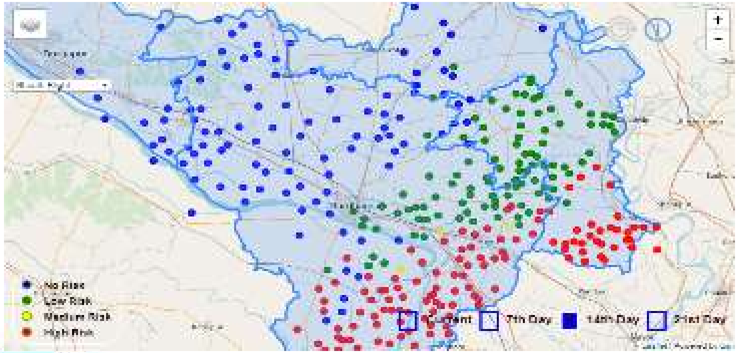
1) Macro agricultural intelligence platform that provides insights on state-of-the-crops across large regions.
2) Multiple agricultural data types handled seamlessly and synergistically.
3) Farmer-centric and client-centric for higher productivity and sustainability.
4) Auto-feedback mechanisms built-in for data-driven prediction improvement.

🌍	Satellite Imagery
📊	Summary
📈	Time Series

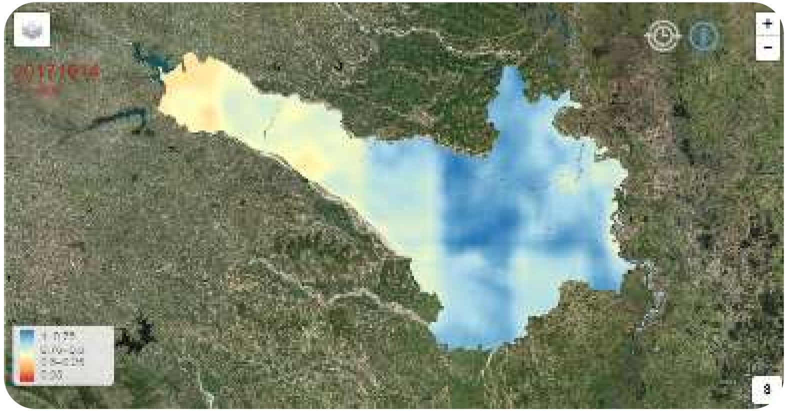
agEYE



“ Real time Crop health and automatic crop acreage estimation helps in planning crop management activities.”


No Risk
Low Risk
Medium Risk
High Risk
Current
7th Day
14th Day
21st Day

“ Strategize crop protection activities for each crop with our disease/ pest prediction models.”



“Understand current/ future drought conditions and water usage conditions like never before with soil moisture maps.”

Intelligent Edge - IoT

Digital Farm @TCS SP Pune Campus

Objective of the Digital Farm is to leverage technology to gather insights on all aspects of crop during the lifecycle and trigger appropriate actions

Sensors used @Demo Farm

Meteorological Sensors:

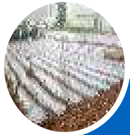
1. Air Temperature Sensor
2. Relative Humidity Sensor
3. Barometric Pressure Sensor
4. Anemometer
5. Wind Direction Sensor
6. Global Solar Radiation Sensor
7. Tipping Bucket Rain Gauge

Plant Sensors:

1. Leaf Wetness Sensor
2. Leaf Temperature Sensor
3. Automatic DEW Point and ET calculation as a virtual sensor

Soil Sensors:

1. Soil Moisture Sensor
2. Soil Salinity Sensor



Mulching paper & Plantation

Installation of Soil Moisture sensor

Installation of IoT System

Installation of Drip Irrigation System

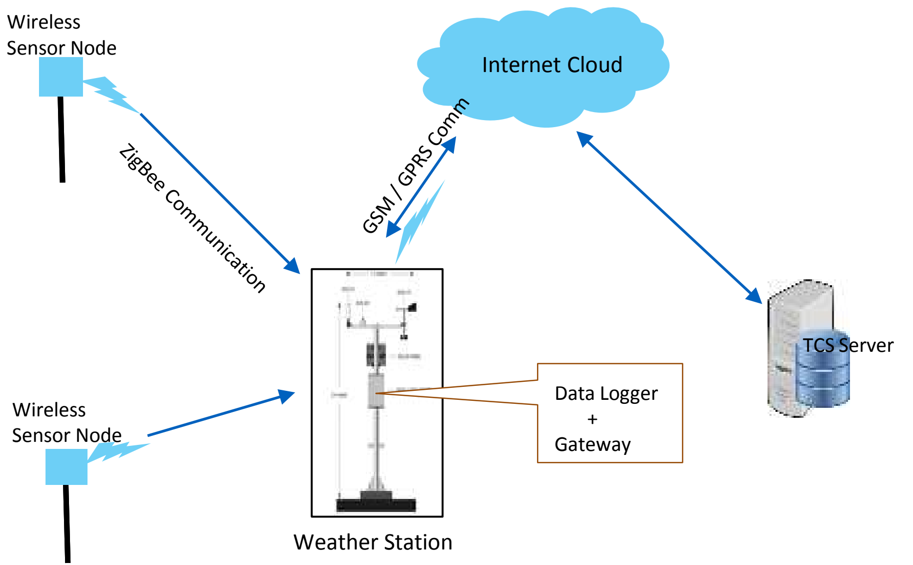
Bed Preparation

Land Preparation

Digital Farm @TCS SP Pune Campus - Results

Health and Yield Monitoring of Cabbage &Capsicum

- 4 nodes and 1 gateway on the farm
- Nodes and gateway communicate over ZigBee
- Gateway streams measurements to **InteGra** every hour


Wireless
Sensor Node
Internet Cloud
ZigBee Communication
GSM / GPRS Comm
Data Logger
+
Gateway
TCS Server
Wireless
Sensor Node
Weather Station

Achievements -

1. Predict the behavior through various sensors and recommend action (DSS system)
2. Demonstrate platform end to end technology, interoperability of application, integration of technologies etc.
3. Increased Crop Yield by 25% and Reduce Cost of cultivation by 20%

Digital Farm @TCS SP Pune Campus - Output

Cabbage Crop

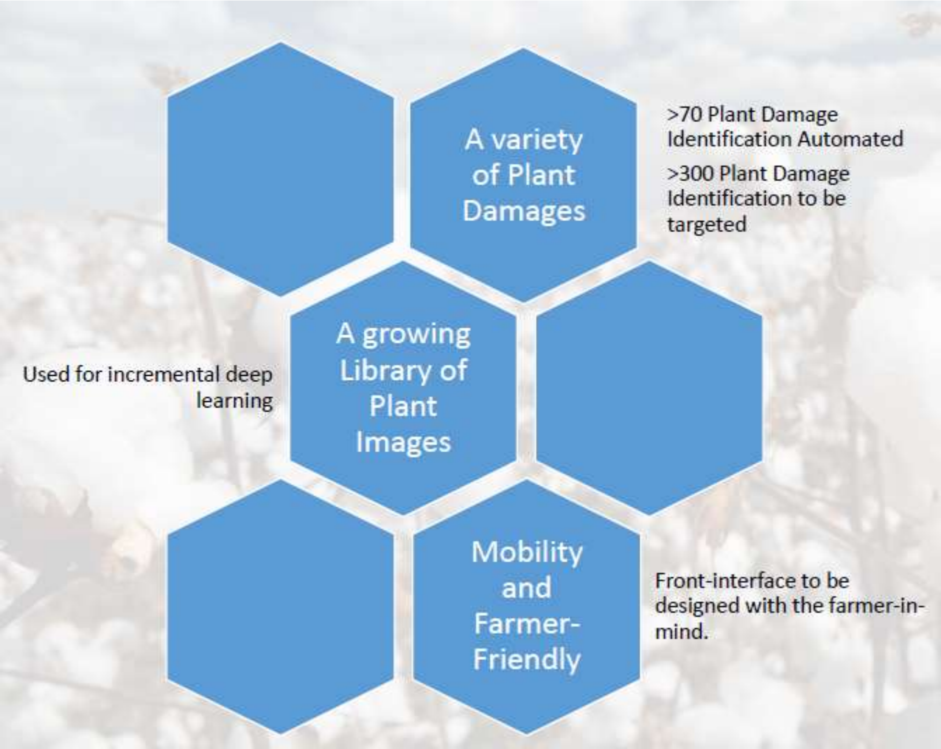
Capsicum Crop

Capsicum Crop with bamboo support

20% more Output Produced

Data Analytics - Image Processing

Problem Identification in Crops



A variety of Plant Damages

>70 Plant Damage Identification Automated

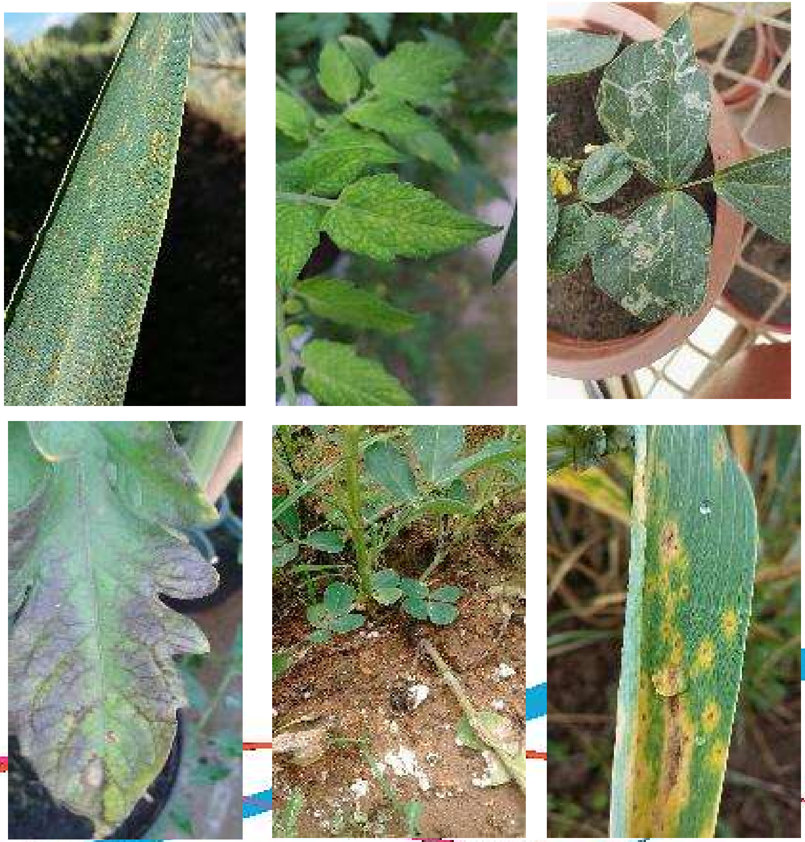
>300 Plant Damage Identification to be targeted

A growing Library of Plant Images

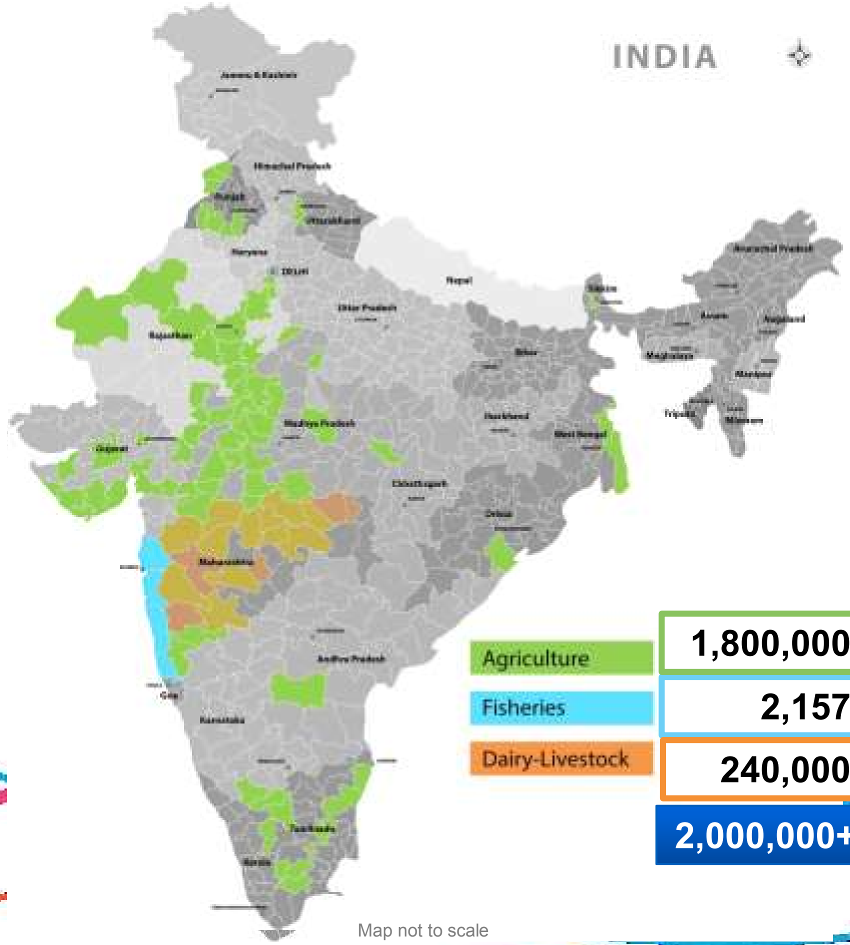
Used for incremental deep learning

Mobility and Farmer-Friendly

Front-interface to be designed with the farmer-in-mind.



Current Areas of Operation


INDIA
Jammu & Kashmir
Himachal Pradesh
Punjab
Uttarakhand
Haryana
DELHI
Nepal
Rajasthan
Uttar Pradesh
Sikkim
Arunachal Pradesh
Assam
Nagaland
Meghalaya
Bihar
Manipur
Tripura
Mizoram
Jharkhand
West Bengal
Gujarat
Madhya Pradesh
Chhattisgarh
Odisha
Maharashtra
Andhra Pradesh
Goa
Karnataka
Tamil Nadu
Kerala

Map not to scale

🟩 Agriculture	1,800,000
🟦 Fisheries	2,157
🟧 Dairy-Livestock	240,000
	2,000,000+

Journey So far

- Wall Street Journal Global Innovation Technology Award (2008)
- Golden Peacock Award for Innovation (2008)
- India Innovation Initiative (i3) Award (2009)
- Aegis Graham Bell Innovation Award (2010)
- Business in the Community - Big Tick (2013)
- Technology patented in US (2015) and India (2016)
- Top 20 Social Innovation
- **Fortune - "Change the World" Initiatives - 2017**
- Express I.T Awards 2017 - Winners in categories - IT Innovation & Mobility Solutions

THANK YOU

> “In a free enterprise the community is not just another stakeholder in our business but it is in fact the very purpose of its existence.”