Smart Precision Agriculture to Reduce World Hunger And Improving Food Security

Utilizing Artificial Intelligence and IoT Smart Precision Agriculture ASEAN countries

2 ZERO HUNGER

Team Dantics Masters

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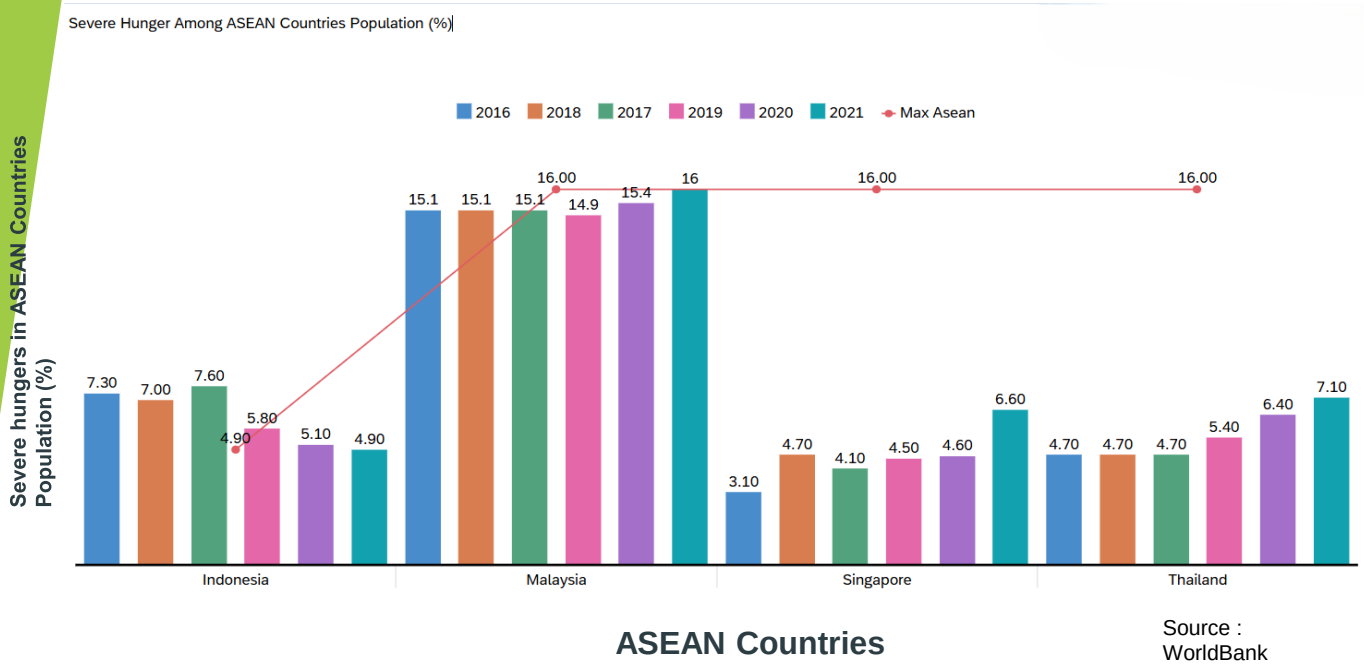
Pak Budi came from a traditional home in the villages in Java facing food insecurity.

In Indonesia, nearly 23 million struggles to meet dietary requirements. (source : wfp.org)

His children were impacted by the lack of food security causing 30 % of children population under 5 years old in the country were stunted. (source: wfp.org)

His attempts to improve food security became difficult as his village most often experienced severe flooding. Crop productivity are low.

Other ASEAN regions faced similar cases of food insecurity which contributes to world hunger cases.

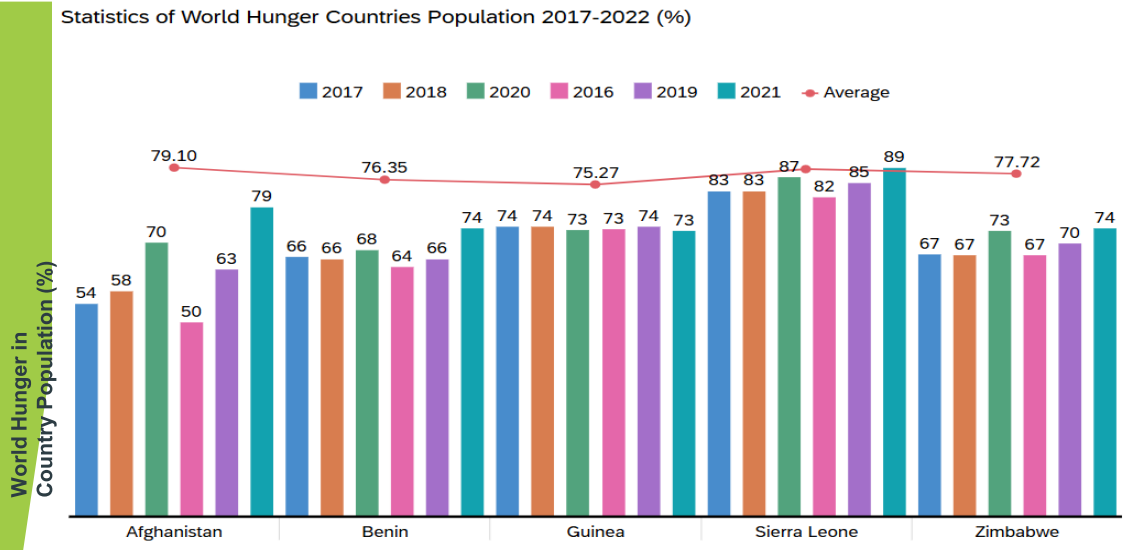


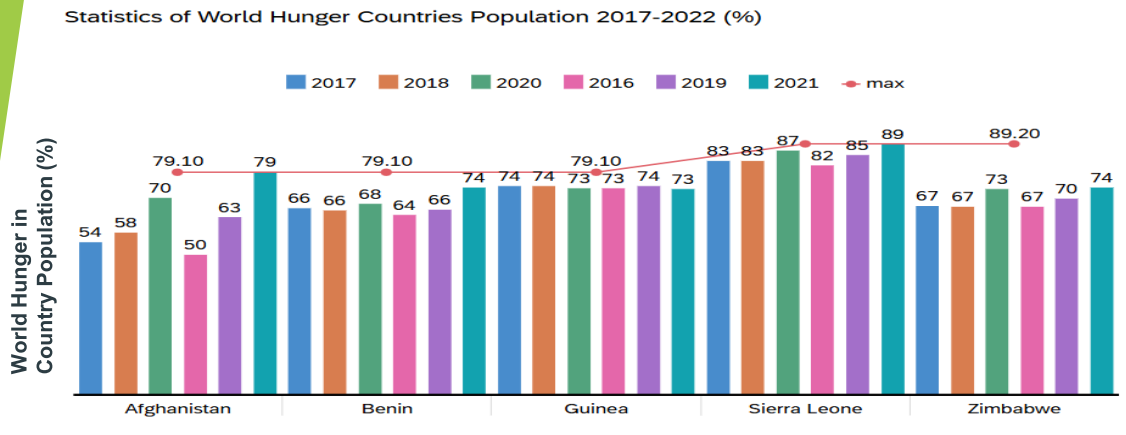
Source : WorldBank

Data Analysis of Severe Hunger Among ASEAN Countries

- A 2020 World Bank study found that 6.2 million people in Thailand, or 9% of the country's total population, lack adequate nutrition
- Among ASEAN countries Malaysia has the highest percentage of hunger trend with 15.10% in 2016 and 16 %
- Financial Constraints and high living cause allows Singapore to face World Hunger percentage of 4.50% of their whole population

Source : WorldBank





Data Analysis of Severe World Hunger

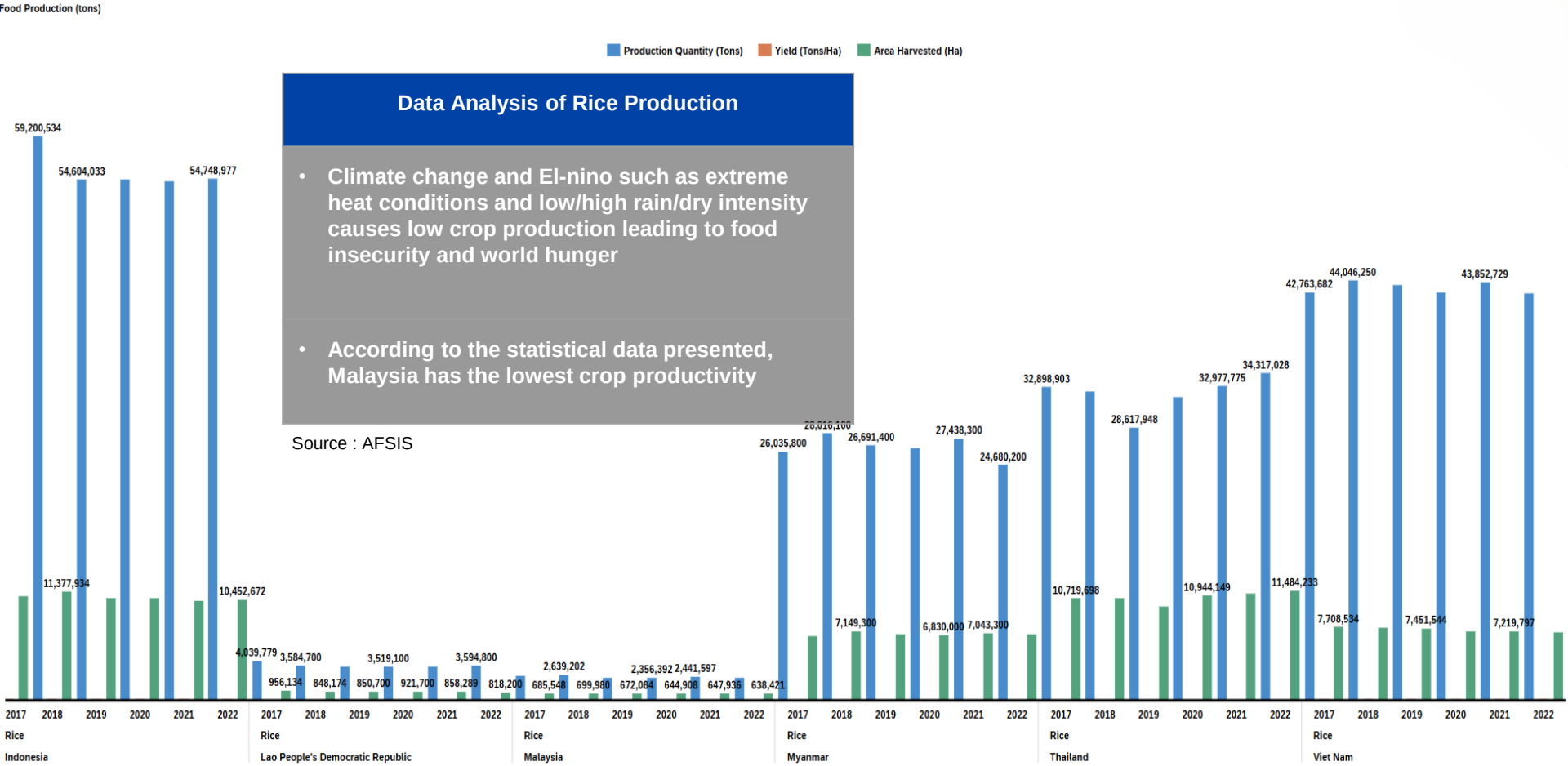
- A total 12.4 million Afghans have acute food insecurity due to an increase of food prices
- In Benin, farmland are small while food prices remained high. Many are unable to afford the crops
- In New Guinea, the weather are relatively hot causing little to no rainfall. Therefore, crop productivity and quality are low
- In Sierra Leone, More than 50% of inhabitants live below the poverty line with USD 1.25 a day

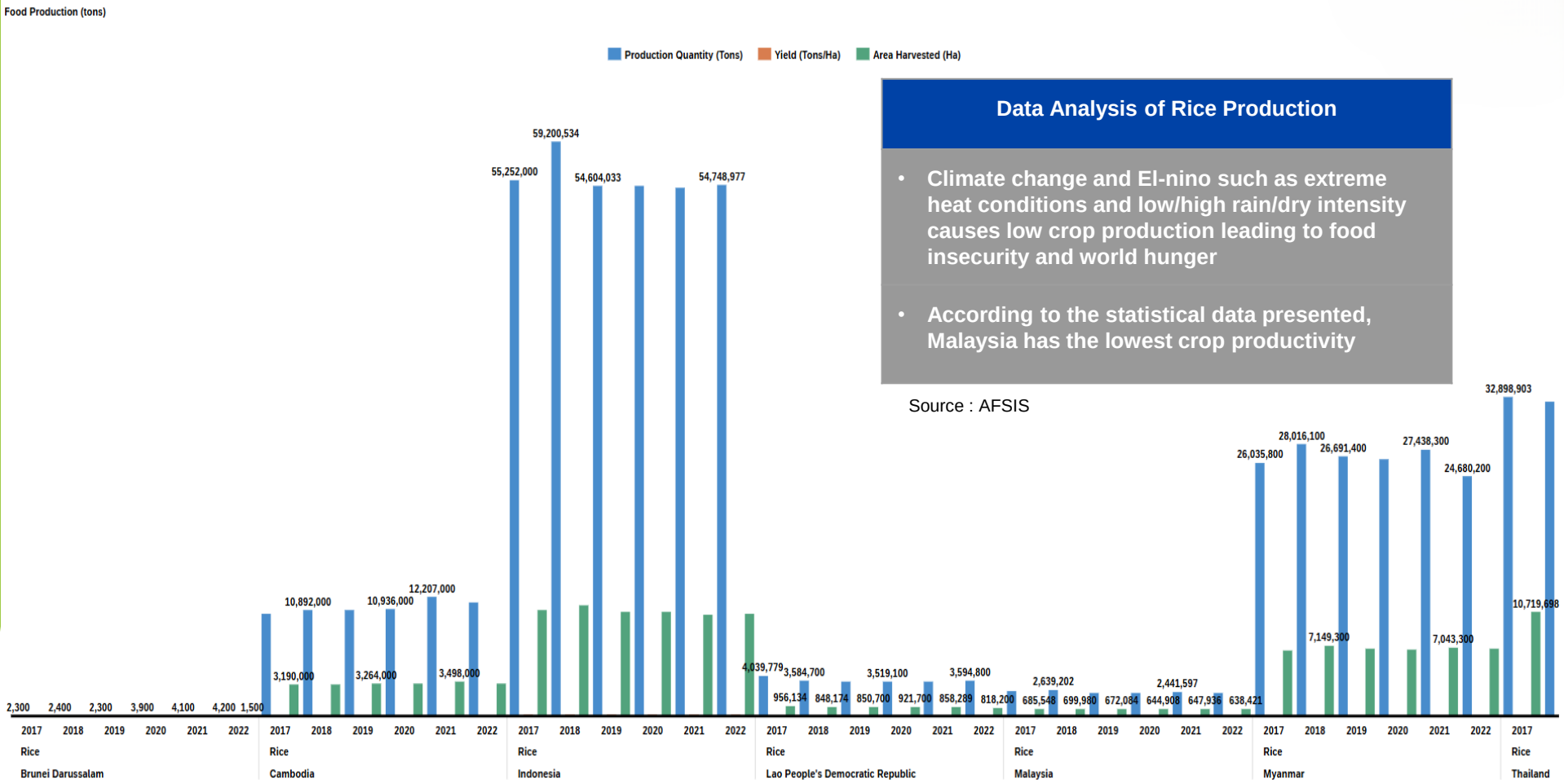
Source : WorldBank

Data Analysis of Rice Production

- Climate change and El-nino such as extreme heat conditions and low/high rain/dry intensity causes low crop production leading to food insecurity and world hunger
- According to the statistical data presented, Malaysia has the lowest crop productivity

Source : AFSIS





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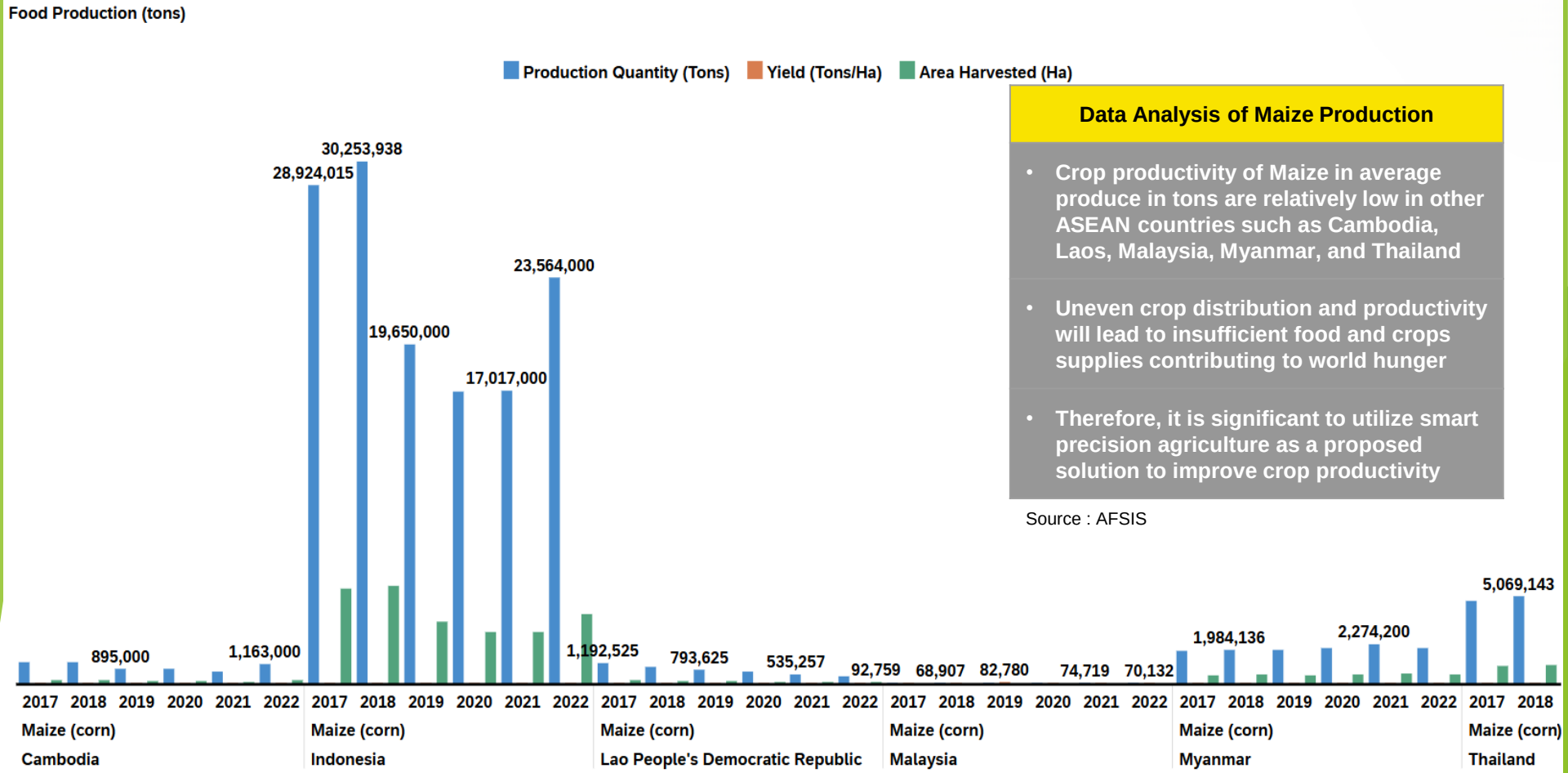
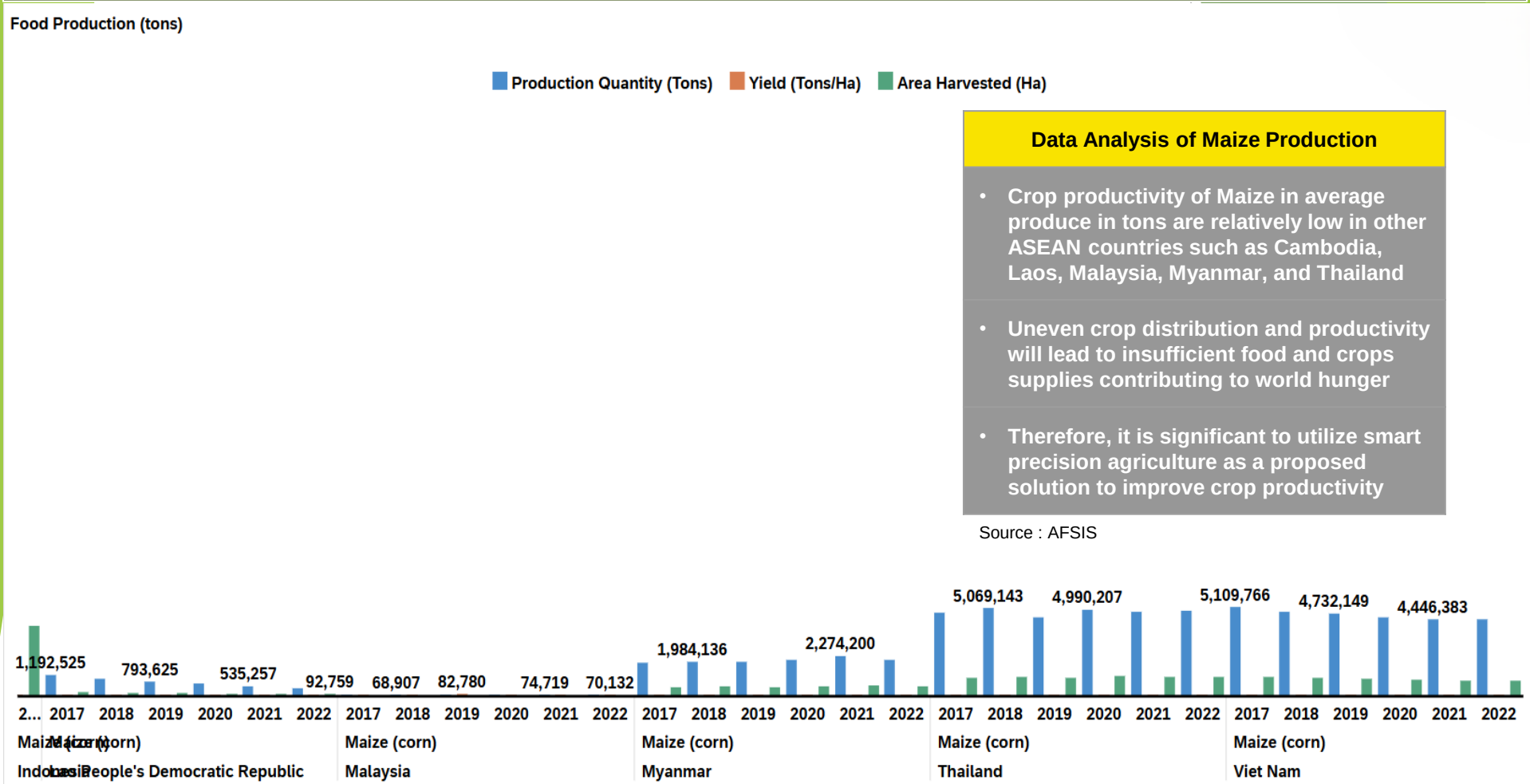


Data Analysis of Maize Production

- Crop productivity of Maize in average produce in tons are relatively low in other ASEAN countries such as Cambodia, Laos, Malaysia, Myanmar, and Thailand
- Uneven crop distribution and productivity will lead to insufficient food and crops supplies contributing to world hunger
- Therefore, it is significant to utilize smart precision agriculture as a proposed solution to improve crop productivity

Source : AFSIS



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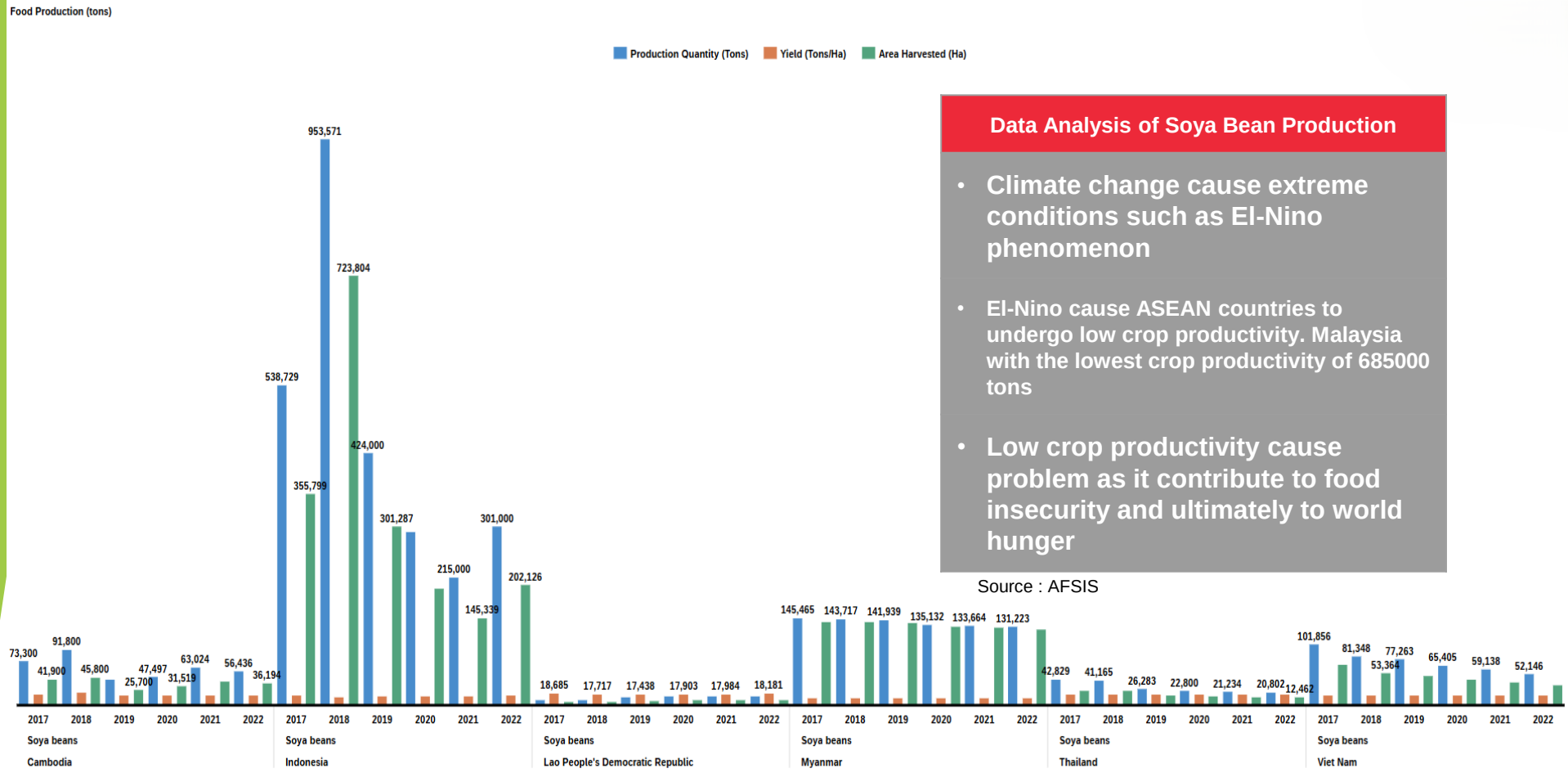
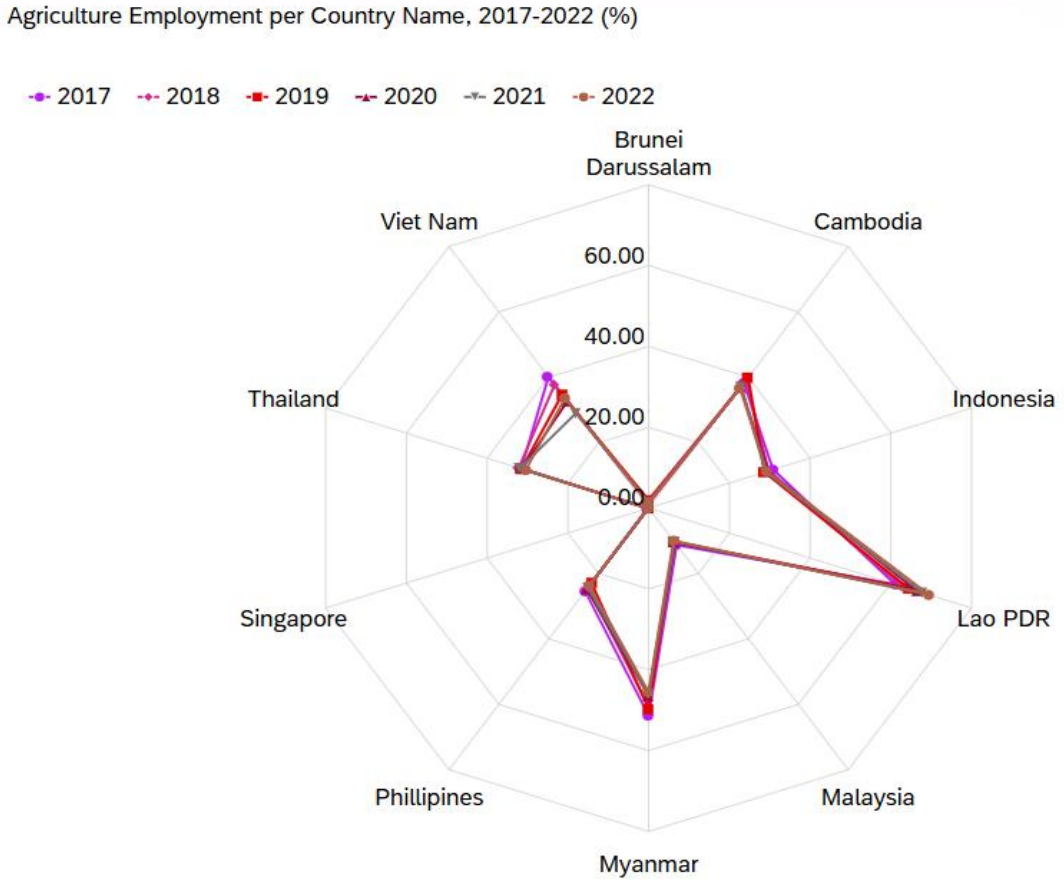


Data Analysis of Soya Bean Production

- Climate change cause extreme conditions such as El-Nino phenomenon
- El-Nino cause ASEAN countries to undergo low crop productivity. Malaysia with the lowest crop productivity of 685000 tons
- Low crop productivity cause problem as it contribute to food insecurity and ultimately to world hunger

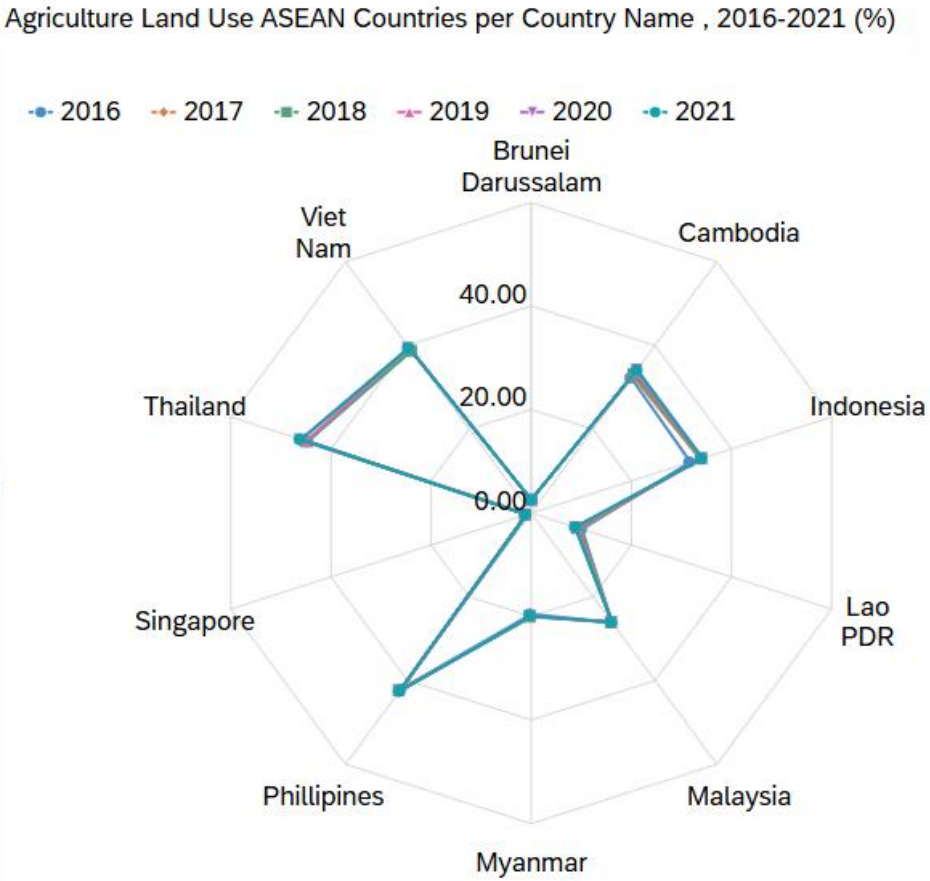
Source : AFSIS



Data Analysis of Agriculture Employment

- Despite Laos pdr is predominantly an agriculture nation with 75% of the country population, Lao PDR still experienced low crop productivity due to Elnino phenomenon and the inability and lack of knowledge of farmers to manage farms
- Myanmar experienced a decreasing trend in the year 2017-2022 with a value up to 37% decreasing to 25 %
- Vietnam experienced a high fluctuation rate on agriculture from a value of 40 % population to a value of close to 20% due to drought and saltwater intrusions

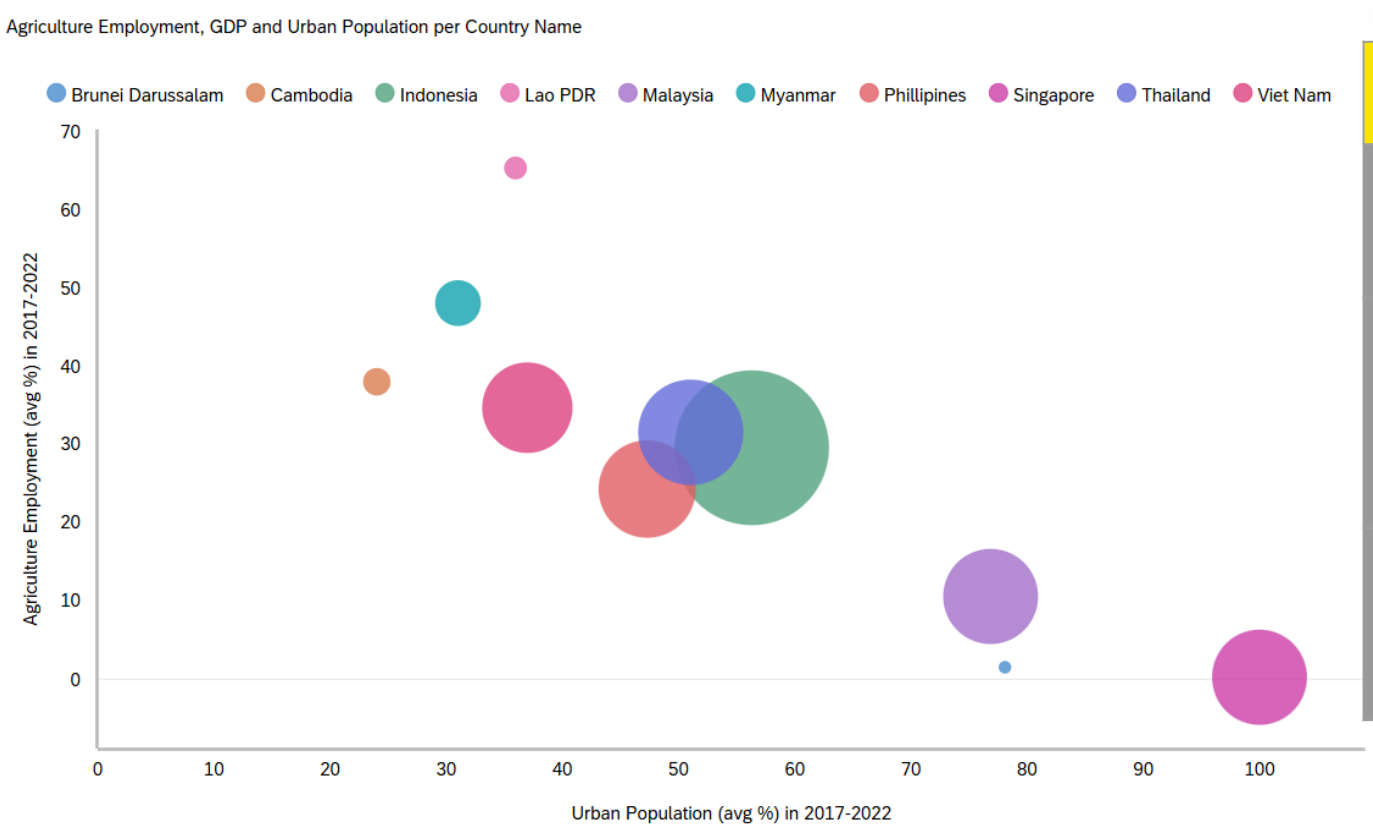
Source : World Bank



Data Analysis of Agriculture Land Use

- **Agriculture land use changes have been severely happening in Indonesia due to massive industrial and housing developments**
- **Thailand has the highest agriculture land use up to 40 % of their land due to GDP growth, Despite this, overall, ASEAN countries agriculture land lies below 50%**
- **Therefore, with a low agriculture land use, it imposes a threat to food insecurity and crop productivity leading to food insecurity and world hunger**

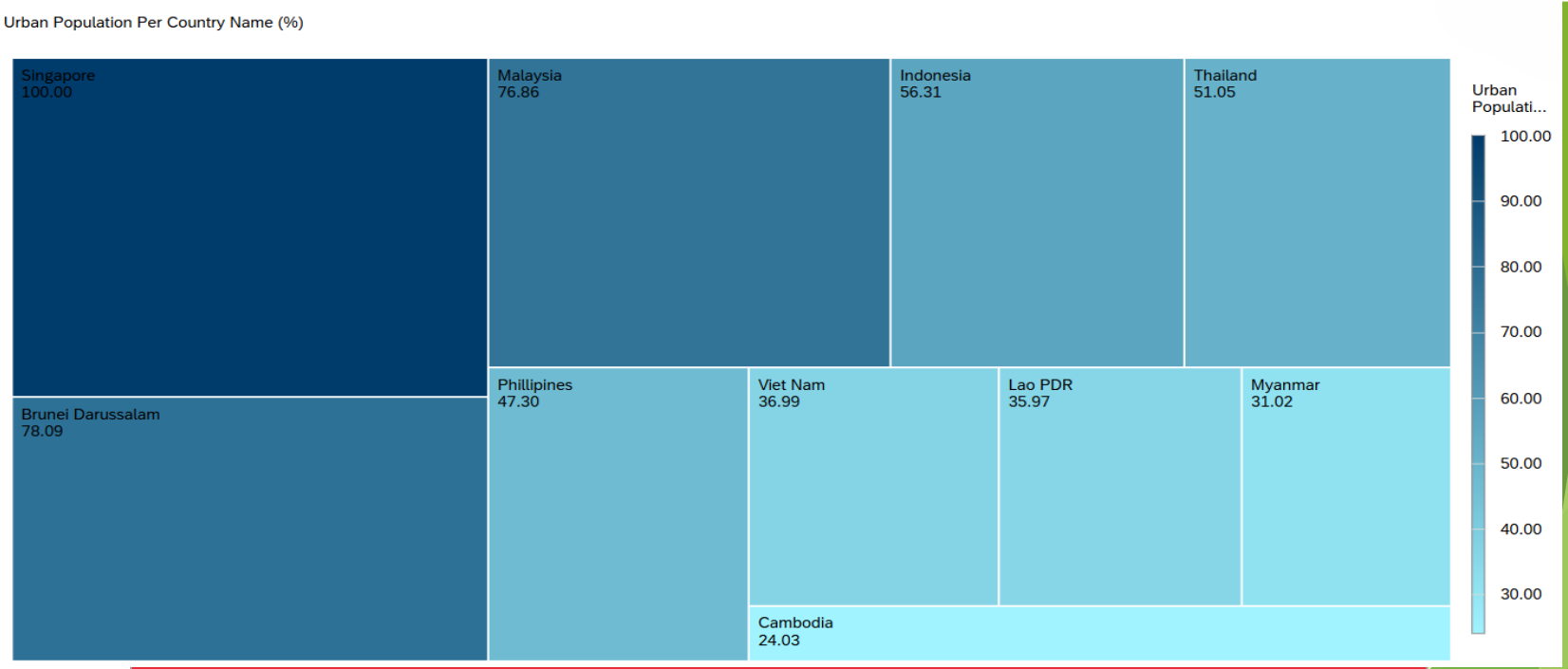
Source : World Bank



Source : FAOStat

Correlation of Agriculture Employment, GDP & Urban Population

- **Climate change cause extreme conditions such as Elnino phenomena**
- **El nino cause ASEAN countries to undergo low crop productivity. Malaysia with the lowest crop productivity of 685.000 tons**
- **Low crop productivity cause problem as it contribute to food insecurity and ultimately to world hunger**

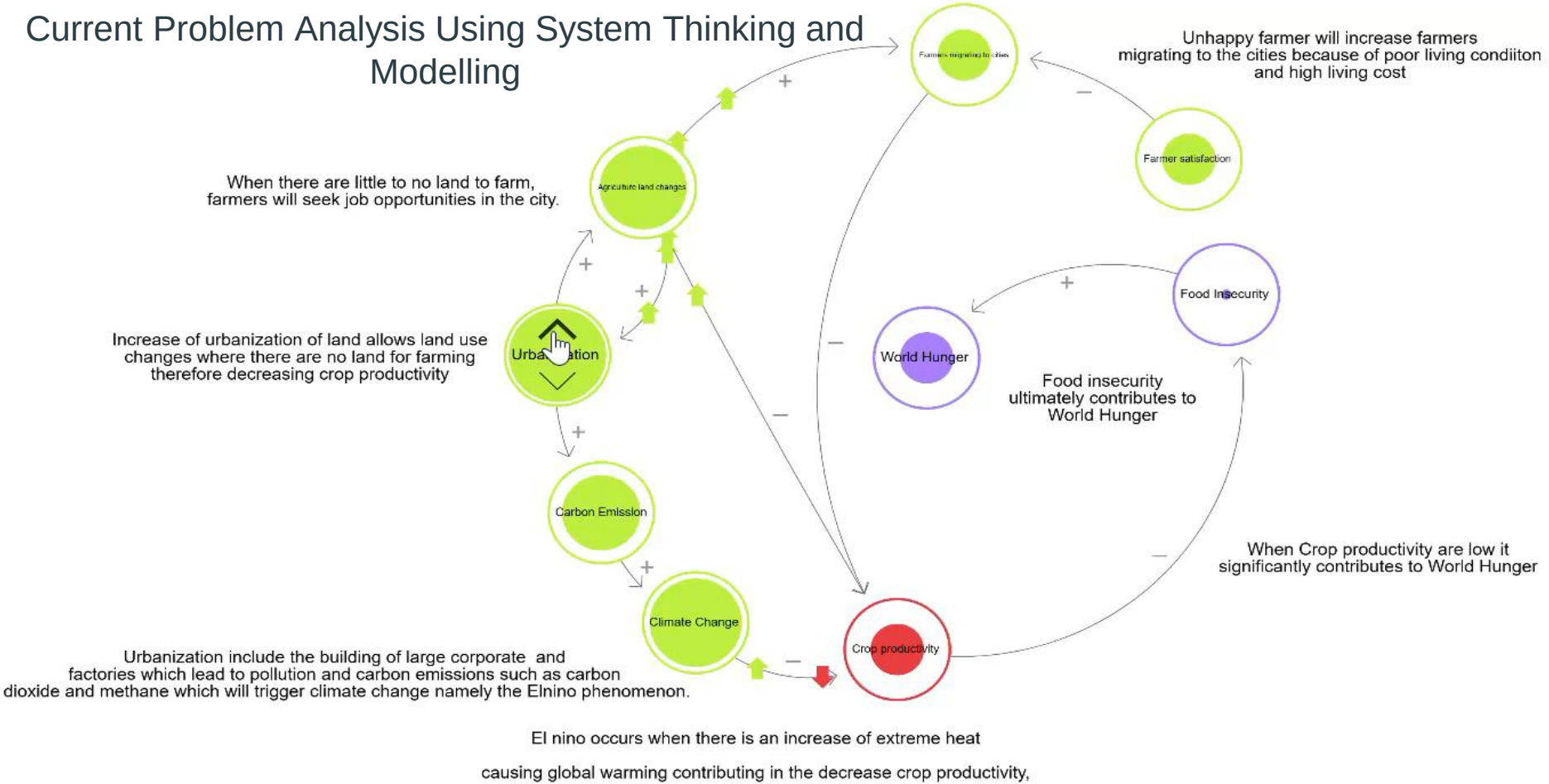


Data Analysis of Agriculture Employment

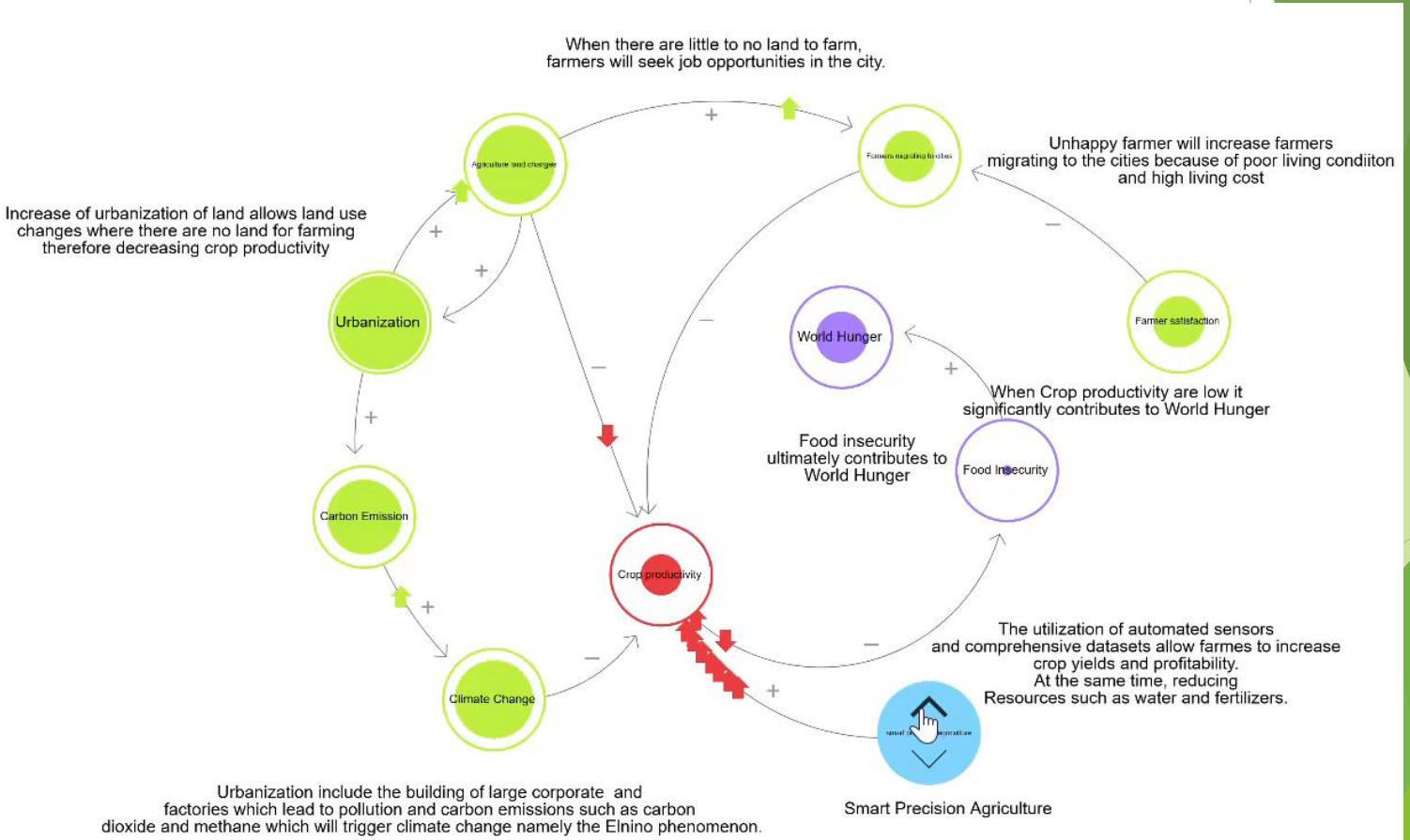
- **Based on the tree map shown, ASEAN regions experienced an increase of urbanization percentage, allowing factories and corporates to take over potentially causing a threat to food insecurity**
- **The statistics poses a threat and increase World Hunger as the increase of urbanization allows the decrease of crop productivity as there are little to no land for farming**

Source : World Bank

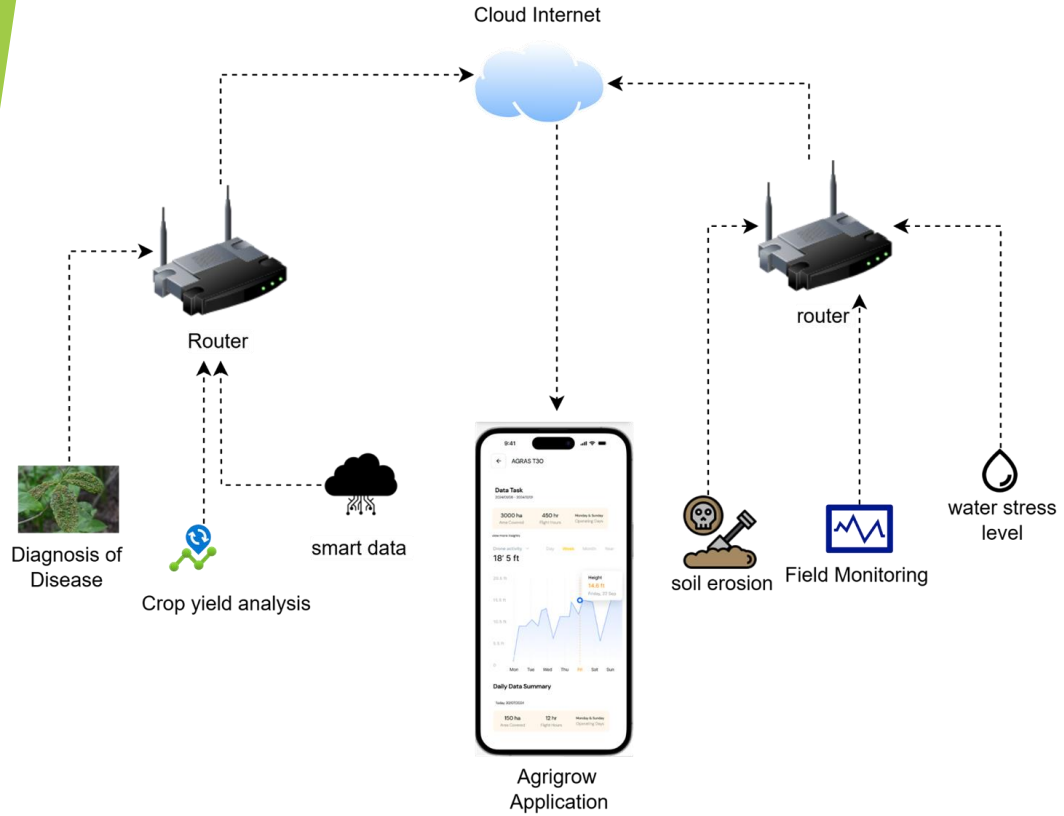
Current Problem Analysis Using System Thinking and Modelling



Finding Solutions with System Thinking Model Simulation



Agrigrow with Advanced Technologies



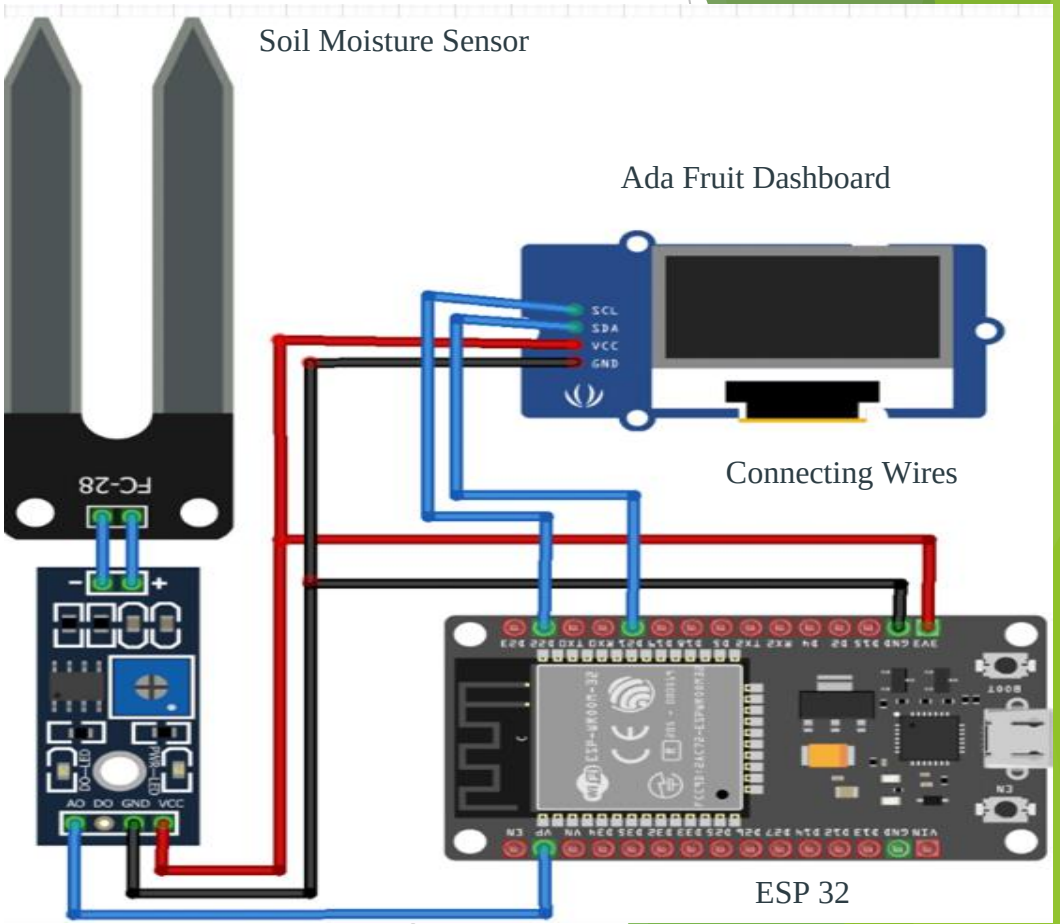
Agrigrow Technologies

- Cloud Computing
- AI and Machine Learning
- Big Data Analytics
- IoT Sensor Networks
- Crop Models
- Water Resources Management
- Real Time Monitoring
- Decision Support System

IoT System Configuration

IoT Components

- **ESP32 Microcontroller**
- **Ada Fruit Dashboard**
- **Soil Moisture Sensor**
- **Temperature Sensor**
- **Humidity Sensor**
- **Water Level Sensor**
- **Weather Sensor**
- **Irrigation Pump and Valve Actuator**
- **Sprinkler & Spray Actuator**
- **Water Gate Actuator**



Set Up Farm

AI Integration

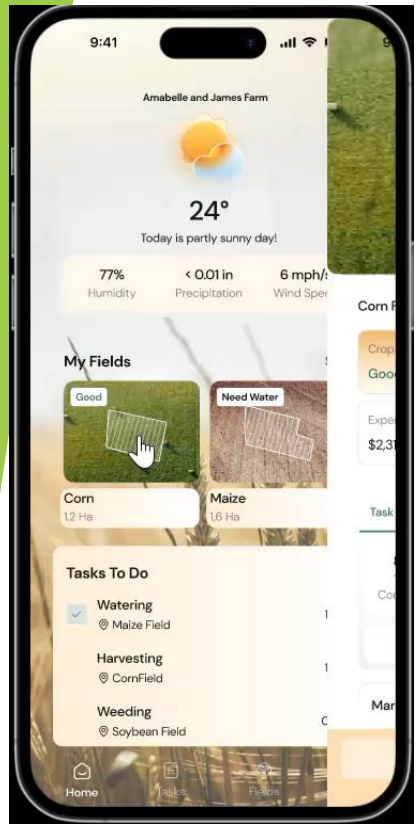
Set and Goals Preferences

Agrigrow Features & Benefits

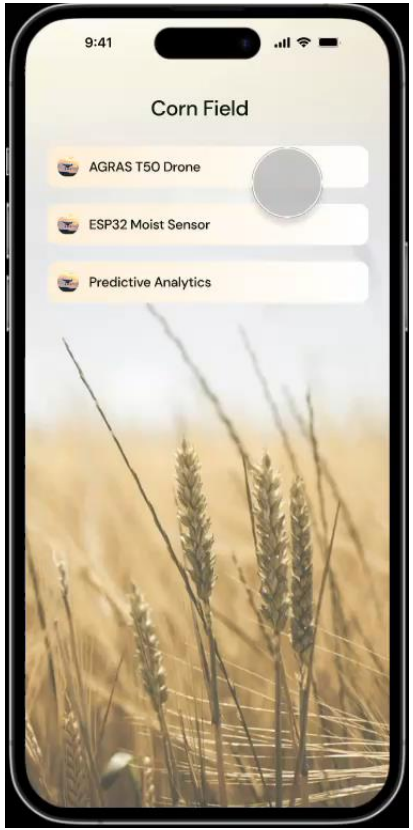
- **Personalized farm enhancing crop yield production**
- **Implementation of AI Integration allowing automated farm handling**
- **Farm goals are focused easier to achieve**

Agrigrow successfully reduce unhappy farmers allowing for easier farm management & decision making

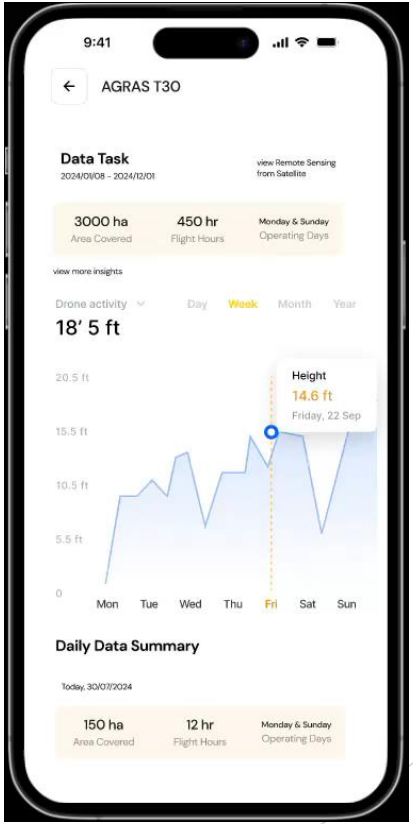
Crop Growth Monitoring



IoT and Drone Surveying and Monitoring



Remote Sensing From Satellite



Agrigrow Features & Benefits

- Crop growth monitoring allows a real-time data visualization of crops
- Supported by Machine learning algorithims such as Regression, Clustering, Classification. (crop production, detect different areas within satellite, monitor crop growth phases)
- Supported by Deep Learning Algorithms : Regression (LSTM). Clustering (Kohenen Map), Classification (CNN)

Agrigrow successfully reduce World Hunger by increasing crop productivity and quality of crops

Predictive Analytics

Agrigrow Features & Benefits

- Predictive Analytics allows to measure crop productivity, water requirement predictions, crop yield prediction
- Data Analytics are formed based on Artificial Intelligence and Machine Learning solutions
- Increase satisfaction of Farmers due to a reliable predictive crop insights

Agrigrow successfully reduce World Hunger by providing a sustainable and controlled solution through predictive analytics.

Agrigrow Business Model And Sustainability

Key Partners
- Subsidy support from government
- Farmers
- Agriculture Experts
- Agriculture startup and company
- Private Company

Key Activities
- App development and maintenance
- Design and programing App
- Tool maintenace

Key Resources
- Technology infrastructure
- Skilled development team
- Human Resources

Value Proposition
- Provides an easy access Information about agriculture
- Agrigrow makes an availability input for farmers
- Give high quality tools to monitor their farms
- Provide an AI to help monitoring their farm whenever the farmer is busy or not available

Customer Relationships
- Personalized support
- Direct and honest feedback
- Services

Channels
- Mobile app stores
- Door to Door sales
- Digital Marketing

Customer Segments
- Farmers
- Company
- Government Agencies
- Research institution

Cost Structure
- Development and maintenance
- Marketing and customer acquisition
- Employees
- App design
- Building
- Contract partner costs

Revenue Streams
- Private consultation
- Partnerships
- workshop
- village development
- Supply Chain Management.
- Profit Sharing
- Investment from Venture Capital.

Implementation Plan

Year 1

- Interview farmers in ASEAN region to identify problem
- Determine user requirements
- Develop system design and architecture
- Create user interface (low Fidelity and high Fidelity for Agrigrow Application
- Collect required data
- Construct Agrigrow prototype
- Analyze satellite data from European Space Agency

Year 2

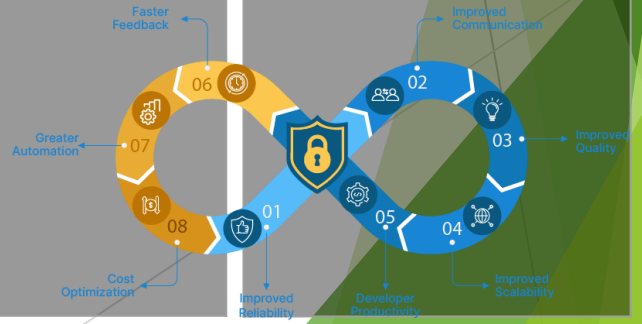
- Code of the Agrigrow application
- Develop front end and back end services
- Build AI and machine learning models
- Integrate the newly acquired data from drone and satellite imageries
- Develop water and crop models
- Test User Acceptance

Year 3

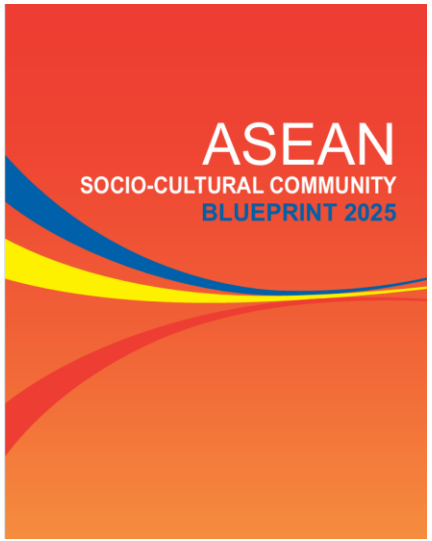
- Partnership profit sharing with large corporates
- Partnership with government to provide subsidiary support to farmers in obtaining drones
- Integration of supply chain management business model

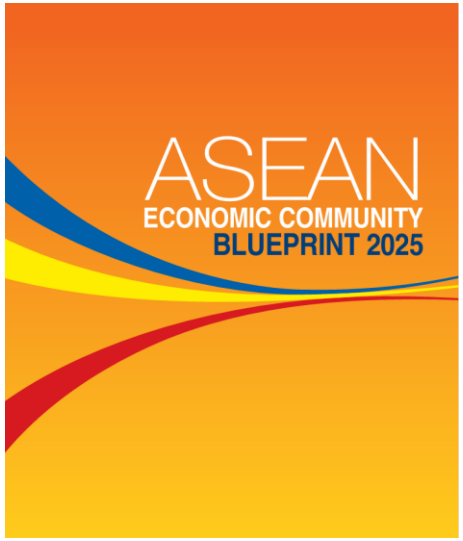
Year 4

- Send agents to promote application to farmers in minor regions
- Implement marketing strategies to increase awareness of application
- Implementation of application within ASEAN region



Agrigrow Solutions Aligned ASEAN Blueprints and SDG





ASEAN's socio-economic progress in these two and a half decades is heralded by remarkable human and sustainable development.

The Goal of ASEAN Economic Community Blueprint is to create a highly integrated and cohesive economy in Southeast Asia that is competitive, innovative, and resilient, while promoting equitable economic development and global engagement.

Identified Problems	Data Analytics and Insights (ASEAN Country)	Solutions	Recommendation
Low Crop Productivity has always been the problem because of climate change weather and el nino phenomenal	Malaysia has the lowest crop productivity in ASEAN countries with the percentage of 15% of all crop types such as padi, maize and , soya beans because of el nino and climate change	Increase crop production by implementing smart agriculture to increase crop productivity and weather API to monitor any incoming weather	Create a mobile apps that farmers can easily access to monitor weather updates, access to drone monitoring, crop growth visualization, and drone surveying.
Based on the 2023 GHI scores levels of Hunger have primarily impact African regions.	In Sierra Leone, More than 50% of inhabitants live below the poverty line with USD 1.25 a day. The country is facing inflation and the devaluation of its local currency.	Increase crop production by implementation of predictive analytics & AI integrations supporting optimal crop growth condition increasing food supply and quality and reducing food insecurity.	Educate farmers on how to use AI-driven tools, precision agriculture techniques, and weather monitoring systems effectively to empower farmers to maximize the potential of these technologies and ensure better crop production.
Stunted children due to lack of food security	30 % of children population under 5 years old in the country were stunted.	Provide nutritious food source through optimal agriculture conditions supported by crop growth monitoring features, AI Integration features.	Implement a crop growth monitoring systems that allows real time visualization of crops Implement a Machine learning algorithms such as Regression, Clustering, Classification.

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Agricultural land (% of land area) - Indonesia, Myanmar, Brunei Darussalam, Cambodia, Malaysia, Philippines, Singapore, Thailand, Viet Nam. (n.d.). Retrieved from https://data.worldbank.org/indicator/AG.LND.AGRI.ZS?end=2021&locations=ID-MM-BN-KH-MY-PH-SG-TH-VN&start=2008&view=chart

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Brainstorm Figjam Link :

Data Science smart precision agriculture – FigJam (figma.com)

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