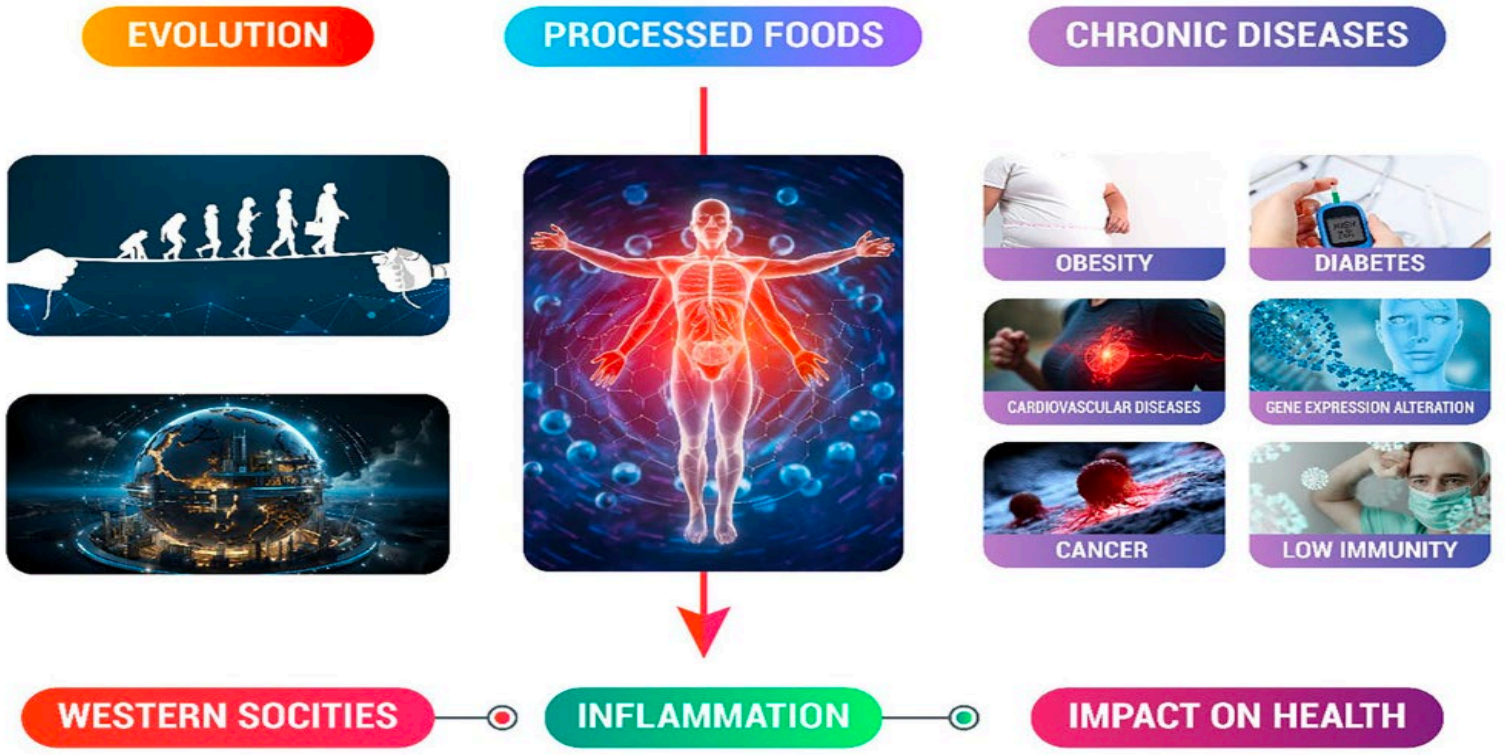
Green Transformation in Tropical Agricultural at Universities



Description of human evolution and the changes in eating patterns caused by increased industrialization and the marketing of processed Foods. npj Science of Food | (2025) 9:138. https://doi.org/10.1038/s41538-025-00484-x

Impact of lifestyle and industrialization on food habits

Integration of food production through industrialization has greatly influenced food consumption patterns and food chains (amending all cycles in the food chain).

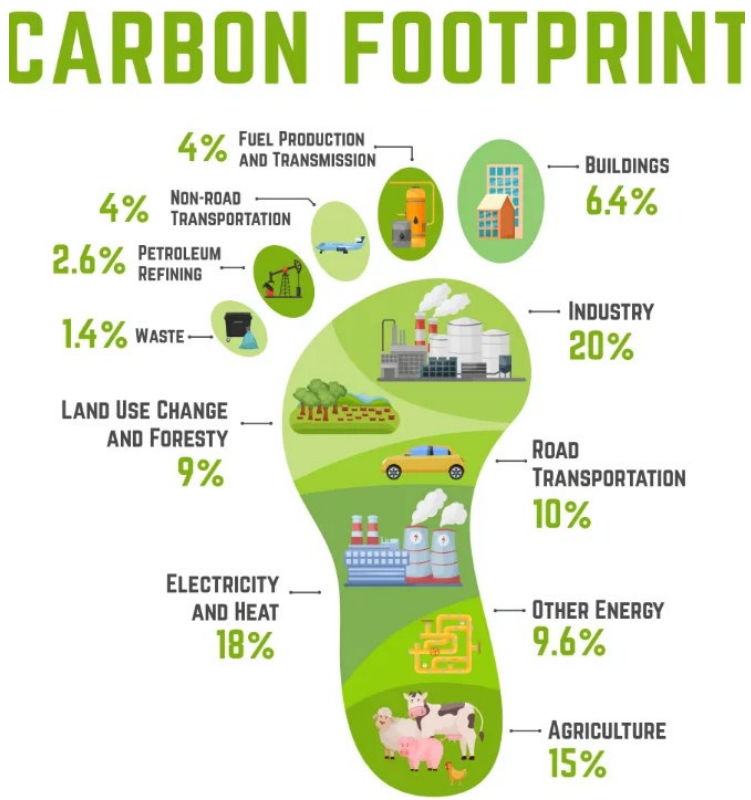
Traditional agricultural practices

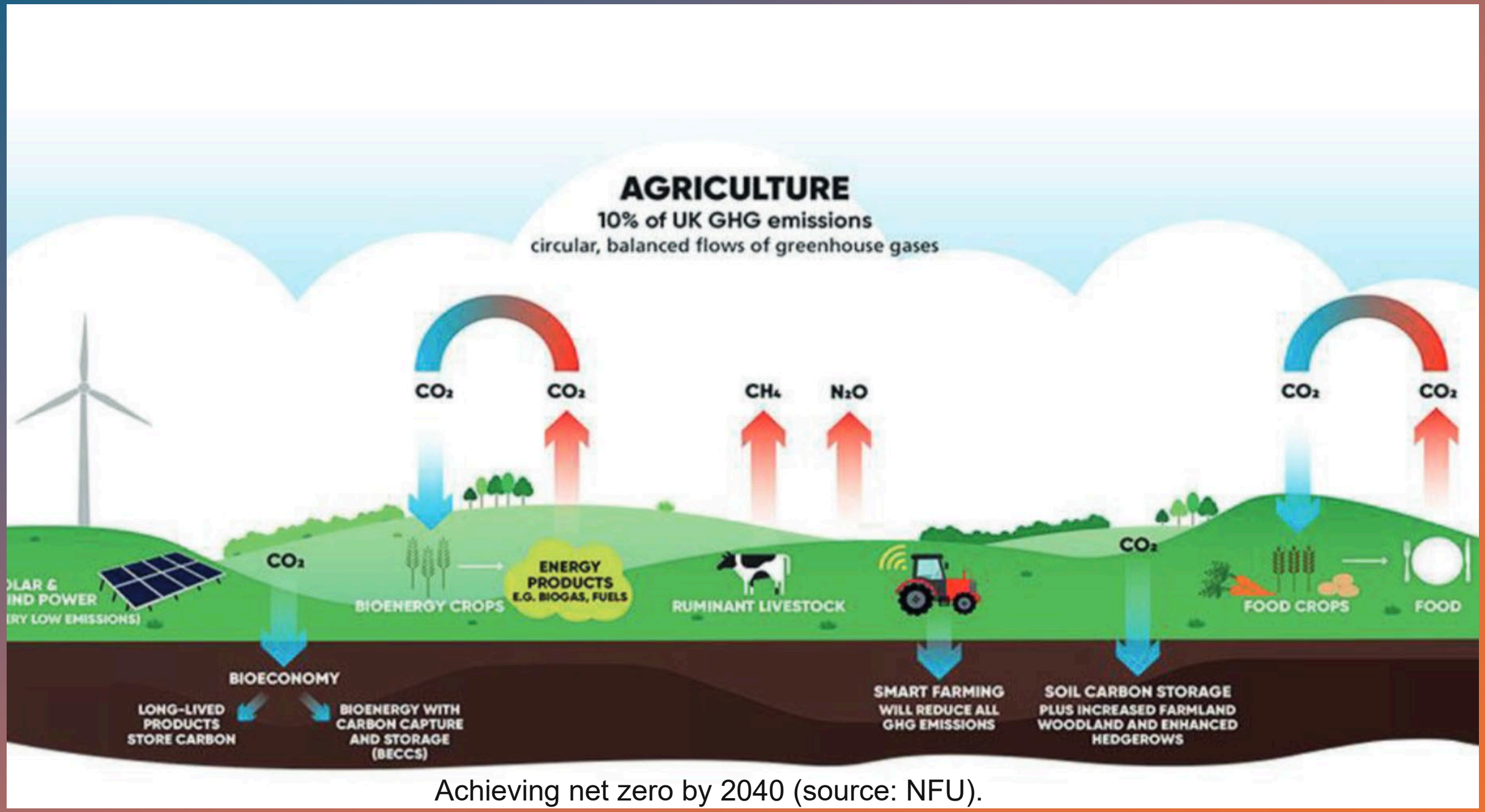
Traditional food systems were deeply rooted in localized agricultural practices that emphasized sustainability and resilience. These systems were characterized by:

- **Subsistence farming**: Small-scale, family-oriented farming focused on local food production.
- **Biodiversity:** The use of diverse crops and livestock, promoting ecological balance and resilience.
- **Minimal processing:** Foods were typically consumed fresh or preserve using natural methods like drying and fermentation

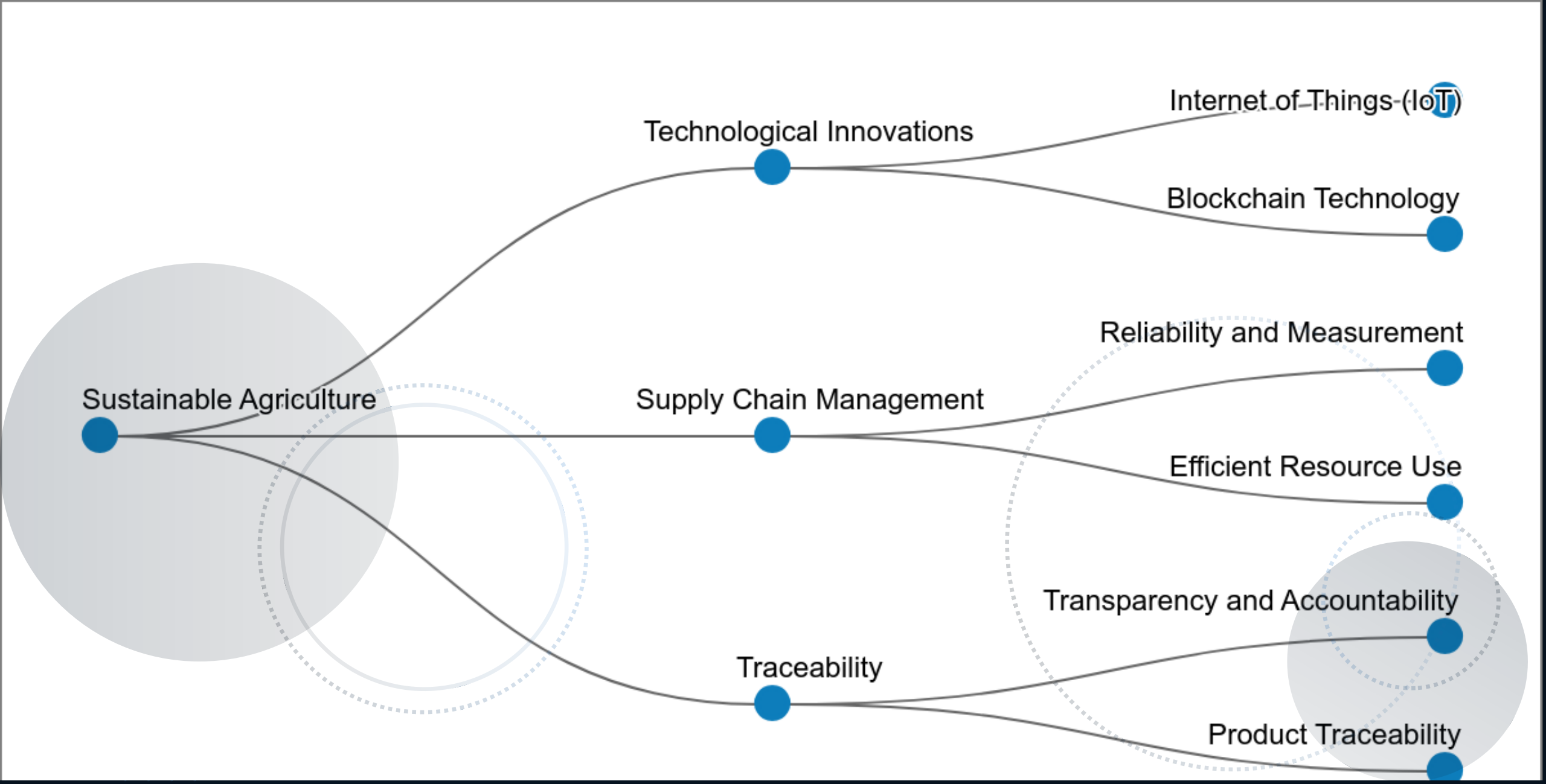
https://doi.org/10.1038/s41538-025-00484-x

Regulating Modern Food Systems





Achieving net zero by 2040 (source: NFU).


Internet of Things (IoT)
Technological Innovations
Blockchain Technology
Reliability and Measurement
Sustainable Agriculture
Supply Chain Management
Efficient Resource Use
Transparency and Accountability
Traceability
Product Traceability

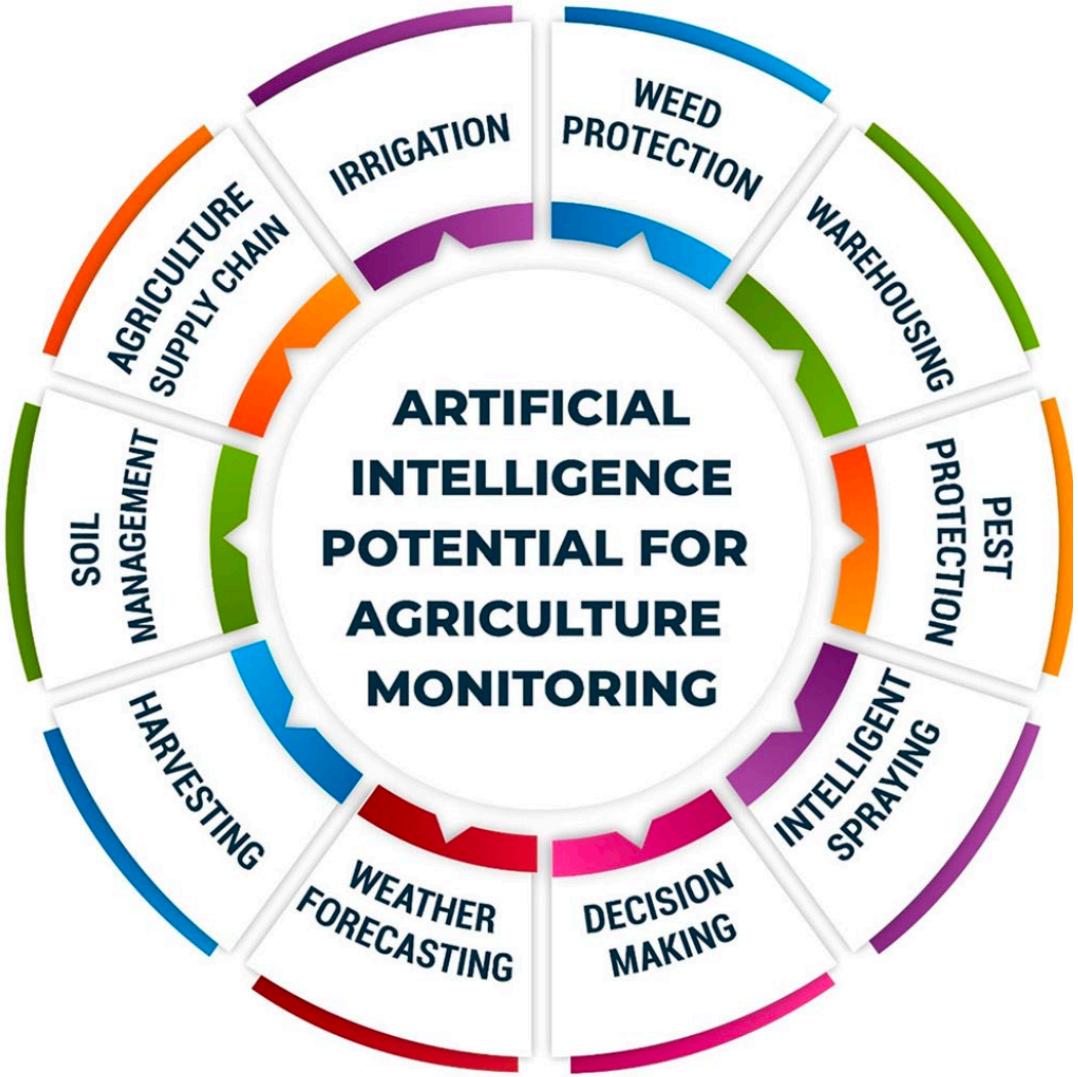
Green transformation in tropical agricultural integrating sustainable practices into **agricultural education** and **research** to promote environmental sustainability and economic resilience. This transformation includes implementing:

Smart and Precision Agriculture	leverages advanced technologies to optimize crop production by using Technologies such as IoT, big data analytics, and AI enable real-time monitoring of crop growth conditions, facilitating precision irrigation, fertilization, and pest management.
Smart Tracing and Supply Chains	Blockchain technology is revolutionizing food traceability and safety by establishing transparent, tamper-proof, and secure supply chains. Blockchain provides a decentralized ledger where every transaction—from planting and harvesting to processing and distribution—is recorded in real-time, enhancing transparency and mitigating risks of fraud and contamination. This technology ensures product authenticity and traceability, boosting consumer trust and improving food safety .

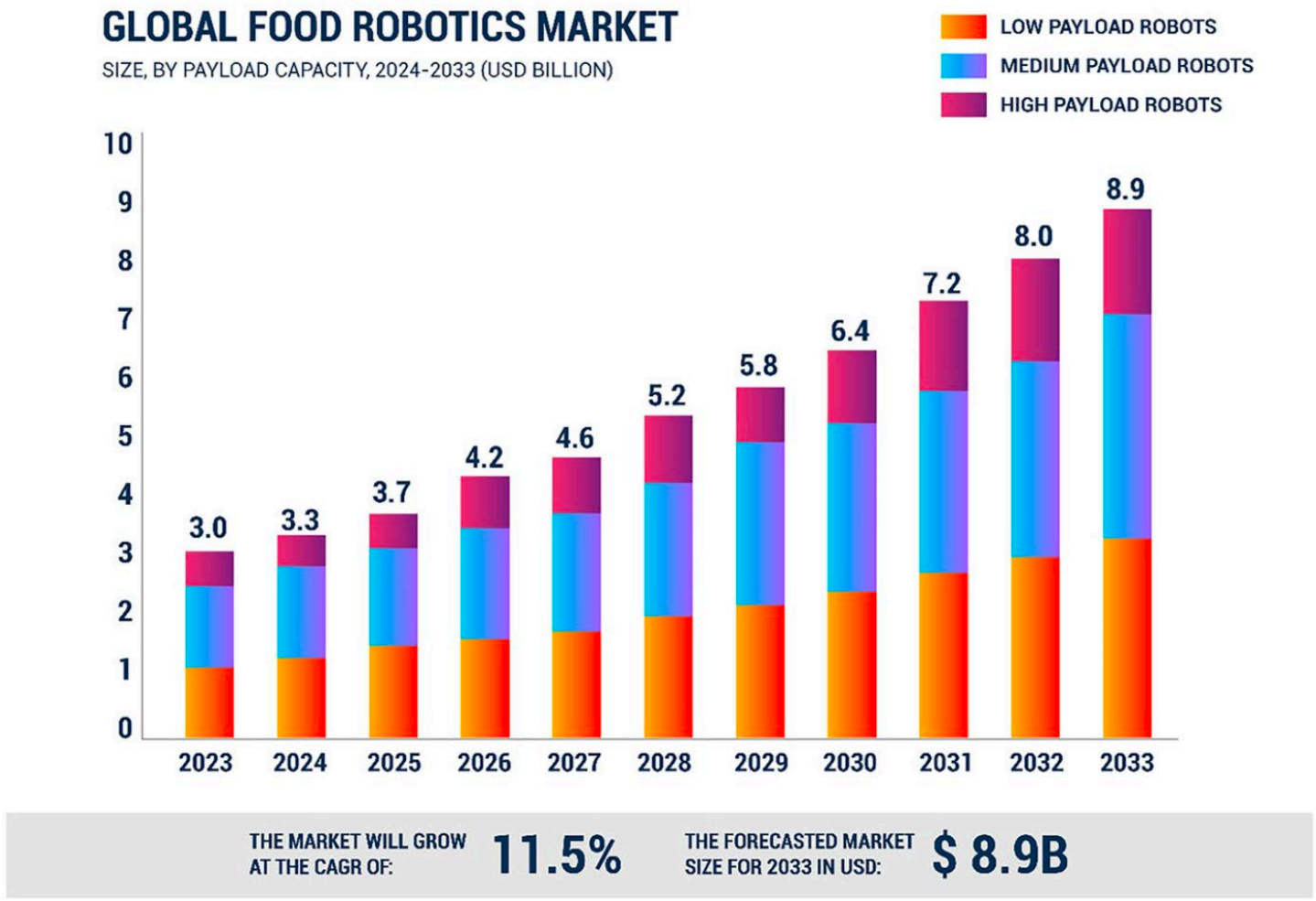
Technology to support Smart Agriculture

Technology	Application	Benefits
GIS and GPS	Mapping and managing spatial variability	Site-specific management of inputs
Remote Sensing	Monitoring crop health and soil properties	Detailed vegetation indices for irrigation management
IoT	Real-time environmental monitoring	Timely interventions and optimized resource use
Variable Rate Application (VRA)	Precise application of fertilizers and pesticides	Reduced input costs and environmental impact
Machine Learning and AI	Data analysis and prediction	Improved farm management and crop stress prediction
Drones and UAVs	Aerial monitoring of crops	Early detection of plant stress and efficient resource management
Soil and Plant Sensors	Nutrient and water management	Real-time data for precise input management
Controlled Environment Agriculture	Tropical greenhouses with IoT-based systems	Mitigation of climate change impact

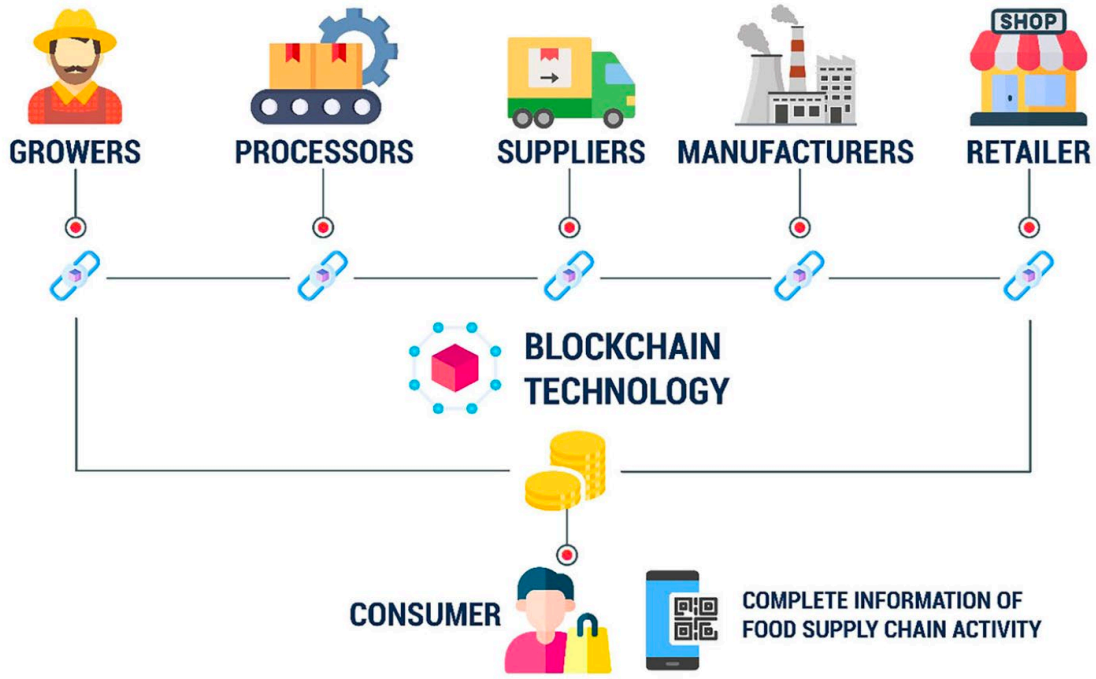

CLIMATE SMART TRADIITONAL AGRICULTURAL PRACTICES
AGROFORESTRY
INTERCROPPING
CROP ROTATION
COVER CROPPING
TRADITIONAL ORGANIC COMPOSITING
INTEGRATED CROP ANIMAL FARMING


ARTIFICIAL INTELLIGENCE POTENTIAL FOR AGRICULTURE MONITORING
IRRIGATION
WEED PROTECTION
WAREHOUSING
PEST PROTECTION
INTELLIGENT SPRAYING
DECISION MAKING
WEATHER FORECASTING
HARVESTING
SOIL MANAGEMENT
AGRICULTURE SUPPLY CHAIN

Key Agricultural Parameters Tracked Using Artificial Intelligence203



Blockchain technology revolutionizes food safety and sustainability by ensuring transparency, traceability, and efficiency across the entire supply chain, from farm to table.



Green transformation in tropical agricultural into agricultural education

Aspect	Technologies	Benefits	Challenges	Solutions
Precision Agriculture	IoT, Big Data, AI	Optimizes crop production, reduces inputs	High initial costs, technical limitations	Financial incentives, training, technical support
Smart Tracing & Supply Chains	Blockchain, Smart Contracts	Enhances transparency, mitigates fraud, ensures food safety	Data privacy concerns	Cybersecurity measures, transparent data management
Educational Integration	Curriculum development	Promotes digital literacy, environmental stewardship	Resistance to change	Integrating green practices into curriculum
Research & Development	Interdisciplinary collaboration	Drives innovation, adoption of sustainable practices	Funding limitations	Collaborative efforts, government support
Policy Support	Incentives, subsidies	Encourages adoption of green technologies	Policy implementation challenges	Clear regulations, targeted incentives

Implementation Strategies

Educational Integration:

Universities should integrate green practices into their curriculum, promoting digital literacy and environmental stewardship among students . This includes teaching students about precision agriculture technologies and blockchain applications in supply chain management .

Research and Development:

Universities should focus on interdisciplinary research to develop and implement green technologies. Collaborative efforts between universities, research institutions, and industry can drive innovation and adoption of sustainable practices .

Policy Support:

Government policies play a crucial role in promoting green transformation. Policies should provide incentives for adopting green technologies and practices, such as subsidies for precision agriculture equipment and blockchain systems .

Challenges and Solutions

High Initial Costs:

Implementing precision agriculture and blockchain technology requires significant investment. Financial incentives and technical support can help overcome these barriers

Technical Limitations:

The complexity of these technologies may pose challenges for adoption. Providing training and resources to farmers and students can enhance their understanding and use of these technologies

Data Privacy Concerns:

Ensuring data security and privacy is essential for the successful implementation of smart agriculture systems. Robust cybersecurity measures and transparent data management practices can address these concerns .

Conclusion

- Green transformation in tropical agricultural universities is essential for promoting sustainable agricultural practices.
- By integrating smart and precision agriculture, smart tracing, and supply chain management into education and research, universities can lead the way in achieving environmental sustainability and economic resilience.
- Collaborative efforts, policy support, and addressing implementation challenges are crucial for the successful adoption of these technologies.

Facutly of Agriculture Technology

PROSPECTUS

SMART AGRICULTURE

UNIVERSITAS BRAWIJAYA

"AI Driven Smart and Digital Innovation for Sustainable Agriculture"

2023

Quick Facts

Established
1963

Location
Malang, East Java
Indonesia

Campus Size
800 hectares

Student Body
48,000 - 50,000 students across 18 faculties

Academic Programs
Undergraduate, Post-Graduate, Vocational, and Dual/Joint Degrees

THE IMPACT RANKINGS

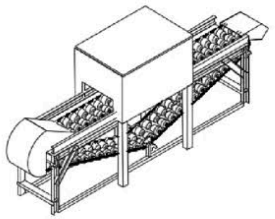
Rank	Name	Best scor
401–600	University of Brawijaya Indonesia	8 65.4 – 69.4
		1 62.5 – 70.6
		3 57.2 – 63.3
		1

SDG

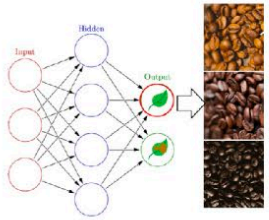
Track record related to current roadmap:

Recent research project of Bio-AI center member related with quality evaluation of agri-products:

Development of a fruit sorting and grading system prototype based on visible-fluorescence optical sensors and artificial intelligence models (Riset Kolaborasi Indonesia, 2022)

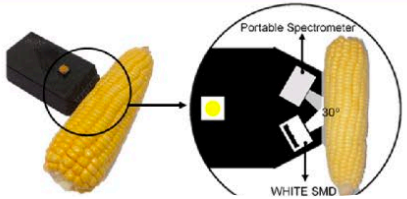


Deep Learning application as intelligent modeling for classification and quality of agro-industrial products (Universitas Brawijaya, 2022)



Development of a sensor based on fluorescence spectroscopy to predict the condition of melon plants and fruit and its relationship with macro fertilizer needs (Fertinnovation PT Pupuk Indonesia, 2022)

Development of a Rapid Detection System for On-Farm Corn Moisture Based on Portable Spectrophotometry for the Implementation of Precision Agriculture in Determining Corn Harvest Times (DIKTI, 2023)



Development of a Computer-Based Citrus Orchard Monitoring and Evaluation System Vision: Development of an Automatic Fruit Detection and Counting Model with Deep Learning Algorithms (Universitas Brawijaya Funding, 2021)

MEKA VISION

FACULTY OF ANIMAL SCIENCE
BRAWIJAYA UNIVERSITY

DIKST

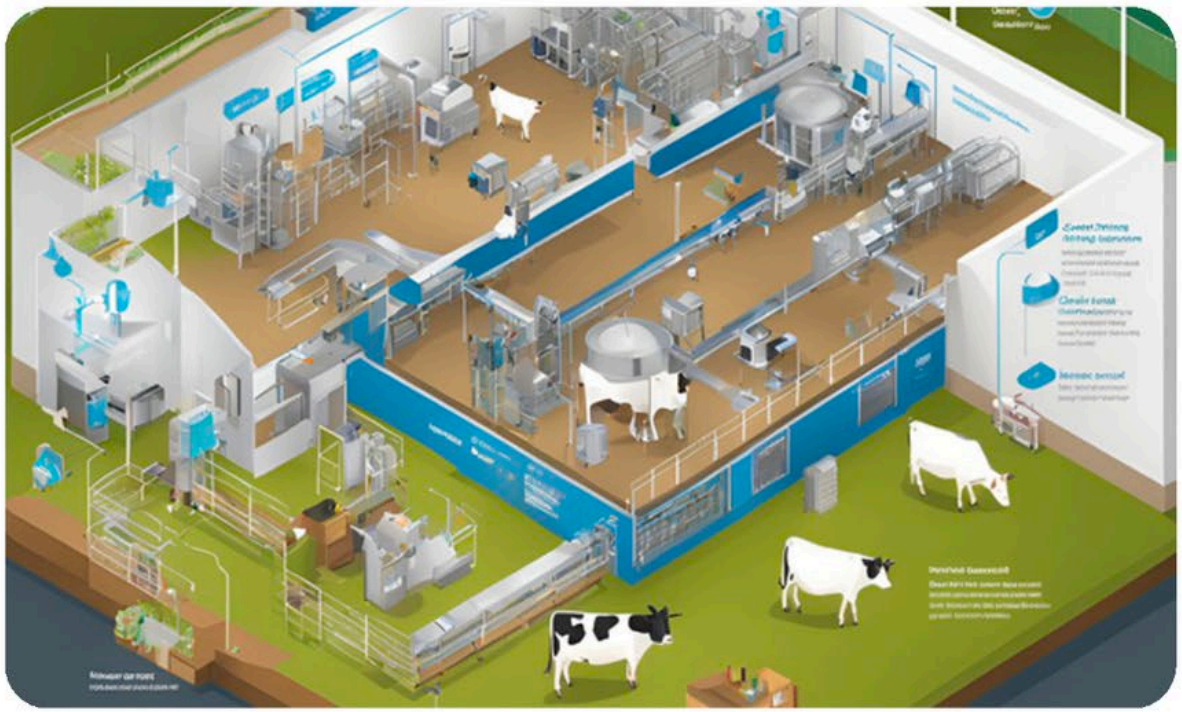
BHISMA SMART EAR TAG

empowering the next generation of farmers through data, technology, and innovation.

Smart Farming For Smart Nation

Now, livestock farming
The era of Smart farmi
collaboration between
Indosat Ooredoo Hutch

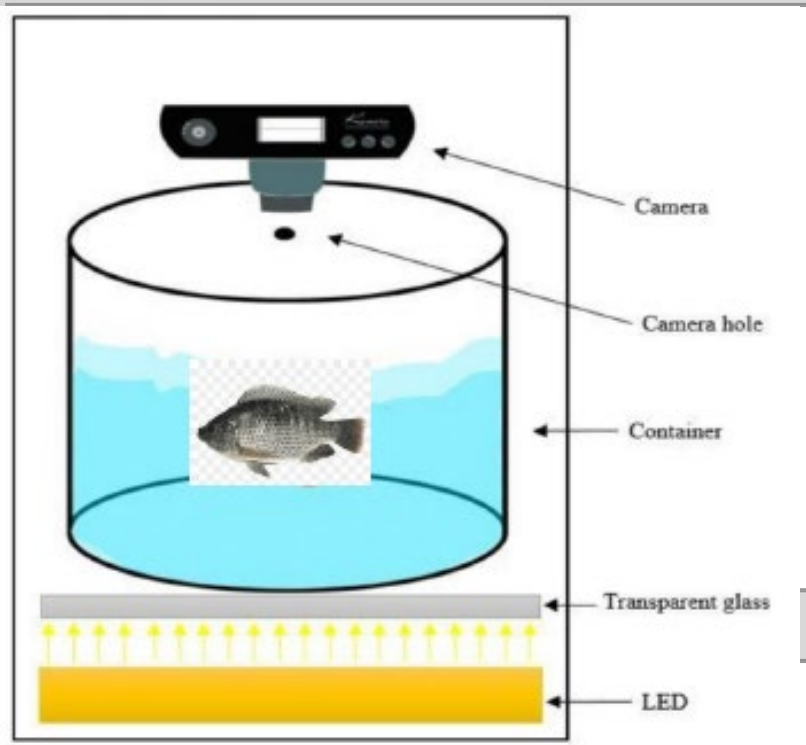
body temperature and movement activity to location and behavioral patterns,



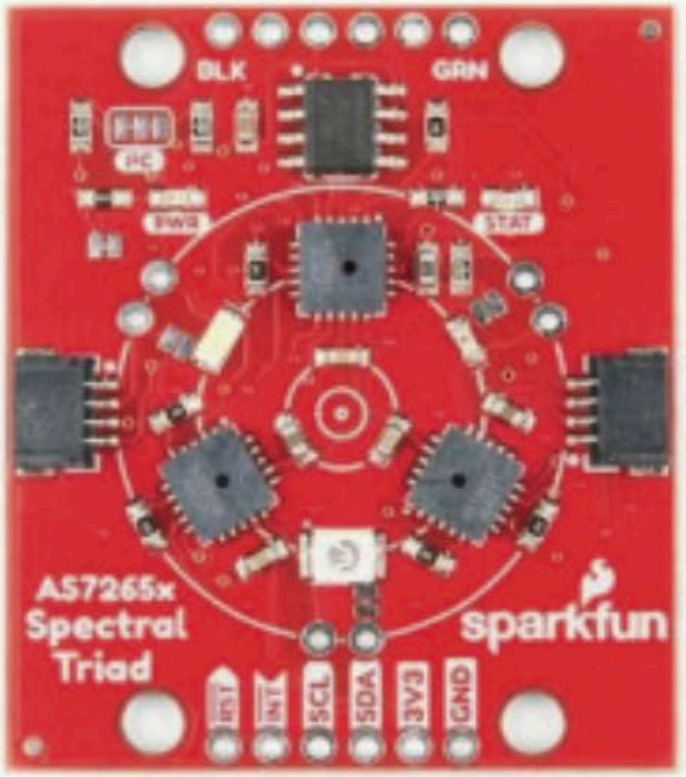
IoT in Dairy Farming
Milk Productivity Optimization
Sustainable Food Security

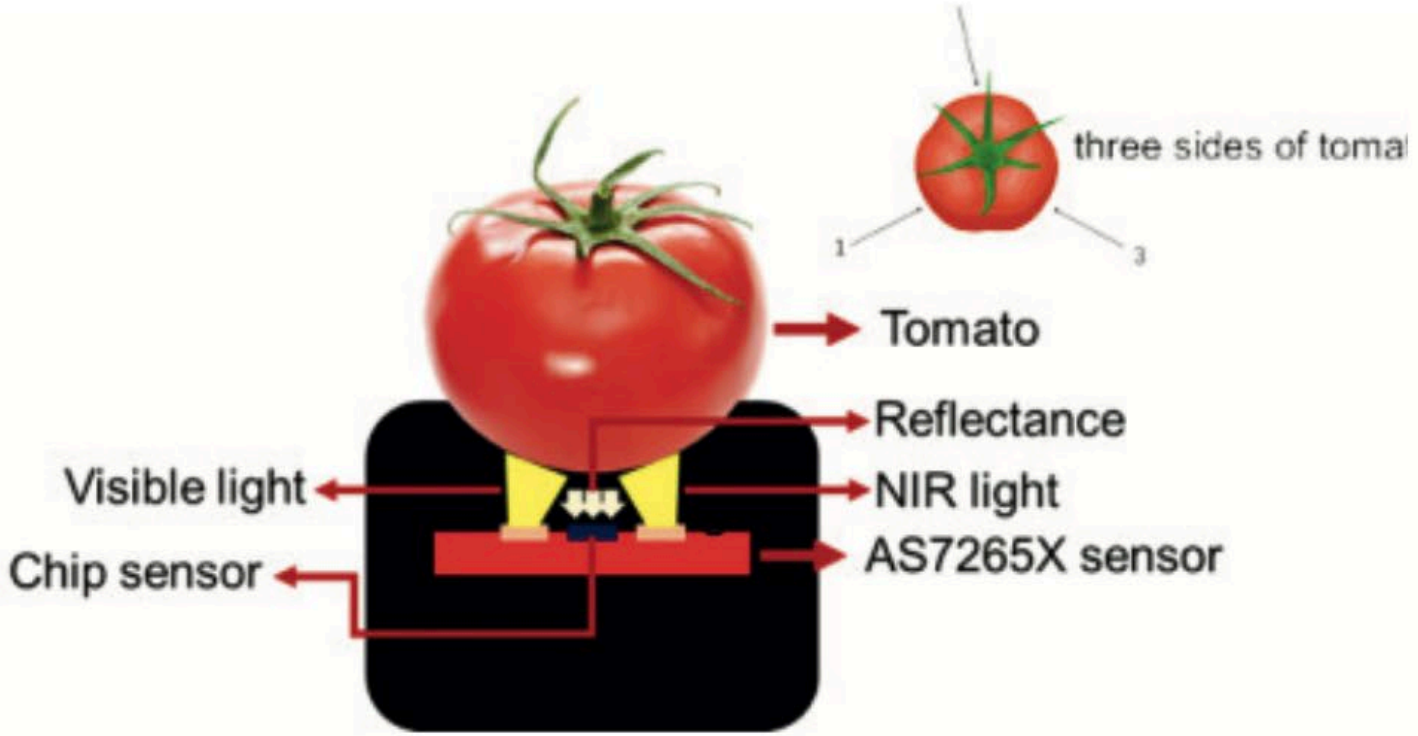
Digital Agriculture
Supply Chain Management
Artificial Intelligence (AI)

YOLO (*YOU ONLY LOOK ONCE*): DEEP LEARNING for Fish monitoring



Automatic Weather Station



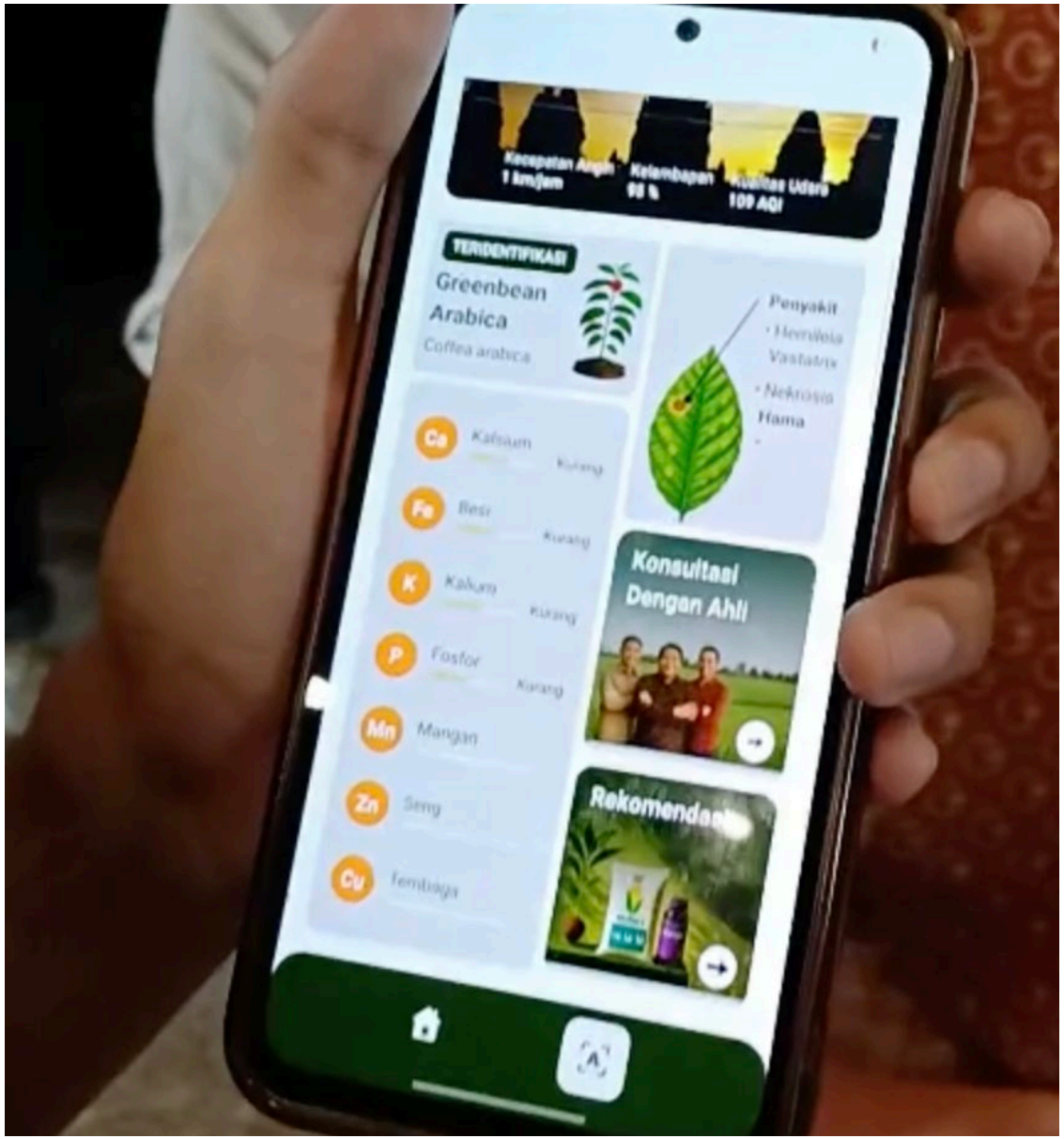


Development of a Portable Fruit Ripeness Measuring Device Based on Spectroscopy and Machine Learning Model

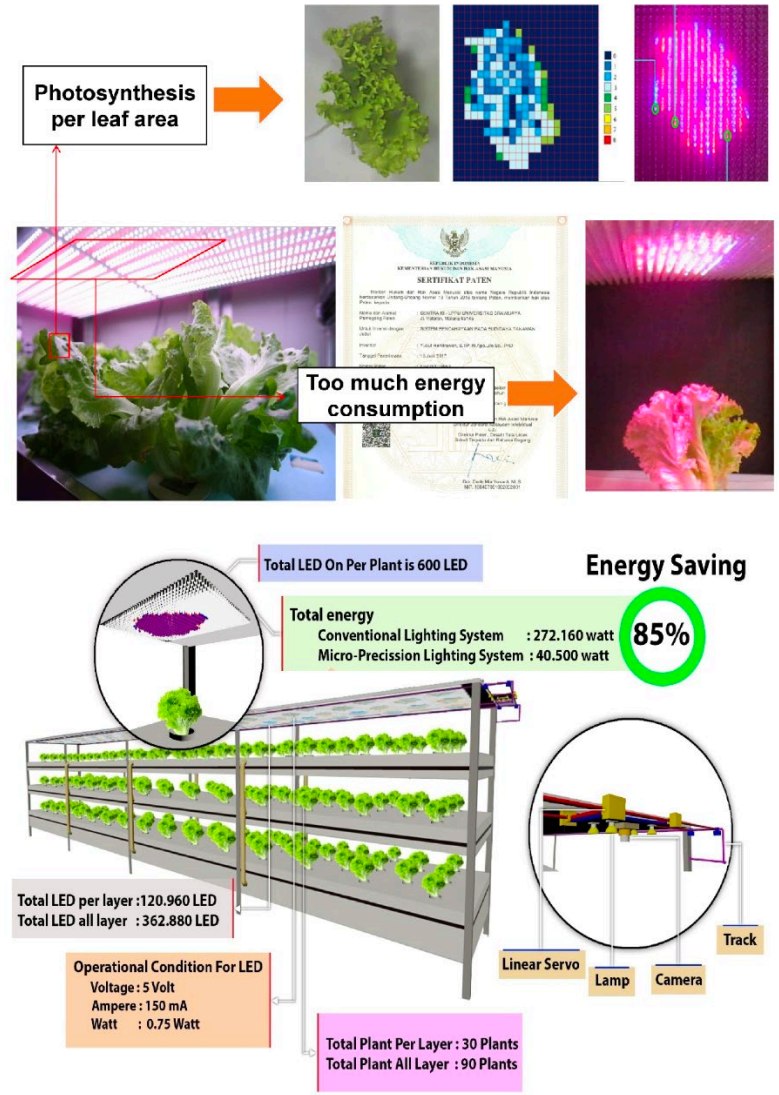
Prediction Model of Soluble Fiber Content in Porang Rice Using Near Infrared Spectrometer and Artificial Neural Network

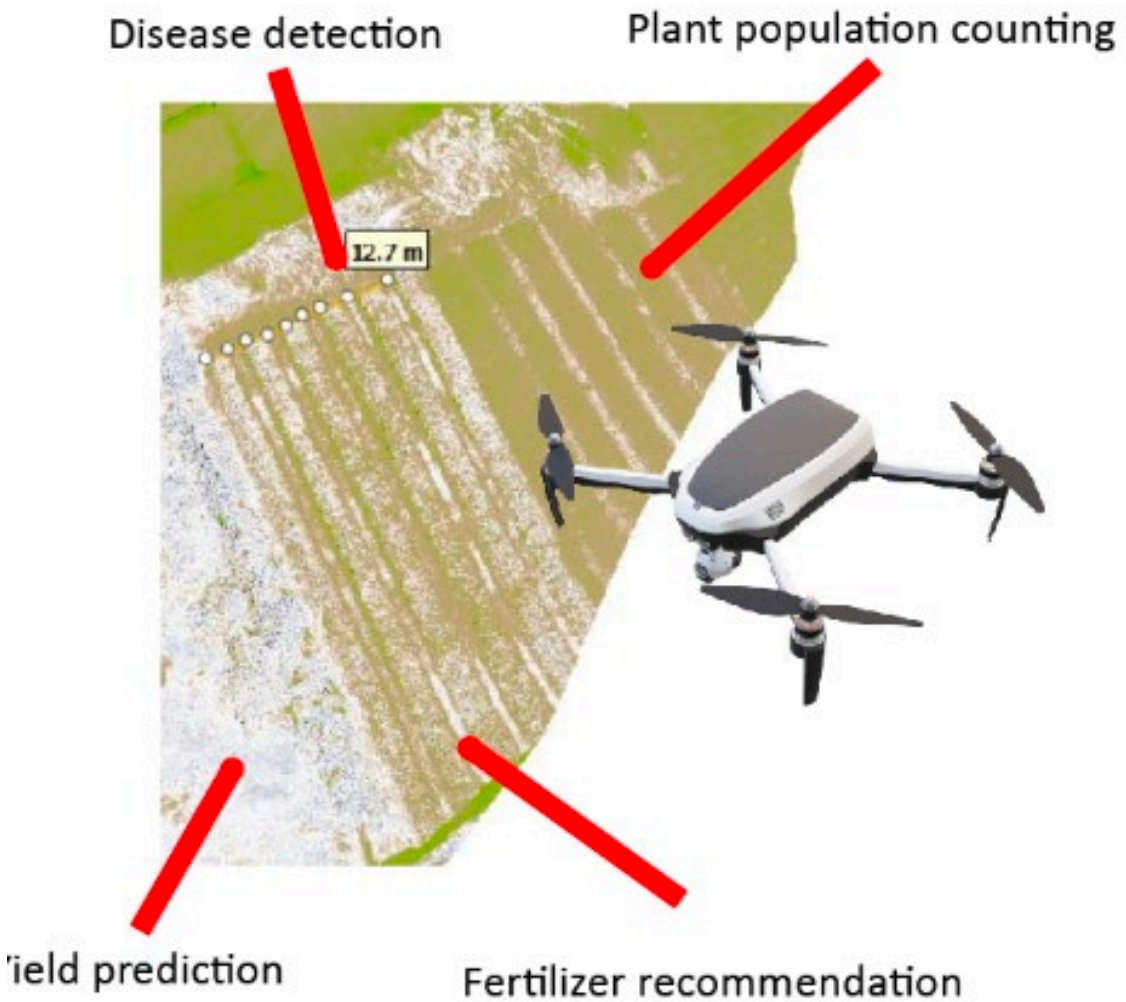
MantiSpectra's SpectraPod

Setup Pengukuran NIRS

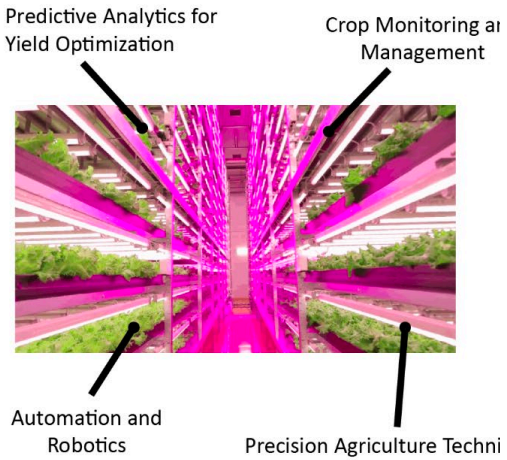


ro Precision LED Lighting System

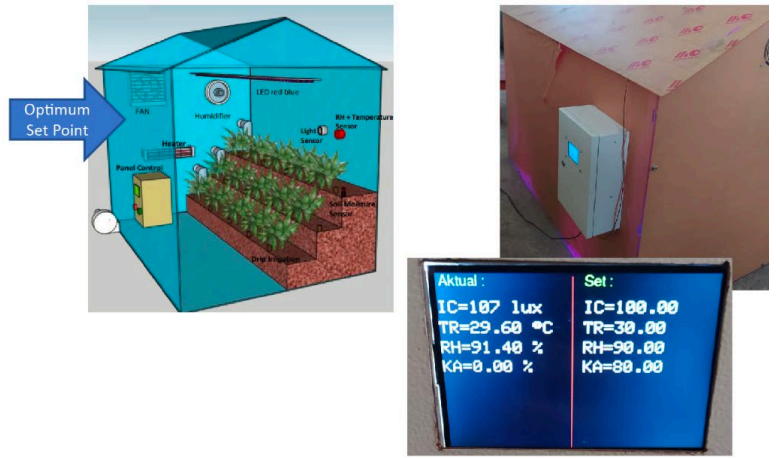




A closed farming system, on the other hand, is a more controlled contained system where the agricultural processes are carried out withir enclosed or controlled environment. This type of system allows for greater co over environmental factors such as temperature, humidity, light, and pest cor This techniques is suitable for urban farming and cultivation of high v commodities.



Smart Greenhouse



UNIVERSITAS BRAWIJAYA

THANK YOU