Asia-Pacific Rural Development and Food Security Forum 2022

Battling Climate Change and Transforming Agri-food Systems

22-24 March 2022

Digital Technology in Agriculture

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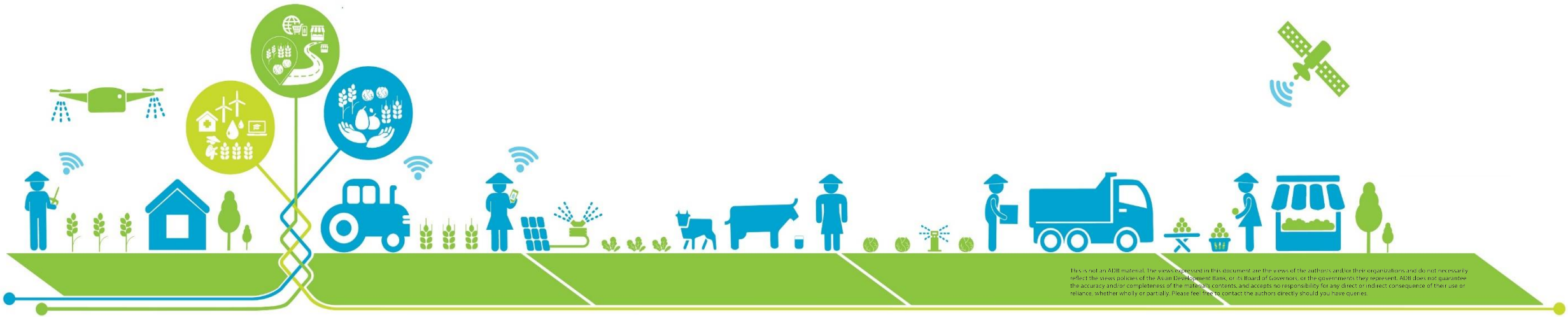


1. Many problems in the agrifood system that can benefit from digital technologies

MACRO-LEVEL

- Need to increase food supply by >50% by 2050 (FAO, 2016)
- Need to increase agricultural productivity by 200% in small farms and 20% in commercial farms (IFPRI)

MICRO, FARM-LEVEL

- Coping with climate change
- Coping with environmental degradation
- Increasing land productivity (nutrients, pests, water)
- Reduce drudgery from labour (ageing farmers)
- Increasing farming space – Urban Peri -Urban Agriculture
- Reducing and using relatively high agri-food losses and waste
- Coping with labour availability and productivity

ASIA-PACIFIC AGRI-FOOD
INNOVATION WEEK
Singapore, November 20-22, 2019

www.agrifoodinnovation.com

Approach: Problems should drive digital technology development and deployment, and provide solutions

Agriculture has historically depended on discoveries and innovations to make big disruptive strides: Mendel's laws, hybrid seed, mechanization, fertilisation, modern dwarf varieties, synthetic pesticides, biotechnology, precision farming, etc.

Twenty-first Century innovations

- ✓ Digitalization in agriculture (production, post-harvest)/Smart farming/ Knowledge Technologies
- ✓ Biotechnology for crop & animal improvement, including nutrition
- ✓ Novel environments for farming
- ✓ Product integrity and fraud prevention
- ✓ Supply chain logistics, infrastructure and risk management
- ✓ Novel food (e.g. Alternative proteins)
- ✓ Waste reduction; Waste valorization.

Disruptive Innovations are needed:

- To increase farm productivity
- To make more food available
- To improve agricultural sustainability &
- To improve nutrition security

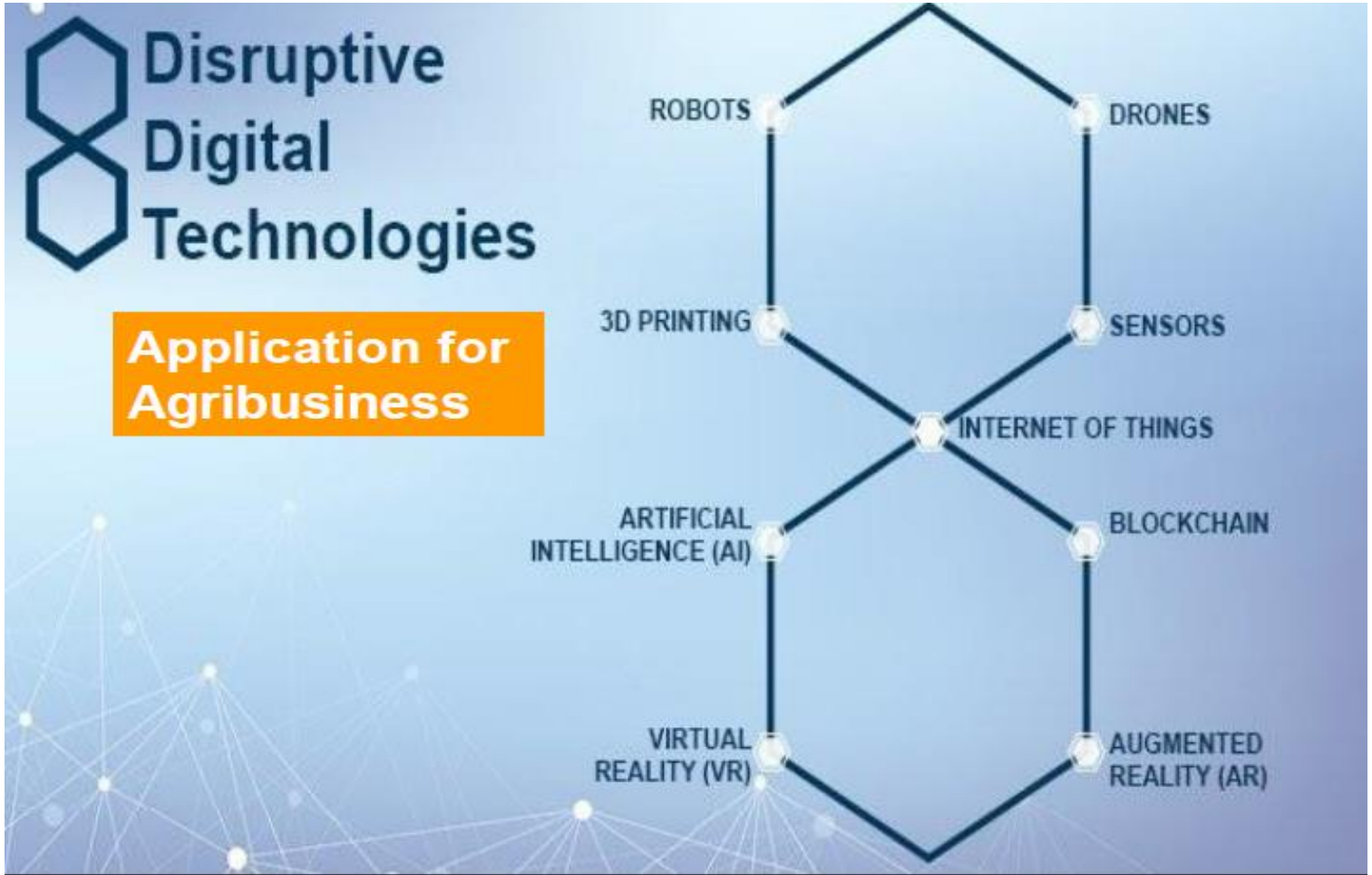
Will digital technologies be the big disrupter in the 21st C?

2. What are appropriate digital technologies?

Two possible perspectives:

- Viewpoint 1 -- What are available digital technologies?
- Viewpoint 2 – Which parts of the agrifood system/ supply chain to use DTs?

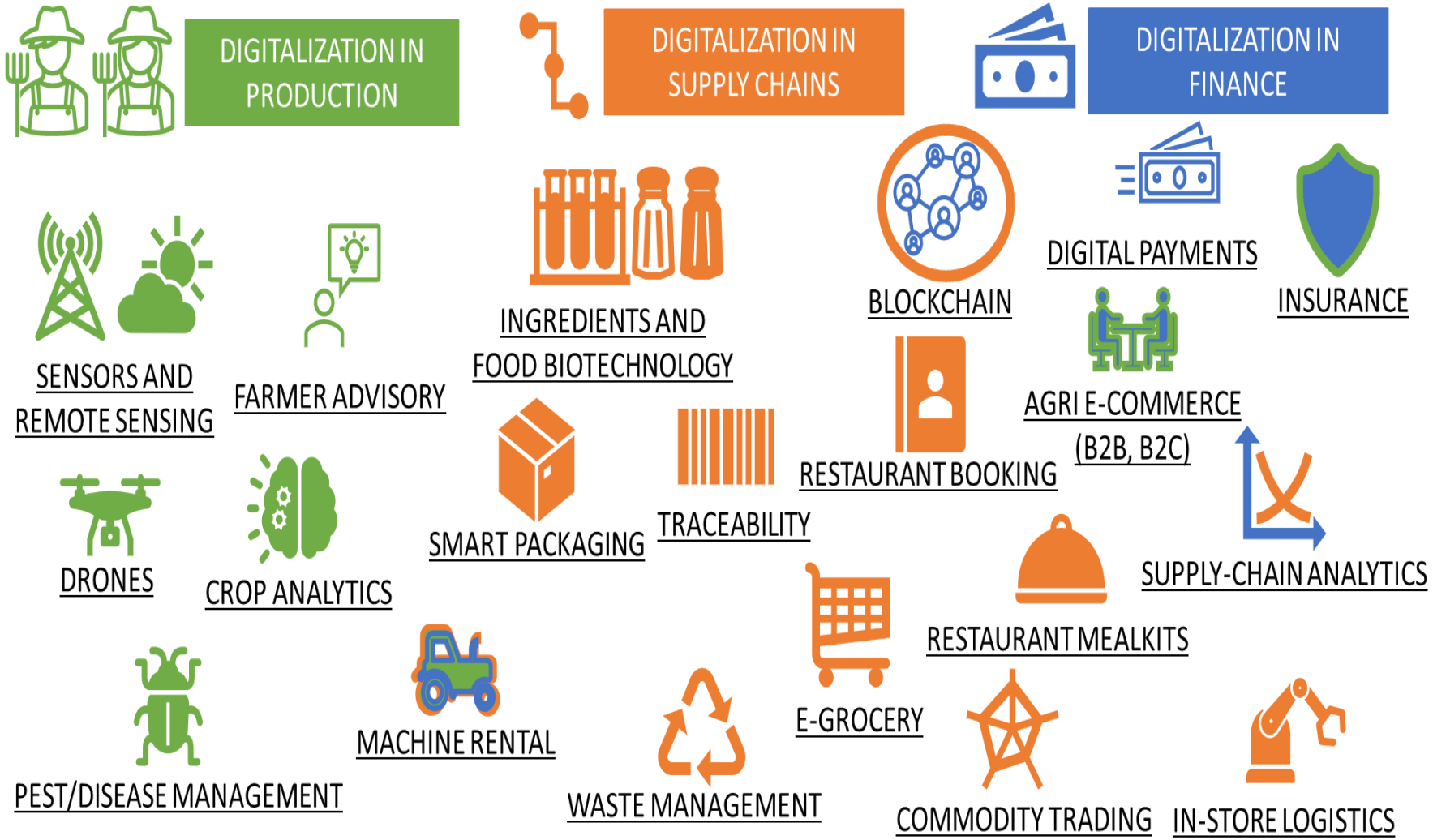
Viewpoint 1
Available Digital technologies



Courtesy:
Michael Dean,
AgFunder, 2020

Viewpoint 2 – Parts of the agrifood system/ supply chain to use digital technologies

Digital Technologies in Agriculture, by Digital Entry Point (Production, Supply Chains (Distribution), Finance)



Source: Montesclaros, Teng & Caballero-Anthony, RSIS, NTU

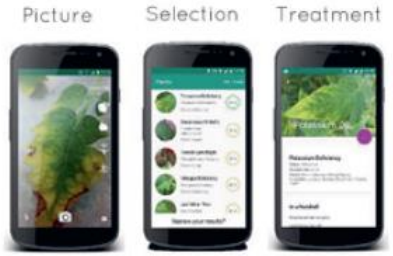
Digital Applications in Production and Processing

ON-FARM PORTABLE DECISION AIDS (Off-line)

IRRI – Rice Crop Manager

ICRISAT - Plantix

Automated disease detection – cutting edge technology available for farmers in India



Smart Farming
Precision Agriculture

DIGITALIZATION IN PRODUCTION

FARMING PROCESS

AGRI E-COMMERCE (B2B) | MACHINE RENTAL | DRONES | PEST/DISEASE MANAGEMENT | MACHINE USE

Decision-Making on Inputs → Purchasing Inputs and Renting Machinery → Planting → Crop Growth → Harvesting

FARMER ADVISORY

SENSORS AND REMOTE SENSING | CROP ANALYTICS

Reduce Yield gaps

Theoretical Yield	Genetically determinants
Potential Yield	Defining factors: *CO2,Radiation, Temperature, Crop features*
Water & Nutrient-limited Yield	Limiting factors: *Water, Nutrients*
Actual Yield	Reducing factors (Loss): *Biotics (Weeds, Insect pests, Diseases); Abiotics*

Source: Montesclaros, Teng & Caballero-Anthony, RSIS, NTU

New farming systems: Controlled environment vegetable farming using precision agriculture concepts

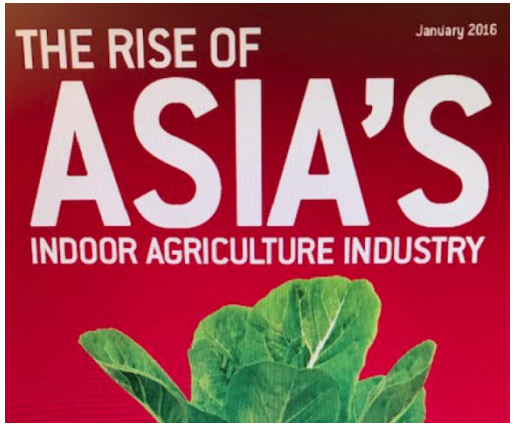
- 'Plant Factory' technology (Urban) – new farming systems called "PFAL" or Plant Factory with Artificial Light
- Use of digital Internet-of-Things (IoT) systems which link environmental sensors to crops to decision algorithms which optimize growth

Example: **HortiPolaris,** China, uses "Digital Twins" (systems models) to guide optimization of plant growth in indoor tomato farm by manipulating the environment and inputs

There were an estimated 450 operational PFALS in Asia (2016) ….NEWBEAN CAPITAL, Singapore

Farm 1 - "Panasonic" Indoor Farm

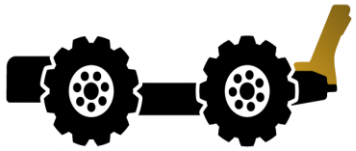
Farm 2 -"Archisen"



Startup costs range from US$82K for 32 sq m unit to US$ Millions for thousands of sqm unit

AMBIT
AGRICULTURAL ROBOTICS

Basis+
MODULAR SMALLHOLDER ROBOTICS



ROBOTS for smallholders

- ✓ Reduce drudgery
- ✓ Increase accuracy at scale
- ✓ Reduce cost of operation
- ✓ Reduce dependency on labour

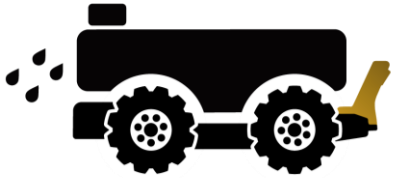
Modular Applications

- ✓ Autonomous
- ✓ Portable
- ✓ Accessible
- ✓ Modular

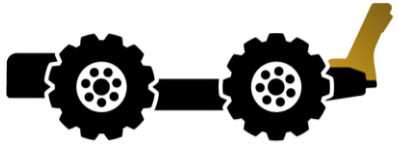
See and Spray

Plant Imaging

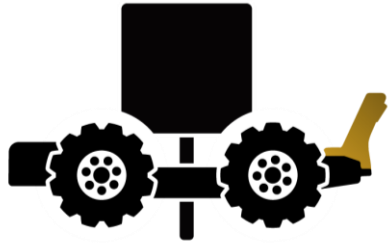
Seeder



Pre-Emergent Spray



Land Levelling



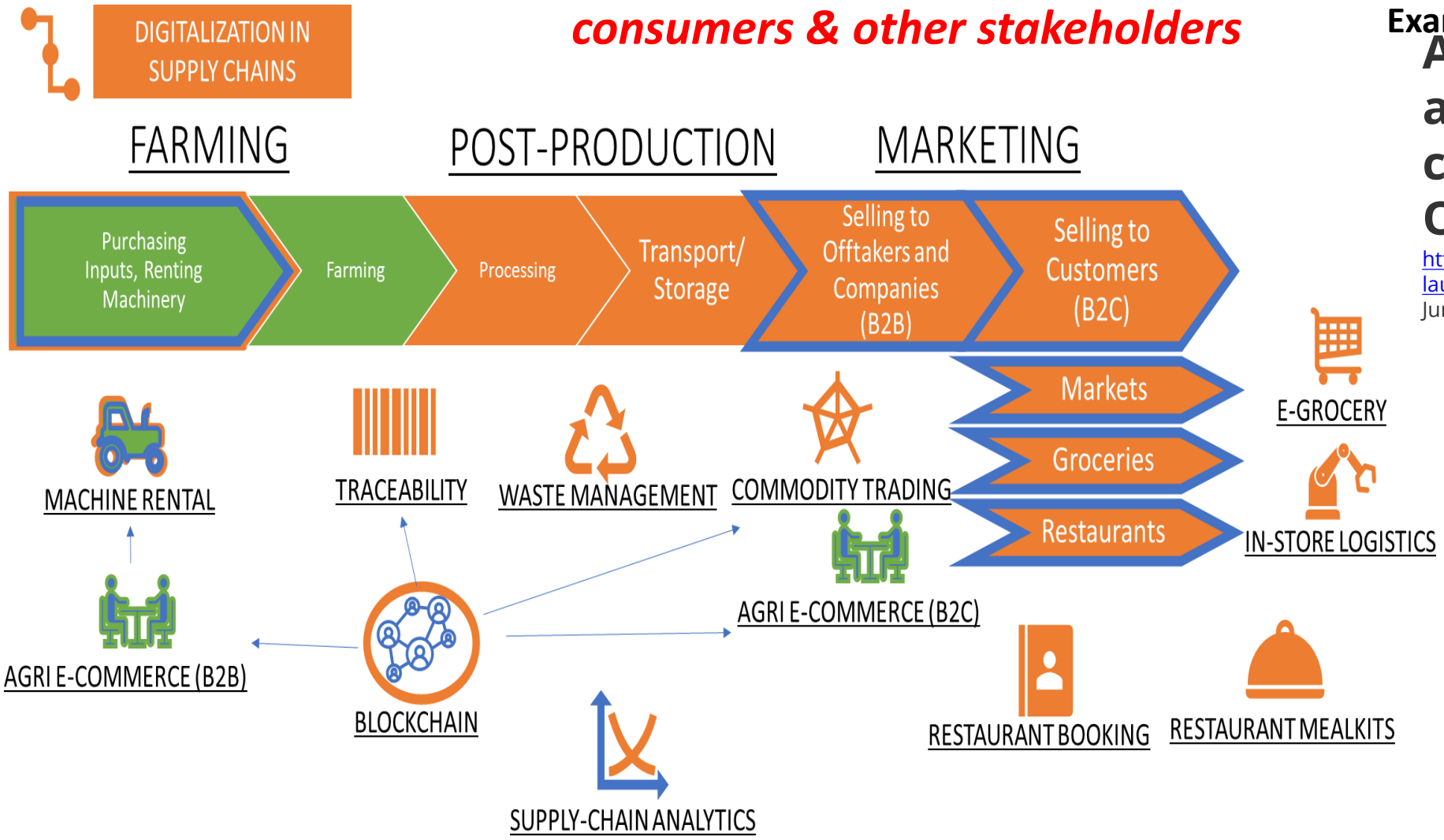
Soil Probe

Variable Rate Fertiliser

www.ambitrobotics.com

Digital Applications in Supply-Chains (Distribution, mid-stream to down-stream)

Connecting farmers to businesses, consumers & other stakeholders



Example: OurFarm

AirAsia launches agriculture e-commerce platform Ourfarm

https://www.theedgemarkets.com/article/airasia-launches-agriculture-ecommerce-platform-ourfarm

June 15, 2020 20:3

Example: Pinduoduo

Pinduoduo

Source: Montesclaros, Teng & Caballero-Anthony, RSIS, NTU

Use of AI, machine learning & risk management algorithms for supply chain logistics and analytics

Food Security Exchange (FSX)

10 June 2020

Food Resilience Optimized

www.foodsecurity.exchange

FSX enables governments & businesses to better manage food supply vulnerabilities by providing technology tools, frameworks & methodologies to mitigate the impact of food supply chain disruptions

Unstructured Data

NLP to mine online news & on social media

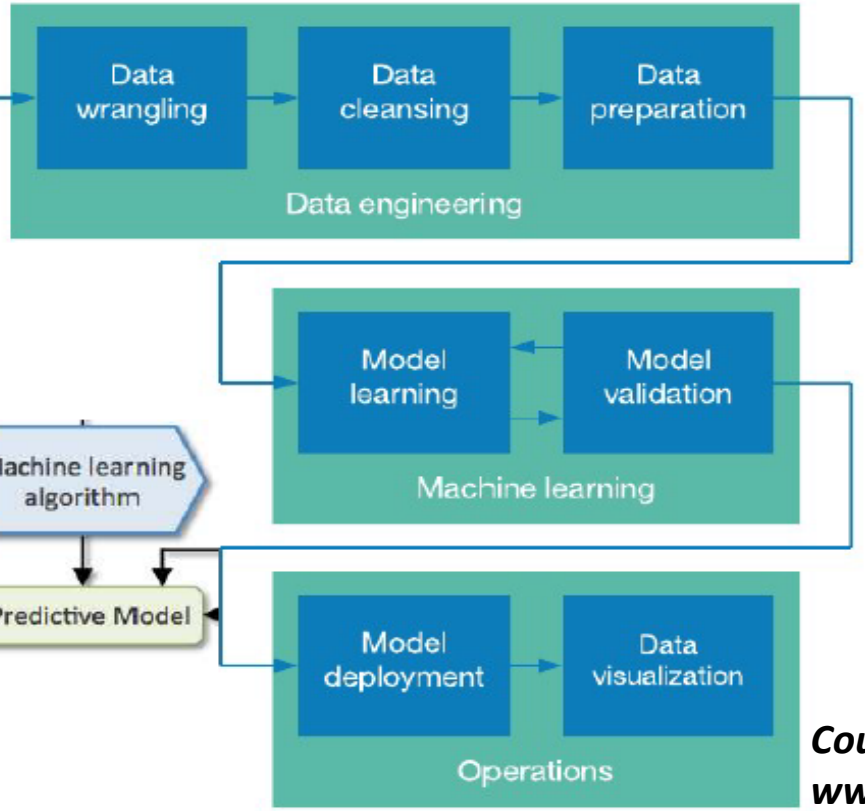
Sentiment Analysis
(eg decision to stop food export)

Global Open Data on Agriculture & Nutrition*

Raw data

FSX will not collect personal data, proprietary or commercially sensitive data

The Teng FIEWS Framework



Predictive Analytics

FSX Command & Control Engine

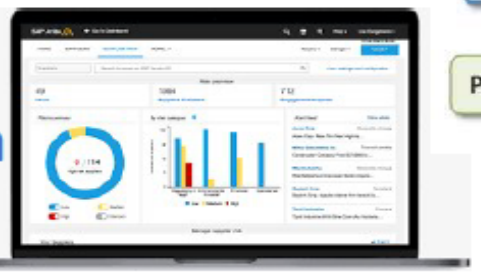
SUPPLY CHAIN INTELLIGENCE

sas

IBM Watson

Legal AI for compliance

Decision-making to manage supply chain disruption risks

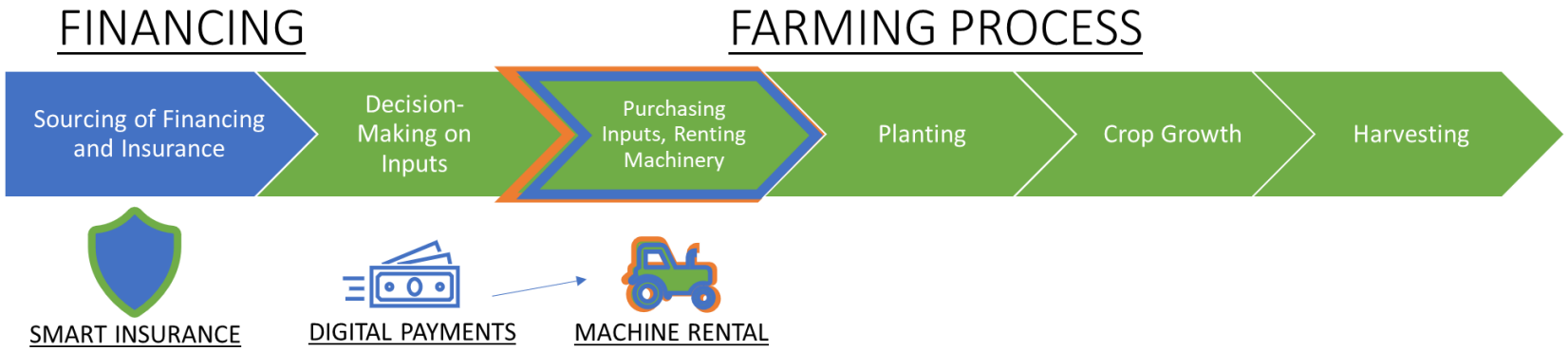


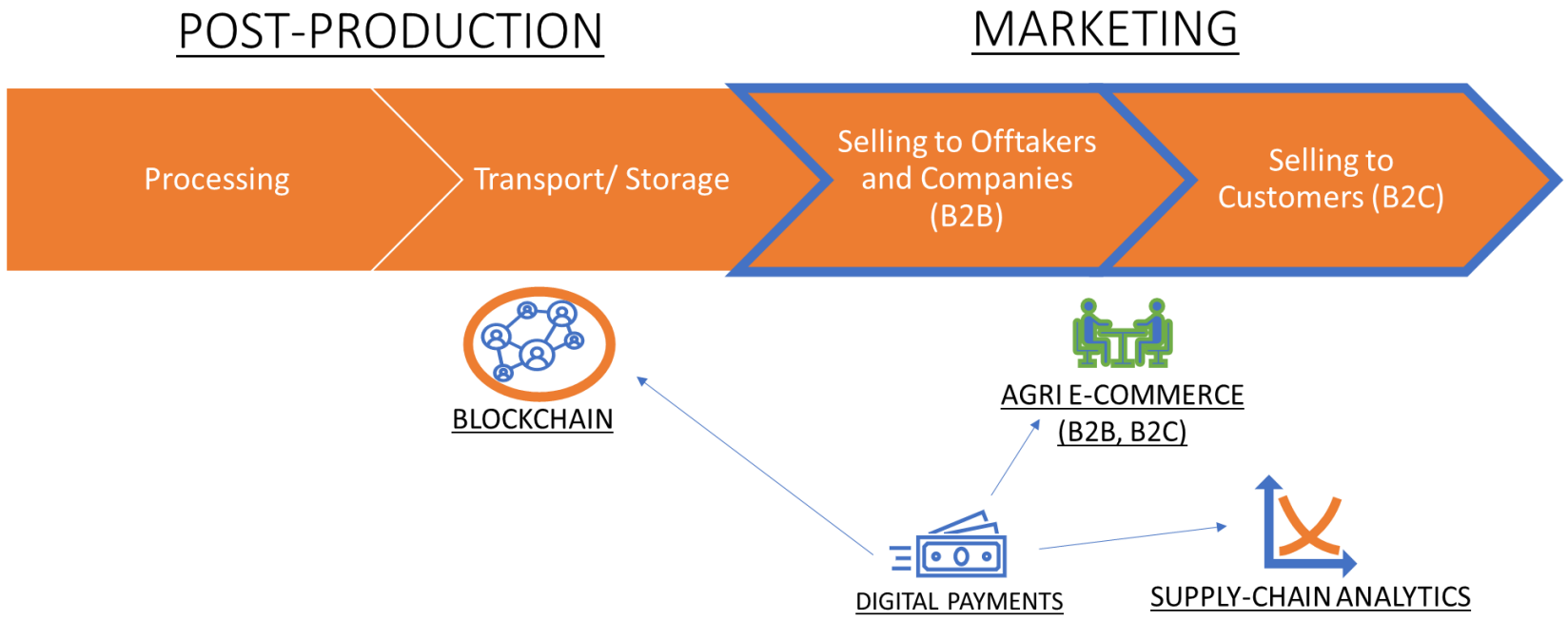
Courtesy: FSX
www.foodsecurity.exchange

Financial Digital Applications (Fintech)

DIGITALIZATION IN FINANCE

Financialization of the "AgriFood System" provides many intervention points across the whole value chain for digital tech.





Example: Philippines

KROPS

Mobile application for connecting farmers and farm produce buyers

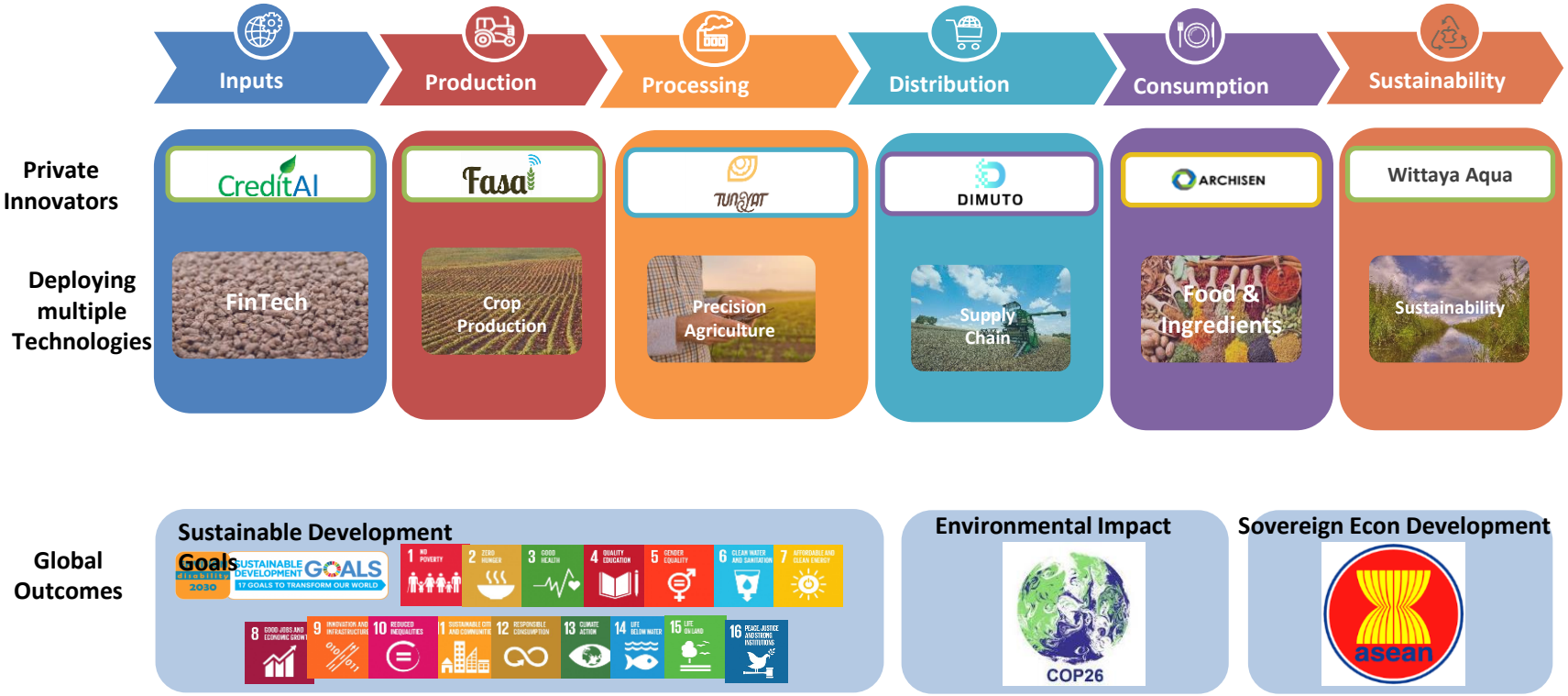
Source: Montesclaros, Teng & Caballero-Anthony, RSIS, NTU

Large investment entities are now stretching across entire value chains in agriculture, aquaculture and "food systems"

Example: The yield Lab

Digital Technology in Agriculture and Aquaculture

Transforming the AgriFood System along the holistic supply chain



Example: Tun Yat is an on-demand farming-as-a-service (FaaS) platform connecting farmers to machine suppliers, fertilizer and seeds, solar water pumps and agri-lenders. It focuses on improving farmer yields.

Courtesy:

THE YIELD LAB

3. The Ecosystem and enablers for adoption of digital technologies

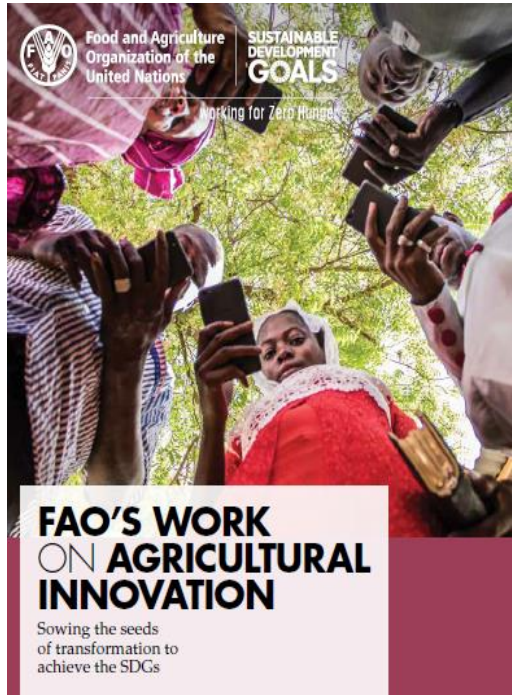
Digital technologies need a supporting ecosystem with enablers to accelerate adoption by stakeholders along the food system

Essential enablers

- ✓ Supportive government policies, regulations and instruments
- ✓ Digital infrastructure
- ✓ Government investments
- ✓ Engagement of the (private) capital markets and financing mechanisms
- ✓ Entrepreneurial spirit

Supportive enablers

- ✓ Existence of focal organizations ("champions") of the technology
- ✓ Investment in relevant human resources, education and training
- ✓ Coordinated infrastructure for R&D, commercial enterprise and supply chain
- ✓ Inclusiveness mechanisms for smallholder farmers



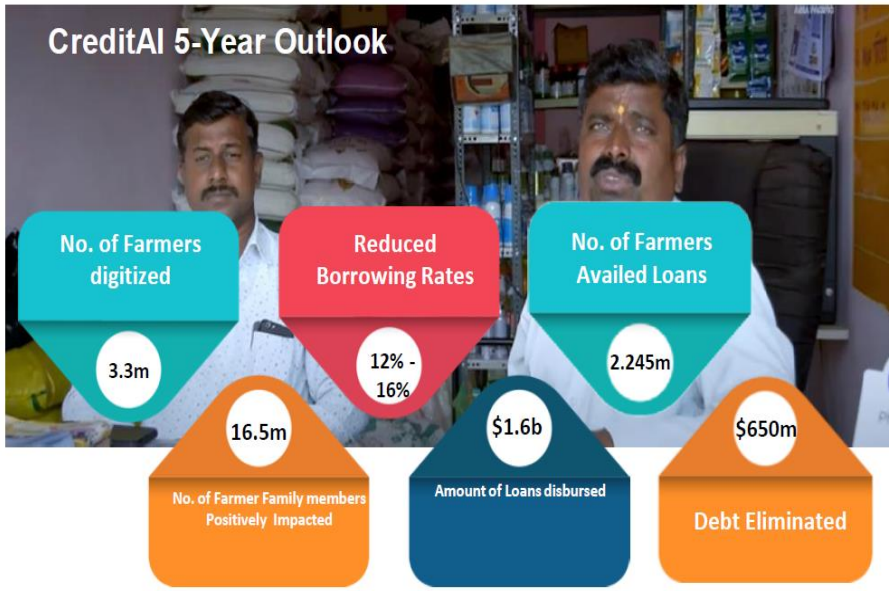
Examples of inclusiveness by private startups: Making an Impact with Innovation for Smallholders

Helping smallholder farmers is not just for social good but also a business imperative –
The Prahalad BOP principle

creditAI

Business target:
100,000 farmers to be onboarded and **USD 8 Mn** of loans to be disbursed by end of 2022

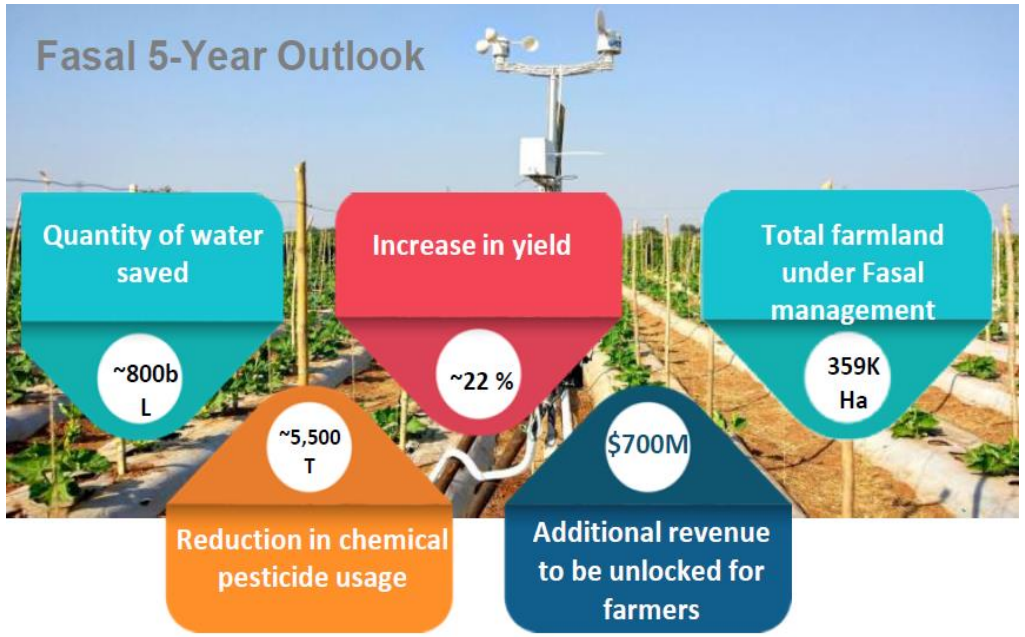
Impact target:
- Reduce Poverty (SDG 1)
- Increase in economic growth (SDG 8)



Fasal

Business target:
9 Bn litres of water saved from irrigation; **Up to 60% reduction** in pesticide cost; **Up to 40% increase** in yield; **100,000** hectares of farmland targeted by Q1 2023.

Impact target:
- Increase farmer yield (SDG 2)
- Reduce waster usage for irrigation (SDG 6)



Courtesy:

THE YIELD LAB

Challenges and constraints in adopting digital innovations

Challenges:

a. Are farmers ready? Who are first movers? Sources of off-grid energy?
b. Relevance of the innovation" -- Better than current non-digital solution? What problem or need is it addressing?
b. "Freedom to Operate", including Regulatory (e.g. drones)
c. Infrastructure (e.g. Telecom, ICT generally – GSMA Digital agriculture maps)
d. Data harmonization, standardization, inter-convertibility (e.g. different, often competing service providers)
e. Technology affordability and access
f. Technology transfer mechanisms/Extension advisory
f. Product stewardship

"Overall, a successful agri-food innovation system requires an ecosystem in which many components function well individually but derive synergies when working together. "Report submitted to a Government by Asia BioBusiness Pte Ltd., January 2019

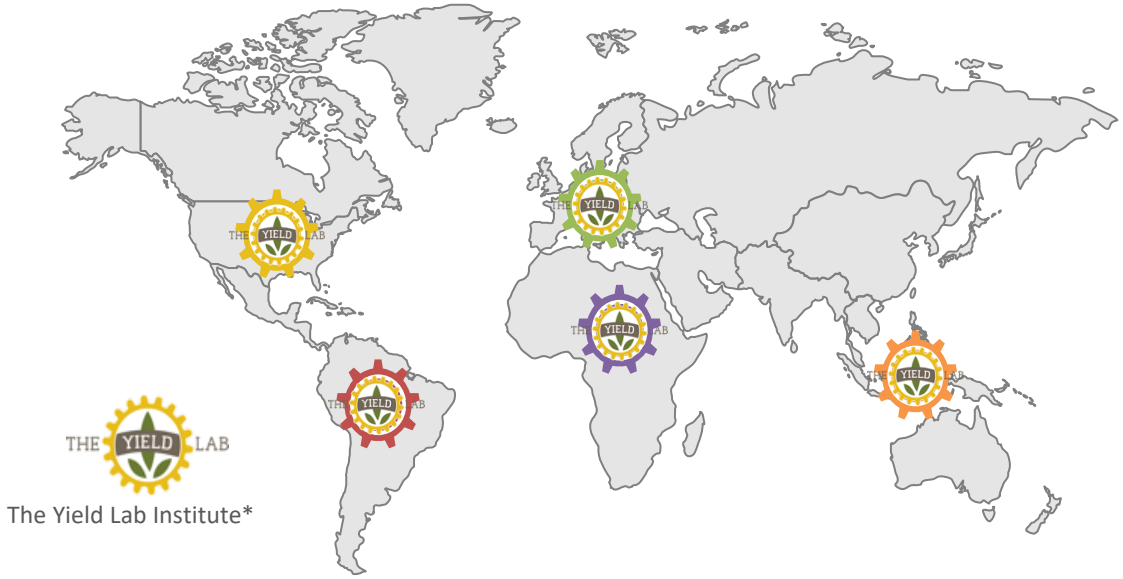
SDG 17: Partnerships

Leveraging and Synergizing public-private sector investments towards sustainable deployment of digital technology in agriculture

"The whole is more than the sum of the parts" : Integrating private sector networks into existing public sectors networks (CGIAR, multilateral development banks, etc.) to serve the farmer

Example: Private financing with Global Reach

Regional Funds, Network and Expertise



The Yield Lab Institute*

Funds	Launch Date	Funding	Ecosystem
North America	2015	$6M / $15M	✓
Europe	2017	€1.5M / €55M	✓
Latin America	2018	$3M / $30M	✓
Asia Pacific	Mid 2019	$50M	✓
Africa	plan 2022	early stage	✓

Partnership Enquiries: Claire Pribula, Managing Director, The Yield Lab Asia Pacific
claire@theyieldlab.com; www.theyieldlab.asia

Courtesy:

The future is NOW!

Acknowledgement: the willingness of private sector entities to share information for the examples cited.

Thank You!

For further conversations:
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