CROP DISEASE PREDICTION USING METAGENOMICS AND COMPUTATIONAL MODELLING

ASEAN IVO FORUM

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Posts and Telecommunications Institute of Technology (PTIT), Vietnam

Credit: Google images

AGENDA

PURPOSE

BACKGROUND

PROPOSAL

MATCH FUNDING - UBD

CONCLUSION

Credit: agriculture.gov.bn

PURPOSE

RATIONALE OF THIS STUDY

To ensure regional self-sufficiency in rice production by providing ICT enabled solutions to crop disease.

BENEFITS OF PROJECT

AGRICULTURE

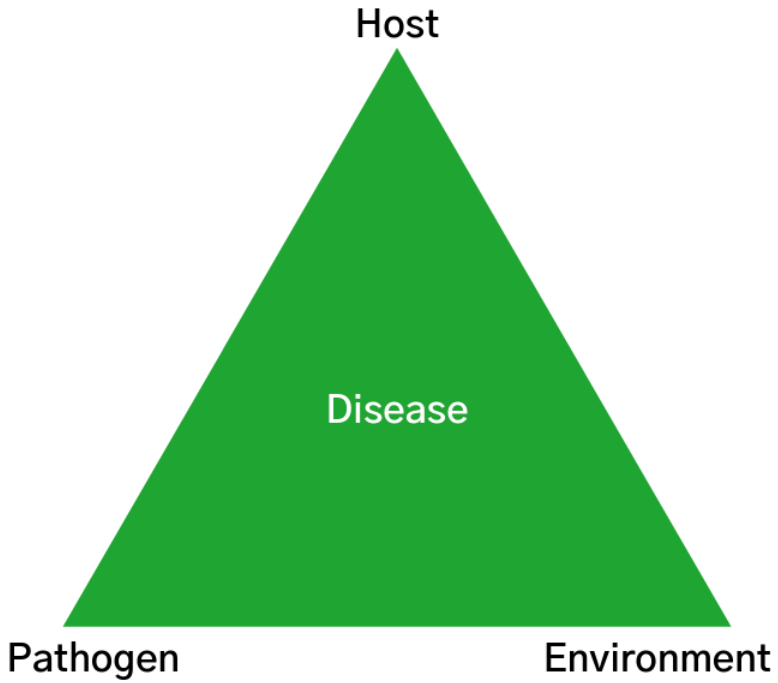
- Identify and develop a national database for rice pathogens in Brunei
- Development of models for farmers and framework for policy makers
- Decision making and anticipating potential problems
- Well informed and cost-effective pest management strategy
- Prevention of losses due to crop disease, self sufficiency and diversified economy
- Long-term academia-research institute collaboration

FOOD

- Sustainable production of staple rice (BDR5)
- Increased food security – SDG 2 (Zero Hunger)
- Better supply chain and storage

Credit: Google images

CURRENT CHALLENGE
PLANT DISEASE TRIANGLE



SAMPLE COLLECTION

Infected plant samples (sheath blight) collected from Paddy Industry Unit and Brunei Agricultural Research Centre (BARC) paddy plots at Wasan and Kandol.




Sampling at Wasan, Brunei-Muara and Kandol area (500 hectare commercial paddy planting), Kuala Belait.

APPLICATION OF NEWLY ISOLATED *TRICHODERMA* SP. AS BIOCONTROL AGENT AND BIOFERTILIZER

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INTRODUCTION

- Agricultural practice needs to be done right to prevent damage to human health, public goods, and the environment as a result of farming.
- Farmers in Brunei are still relying on synthetic pesticides and fertilizers because of their efficiency, but this could pose a threat to human health as well as cause environmental and ecological issues in the long term.
- An alternative to this is to adopt eco-friendly agro-practices by using biological control agents and biofertilizers.

MATERIALS AND METHODS

GERMINATION

- Seeds inoculation treatment
- Seedlings vigour assessment
  - ✓ Vigour index i = germination (%) x seedling length (cm)
  - ✓ Vigour index ii = germination (%) x dry weight (mg)
- Chlorophyll content determination

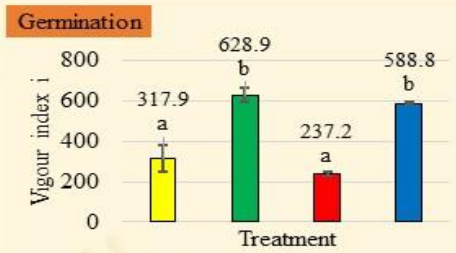
GROWTH BIOASSAY

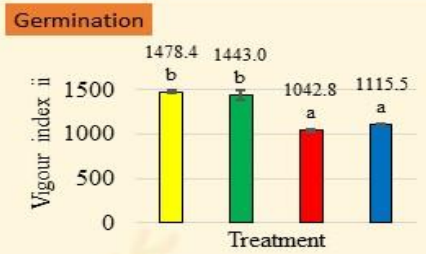
- One germinated paddy seed per pot.
- 10 pots per treatment.
- Soil treatment
- Yield parameters analysis

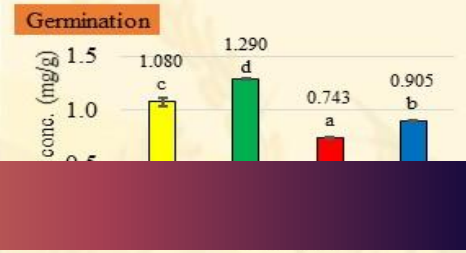
4 Treatments:

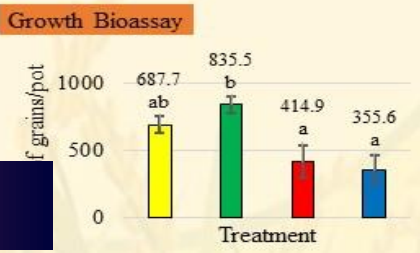
- **Control:** Au
- **T:** *Trichode*
- **R:** *Rhizocto*
- **TR:** *Trichoderma* sp. + *Rhizoctonia* sp.

RESULTS AND DISCUSSION









- *Trichoderma* sp. improves seedling vigour indices and chlorophyll content, thus enhancing root growth and nutrient uptakes to produce better yield.
- *Rhizoctonia* sp. infection causes sheath blight disease during the late stage of paddy growth, which lowers leaf area and induces senescence of leaves, and immature tillers.

CONCLUSION

- *Trichoderma* sp. (UBDFM 01) has the ability to be a biocontrol agent against sheath blight disease and as a biofertilizer to improve paddy growth and development.

SCAN ME

REFERENCES AND FUNDING SOURCE

UNIVERSITI
BRUNEI DARUSSALAM

Dr Pooja Shivanand (PI)
Dr Hussein Taha (Co-PI)
Faculty of Science
Universiti Brunei Darussalam

Dear Drs.,

FOS RESEARCH GRANT APPLICATION

On behalf of the Office of Assistant Vice Chancellor (Research), I am pleased to inform that your research grant application for the research project entitled **"Disease prediction in rice through metagenomics and computational modelling"** has been approved for:

1) The period of **two (2) years** whereby the commencement date of your project is **1 January 2022** and the completion date will be on **31 December 2023.**
2) The total grant amounting to **B$46,964.00** where the allocation of budget categories are as below: -

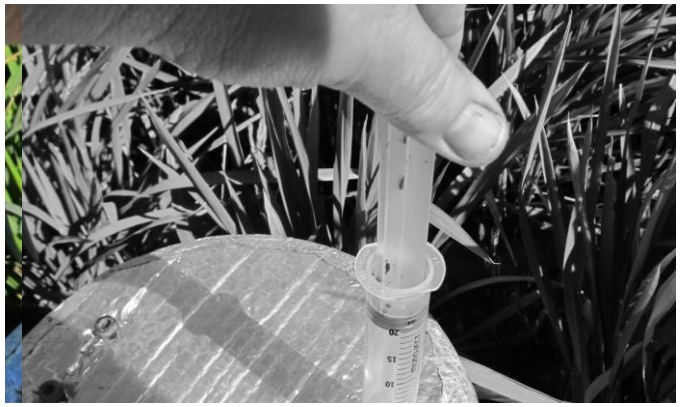
HALF-YEARLY TIMELINE

T1	T1	T3	T4
Jan to Jun	**Jul to Dec**	**Jan to Jun**	**Jul to Dec**
SAMPLE COLLECTION Collect air and environmental samples from agri-fields.	METAGENOMICS Identify pathogens through DNA barcoding.	MODELLING Develop models to predict crop damage by pathogens.	SOLUTIONS Offer strategies and solutions to counter causative organisms.

UBD GRANT - GOALS FOR T1

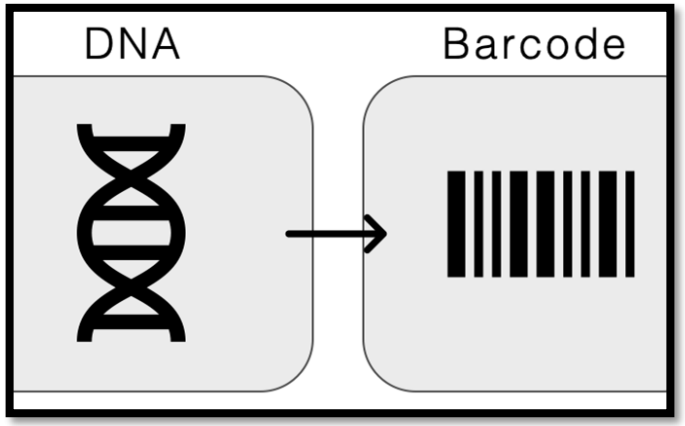
PROCURE EQUIPMENT

- Air sampler
- Consumables



COLLECT SAMPLES FROM AGRI-FIELDS

- Air sample for spores
- Plant specimen



METAGENOMICS THROUGH COLLABORATION

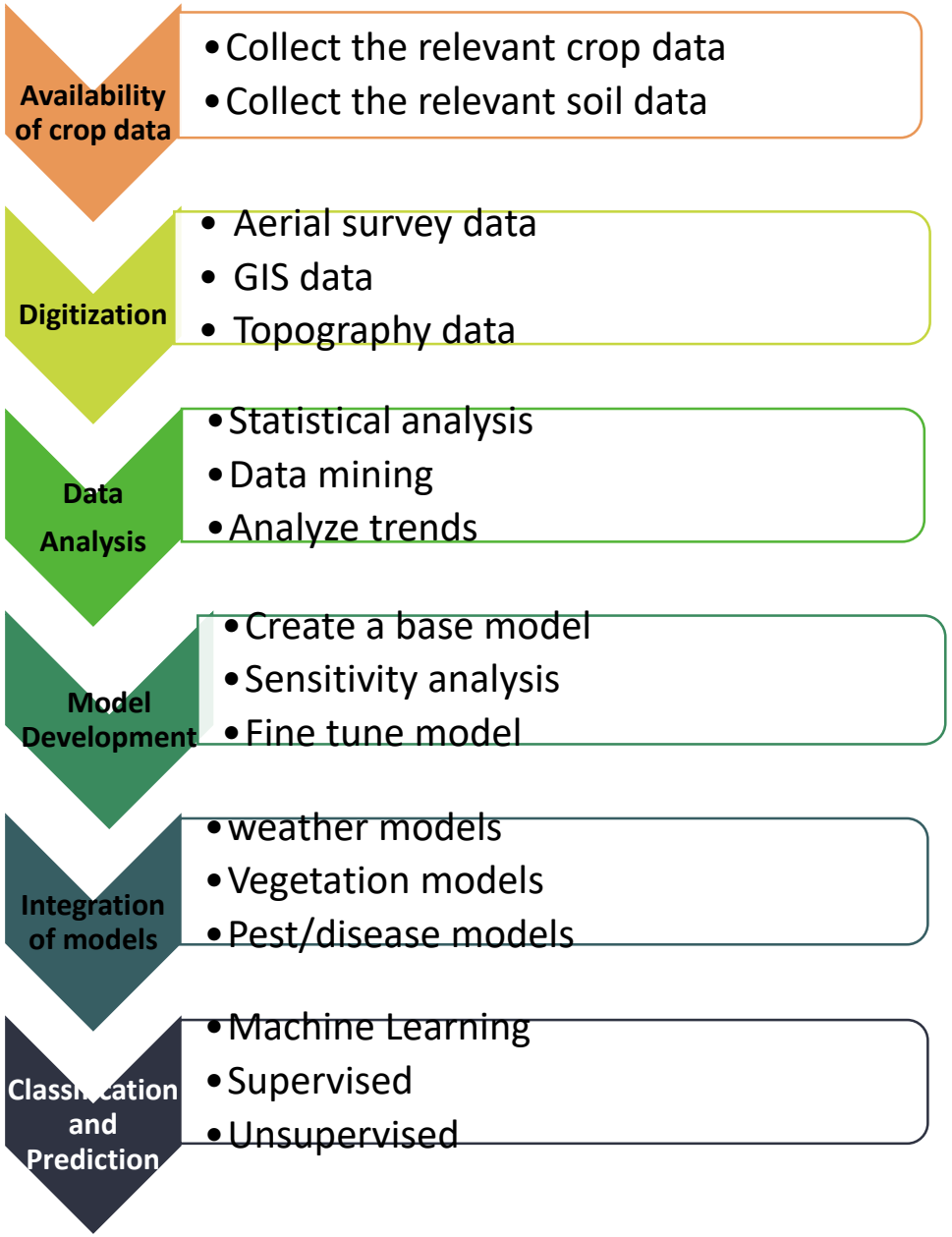
- DNA barcoding
- Phylogenetic analyses

Credit: Google images

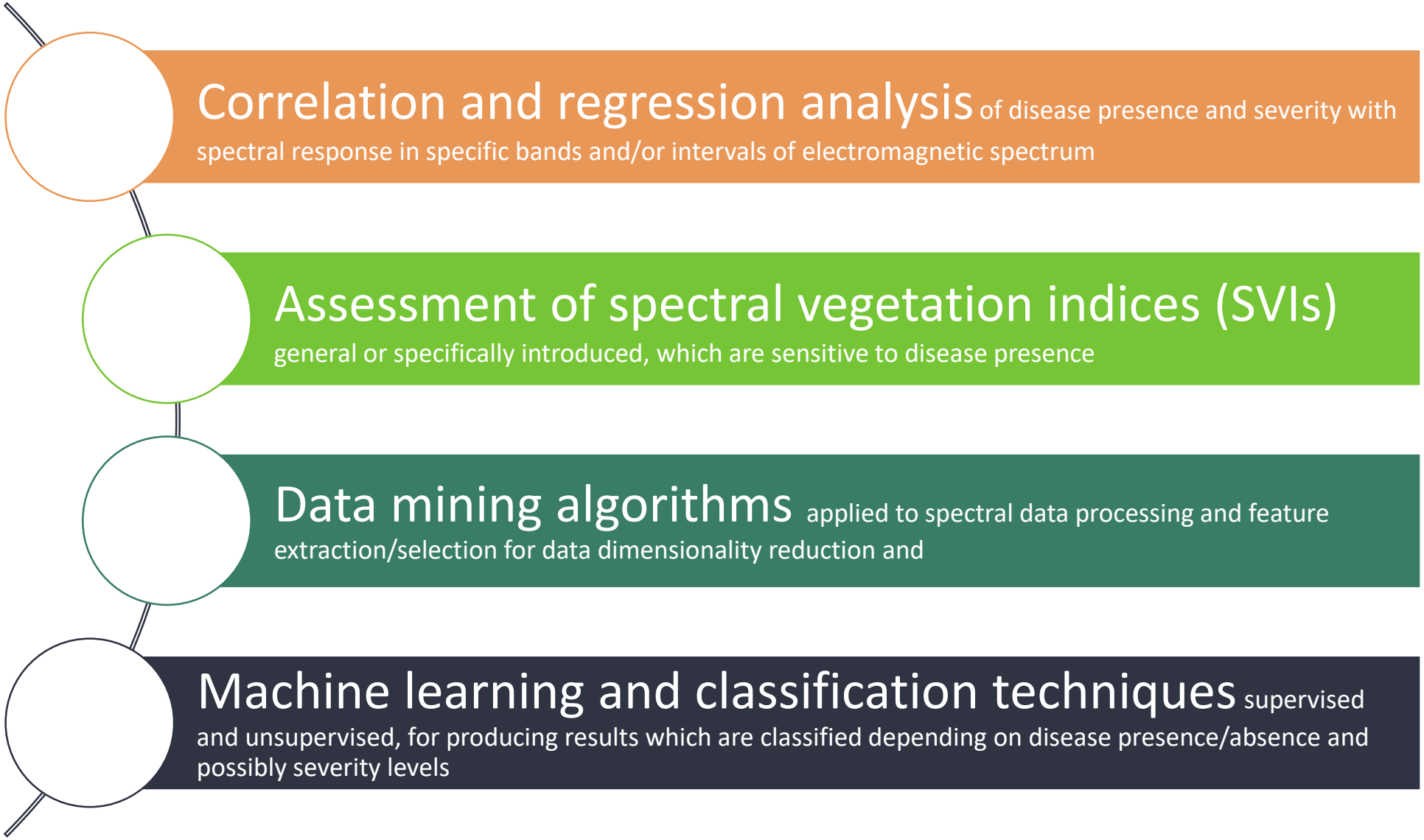
WHAT'S NEXT?

ASEAN ICT VIRTUAL ORGANIZATION FORUM 2020

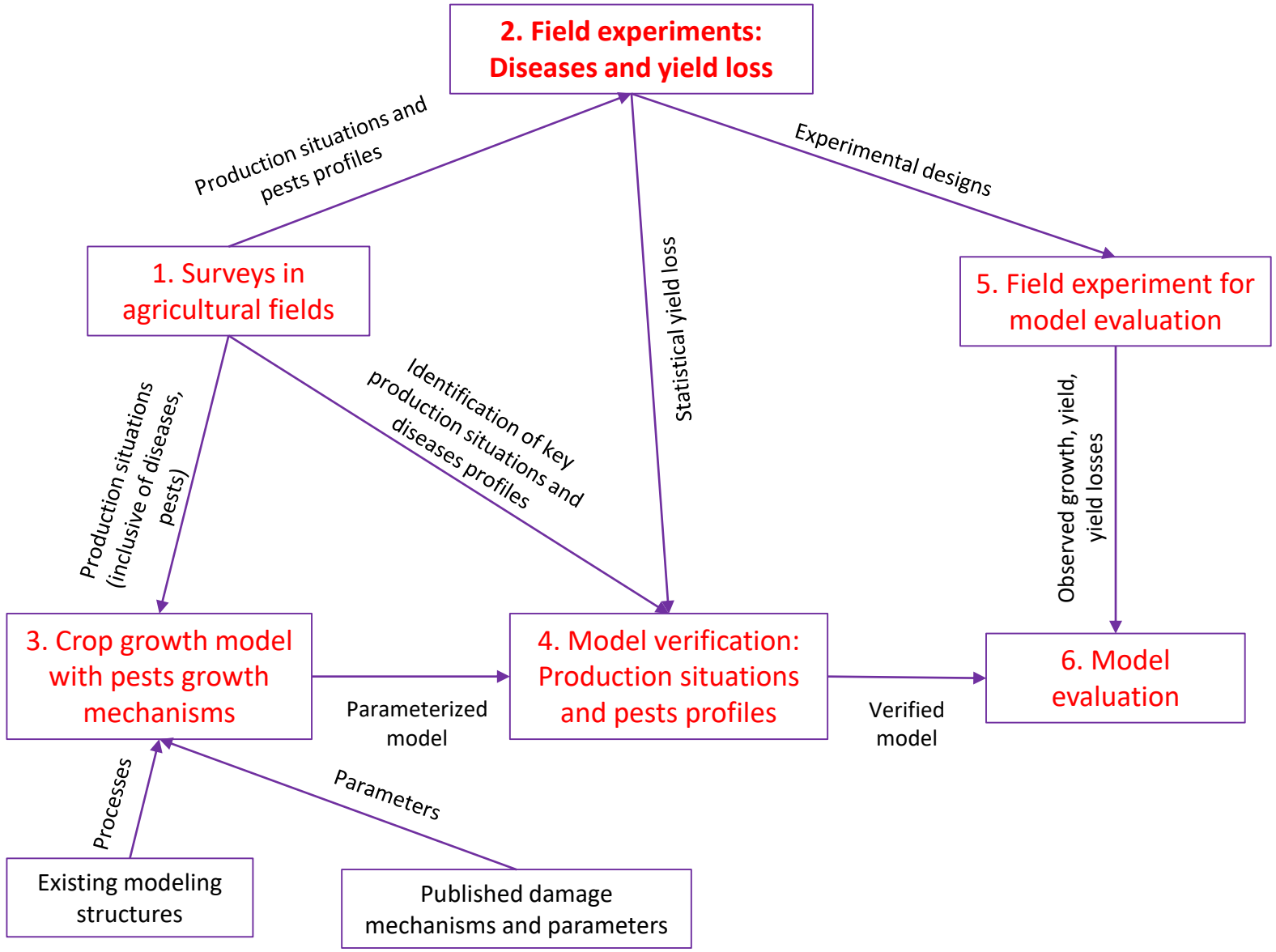
STRUCTURE FOR DATA MODEL INTEGRATION

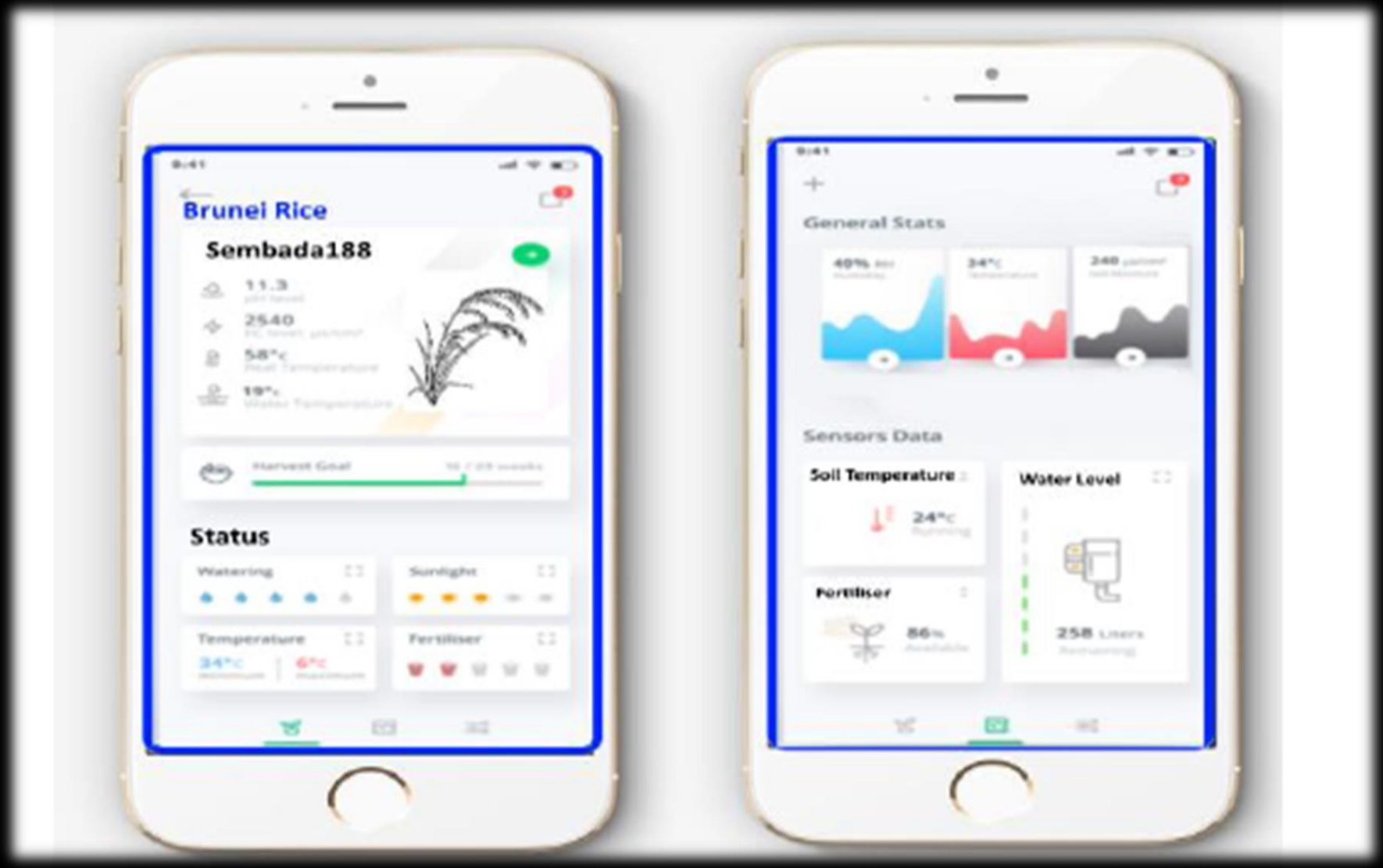


MODELLING STAGES



DATA-MODEL INTEGRATION





MOBILE BASED/ONLINE BASED APPLICATION TO DISSEMINATE THE KNOWLEDGE GAINED BASED ON THE PAST DATA AND FORECAST THE POSSIBLE Spread OF PESTS/DISEASES

ROADMAP TO IMPROVE THE PREDICTION OF THE IMPACTS OF PESTS AND DISEASES IN AGRICULTURAL CROP YIELD

The action plan covers six areas:

i) Improve the quality and availability of crop data as model inputs

ii) Develop a systematic crop model

iii) Design a structure for data model integration

iv) Integrate the crop model with weather models

v) Establish diseases and pests mitigation framework

vi) Provide a robust and reliable crop model for predictable crop yield

Credit: Google images

SUMMARY

Diversification of economy

Thrust on agricultural sector in Brunei

Identify crop pathogens

Sheath blight a widespread concern of crop loss

Develop models for prediction

Predict scale of crop damage though modelling

Apply ICT for self sufficiency

Offer solutions based on prediction

THANK YOU

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