



AI Forum

“Cultivating Indonesia's Agricultural Success: How AI Can Transform Agriculture for Food Security, Productivity, and Decent Work”



Mind the Gap: Bridging the AI Divides for Agricultural Prosperity in Southeast Asia

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Jakarta, 4 December 2024

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Topics

- Food Security and AI Adoption in Southeast Asian Agriculture
- Challenges and Opportunity of AI in Agriculture
- Leveraging Digital Technology to Overcome Agricultural Challenges
- Bridging the AI Divide: Bringing AI to the Field
- Policy Recommendation
- IPB Program and Research Collaboration



“Southeast Asia is home to some of the world’s largest agricultural exporters, but low productivity and crop wastage—reaching as high as 20 to 30 percent—pose significant challenges.”

Source: Kearney (2020) in “*Racing toward the future: artificial intelligence in Southeast Asia, Kearney analysis*”



The worldwide population of smallholder farmers is estimated at 450 million, with approximately 350 million in Asia, including **100 million in Southeast Asia.**

These farmers — occupying two hectares of land each at most — are at the forefront of the region's agricultural production

Source: Grünbühel, C. (2019) SEI Perspectives: How investing in smallholder farms is investing in our society. Retrieved February 2020, from <https://bit.ly/327jAlq>

Table 1: Importance of smallholder farmers in selected Southeast Asian countries

Country	Number of smallholders ¹⁷	Portion of smallholders in total population (%) ¹⁸	Contribution to agricultural GDP (%) ¹⁹
Cambodia	3.7 million	22	16.3
Indonesia	38.9 million	14	12.5
Malaysia	1.6 million	5	7.3
Philippines	11.8 million	10	8.1
Thailand	12.7 million	18	6.2
Viet Nam	24.4 million	25	14.3



Southeast Asia's agricultural landscape has also faced challenges posed by Climate Change, resulting in significant production losses of about USD 21 billion due to extreme weather events between 2008 and 2018 (Asian Development Bank, 2021).

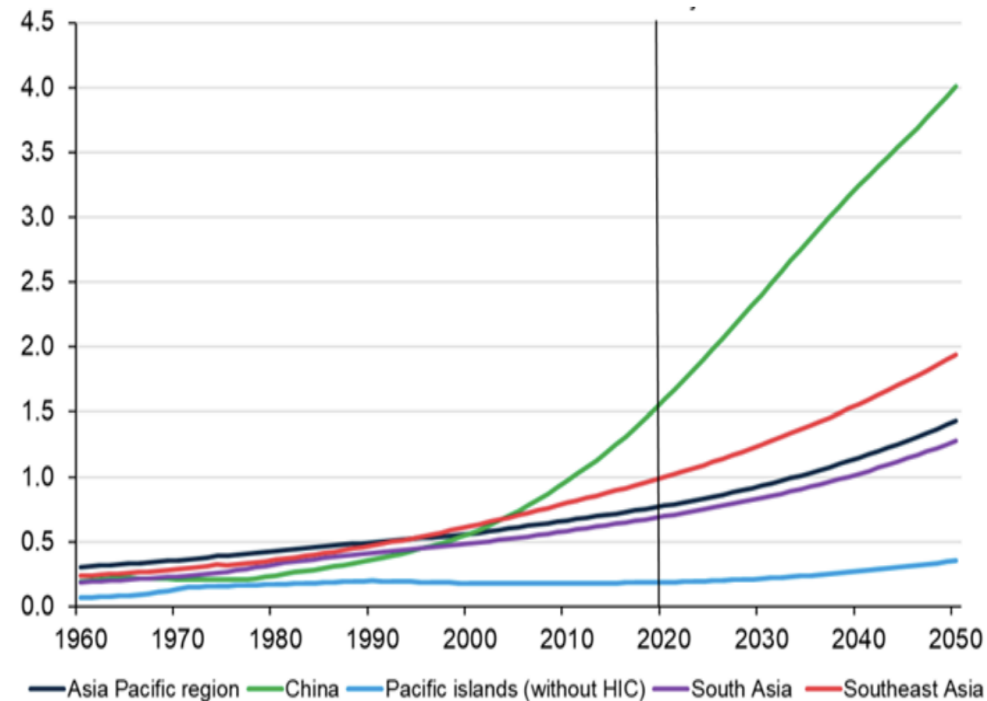


Around one-third of all
food produced in
Indonesia is either lost or
wasted
(Bappenas 2021)

Food Security: Population Growth & Workforce Issue

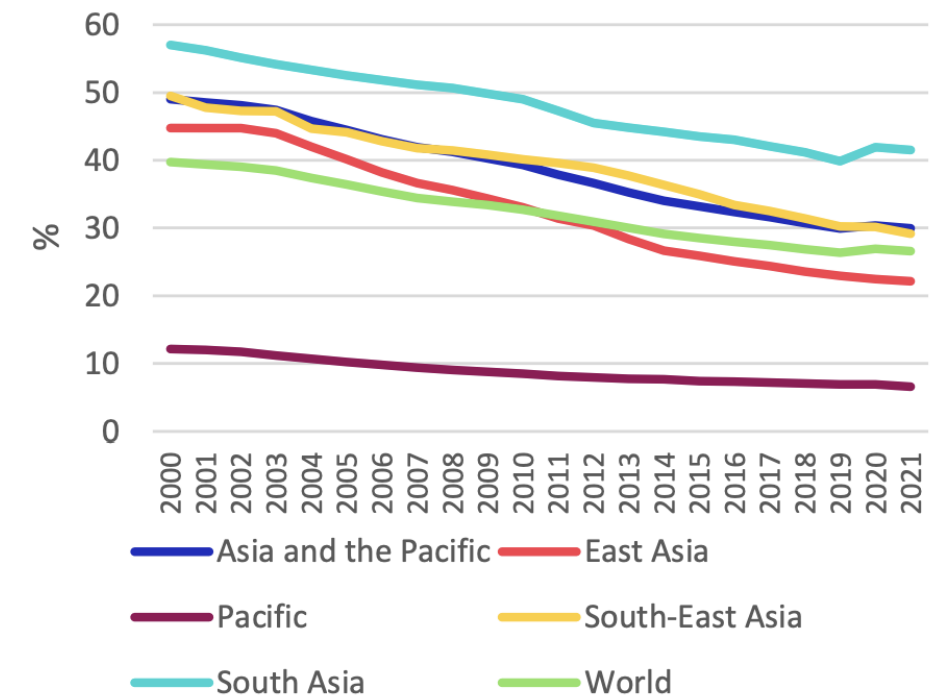
Population Growth

Figure 3. Urban/rural population ratio, historical (1960–2019) and projected (2020–2050)



Source: UN Population Division Data Landing Page. <https://www.un.org/development/desa/pd/data-landing-page> ; accessed through the FOFA Data Dashboard. <https://foodandagricultureorganization.shinyapps.io/FOFA-DASHBOARD/>

Share of agriculture in total employment, 2000–21 (per cent)



Source: ILO modelled sectoral estimates, Nov. 2022.

Challenges:

Production Challenges:

Low productivity, Climate Risk,
Resource Scarcity

Supply Chain Inefficiencies:

Post harvest losses, Market Access,

Financial Barriers:

Limited access to credit, Price Volatility

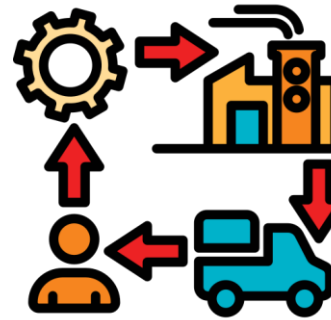


How Digital Technology Addresses These Challenges?

Digitalization in Production



Digitalization in Supply Chain



Digitalization in Finance



Sensor and
Remote Sensing

Drone

Sensor and
Remote Sensing

Farmer Advisory
Pest and Disease
Management

Machine Rental

Crop Analytics

Ingredients and
Food Technology

Smart Packaging

Waste Management

Traceability

E-Grocery

Blockchain

Restaurant Booking

Commodity Trading

In-store Logistic

Supply Chain Analytics

Digital Payments

Insurance

Agri-e-commerce

More than 80 percent of the region is in early stages of AI adoption

Stages of AI (by % of respondents, region, or country)

		Early stages: 83% of ASEAN			Advanced stages: 15% of ASEAN	
		Stage 1. Not interested in investing in AI	Stage 2. Keen to invest/ developing AI strategy	Stage 3. Piloting initiatives within discrete activities	Stage 4. Scaling initiatives across discrete activities	Stage 5. End-to-end scaled implementation of AI
	Southeast Asian nations	2%	27%	56%	9%	6%
	Singapore	2%	22%	58%	12%	7%
	Malaysia	–	26%	60%	9%	6%
	Indonesia	2%	28%	57%	9%	4%
	Thailand	5%	28%	55%	8%	5%
	Philippines	7%	26%	54%	4%	9%
	Vietnam	–	36%	49%	11%	4%

Advanced stages by sectors

7%	Agriculture
19%	Communications, media, and technology
5%	Energy
14%	Financial services
12%	Government, safety/ security, and smart cities
7%	Manufacturing
10%	Retail and hospitality
17%	Transport and logistics
10%	Others

Note: Percentages may not resolve because of rounding.
Source: Kearney–EDBI artificial intelligence study

Source: Racing toward the future: artificial intelligence in Southeast Asia (2020)

Southeast Asia Farmtech

Smallholder Farmtech 2022 (\$ USD)

Reflecting the diversity of farming types in Southeast Asia, top farmtech deals spanned several areas including aquaculture, insect farming, and agribusiness marketplaces & fintech. The latter category is especially important for smallholder farmers in need of access to supplies, credit and more direct relationships with customers. Farm robotics and mechanization is another important category in the region as it grapples with the impacts of climate change and ensuing labor challenges.



- Upstream
- Midstream
- Downstream

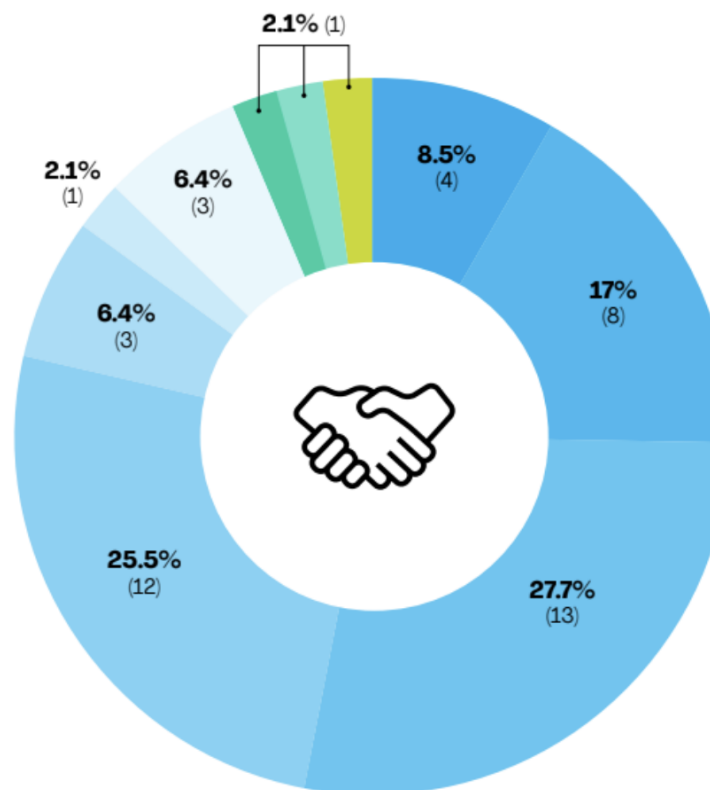
Top Farmtech deals in Southeast Asia

COUNTRY	RAISED	COMPANIES FUNDED	STREAM
	\$90m	eFishery FARM ROBOTICS, MECH. & EQUIP.	●
	\$35m	AgriAku AG MARKETPLACES & FINTECH	●
	\$33m	eFishery FARM ROBOTICS, MECH. & EQUIP.	●
	\$30m	Entobel NOVEL FARMING SYSTEMS	●
	\$30m	Aruna AG MARKETPLACES & FINTECH	●

Farmtech deal count by category

Category	\$USD	Deals
● Farm Robotics, Mechanization & Equipment	263m	6
● Ag Marketplaces & Fintech	95m	12
● Novel Farming Systems	66m	15
● Farm Management Software, Sensing & IoT	41m	16
● Bioenergy & Biomaterials	2m	5
● Innovative Food	2m	1
● Ag Biotechnology	-	3
● Midstream Technologies	23m	1
● Miscellaneous	0.6m	1
● Farm-2-Consumer eGrocery	119m	1

Investment by deal count



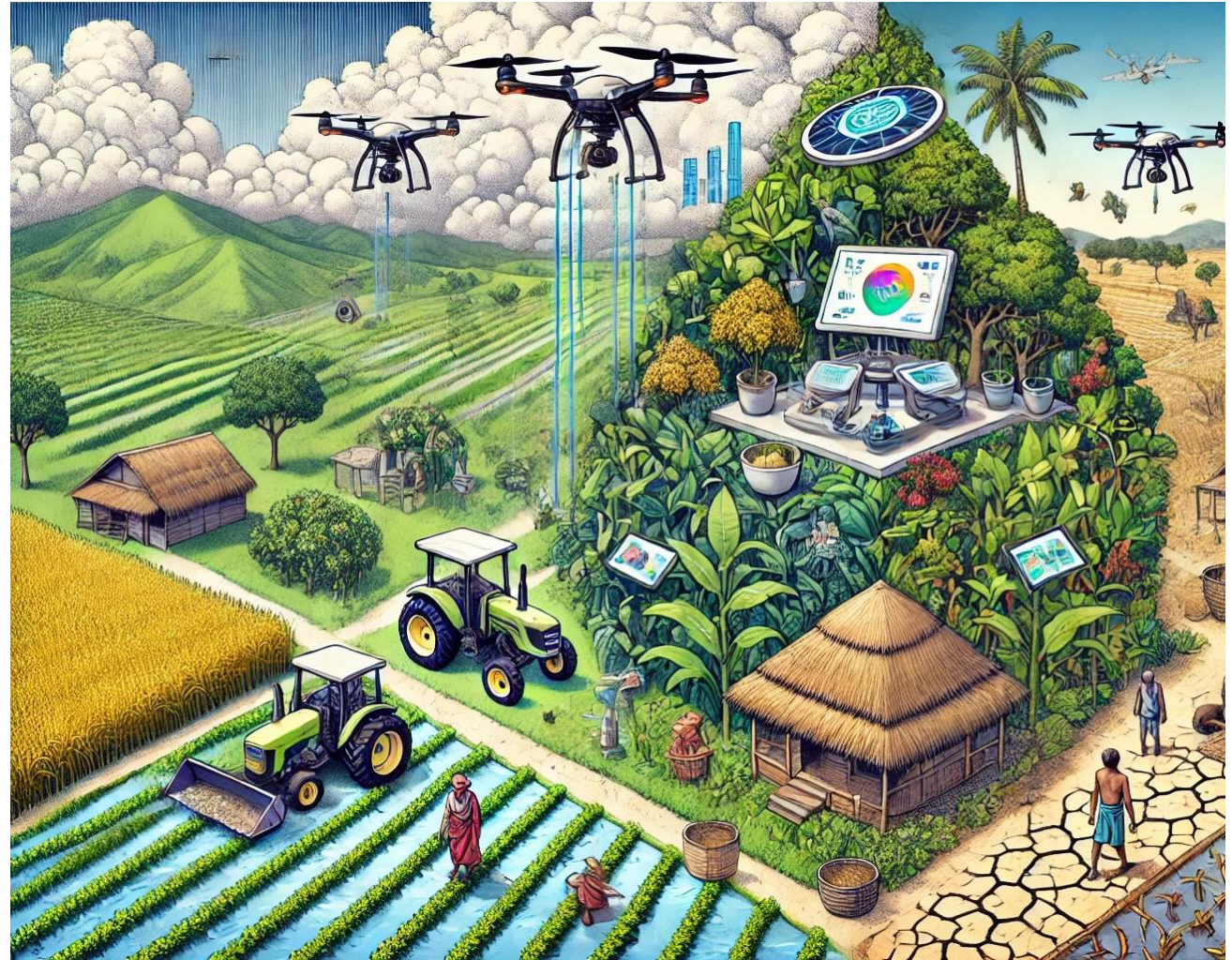
Source: Asia-Pacific AgriFoodTech: Investment Report 2023



AI Divide

Why Smallholders Are Most Affected by the AI Divide?

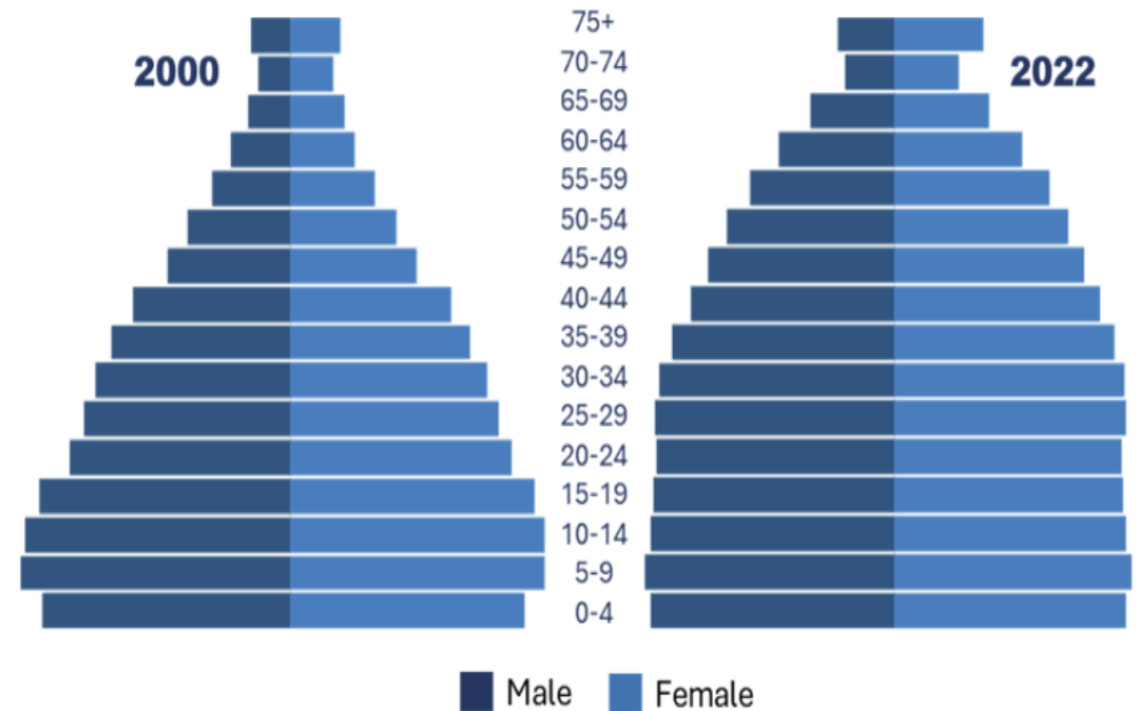
- Low Literacy
- Inadequate Digital Infrastructure
- Financial Cost
- Gender Digital Divide



Demographic Bonus in ASEAN

“The productive working-age population (20–59) increasing from 51.4% in 2000 to 55.8% in 2022.”

Shifting Demographic Structure



Source: UN DESA, World Population Prospects 2022, July 2022

How to bring AI to the field?

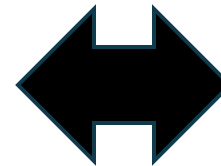
Bridging the AI Divide: Bringing AI to the Field



Farmer-Led Innovation Project: The Farmer-Centric Approach for Empowering Smallholder farmers with AI



Farmer-Centric Approach



Business-Centered Approach

Collaborative Approach

Integrated Hilirization of AI Services for Farmers



Government

- As Connector
- As Regulator
- As Financier



University

- Conduct Research
- Develop AI solution
- AI Education



Companies

- Scale up AI Innovation and deploy platform for farmers
- Provide technical support and ensure usability of AI tools

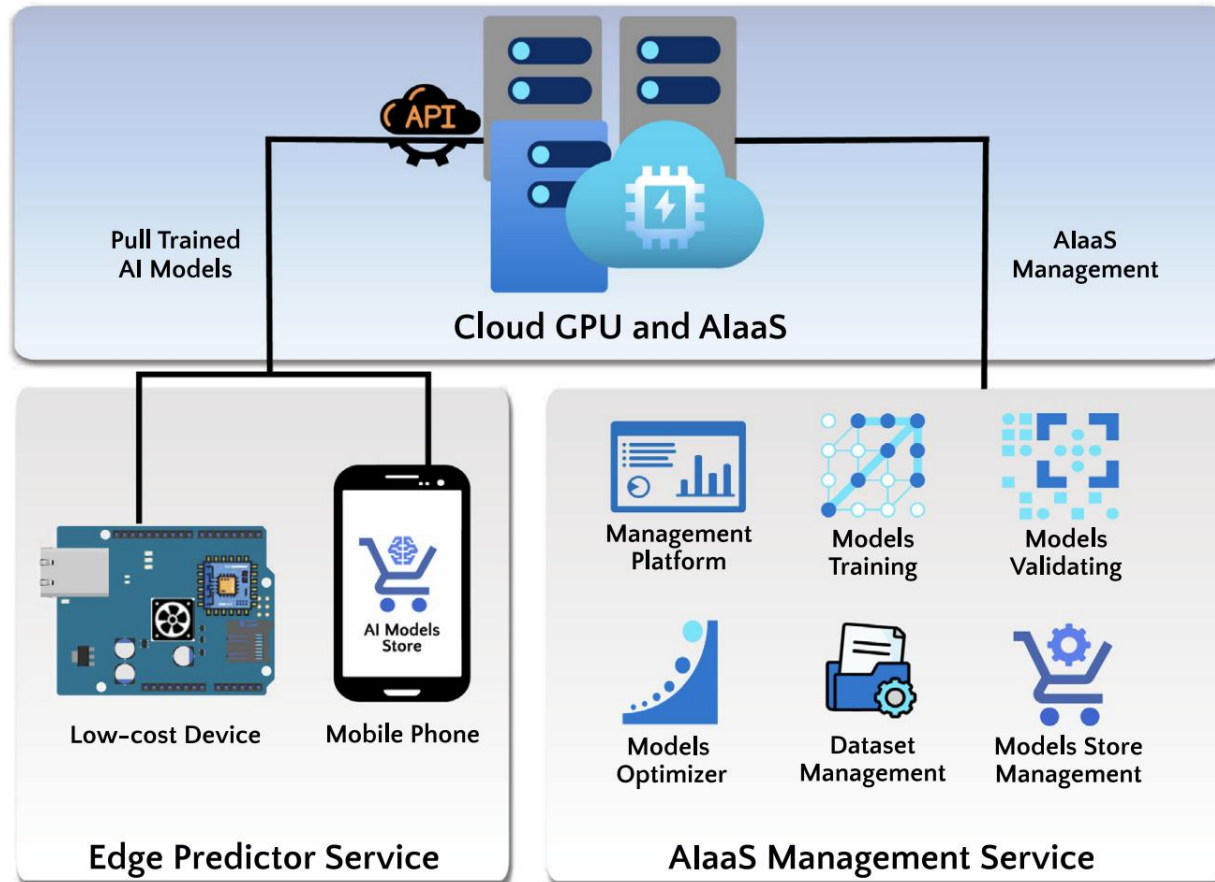


Farmers

- Adopt AI tools
- Provide data for AI system
- Share feedback

AI-as-a-Service (AlaaS) Architecture:

Cloud Based Delivery Model to Bridge the AI divide for smallholders farmers



Principal for Digital Development

1. Understand the Ecosystem
2. Leveraging Data-Driven
3. Use Open Standards, Open Data, Open Source and Open Innovation
4. Reuse and Improve
5. Be collaborative



Policy Recommendation

- **Infrastructure connectivity:** Improving digital infrastructure
- **Financial Support:** Provide subsidies and financial support for AI Adoption
- **Interoperability:** Promote Open Data and Open Standards
- **Farmer Engagement and Education:** Build Farmer Capacity and Digital Literacy
- **Inclusivity:** Develop AI Solutions Tailored for Smallholders
- **Collaboration:** Foster regional collaboration
- **Ethics:** Ensure Ethical and Inclusive AI Deployment

“AI for agriculture **isn't just about advancing technology**—it's about building a sustainable, empowering farmers, optimizing resources, and creating value for all in the food system”

IPB Program and Research Works

Building an AI Ecosystem

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IPB University
— Bogor Indonesia —

Building an AI Ecosystem: IPB's Vision for Innovation and Impact

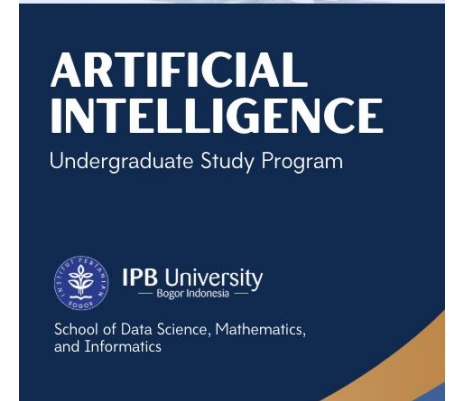


**Kisah Rizky Maulana, Petani Milenial Alumni
IPB Sukses Budidaya Sayuran Hidroponik**

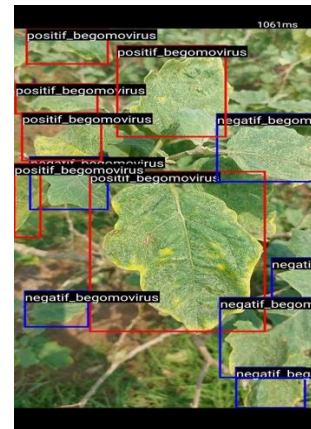
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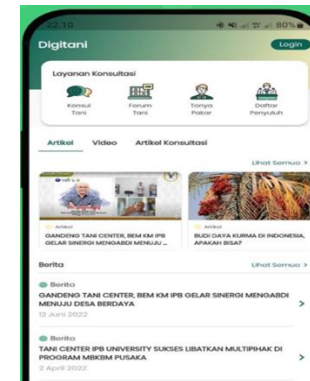
Tani & Nelayan Center IPB



Program MBKM Kampus Sawah Merdeka (PUSAKA)



**Research work for AI
agriculture**

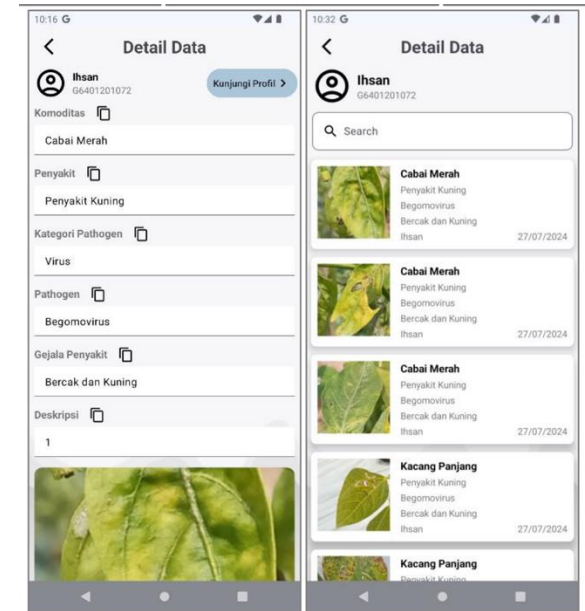
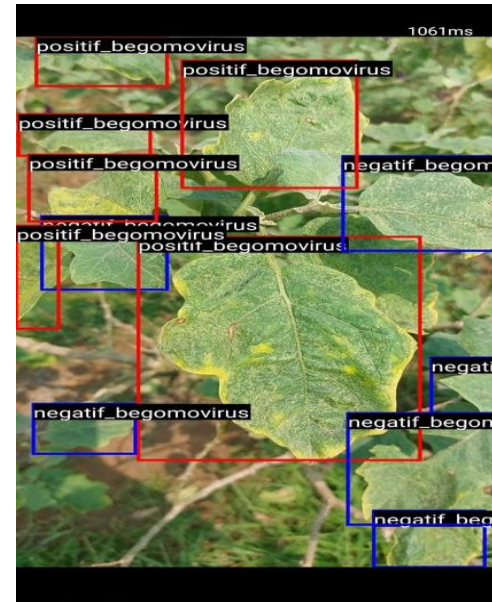
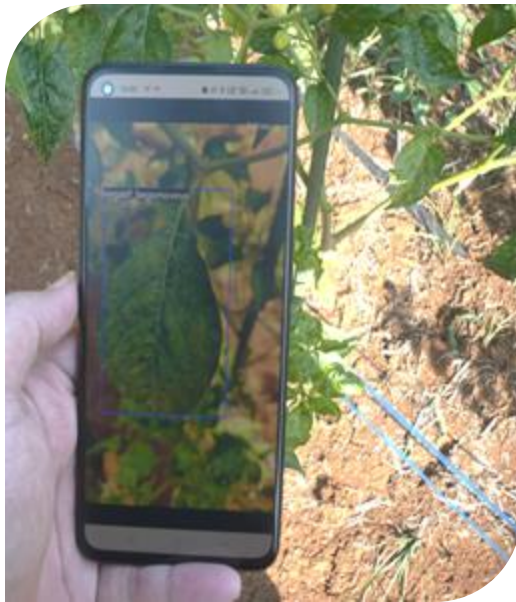


IPB Digitani

<https://ai.ipb.ac.id/>

Mobile Apps for Diseases Detection

Leaf Diseases Detection in Horticulture Crops using Deep Learning



This research, a collaboration between the Dept of Computer Science and Dept of Plant Protection IPB University

Remote Sensing for Precision Monitoring

Assessing Rubber Plant Health and Disease Severity



Drone



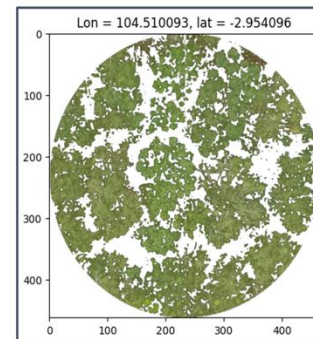
Hemispherical camera



Sentinel 2.0



Local Weather Station



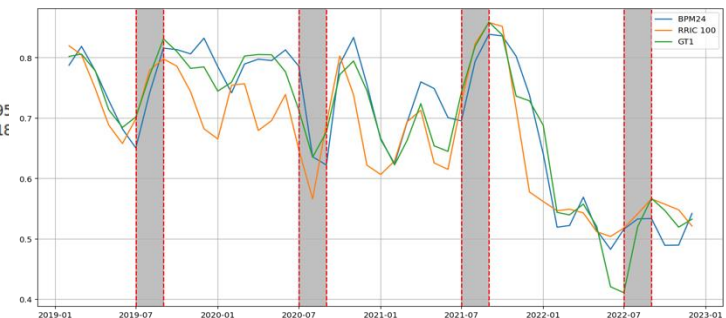
Label : Level 1 (L1)

Hasil Prediksi:

Predicted : Level 1
Density NDRE : 0.8665795
Density LCI : 0.88105616
NDRE : 0.19441849
LCI : 0.2925156

Probabilitas:

L1 : 0.7415
L2 : 0.231
L3 : 0.0275

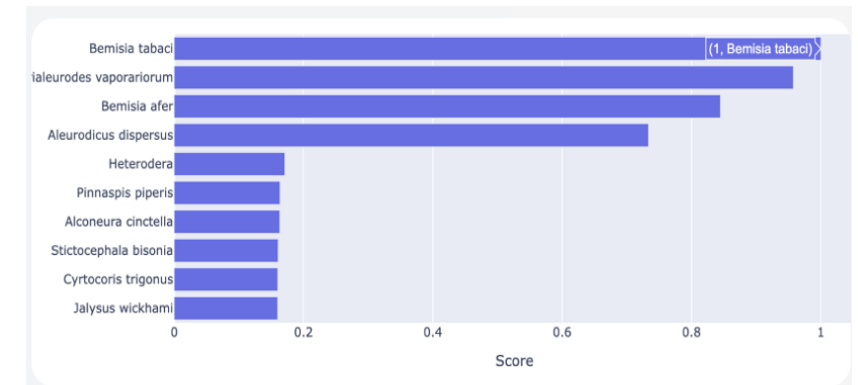
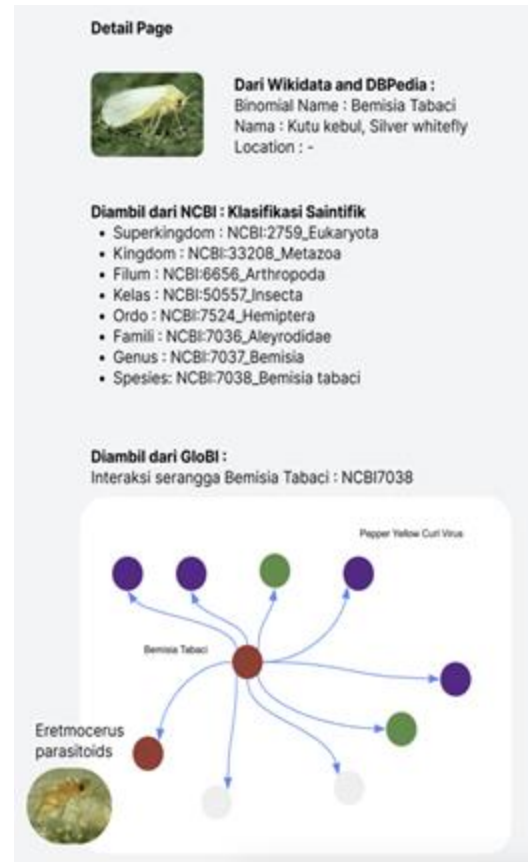
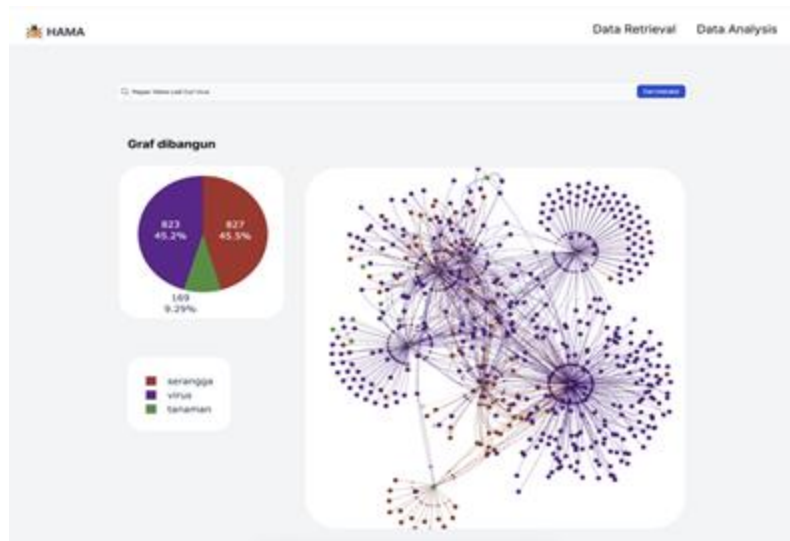


Herdiyeni, Yeni, et al. "Analysis and prediction of rubber tree phenological changes during Pestalotiopsis infection using Sentinel-2 imagery and random forest." *Journal of Applied Remote Sensing* 18.1 (2024): 014524-014524.

Agriculture Advisory

with Knowledge Graphs and Large Language Models (LLM)

Pepper Yellow Curl Virus



Katili, Moh, Yeni Herdiyeni, and Medria Kusuma Dewi Hardhienata. "Leveraging Biotic Interaction Knowledge Graph and Network Analysis to Uncover Insect Vectors of Plant Virus." *Journal of Information Systems Engineering & Business Intelligence* 10.1 (2024).

“Democratizing AI in agriculture is **not just a technological challenge**—it’s a policy imperative. **By investing in infrastructure, fostering collaboration, and ensuring inclusivity**, Southeast Asia can bridge the AI divide and empower its smallholder farmers to achieve sustainable agricultural prosperity.”



Thank You

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