Digital Disruption in Agriculture
Digital Solutions for smallholder farmers

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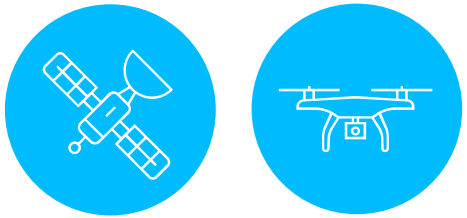
Sam Nguyen
Venture Lead, APAC Digital Farming
Solution Incubator

Digital farming solutions can support farmer's decision making and operation efficiency for risk mitigation & better produce

How Digital Farming Solution works

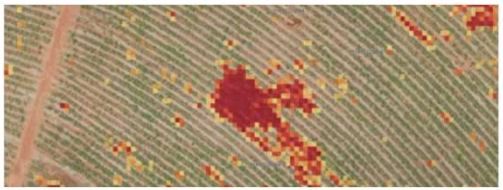
Data Sensing / Pipelining

- Seed genetics
- Environmental conditions
- Data from IoT sensors
- Agri-machinery applied data
- Farming practices



Data Engineering / Advanced Analytics

- Data science models
  - Detection
  - Diagnosis
  - Prediction
  - Prescription (what, when & how to apply agri-inputs)



Execution / Delivery

- Customer facing apps
- Smallholder ecosystem stakeholders (e.g., agri-entrepreneur, lead farmer, channel partner)
- Service providers
- Automated solution

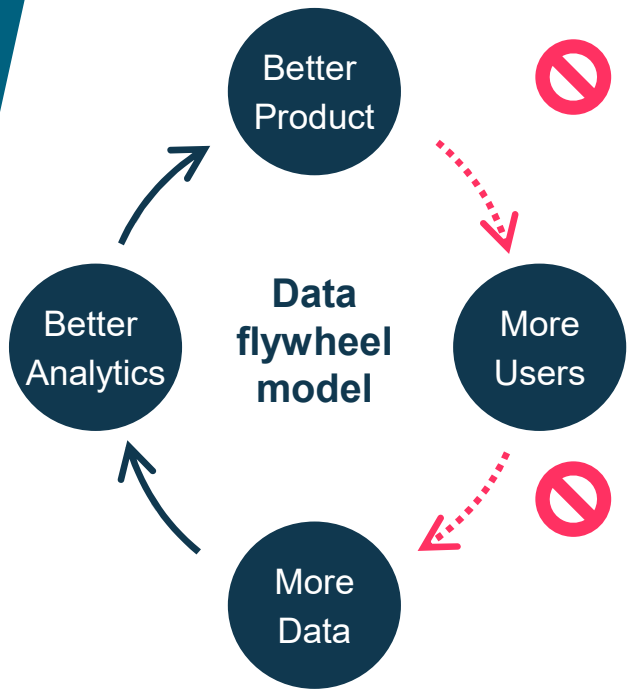
Risk Mitigation, Yield Increase, Harvest Quality Improvement

Digital Disruption in Agriculture 2022: Digital Solutions for smallholder farmers in Vietnam

Bayer aims to build Digital Farming solutions addressing key Smallholder pain points comprehensively along the value chain together with like-minded partners

	To the farm		On the farm			Beyond the farm	
These pain points are common to SHF in APAC, but have varying intensity between locations and farmer segments							
SHF key pain points	Access to agricultural inputs (nutrients, irrigation, CP, seeds, tools)	Agronomic know-how	Labor shortage & cost	Sustain-ability	Market linkage	Financing and risk mitigation	
Our focus solution spaces	**ADVISORY**		**MECHANIZATION / IoT**			**MARKET LINKAGES**	

Data collection and last-one-mile execution are unique challenges in developing and deploying digital farming solutions for smallholders



Behavioral change

// Limited digital literacy
// Structural roadblocks (i.e., output market access, finance)
// Dependency on existing ecosystem

Data Collection

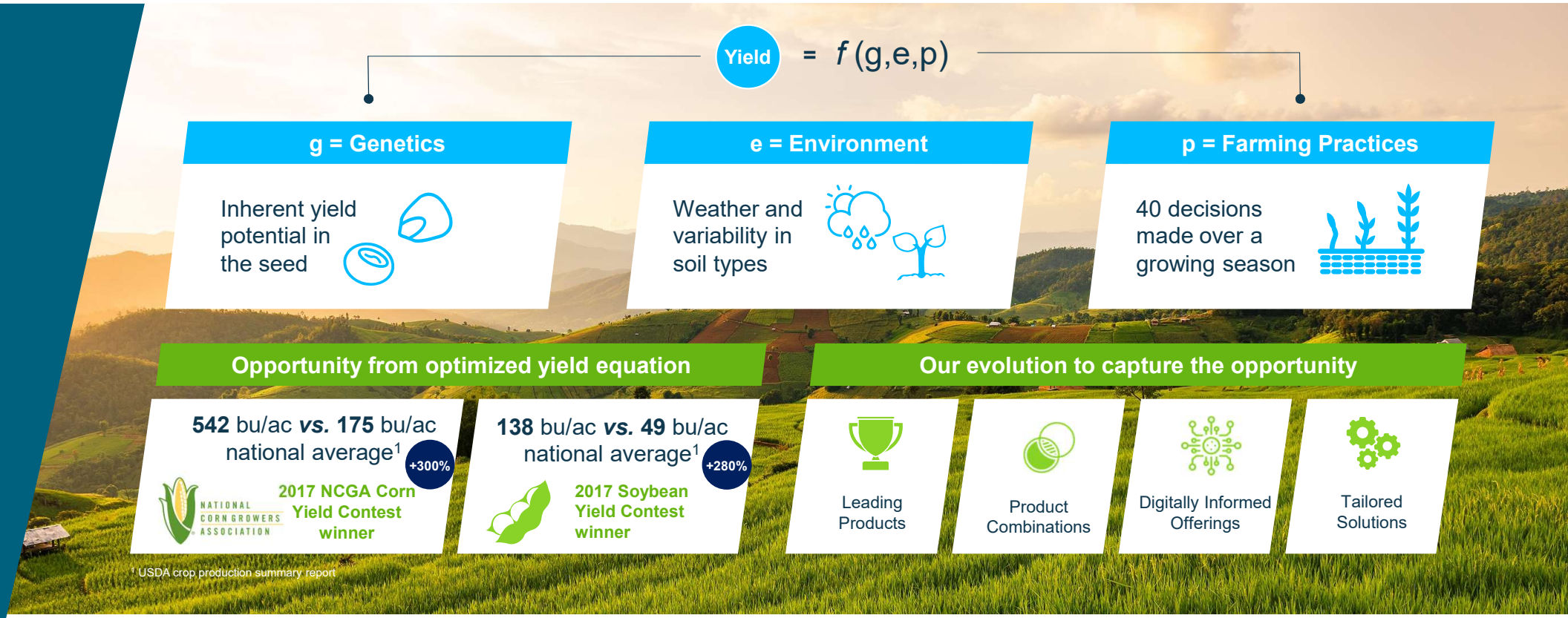
// No as-applied data available
// Low willingness to record data by farmer
// Negative RoI to utilize remote sensing or IoT tools

// How can we create **tangible and visible value**?
// How can we **incentivize** for behavioral changes?
// Can we **semi-automate data collection** in cost efficient way?
// Can we leverage **analogue touchpoints**?
// How can we **aggregate demand**?
// Who can be **complementary partners** to co-develop solutions?

Digital farming solutions enable farmers to drive sustainable farming and better livelihood, and Bayer will co-create those with public & private partners

Opportunity for Digital Transformation and Tailored Solutions

Precise Resource Use and Innovation Required to Address Significant Demand Growth, Field Variability and Increased Pressure On Ecosystems



From inputs to outcomes: Climate FieldView™

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Vast, Diverse Data and Technical Infrastructure Drive Machine Learning Capabilities and Competitive Advantage

Smarter Digital Tools Enable Significantly Improved Decision-Making and Productivity for Growers

Data Sources

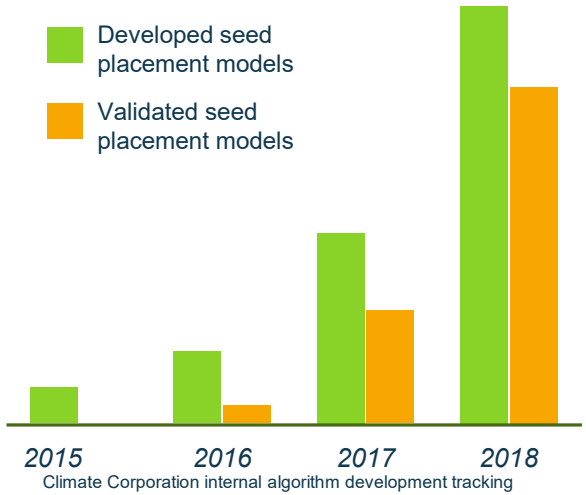
- // Bayer Research Trials
- // Climate Research Farms
- // Climate Research Partners
- // FieldView Data
- // Environmental Data
- // Platform Partner Data

Proprietary Data Science Warehouse

// Ingest // Grid // Standardize
// Clean // Integrate

- *Scalable Machine Learning*
- *Scalable Data Visualization*
- *Rapid Prototyping Framework*
- *Derived Data Layers*

Machine Learning Algorithm Development



Climate Corporation internal algorithm development tracking

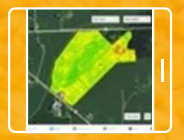
Our data science warehouse and machine learning platform dramatically improves predictive models

Climate FieldView™ Supports Activities and Decisions

Throughout the

crop season

Fall – Harvest	*Winter – Planning*	*Spring – Planting*	*Summer – Growing*
Sept / Oct / Nov /	*Dec / Jan / Feb /*	*Mar / Apr / May /*	*Jun / Jul / Aug /*
FieldView Drive & FieldView Cab (Harvest)	**Yield Analysis & Mapbook**	**Advanced Seed Rx & N Monitoring & Scripting**	**FieldView Drive & Cab (Planting, As Applied)**	**Disease Management, Imagery, Scouting**



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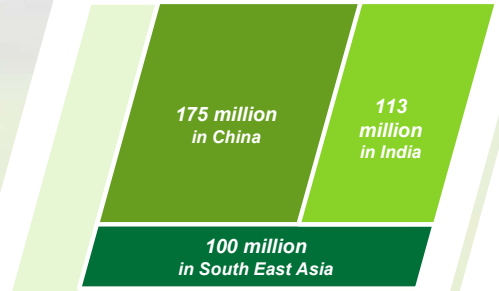
Smallholders' footprint in Asia Pacific is unmatched globally

Land ownership likely to remain fragmented despite slow consolidation in some countries

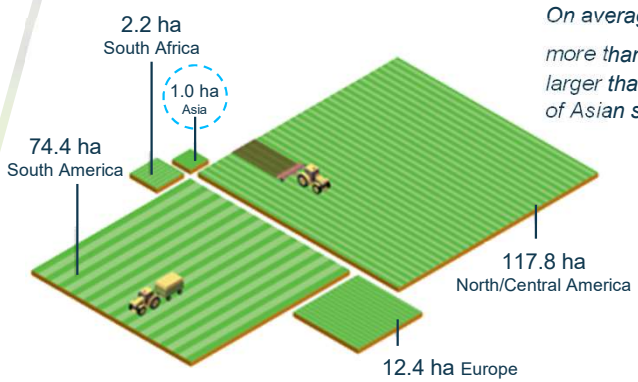
Asia Pacific accounts for ~80% of smallholder farmers worldwide

with China, India and South East Asia home around ~388 million



493 million Smallholder farmers Worldwide

570 million estimated global farmers



On average, U.S. farms are more than ***100 times*** *larger than the farms of Asian smallholders*

Significance in Agriculture and Food Supply

- 80% of food production in developing countries; rising GDP driving food & nutrition demand
- Productivity at ~50% of world average
- EUR 17-20B seed & crop protection market (~16% share of global market) Expected to grow to EUR 23-26B by 2023 (~6.5% CAGR – above global average)**

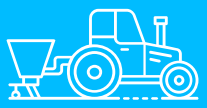
other data reflect internal estimates based on various external sources Sources: Dalberg Global Report 2016, Inflection Point, FAO

Digital solutions are expected and introduced by various players to address smallholder paint points at scale

Digital tool and business model examples in the market

Digital advisory for better outcome

Drone for data collection & smart spray



Mechanization-as-a-Service for labor efficiency

Farm-to-Folk traceability for food safety

Digital marketplace as one-stop portal

Data-driven credit scoring, P2P lending

What are challenges and opportunities to drive adaptation of these solutions to broader smallholder farmers?

	Challenges	Opportunities

Digital infrastructure readiness and farmer's savviness	// Limited or unequal access to digital infrastructure
	// Limited digital literacy
		// Grant, subsidy, business funding
		// Younger/new generation farmers
		// Community approach
		// Online merges with Offline

Marrying agronomic science & data science	// Suboptimal solution to individual vs. group of farmers (e.g., non-coordinated crop protection)	// Collaboration among technology solution provider, service provider and incumbent from agriculture industry (e.g., agri-input company)
Farmer centric digital farming ecosystem development	// Too many island solutions // No integrated and comprehensive offering	// Platform-to-Platform compatibility // Data-sharing steered by farmer

The **unique online application** in Vietnam.

Farmers can actively accumulate **bonus points** and **choose rewards.**

Service or product providers joining this platform can also have **more opportunities to sell, build trust and take a better care** of their customers.

4 top benefits : saving time, easy connection, increasing productivity, increasing product competitiveness

Airfarm

Digital farming platform that helps to **connect** the fragmented **agricultural value chain**

Drone spraying service and predictive analysis

Offers a **wide range or products & services,** such as e-learning, farm management software, spraying-as-a-service application, digital advisory and marketplace.

Operating in 4 localities: **Long An, Dong Thap, An Giang, and Kien Giang.**

In Vietnam, in order to build a thriving digital farming ecosystem, we need to prepare the groundworks

SMART & CONNECTED SYSTEM

A holistic system that permit seamless data exchange between machines, with business partners, and among data portals

DATA INFRASTRUCTURE

DATA MANAGEMENT

Setting up an efficient data platform to manage and control the massive data volumes from the agriculture production chain. This platform can also provide a comprehensive data platform: data storage, data management, data processing and data analysing.

DIGITAL FARMING ECOSYSTEM

Centralise data platform

CONNECTING THE ENTIRE VALUE CHAIN

Bringing all stakeholder online, from farmers to distributors, so that we can capture the end-to-end journey of agriculture production

AGRICULTURE INFRASTRUCTURE

BRINGING FARMERS ONLINE

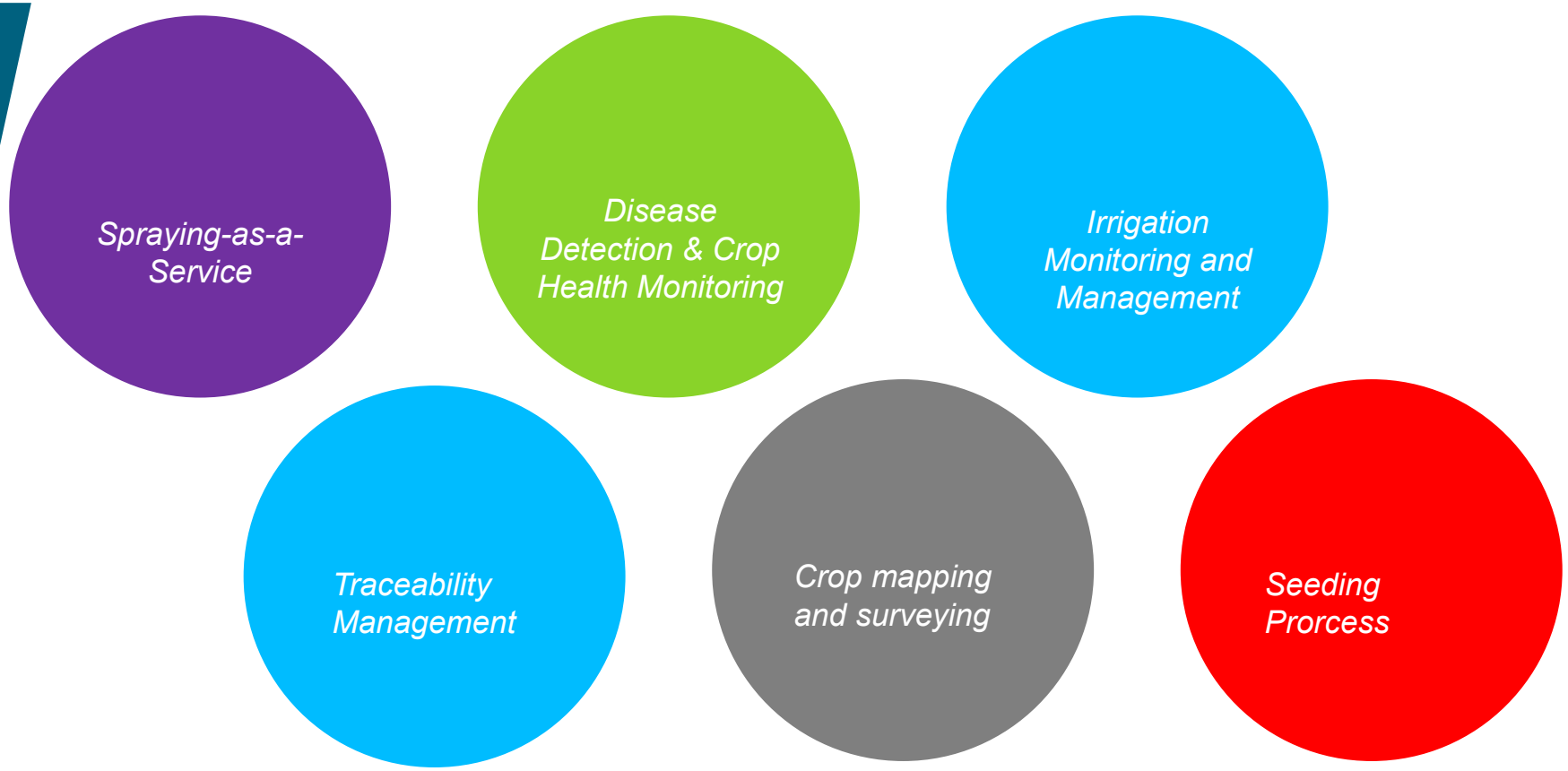
Helping farmers to get online by removing the barriers to access technology (device, financial, cost, etc)

With a high acceptance rate among smallholder farmers, Drone is the great starting point to enable data-driven agriculture in Vietnam

Drone is the idea starting point because of natural alignment between drone technology maturity (we have extensive research on agricultural drone applications, software and hardware) and the Vietnamese market (drone has been around for a couple of years and it is the most quoted form of digital farmings)

In north East China, the drone penetration rate for field crop is 50%. The potential of drone in Vietnam is very promising

Potential digital business models and applications for drone in the agriculture sector



Most common personas for drone spraying service providers in Vietnam's Mekong Delta

Nguyễn Minh Quân — 1-2 DRONES

FARMERS

Purchase drone to spray for his own field. He also offers his service to farmers in his local area

Trần Ngọc Quỳnh — 1-2 DRONES

AGRICULTURE INPUTS RETAILER

Purchase drone to spray for her customers. Quỳnh wants to use drone to increase the sale of her crop protection product (possibly fertilisers and seeds in the future)

COMPANY B — 10 DRONES +

CONTRACTED FARMING COMPANY

COMPANY B offers drone spraying service to their farmers. They hire the entire pilot team and purchase more drones to fulfil demands from their farmers/growers

Nguyễn Hữu Nghị — 3-5 DRONES

SMALL-MEDIUM SIZE DRONE SPRAYING SERVICE PROVIDERS

Farming Drone is a company that offer drone spraying service. He can only cover one province as he only owns 3 drones

Lê Văn Kiên — 10 DRONES +

LARGE DRONE SPRAYING SERVICE PROVIDERS

Viet Drone is a company that offer drone spraying service. He can cover three province as he owns 10 drones

Phạm Quốc Toản — 1-2 DRONES

FARMER CO-OPERATIVE (HỢP TÁC XÃ)

Toản purchase drone to spray for the farmers in his Co-Operative. He also offers service to other farmers if one of the drones is free. He receives government's support to purchase drones

The persona of smallholder farmers who can become early adopters for drone technology

Nguyễn Minh Tuấn

NEW GENERATION

AGE	35
EDUCATION	LOCAL COLLEGE
FIELD SIZE	20HA
INTERNET USAGE	HIGH
TRACEABILITY NEED	YES
BAYER CP PRODUCT USAGE	MEDIUM
WHERE TO FIND THEM	• WORDS OF MOUTH • ZALO FACEBOOK • BAYER'S REFERRAL • LOCAL AUTHORITIES
SMARTPHONE PROFILE	IPHONE X (iOS)

Trần Văn Sáu

INFLUENCERS

AGE	62
EDUCATION	HIGH SCHOOL
FIELD SIZE	50HA
INTERNET USAGE	LOW-MEDIUM
TRACEABILITY NEED	YES
BAYER CP PRODUCT USAGE	MEDIUM
WHERE TO FIND THEM	• WORDS OF MOUTH • LOCAL AUTHORITIES • WHOLESALER'S REFERRAL
SMARTPHONE PROFILE	OPPO RENO 4 (ANDROID)

Lê Hữu Tuấn

BAYER AMBASSADOR

AGE	55
EDUCATION	SECONDARY SCHOOL
FIELD SIZE	50HA
INTERNET USAGE	LOW-MEDIUM
TRACEABILITY NEED	SOMEWHAT
BAYER CP PRODUCT USAGE	HIGH
WHERE TO FIND THEM	• WORDS OF MOUTH • LOCAL AUTHORITIES • BAYER'S REFERRAL
SMARTPHONE PROFILE	SAMSUNG GALAXY A51 (ANDROID)

The How Might We questions that we need to ask to create meaningful application for drone spraying technology

How might we retain farmers on our platform and fending off drone spraying service providers attempts to bring farmers away from our platform?

How might we automate our current workflow, seeing that it might take sometime to achieve large scale adaptation from smallholder farmers?

How might we achieve network effect that can bring more smallholder farmers and drone spraying providers to join our platform?

How might we change drone service provider's attitudes toward data sharing?

Thank you!