Digital Technologies in Agriculture – trends and focus areas

ADB Digital Development Forum, 2019

Digital technologies in Agriculture – key trends

Agri-tech is driving the next generation revolution in global agriculture markets

Key technology themes

Farm mechanization
Application of tech in agro processing or supply chain such as agro logistics (Rivigo, Hello Tractor), smart warehousing solutions among others.

Machine learning and analytics
Mine data for analysis of trends in cropping, location, farm management, weather logistics and commodity markets

Blockchain
Self-executing smart contracts together with automated payments and real-time supply chain traceability

IoT and Remote Sensing
In-field sensors, drones, satellite imagery, to enable farmers to view crops from multiple perspectives

Key highlights

Global Smart Agriculture Market to reach **USD 26.7 billion BY 2020**

AgriFood Tech Funding in 2018: **USD 16.9 billion, at 43% Y-o-Y**

Global agro equipment market to reach **USD ~232 billion by 2025**

Precision farming market to reach **USD 10.2 billion by 2025**

Blockchain in food supply chains and agriculture to reach **USD 429.7 million by 2023**

Some Agri-tech Startups

RIVIGO
PRODUCEPAY
FARMERS BUSINESS NETWORK
bovcontrol
hello tractor
indigo
TRRINGO
AB TRACTOR CALL KARO

Source: Agfund, Markets and Markets, Forbes, Grandview Research, Business World

What is going well…

Crop and weather advisory and value chain traceability are the emerging commercial opportunity areas

Input side of the Agri Value Chain

Planning » Inputs » On-farm Production »

Output side of the Agri Value Chain

Storage » Post Harvest Processing » Transport » Market

Crop Advisory

Weather Advisory

- Specific B2B advisory services around weather and crop are gaining traction
  - 51 mn Indian farmers receiving agro-met advisories through m-kisan portal
  - 35% of active 390 agri-tech solutions in Africa, pertain to advisory and information services
- Increased willingness to pay for B2B agri advisory services

Traceability in the value chain enabling real time monitoring and transparency…

- Potential to reduce annual food fraud of USD30-40 billion
- Ensured quality and consignment safety
- Record keeping and accountability
- Sustainability in consumption

Cropin

- Digitised over 3.1 million acres of farmland
- Benefitted ~2.1 million farmers
- Managed 265 crops and 3,500 crop varieties

skymetweather

Benefitted +80,000 farmers in India through ICT-based weather advisory services

MOVCDNER, India

Developed traceability platform for Indian organic produce to monitor flow from farm to fork

agri digital

Over 1.6 million metric tons of grain transacted ensuring traceability in value chain

FoodLogiQ

FoodLogiQ enabled Independent Purchasing Cooperative, a Subway Franchisee-owned company to save USD1.3 million through accurate traceability data.

EY Blockchain for Wine

Some agri-tech startups

Other Cases

UNDERSTORY, Sencrop, SatSure, ignitia TROPICAL WEATHER FORECASTING, TARANIS, FarmersEdge™, FoodLogiQ, ripe.io Blockchain of Food®, Hectare

Source: FAO, Government of India, USAID, World Economic Forum, The Technical Centre for Agricultural and Rural Cooperation, Africa

EY Building a better working world

What is going well…

On the other hand, governments are investing in developing agri-stack platforms

Input side of the Agri Value Chain | **Output side of the Agri Value Chain**

Planning → Inputs → On-farm Production → Storage → Post Harvest Processing → Transport → Market

Spanning the entire Agri value chain

Agri-stack Platforms

Integrated data-driven decision-making for smart agriculture ensure wide scale accessibility and cost economies…

POCRA, Maharashtra India

- Ease in accessing the Database through Cloud Based API Stack
- Precise Weather Advisory for improved crop yield
- Financial Benefit transfer directly to the beneficiary Bank account (DBT)

Diesel Subsidy Scheme, Bihar, India

- Registered +6.5 million farmers with Aadhaar authentication
- Disbursed + USD 278 million to the farmers
- Successfully implemented an end-to-end digital platform

ePragati, Andhra Pradesh, India

- Mapping of agriculture goals and challenges to actual impact
- Provided a range of agriculture solutions such as price and weather information, input advisory, traceability, agri-finance and such others

Source: FAO, Government of India, The Hindu, World Bank

What is not going well…

Low viability of tech commercialization and heavy costs are the key roadblocks

Transition from B2B to B2C and G2C models, for farmers

Limited ability and willingness of smallholder farmers to pay

~80% of farmland in sub-Saharan Africa and Asia managed by smallholders

Low viability of tech commercialization

As per a study by CISCO, about 75% of IoT projects are failing

Key concerns

- High entry barriers for startups
- Concerns over data security and ownership
- Limited Expertise in IoT solution building
- Limited knowledge among farmers
- Lack of Industry Partnerships
- High switching cost due to vendor lock-in
- Poor access to internet and IoT network on farms
- Low margins in agriculture makes IoT investment as unattractive

Microsoft 2019 research report on IoT

- **About 40%** of respondents cited **complexity and technical issues** as major roadblocks
- **97%** expressed concerns on **security of IoT devices and infrastructure**
- About one-third of the **IoT projects fail** in the PoC stage due to **expensive implementation** and/or **unclear value proposition**

Source: FAO, CISCO Newsroom, Microsoft, Hackernoon, Techtarget

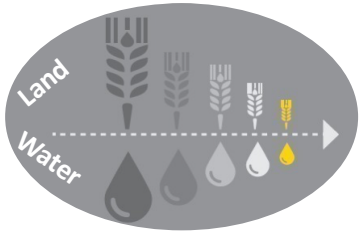
Recommendations

A platform centric approach…

A holistic solution offering integrated datasets at an aggregated level, as an open source platform

Farm to Plate Lifecycle

Farm | **Produce** | **Transform** | **Make** | **Retail** | **Plate**



Agribusiness

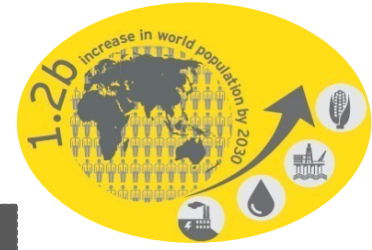
- Soil Management
- Organic chemical
- Digitization
- Micro Irrigation
- Fruits and Vegetables
- High Value Horticulture
- Perishable Spices
- Animal Feed
- Aquaculture
- Dairy
- Livestock
- Meat Processing
- Floriculture
- Call Center
- Custom Hiring Center
- Agricultural Equipment
- Agricultural Services (mobile)
- Vet Lab

Make

- Packaged Food
- Beverage
- Bio-Fuels
- Agro-Industrial Products
- Household Products
- Food Supplements
- Bio-fertilizer
- Textiles & Apparel
- Phyto-neutracuticals
- Animal Feed

Retail

- Traditional Trade/ Mandi
- Grocery
- Club
- Discount
- Convenience
- E-Commerce



Plate

- Transportation
- Power & Utilities
- Real Estate & Equipment
- Government & NGO's
- Financial Services

Emerging Trends

Environmental Factors
- Social awareness
- Scarcity of Resources
- Climate Change
- Farm Consolidation

Technological Breakthroughs
- Autonomous Tractors/ Drones
- Data proliferation/ Big Data
- Precision farming/ Ubiquitous Sensors
- Genetics & agricultural biotechnology

Infrastructure & trade
- Food security
- Infrastructure constraints
- Advanced traceability
- Geo-political stability

Consumer demographics
- Population growth
- Rising middle class
- Urbanization
- Hunger vs. obesity paradox

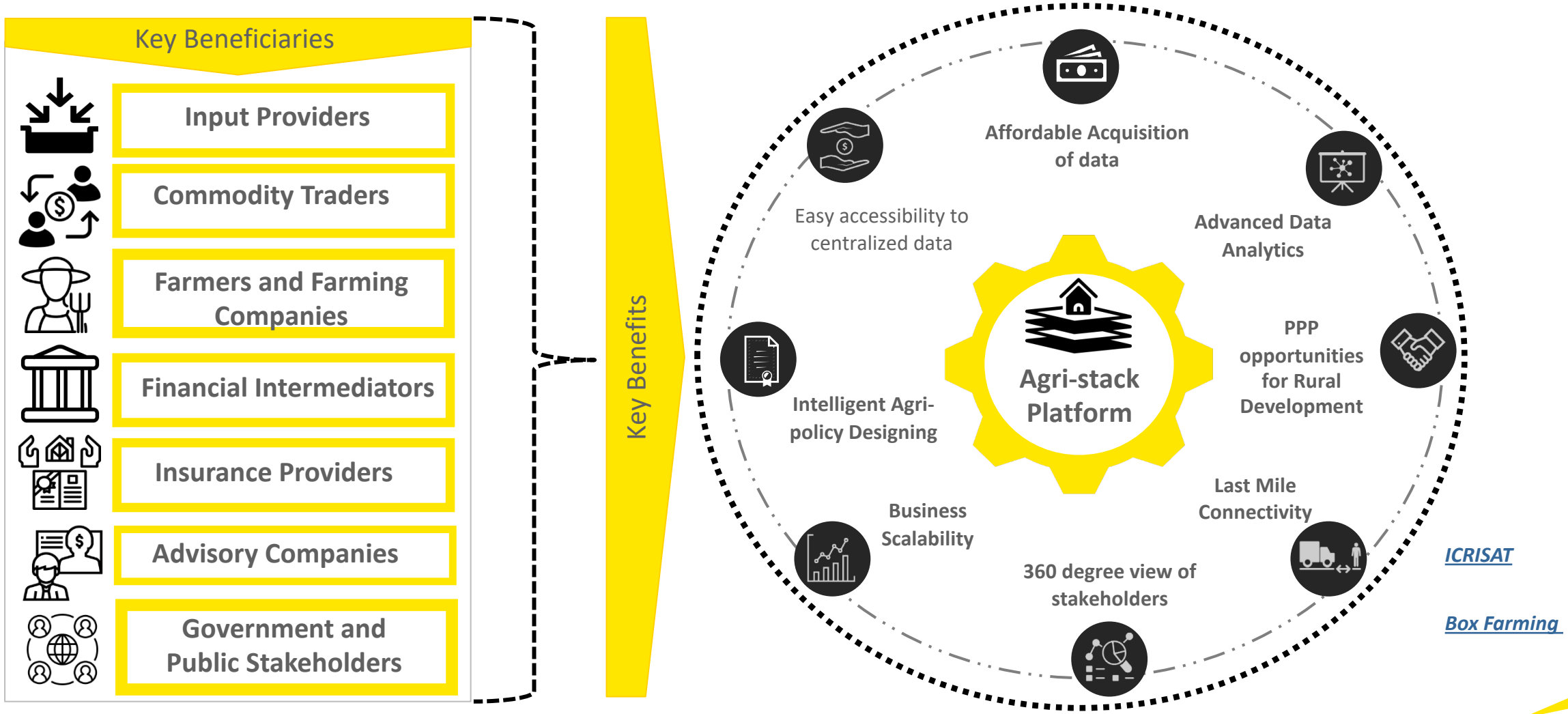
Producer profile:
- *Consolidation of family farms*
- *Shift from subsistence to industrial farming*
- *Greater reliance on inputs & technology*
- *Influenced by global markets*
- *Resource conservation*

Consumer profile:
- *Higher disposable income*
- *Seeking convenience*
- *Health conscious*
- *Environmental & social awareness*
- *Omni-channel*
- *Multi-generational*

An integrated approach to utilization of datasets

Agri-stacks have numerous benefits…

Reduced acquisition cost, easy accessibility, usage of advanced analytics are the major benefits



An agri-platform app would enable the delivery of numerous benefits and provision of services in the PPP mode, such as last mile connectivity, especially targeting the rural area

Source: Economic Times, NASSCOM

Agri-stack – Case study

Data based decision support and monitoring system

E-Agriculture Platform for Kampong Cham, Cambodia

Asian Development Bank

ADB is undertaking a regional investment intervention on **promoting Climate-friendly and inclusive agricultural value chains in three countries of the Greater Mekong Sub region (GMS)**: Cambodia, Laos PDR, and Myanmar.

Context:

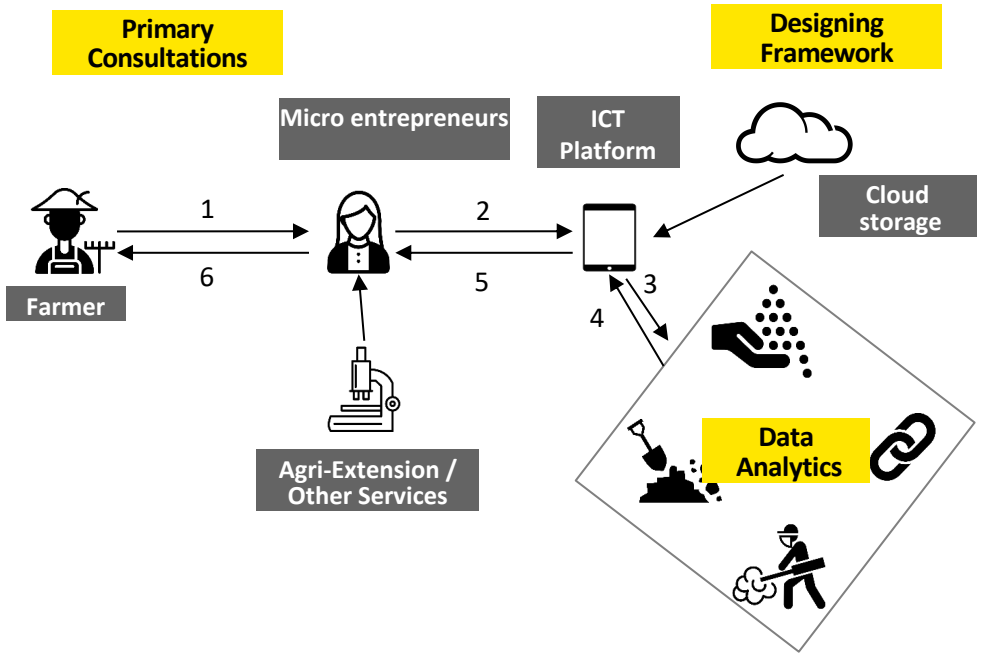
Traditional, rain fed farming practices
low efficiency

Risk management through access to agriculture information and expertise

Lack of market transparency (price, market demand etc.)

Designing framework, functional and technical requirements of e-agriculture platform

Solution: ICT for Agricultural value chain



Impact

Promoting climate-friendly and inclusive value chains in the province

Application of **Information and Communication Technology (ICT)**

Research, Data Collection and Analysis

Economic analysis for **e-agriculture platform**

Stakeholder Workshop to identify focus intervention areas in the identified issues and gaps in **the agriculture sector**

Building a better working world

Ernst & Young LLP

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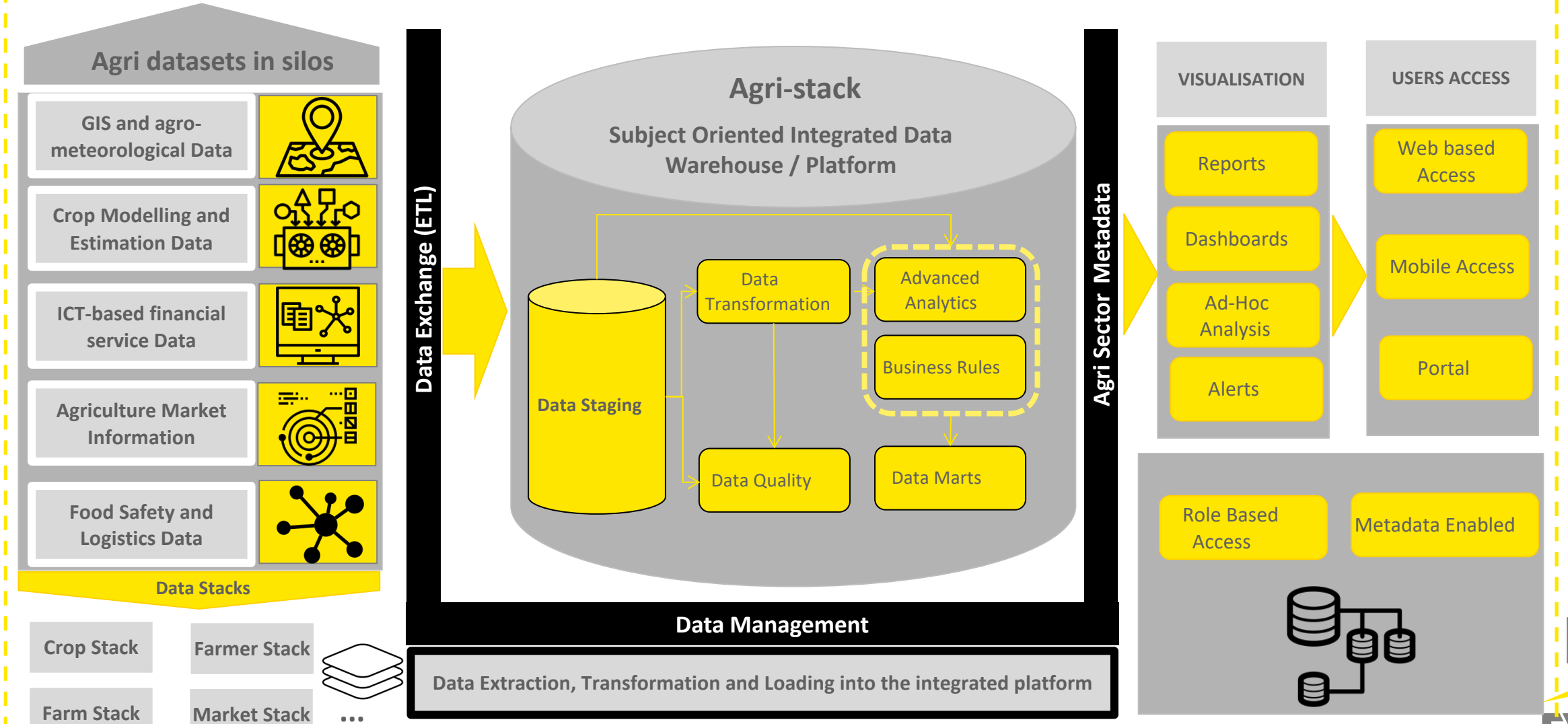
Annexures


11 Oct, 2016
17:35
Rear PTO speed
0 rpm
Engine Hours
545.6 h
Battery voltage
13.4 V
Speed
0.00 km/h
Slip
0 %
Engine speed
850 rpm
Engine load
6 %
Eng. cool. temp
80 °C
Engine oil press
3.00 bar
Fuel rate
4.6 l/h
Fuel/Hour,Fld,Avg
23.5 l/h
F3
52.0
F2
12.2
F1
9.10
kph
0.00
Back
Run1
Run2
Run3
Run4
Run5
Run6

An integrated approach to utilization of datasets…

Focus needed on funding Agri-stack platforms to cover the entire gamut of agri-value chain



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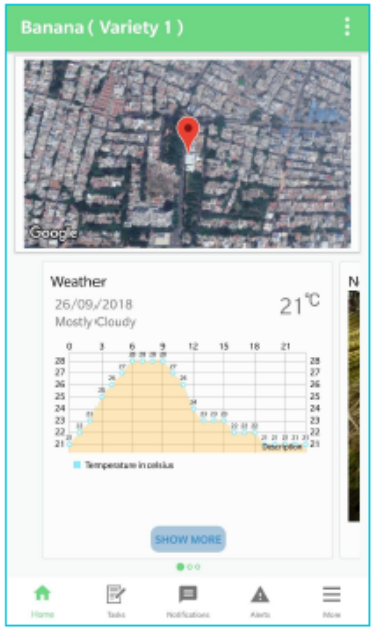
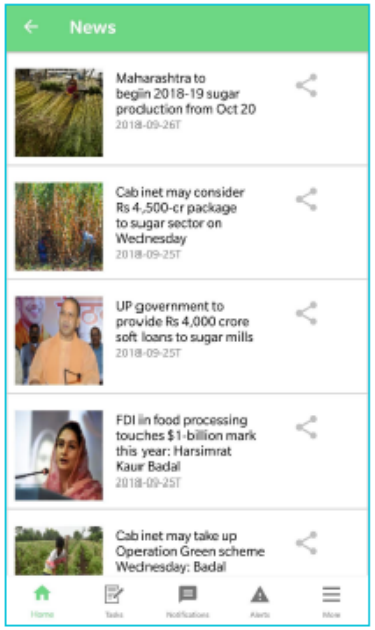
CropIn – Crop advisory services

Benefits to farmers

- Effective crop planning
- Ability to maximize production sustainably
- Ability to increase ROI from farming (cost of production and income)

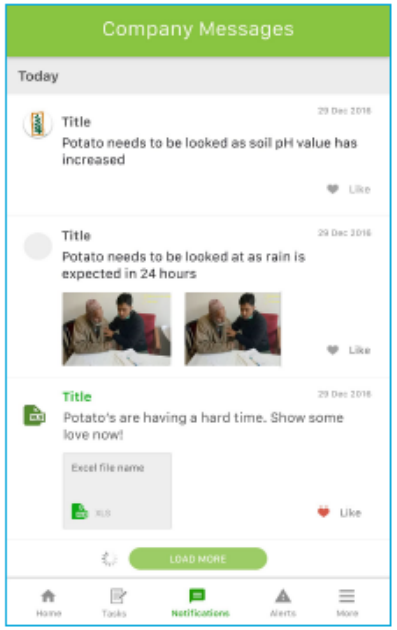


Single dashboard for farm level analysis



Push news articles, information to farmers

Plot level satellite data



Push company messages to farmers

Accurate and specific advisory

- Weather based crop advisories
- Crop POP and pest advisory – sowing to harvest
- Water conservation practices
- Building resilience in soil
- Improved crop practices for new cultivars
- Climate literacy
- Access to market

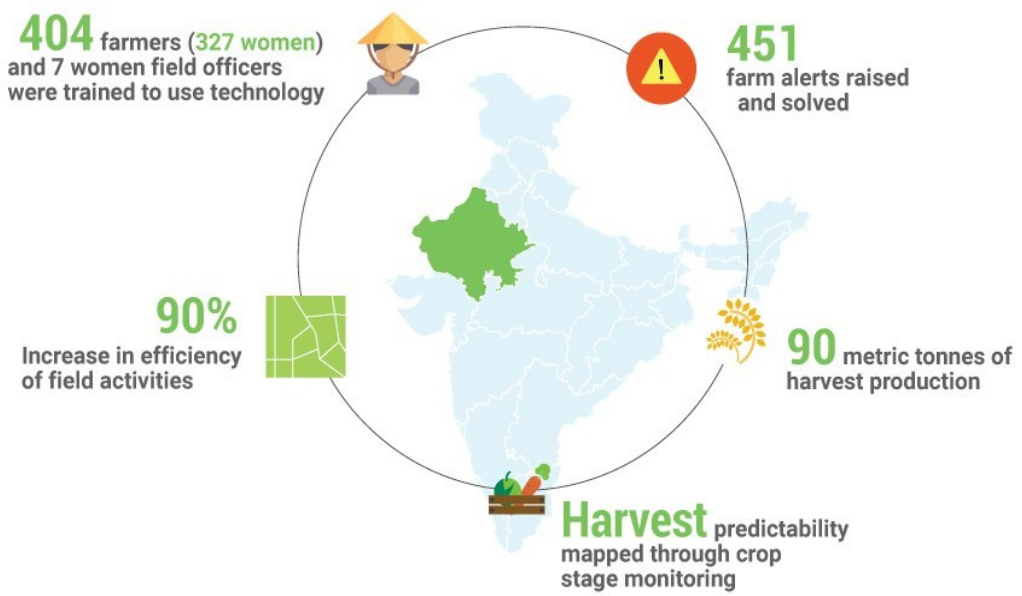
Source: CropIn website

Building a better working world

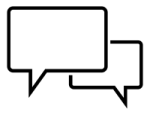
CropIn – Case Study on risk mitigation in Bundi, Rajasthan

CropIn partnered with the CSR arm of a telecom enterprise to introduce and successfully implement an agricultural technology for rural and social upliftment of an arid region in the state of Rajasthan (India). Bundi is a town that received deficit rainfall, which impacted crop cultivation and the rural livelihood.

CropIn enabled the digitisation of over 400 farmers and their farmlands in the region, and provided them with access to a recommended package of practices specific to their region, crop and farm.



Farmers encouraged to raise alerts through mobile app in cases of pest infestation or crop disease



Farmers provided with quick advisories by agronomist to resolve alerts.

Prompt action from both farmers and agronomist ends helped reduce spread of infestation/disease, and reduced crop loss effectively.

Source: CropIn website

Building a better working world

Skymetweather – Key Offerings

Skymet Overview

- India's leading Weather forecasting & Agri risk solutions company.
- Solutions are based on based on IoT, SaaSS (software as a smart solution) and DaaS (Data as a Services), leveraging artificial intelligence & machine learning.
- Expertise in Weather Forecasting, crop monitoring & loss assessment, crop acreage/yield modelling
- Network of 7000 + Automatic Weather Stations (AWS) across India.

Key Solutions

- Real time / Live weather data
- Real Time Crop Monitoring & Yield Assessment
- Development of innovative insurance products
- Transportation intelligence services
- Agri credit Risk tools for Banks / FI's

Value Delivered

- Identification of crop risks zones
- Accurate and precise weather data
- Facilitates data-driven decision
- Minimizes risk in crop failure
- Identification of business potential areas for B2B clients

Source: Skymet website

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Skymetweather – Case Study

USAID and Skymet Partnership in Climate Services for Resilient Agriculture in India

Background and Context

- USAID entered into a unique collaboration with Skymet called as "Partnership in Climate Services for Resilient Agriculture in India (PCSRA)", to further its global initiative "Feed the Future"
- The four year project ((October 2015 to September 2019) aims to extend a full-fledged support to the farmers through **digitalization and development of new risk mitigation products for weather forecasts, agro-advisories and insurance facilitation**

Skymet's Approach: farmer mobile app

- Installed 675 new Automated Weather Stations (AWS) for USAID
- Developed two co-branded apps (SkyGreen and SkyMitra) for farmers
- Provided weather information to the farmers through IVRS, weather display boards and WhatsApp groups

Impact Created

- Benefitted +80,000 farmers spread across 31 districts in 9 states of India
- 10% female farmers on boarded
- Reduced crop losses
- Increased awareness on latest innovation and trends in the agriculture

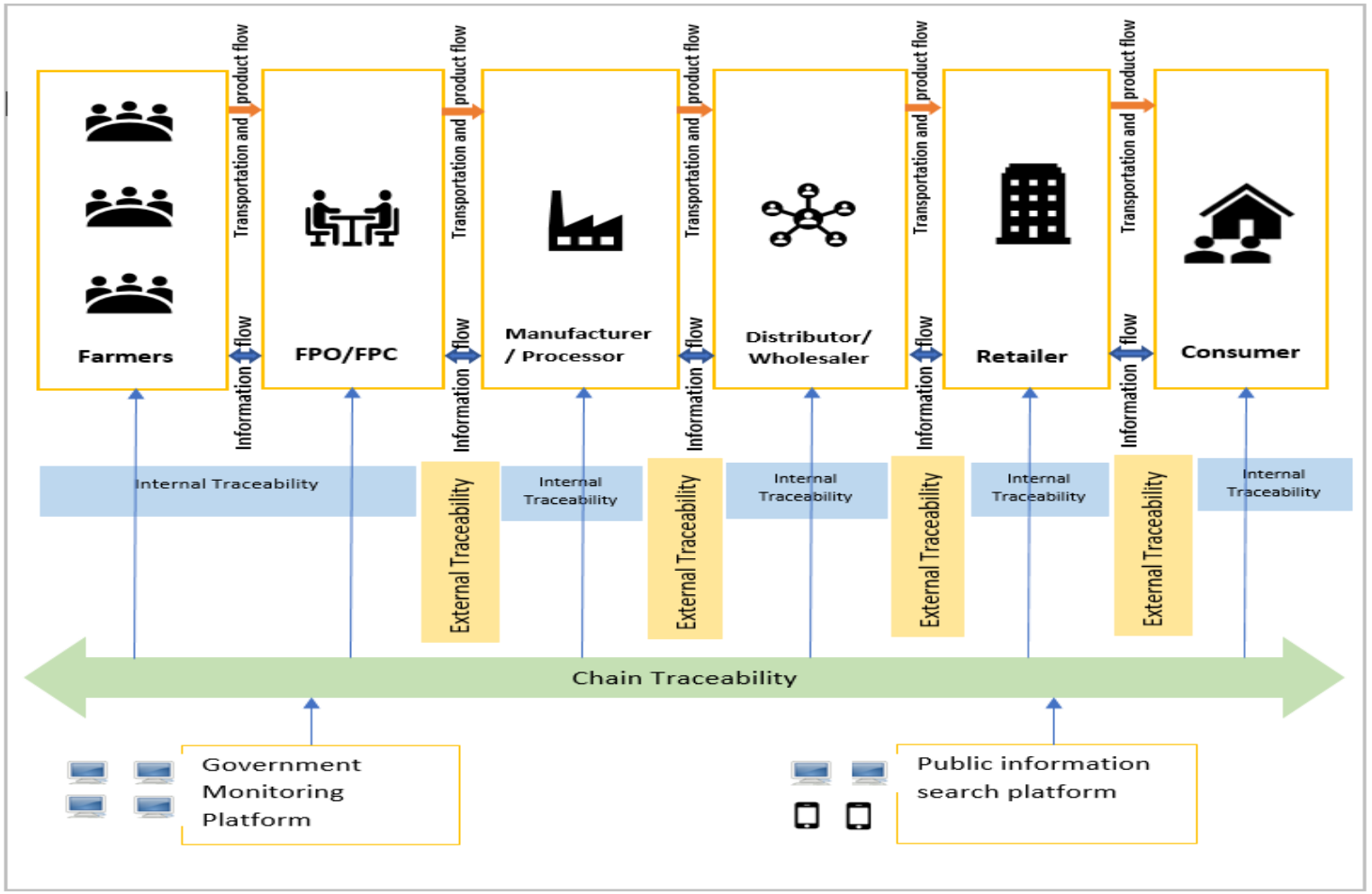
USAID-Skymet team visit a project site in Gujarat to install an AWS

Source: Skymetweather website

MOVCDNER - Framework for traceability

The whole process of MOVCDNER organic product quality control system consists a series of operations of MOVCDNER products including production, processing, packaging, transportation, storage and distribution.

Traceability information system for quality of organic products should be established in the information platform to carry out the whole quality control, so related bureaus consumers can check on information related product quality and safety.



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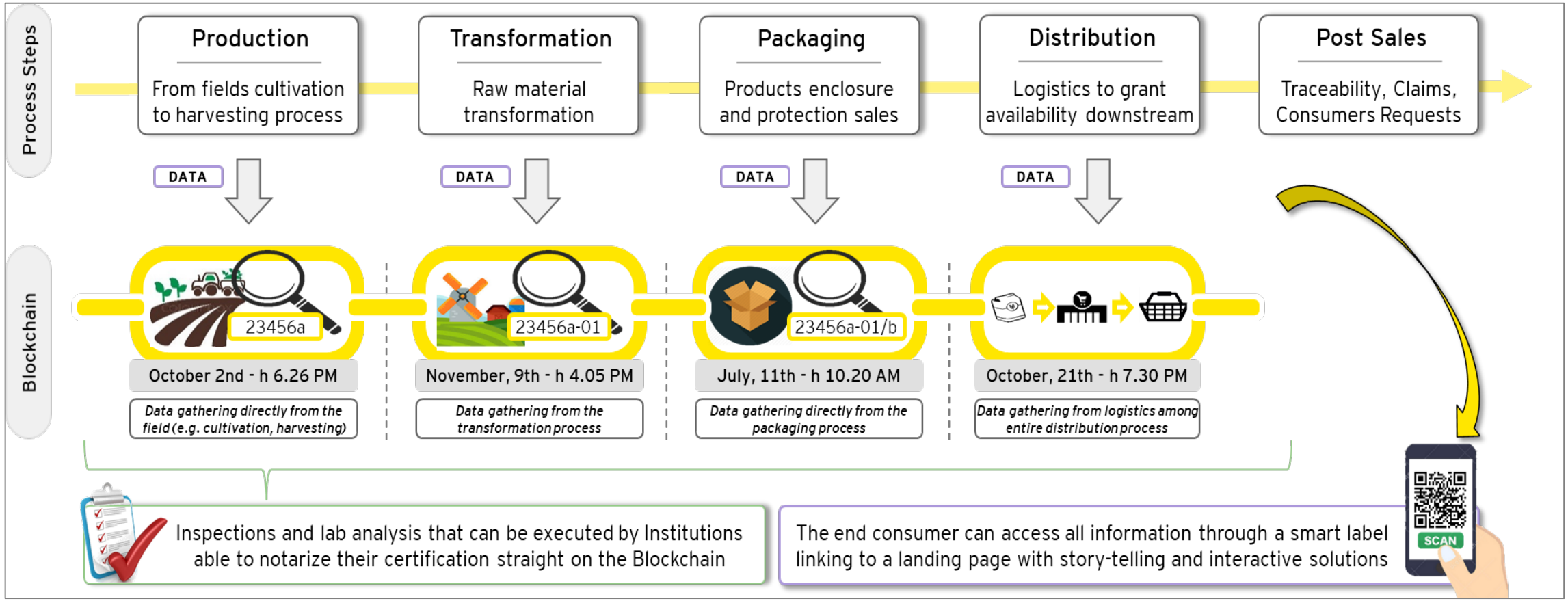
EY Blockchain Solution for Wine – From Grape to Glass (1/2)

The EY Blockchain approach

Data along the entire supply chain is collected, including self-certify cultivation and wine-making info, in order to ensure origin, quality and authenticity. This certification is created through the notarization of immutable data in the Blockchain. Everything is then visible to the consumer through a landing page accessible via smart labels.

Wine blockchain video



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EY Blockchain Solution for Wine – From Grape to Glass (2/2)

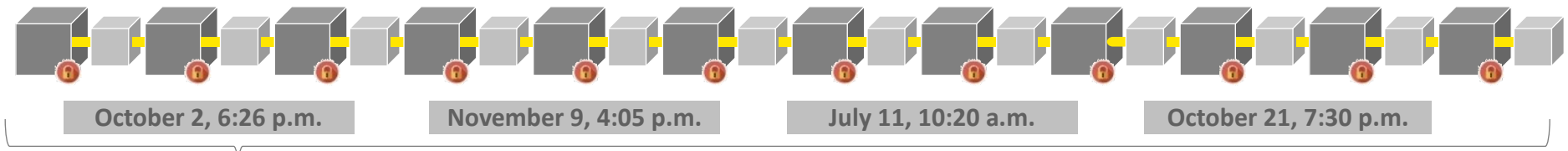
Information gathered and tracked from supply chain, delivers certified product data, including origin and quality. Certification and publication takes place through data storage on blockchain.

Process steps

Production	Transformation	Packaging	Distribution	Post sales
From field cultivation/ harvesting process	Raw material transformation	Product enclosure and protection sales	Logistics to grant availability downstream	Traceability, claims, consumers requests

Blockchain

DATA | DATA | DATA | DATA



October 2, 6:26 p.m. | November 9, 4:05 p.m. | July 11, 10:20 a.m. | October 21, 7:30 p.m.

Inspections and lab analysis can be executed by institutions able to notarize their certification directly on the blockchain

The end consumer can access all information through a smart label linked to a landing page with storytelling and interactive solutions

Benefits

- Data collection model auditing and digitalization
- Creation of an integrated platform from an AS-IS fragmented scenario
- Real-time access to ministerial and regional data for full compliance
- Precision farming/business intelligence systems integration
- Brand value increase and better reputation/awareness on the market
- VAS analytics integration for a geo-distribution control purpose

Manufacturer side

Final customer side

- High-quality product warranty to final consumer thanks to blockchain certification process
- Direct mobile access to certified information through QRcode
- Easy interaction through a targeted storytelling focused on UX
- Production process transparency
- Education about whole industrial processes for goods production

Source: FAO, Hindu News

Building a better working world

Case Studies – Traceability as a game changer in agri-chain

1

Connecting to Global Supply Chains – AgriDigital and CBH Group

Case Overview

CBH Group, Australia's largest exporter of grain and AgriDigital, conducted a pilot to test the application of blockchain in Blue Lake Milling, an oats processor in South Australia

Problem Case: Lack of transparency and authenticity in the batch of oats labelled as organic

Piloting the Solution

Farmgate → Transportation → Processing & Milling → Retail customer

Record data on the provenance, storage, transport and of the oats

Web application and the AgriDigital SaaS-based platform enabled by Blockchain

Scanning the QR code at the point of sale produced a report either confirming or denying the organic status of the oats.

Expected Impact

- Traceability of the product
- Consumer Trust
- Accountability among the participants

2

Seed Potato Traceability - Punjab Agri Export Corporation and CropIn

CropIn has partnered with the Punjab Agri Export Corporation (Pagrexco), to incorporate a first-of-its-kind '**Seed Potato Traceability**' in the entire value chain and to improve the quality of potato seed production in the State

Problem Case: Misbranding of seed potato as Punjab Potato seed through illegal mixing of seed potato from other states

Seed Growers → Packaging and Warehousing → Indian and International Farmers

CropIn's AI-enabled Technology for Traceability

QR-code tagging during packaging and warehousing process would ensure that potato farmers are able to trace the origin of the seeds

Expected Impact

- Certified seeds to cover 55,000 ha of land in Punjab
- Branding of Potato seeds
- Transparency in trade
- Forward linkage and international marketing

Source: FAO, Hindu News

FoodLogiQ – Case Study

FoodLogiQ - Delivering the Promise of End-to-End Traceability Throughout the Subway System

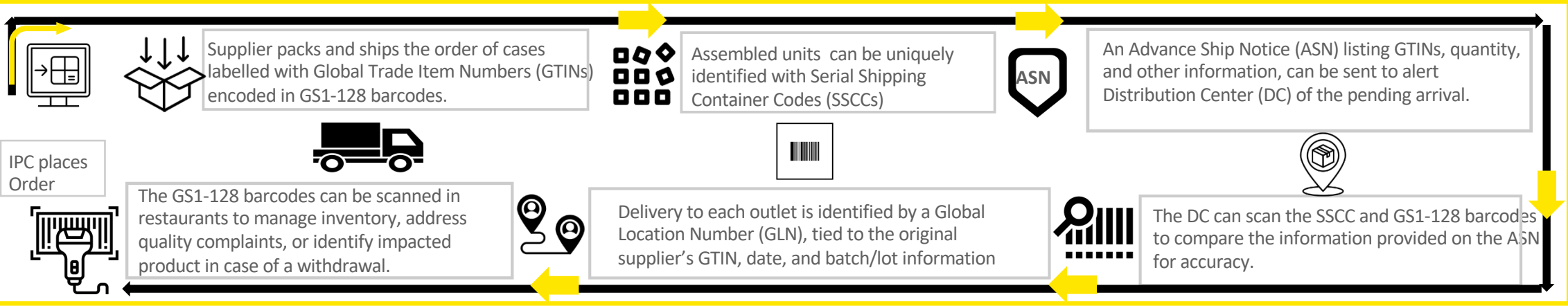
Background and Context

- Independent Purchasing Cooperative (IPC) is a Subway franchisee-owned and operated purchasing cooperative.
- To ensure supply chain efficiency and food freshness, and safety of the materials supplied (fresh vegetables, meat, sauces and such others), IPC wanted to achieve traceability of suppliers' products as they travel to Subway outlets.

Challenges

- Lack of accurate product data
- High costs and inefficiencies in the supply chain
- Concerns on ingredient freshness and quality

Solution: Levergaing FoodLOgiQ's connect platform, IPC launched a data quality initiative, using the Global Data Synchronization Network (GDSN), to create a single source of truth for all partners in the supply chain



Value Delivered

~99% Of products by volume are traceable

~94% Of suppliers by volume are sending shipment information to IPC's traceability system

31% Of the product is being scanned at the Subway system in North America

$1.3 mn Saved in annual cost based on accurate product data enabled by GS1 Standards.

Source: FoodLogiQ website

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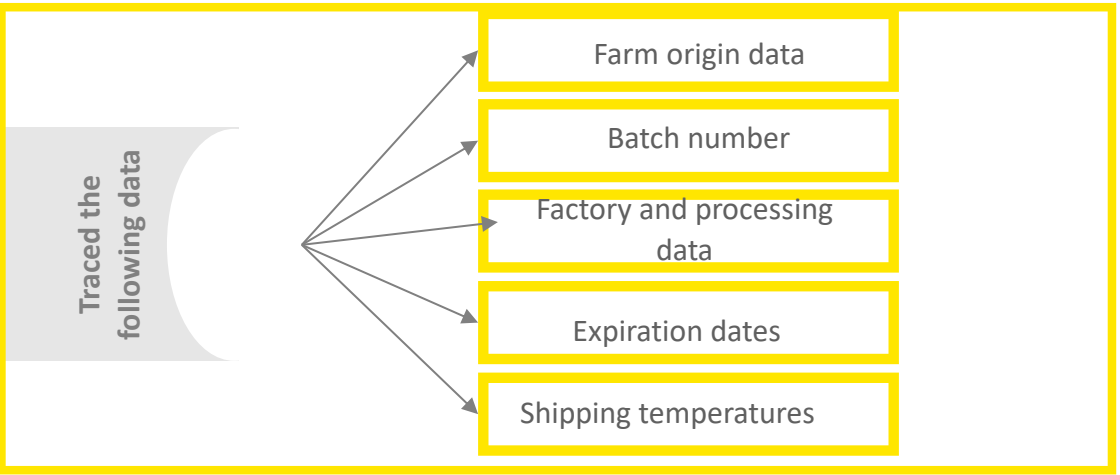
Other case studies on traceability

1 Walmart- food traceability system based on Hyperledger Fabric, powered by blockchain

- In 2016, Walmart, IBM, and Tsinghua University collaborated on a blockchain pilot to trace Mexican mangos in the US using the IoT sensors along the supply chain.
- The aim was to test for reducing the food recall cost, tackle the illness caused by consumption of contaminated food and bring efficiency in supply chain



Efficiency in Mango supply chain: The time needed to trace the provenance of Mangos **reduced from 7 days to just about 2.2 seconds**

Walmart can now trace the origin of over 25 products from 5 different suppliers using a system powered by Hyperledger Fabric.

Plans to trace fresh leafy greens (like salad and spinach) using the system by 2019 end.

2 Roundtable on Sustainable Palm Oil (RSPO) – PlamTrace under RSPO certification program

- RSPO launched traceability system that allows the identification of the mill of origin for all Certified Sustainable Palm Oil (CSPO), across the RSPO supply chain systems
- RSPO eTrace platform was launched in 2012 in partnership with UTZ as the traceability platform based on the identity preserved, segregated, mass balance supply chain models
- In 2017, the eTrace was relaunched as RSPO PalmTrace, with an additional feature of a marketplace for RSPO Credits under the Book and Claim supply chain model.

Certified area and CSPO volume

3.5 million ha and 14.5 million tonnes

Certified Palm Oil Mills

394 units/mill

Companies with Supply Chain Certificates

2,837

Facilities with Supply Chain Certificates

4,880

Individual Smallholders

144,934

Smallholders Certified Area

376,419

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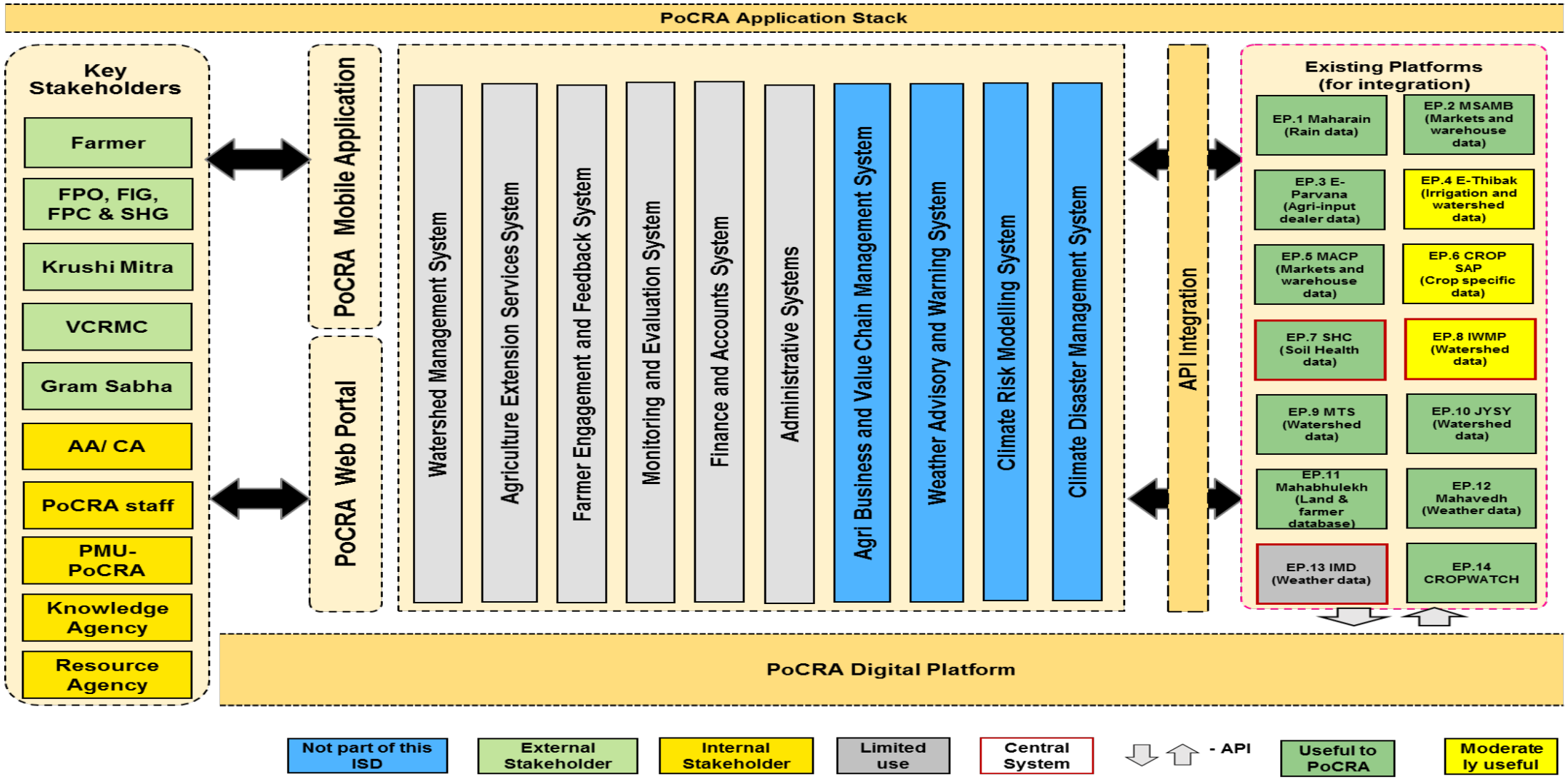
PoCRA application architecture



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System to disburse subsidy to Farmers through DBT Portal

Key Challenges

1 Lack of a platform for seamless distribution of subsidy

2 Non availability of integrated platform for DBT for individual farmers, communities and FPO / FPCs

3 Lack of an efficient mechanism for scheme implementation

Solution Delivered

- Conceptualization of integrated Platform for DBT
- Design and implementation of scheme wise dashboards & reports
- Robust tracking system of scheme at various stages
- Integration with Aadhaar and other payment gateway services
- Looping various offices under Department for successful integration of robust platform

Value delivered

Robust platform development in the form of Direct Benefit Transfer

Integrated solution for subsidy disbursement for Diesel, Drought and seeds

Registered more than 6.5 million farmers with Aadhaar authentication

Disbursement of more than USD 278 million made to the farmers

Successful implementation of end to end digital platform

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e- Pragati core platform: mapping of agriculture goals and challenges to actual impact

Agriculture Goals & Challenges

a) Improve Farmer Income (doubling, 10,000/month)

b) Climate resilient cropping stystem

c) Institutiona Financial Access to All

d) Improve Traceability & Quality/Health of Food

e) Timely & Transparent services to Farmers

f) Sustainable double digit growth in GVA

Agriculture Outcomes

- Better Access to Information
- Better Access to Finance
- Better Access to Quality Inputs
- Better Access to Extension
- Market Linkage
- Optimal use of Fertilizer & Pesticide, Natural Farming

Agriculture Solution

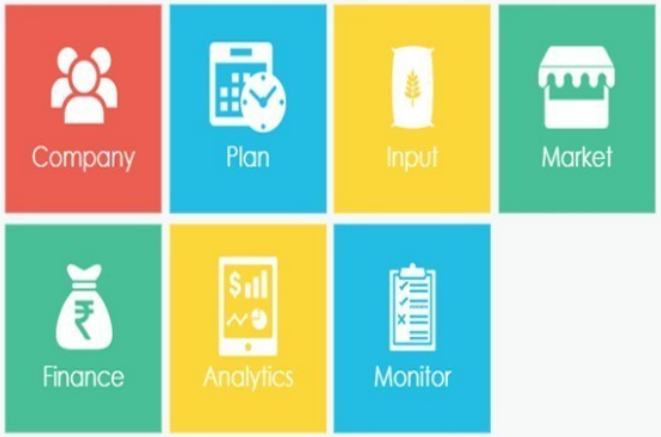
- Agro-Planning
- Price Information/Forecast
- Weather & Water Information
- Advisories
- Credit, LEC, COC
- Insurance
- Seed, Fertilizer, Pesticide & Other Licenses
- Farm Mechanization, Power
- Quality Control
- Traceability
- Good Agricultural Practices
- Farm Mechanization
- Soil Health Card
- ZBNF
- Reliable Crop Booking & Enumeration
- Disaster & Drought Management, Early Warning
- Direct Linkage between Farmer, Suppliers & Buyers (eNAM, FOSS)
- Pre-processing, Storage & Logistics
- Capacity Building

Impacts

- Better & more resilient Crop Planning
- Optimal mix of Agri & Hori Crops, Maximize GVA
- Better Disaster and Risk Management
- Improve Income & Better Productivity
- Reduce Exploitation by Local financers
- Reduce Risk
- Improve Productivity & Reduce Risk
- Reduce Fake/Low-Quality Inputs
- Timely Farm Practices, Improve Productivity
- Reduce Input Costs
- Increase Price Realized
- Branding & Differentiation
- Reduce Fertilizer Usage
- Improve Health Benefits
- Timely Benefits to farmers
- Reduce Fraud & Leakage

FARMORE by Keansa (ICRISAT) – open platform with multi later data abstraction

- Open Technology Platform
- High Scalability
- Multi-layer data abstraction
- One system for Planning, Execution and Decision Making
- High Confidentiality and Security
- Regional Language Support
- Offline and Online Hybrid



Reporting and analytics

Generate reports for procurement, sales, Inventory, market participation, revenues and volume traded.

Monitor

Facilitate internal and external review of company to measure performance and compliance on indicators like membership, Financial inclusion, Loans, Insurances and Risk Protection, Leadership and Communication.

Company module

Capture information for companies including financial , compliance, farmer groups, federations etc.

Planning module

Crop templates, input planning, output planning and yield schedule

Procurement

Capture information transactions. Connect to financial account journals and update inventory on hand.

Sales and inventory

Capture all sales transactions. Use for stock verification.

Auction

Create auction platform. FPO earns a commission to facilitate transaction.

Financial management

Review accounts of farmers, traders, suppliers. Managed receivables and payables. Track cash / digital payments

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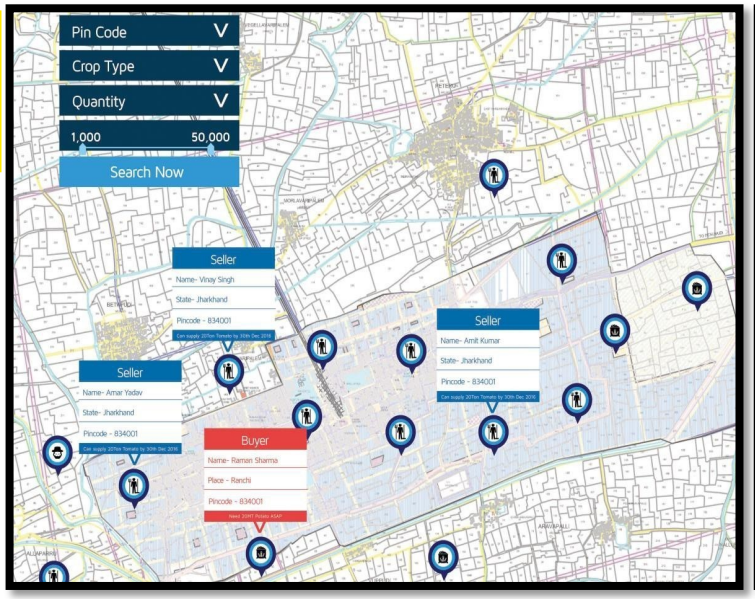
Boxfarming – A digital platform for the farming community

Boxfarming is a complete digital platform operated and executed through micro services, run by micro entrepreneurs, for farmers and farming community, for achieving High Crop Yield. It leverages the following:

IoT: Moisture, Temperature measurement Live data capturing when using with tools

BigData and AI: Prediction on yield, disease, supply chain optimization, demand forecasting, plant health analysis

Blockchain: Traceability of farming practices – method used, composition



Key Components of Boxfarming

Micro Entrepreneurs

Face of boxfarming to the farmers. Single Point of Contact Service Providers.

Master data of Diseases

List of all diseases and preventive action needed on urgent basis.

Package of Practices

Collection of Best Practices of Farming by Crop, by season, by Location

Data Analytics

Digital Repository of all happenings for future prediction. Master Controller for the entire process.

Agro Experts

Panel of Agro Experts cum Scientists for Consultancy and help. Ex. Diseases

Trade Engine

Digital Crop trading platform for buyers, sellers.

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