



World Vegetable Center

Asia-Pacific Rural Development and Food Security Forum 2022

Battling Climate Change and Transforming Agri-food Systems

22-24 March 2022

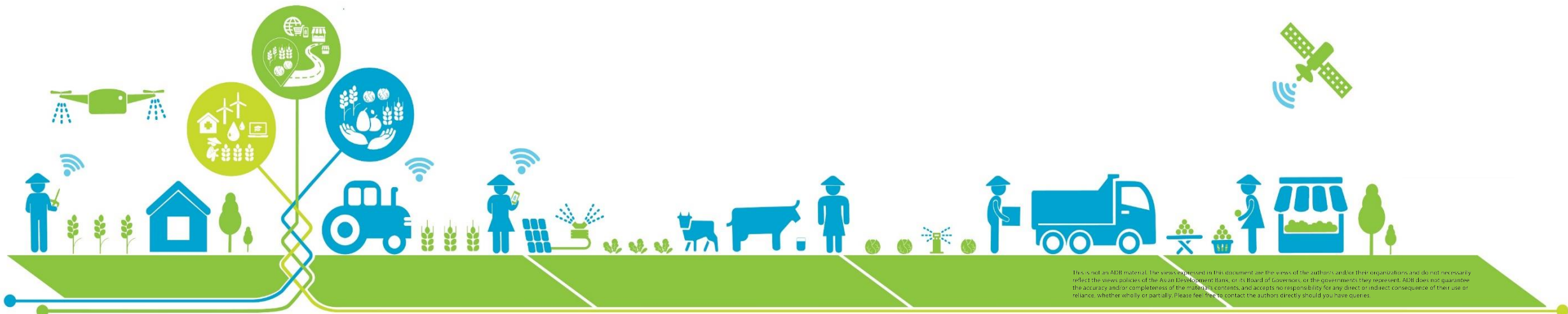
Digital Technology in Agriculture

Paul Teng, J.M.L. Montesclaros & Mely Caballero-Anthony

Centre for Non-Traditional Security Studies

S. Rajaratnam School of International Studies

Nanyang Technological University Singapore



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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

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



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

www.agrifoodinnovation.com

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

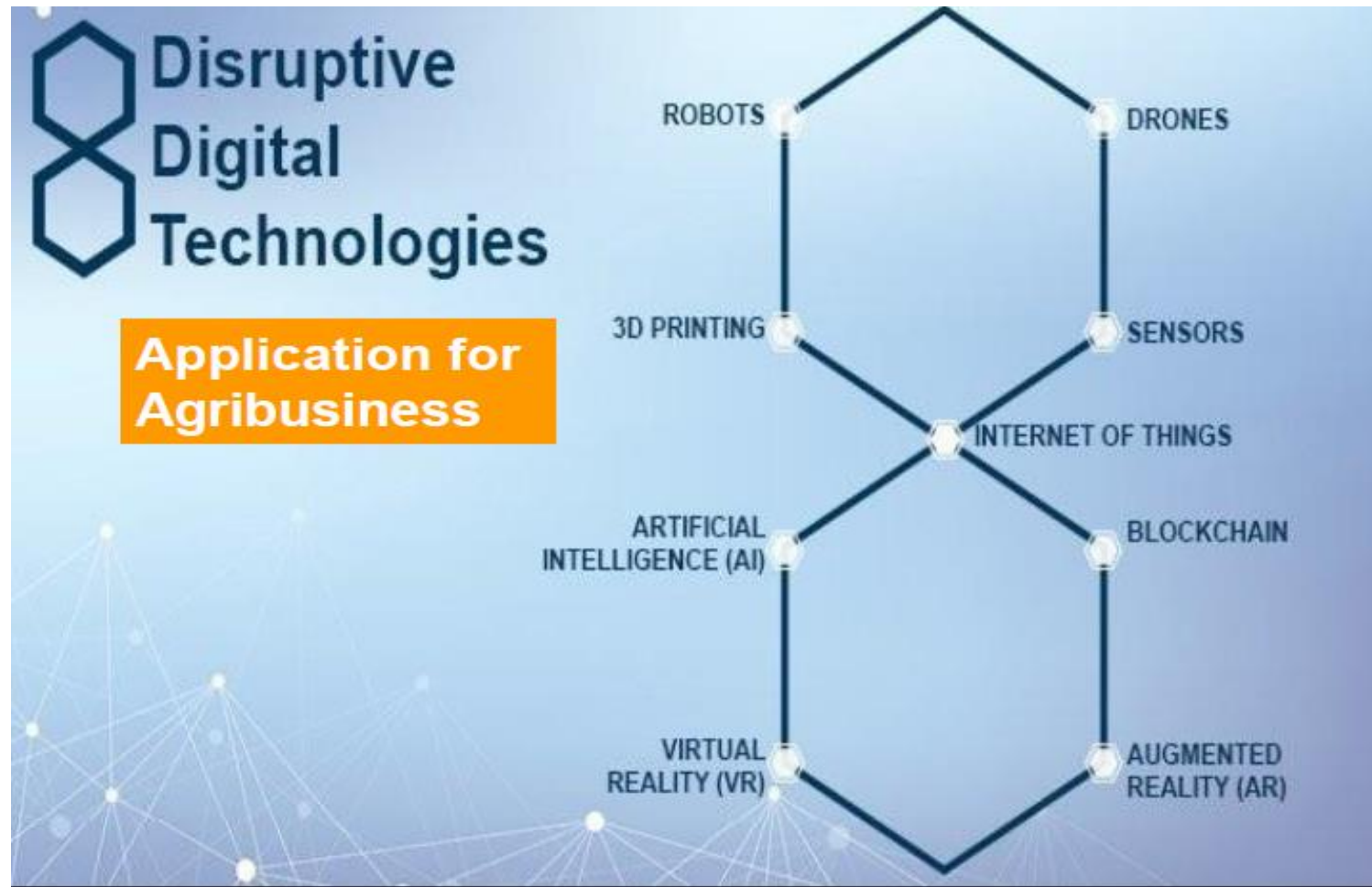
Will digital technologies be the big disrupter in the 21st C?

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?

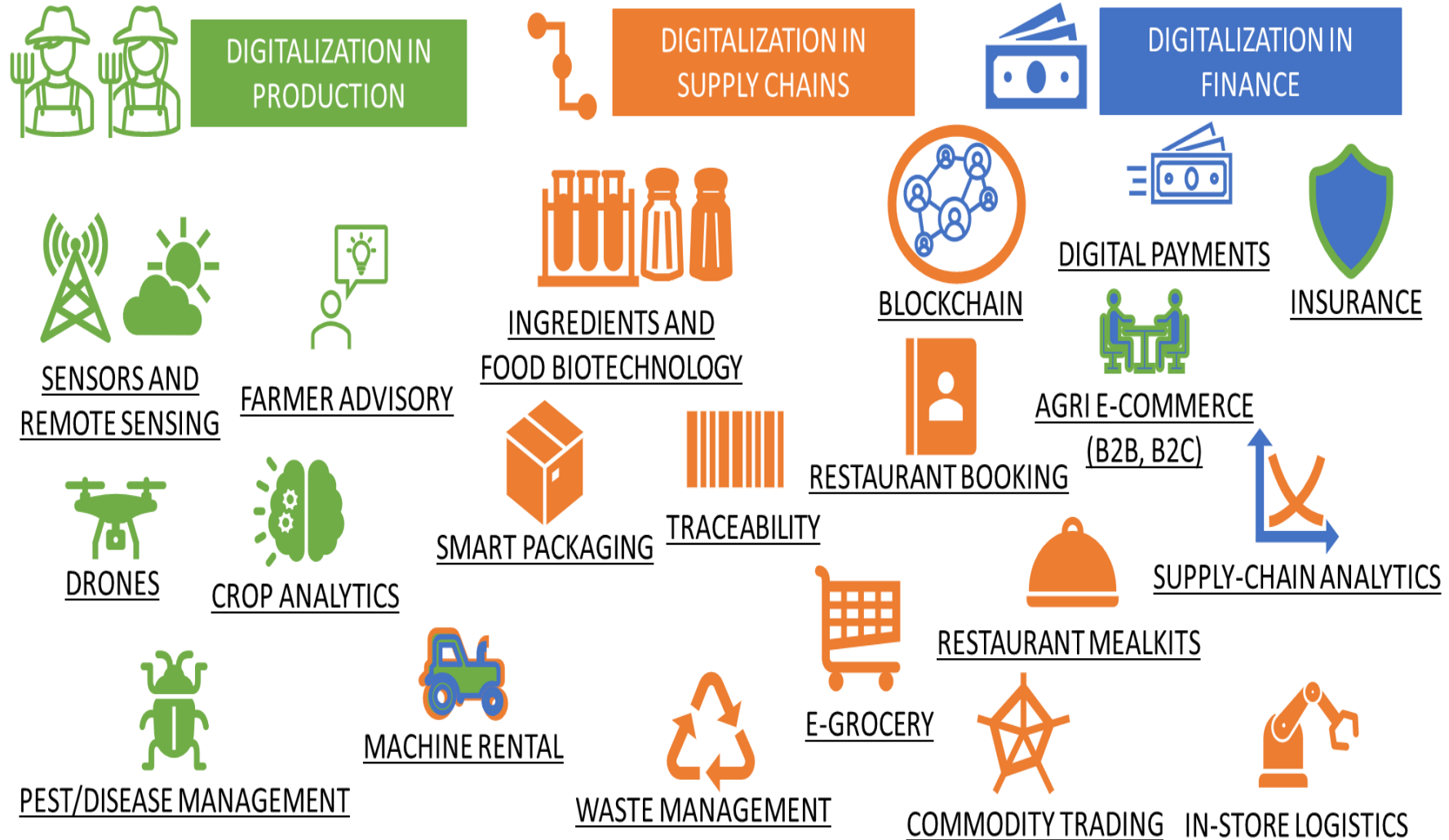
Viewpoint 1
Available
Digital
technologies



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**)



Digital Applications in Production and Processing

*Smart Farming
Precision Agriculture*

**ON-FARM
PORTABLE DECISION AIDS
(Off-line)**



DIGITALIZATION IN PRODUCTION

FARMING PROCESS



AGRI E-COMMERCE (B2B)



MACHINE RENTAL



DRONES



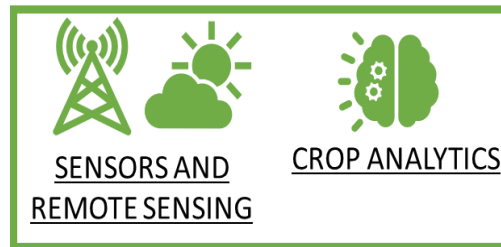
PEST/DISEASE MANAGEMENT



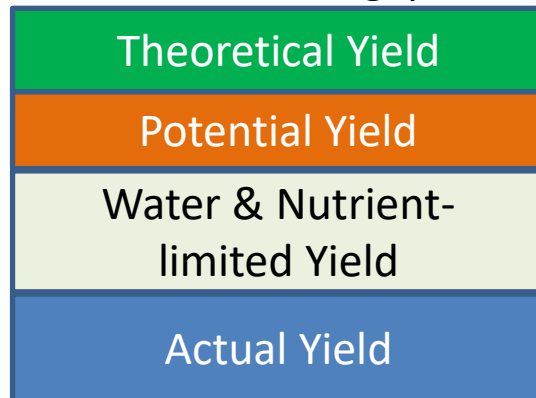
MACHINE USE



FARMER ADVISORY



Reduce Yield gaps



Genetically determinants

Defining factors: *CO2, Radiation, Temperature, Crop features*

Limiting factors: *Water, Nutrients*

Reducing factors (Loss): *Biotics (Weeds, Insect pests, Diseases); Abiotics*

IRRI – Rice Crop Manager



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

Picture Selection Treatment



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

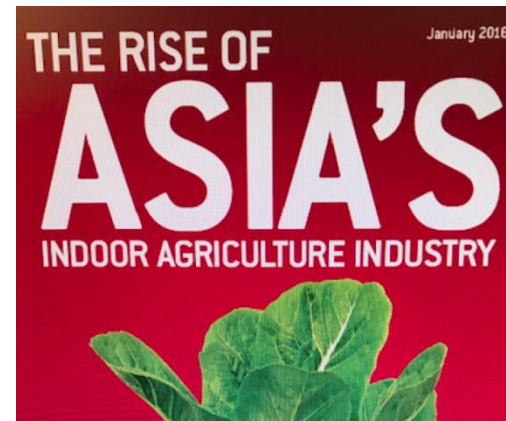
There were an estimated 450 operational PFALS in Asia (2016)
....**NEWBEAN CAPITAL**, Singapore



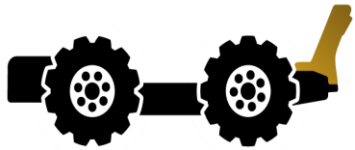
Farm 1 - “Panasonic”
Indoor Farm



Farm 2 - “Archisen”



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

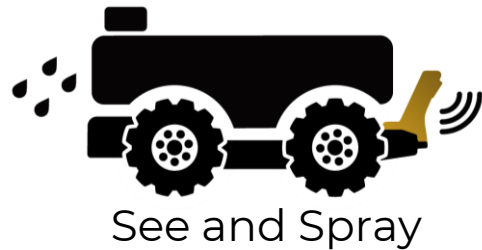


ROBOTS for smallholders

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

Modular Applications

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



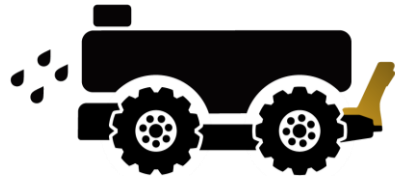
See and Spray



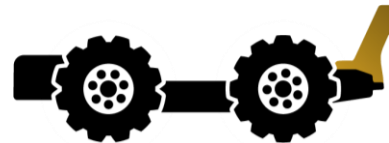
Plant Imaging



Seeder



Pre-Emergent Spray



Land Levelling



Soil Probe



Variable Rate Fertiliser

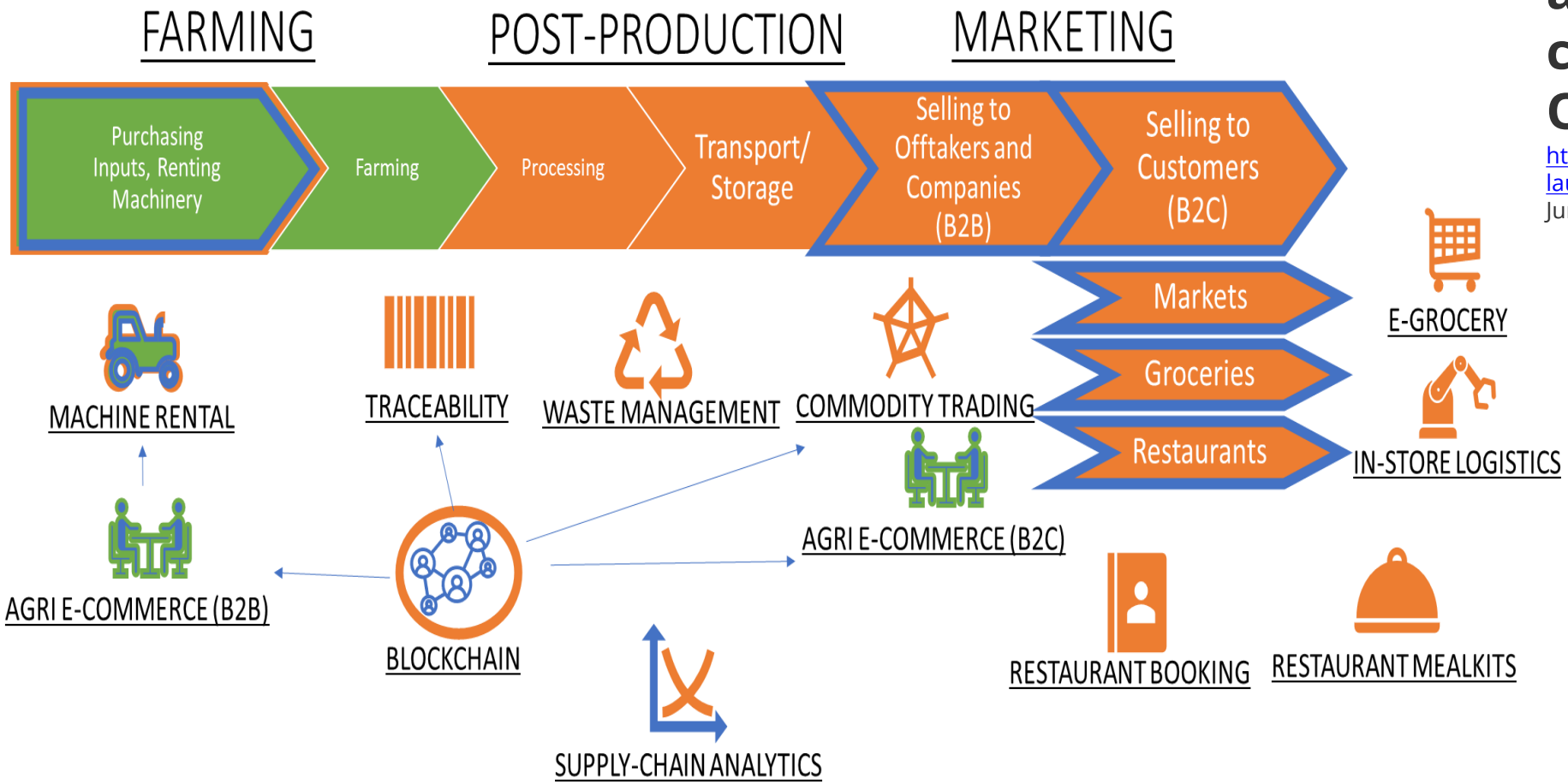
Digital Applications in Supply-Chains (Distribution, mid-stream to down-stream)

Connecting farmers to businesses, consumers & other stakeholders

DIGITALIZATION IN SUPPLY CHAINS

Example: **OurFarm**
AirAsia launches agriculture e-commerce platform Ourfarm

<https://www.theedgemarkets.com/article/airasia-launches-agriculture-e-commerce-platform-ourfarm>
 June 15, 2020 20:33



Example: **Pinduoduo**



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

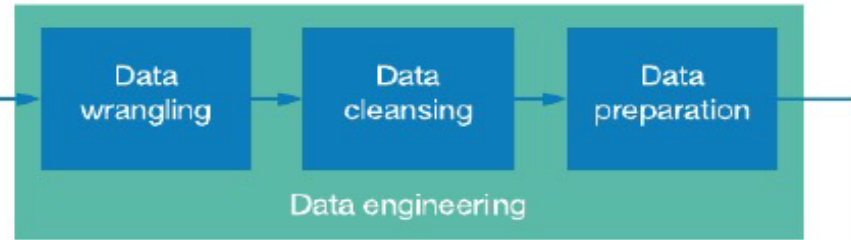
The Teng FIEWS Framework

Unstructured Data

Global Open Data on Agriculture & Nutrition*



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



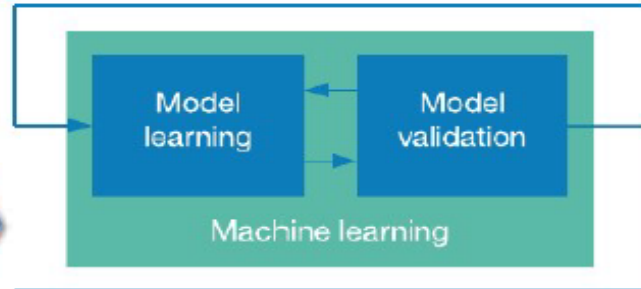
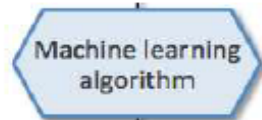
Predictive Analytics

FSX Command & Control Engine

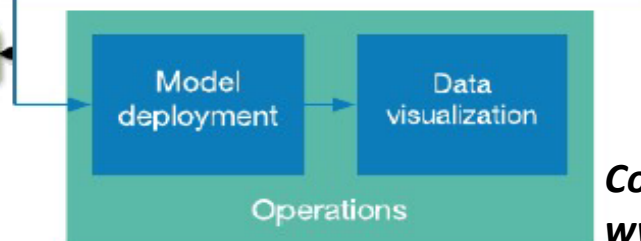
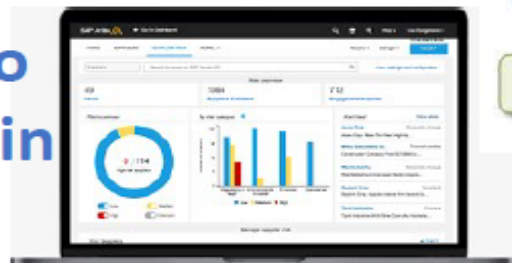


NLP to mine online news & on social media

Sentiment Analysis
(eg decision to stop food export)



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.

FINANCING

FARMING PROCESS



SMART INSURANCE



DIGITAL PAYMENTS



MACHINE RENTAL

POST-PRODUCTION

MARKETING



BLOCKCHAIN



AGRI E-COMMERCE
(B2B, B2C)



DIGITAL PAYMENTS



SUPPLY-CHAIN ANALYTICS

Example: Philippines



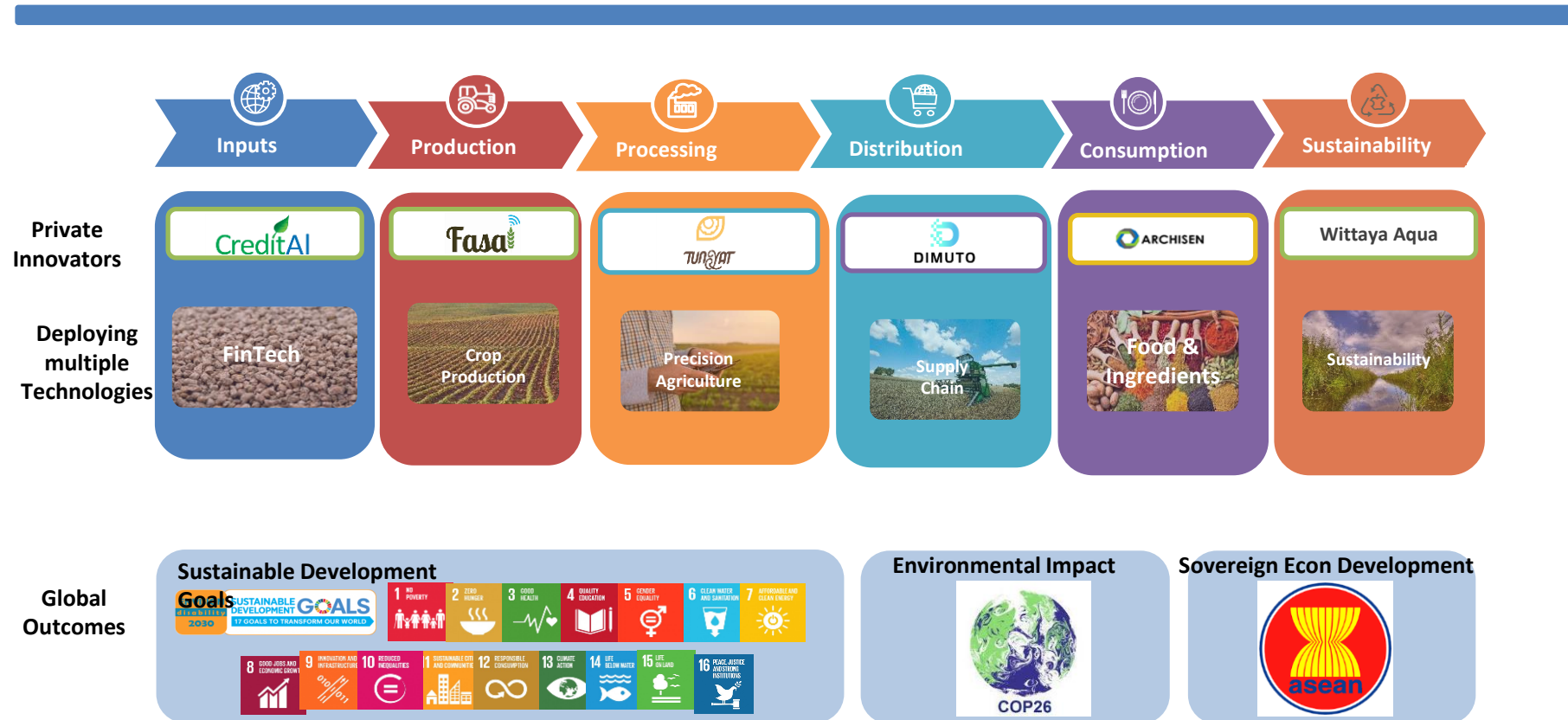
Mobile application for connecting farmers and farm produce buyers

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:



3. The Ecosystem and enablers for adoption of digital technologies

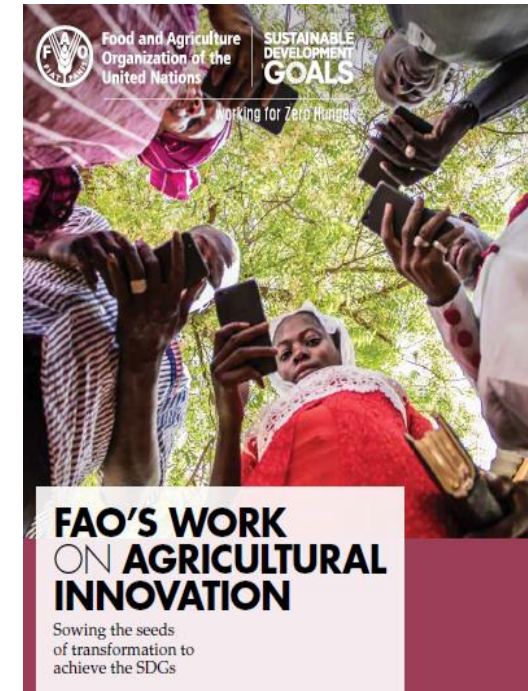
Digital technologies need a supporting ecosystem with enablers to accelerate adoption by stakeholders along the food system

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

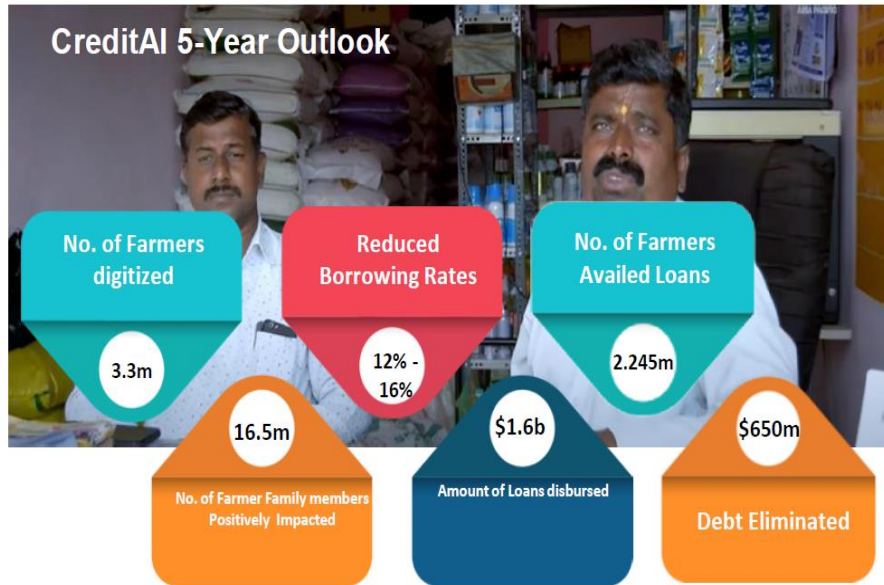


Business target:

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)

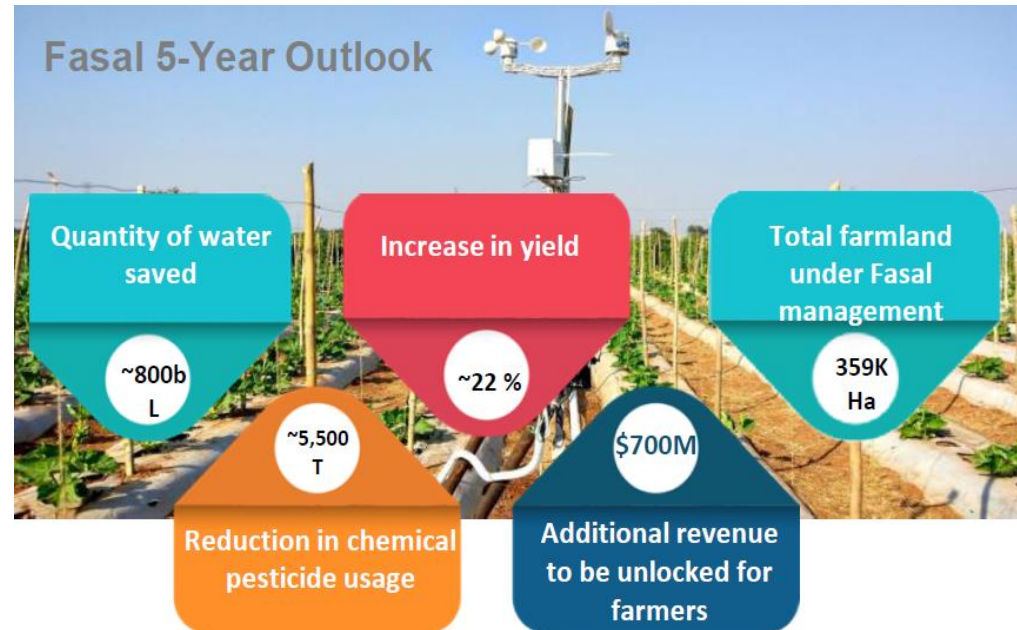


Business target:

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)



Helping smallholder farmers is not just for social good but also a business imperative –

The Prahalad BOP principle

Courtesy:



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

Example: Private financing with Global Reach

Regional Funds, Network and Expertise



“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

 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:
ispaulteng@ntu.edu.sg**