DIGITAL PADDY CULTIVATION IS IT POSSIBLE?

Dr. Mohd Nazrin Md Isa
School of Microelectronic Engineering
Universiti Malaysia Perlis (UniMAP)
nazrin@unimap.edu.my

THE FACT…

Rice is a staple food for Malaysia and a defining feature of our culture. Malaysians consume the grain daily either as cooked rice or indirectly in the form of rice flour. *Nasi lemak, bihun goreng, laksa, kuih apam* and *lepat pisang,* are some of the many rice-based foods we consume. During festive occasions, we see *pulut kuning* at Malay weddings and red tortoise cakes during Chinese New Year. Therefore, it is not surprising that in 2016, we consumed **80kg of rice per person,** which is about **26%** of the total caloric intake per day, costing an average of **RM44/month per household**[1]. Among the states, households in **Sabah** spent the most on rice at **RM73/month** while households in **Perlis** spent the least at just **RM13/month**. This means that in the same year, **2.7m MT**[2] of rice was consumed, whereby **67%** was produced locally, and the rest imported primarily from Thailand, Vietnam and Pakistan[3].

Source: KRI

"Toward 2050, rising population and incomes are expected to call for 70% more food production globally, and up to 100% more in developing countries, relative to 2009 levels(...) The largest contribution to increases in agricultural output will most likely come from intensification of production on existing agricultural land. This will require widespread adoption of sustainable land management practices, and more efficient use of irrigation water through enhanced flexibility, reliability and timing of irrigation water delivery."

Source: UN Food and Agriculture Organisation

THE FACT…

Malaysia consumed **2.7 million** tonnes of rice in 2016. Of the amount consumed, **67%** was produced locally, while the rest was imported primarily from Thailand, Vietnam and Pakistan.

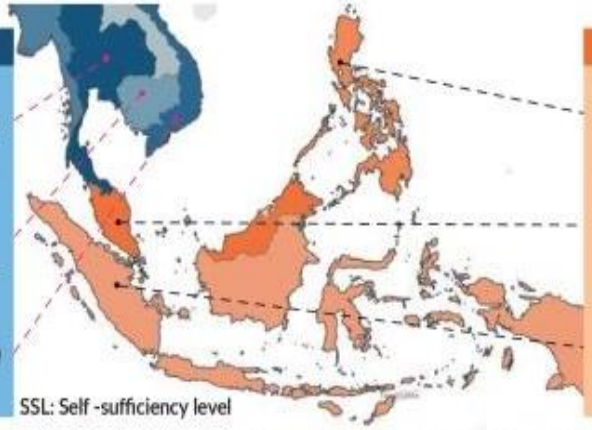
South-East Asia plays a central role in the global rice economy, accounting for **16 million** tonnes, or **40%,** of world's rice exports, with Thailand and Vietnam being the region's top exporters. Malaysia, Indonesia and the Philippines are net importers

Rice Exporters

Thailand
9,870,079 (24.5%)
SSL: 196%

Cambodia
529,888 (1.3%)
SSL: Not available

Vietnam
5,210,843 (12.9%)
SSL: 124%



SSL: Self -sufficiency level

Rice Importers

Philippines
446,268 (1.2%)
SSL: 93%

Malaysia
821,869 (2.2%)
SSL: 70%

Indonesia
1,282,427 (3.4%)
SSL: 97%

Malaysia performed fairly well in terms of paddy yield. in terms of paddy yield in 2016 at **3.2 million** tonnes per hectare vs Thailand's **2.9 million** tonnes per hectare

Malaysia's rice consumption grew faster than its production. Compared to neighbouring countries, its rice consumption and production remain relatively small.

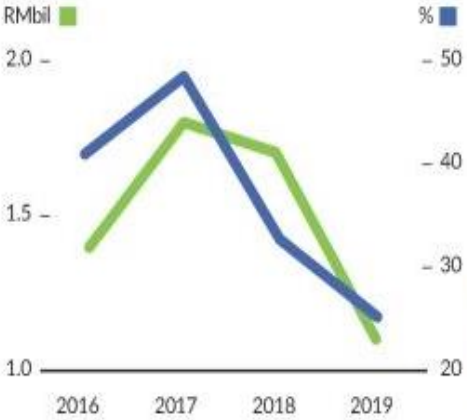
		Production		Consumption	
	Population (million)	million tonnes	annual growth rate	million tonnes	annual growth rate
World	7,466.9	501.5	1.5%	497.5	1.4%
Asia	4,462.7	453.2	1.4%	434.4	1.2%
Indonesia	261.1	45.6	2.1%	46.7	1.9%
MALAYSIA	31.2	1.8	1.6%	2.7	1.8%
Philippines	103.3	12.1	2.6%	13.5	2.8%
Thailand	68.9	21.6	1.8%	13.6	2.0%
Vietnam	94.6	28.1	1.8%	22.1	1.2%

Notes: Statistics based on year 2016

Source: KRI

Albeit the declining trend, the paddy and rice industry continue to receive more budgetary assistance than any other crops.

Paddy subsidies and incentives vs percentage of Ministry of Agriculture's expenditure



Of the **14 million** employed persons in Malaysia, **1.6 million** workers, or **11.4%**, belonged to the agriculture, forestry and fishing industry. Within this category, around **200,000** were paddy farmers, mostly aged 50 years and above. The monthly household income for paddy farmers stood at **RM2,527**, putting them in the Bottom-40 income category.

Source: NST

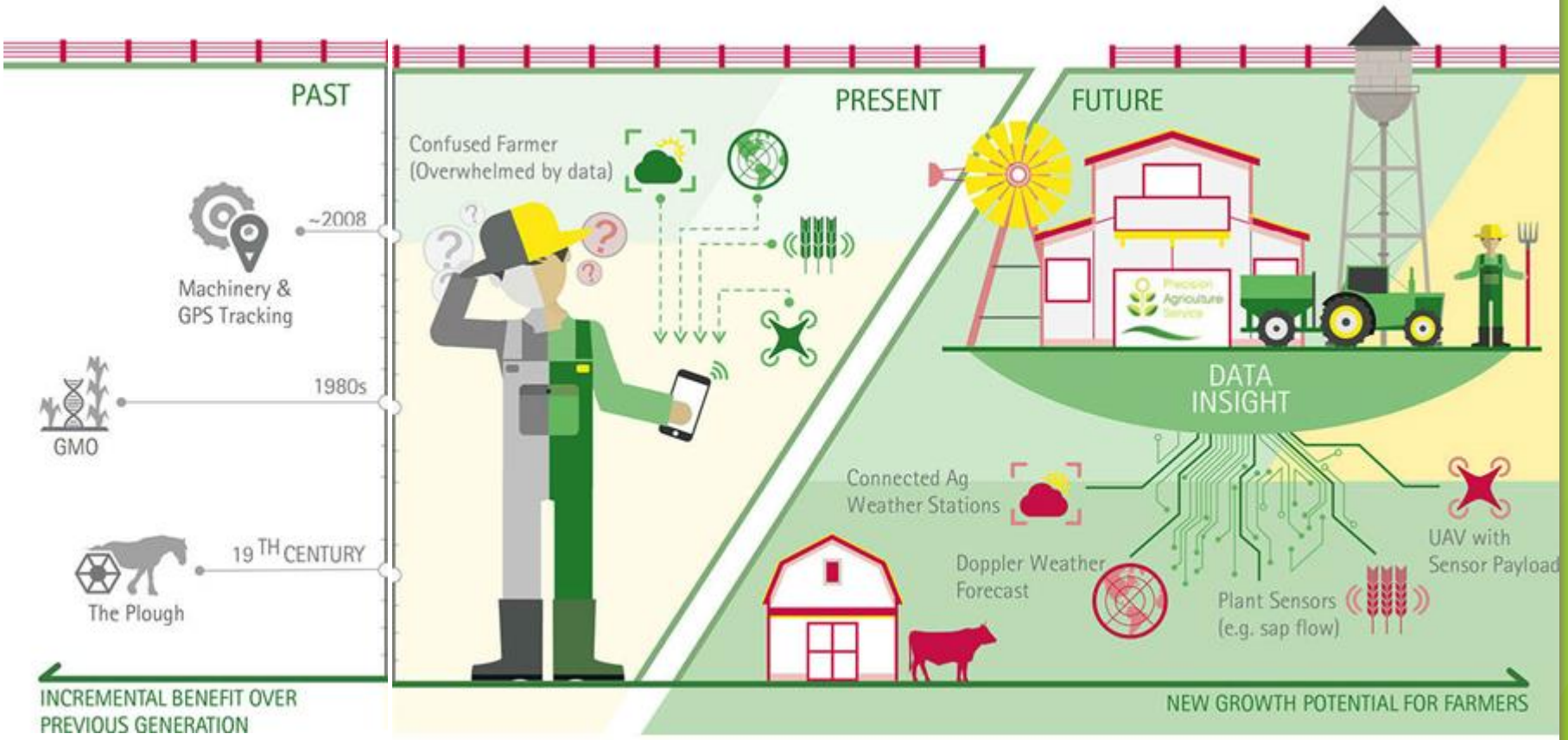
THE FACT…

Granary	Area (ha)	Production (t) Paddy	Production (t) Rice	Ave. paddy yield (t/ha)
MADA[1]	187,413	941,889	612,228	5.03
KADA[2]	38,641	159,800	103,870	4.14
IADA[3]:				
Kerian Sg. Manik	41,955	188,586	122,581	4.50
Barat Laut Selangor	**37,833**	**237,594**	**154,436**	**6.28**
Pulau Pinang	20,610	120,383	78,249	5.84
Seberang Perak	27,686	126,027	81,918	4.55
Ketara	9,752	54,114	35,175	5.55
Kemasin Semerak	5,383	18,815	12,229	3.50
Total (MADA, KADA, IADA)	369,273	1,847,208	1,200,686	5.00
Malaysia	**606,846**	**2,555,132**	**1,648,414**	**4.21**

[1]Muda Agricultural Development Authority
[2]Kemubu Agricultural Development Authority
[3]Integrated Agricultural Development Areas

Source: Paddy Statistics of Malaysia (2013).

PAST, PRESENT, FUTURE AGRICULTURE



Source: Accenture

PAST, PRESENT, **FUTURE AGRICULTURE**









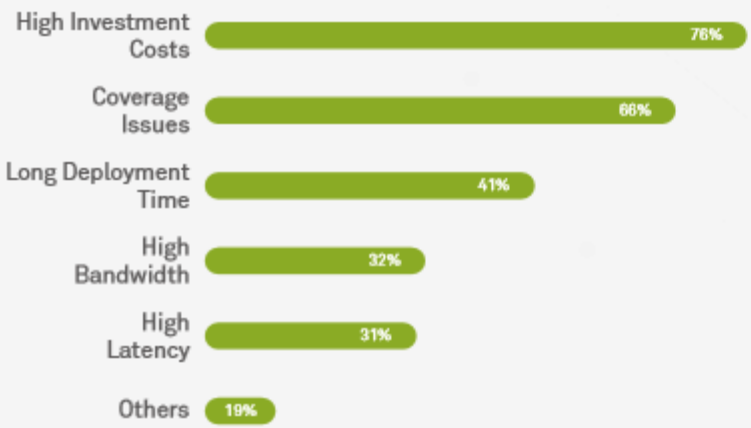



- ✓ Connected Farm/ Farm Area Network (FAN)
- ✓ IoT + Artificial Intelligence (AI)
- ✓ Precision Agriculture (PA)

Google images

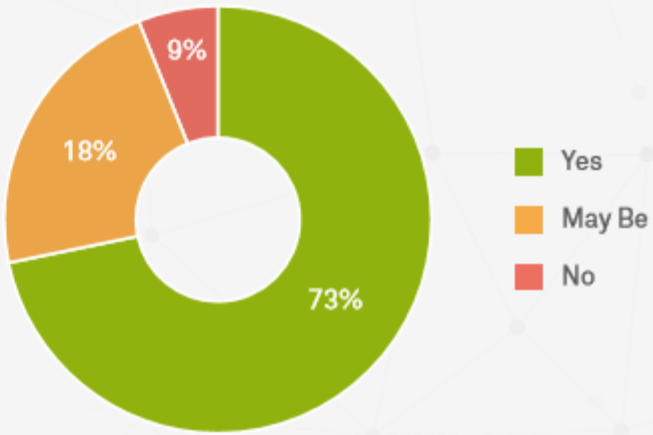
What end users say….

Major Pain Points Communication Technologies



More than 60% of farmers agree that the high investment costs of smart farming technologies and coverage issues are the major pain points which must be addressed. This is followed by long deployment time and bandwidth concerns.

Investment in Agriculture



More than 70% of farmers are willing to pay for more advanced technologies to be implemented provided that they can improve productivity and profits. Farmers are ready to invest more in both precision farming and farm management.

Source: HUAWEI: A Smart Agriculture Market Assessment

Selected **PRESENT** IoT Prototypes and Products in Agriculture

A sensor box of Midori Cloud

Irrigation Controller

Harvesting robots

Spraying robots

Seed and Fertilizer

Soil

Arable Capture Predict

Stem Size Sensor

Monitoring robots

Bug Detector

Crop Health Assessment

Leaf Sensor

Food Safety Tools

e-PADI

An IoT-based Paddy Productivity Monitoring and Advisory System [Our Past Experience]

school of micro electronic engineering UNIVERSITI MALAYSIA PERLIS

UNIVERSITI MALAYSIA PERLIS

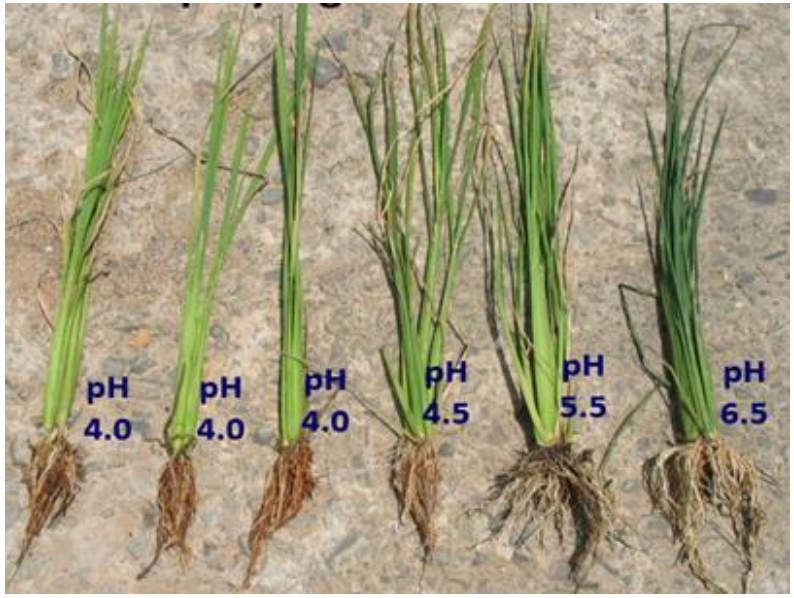
MCMC

MTSFB Malaysian Technical Standards Forum Bhd

MASDAR AGRO

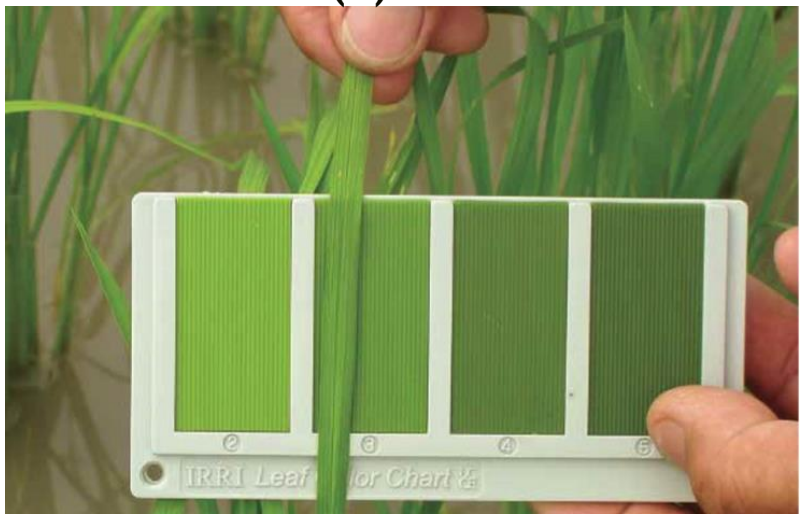
JABATAN PERTANIAN

Motivation: pH



(a)

(b)



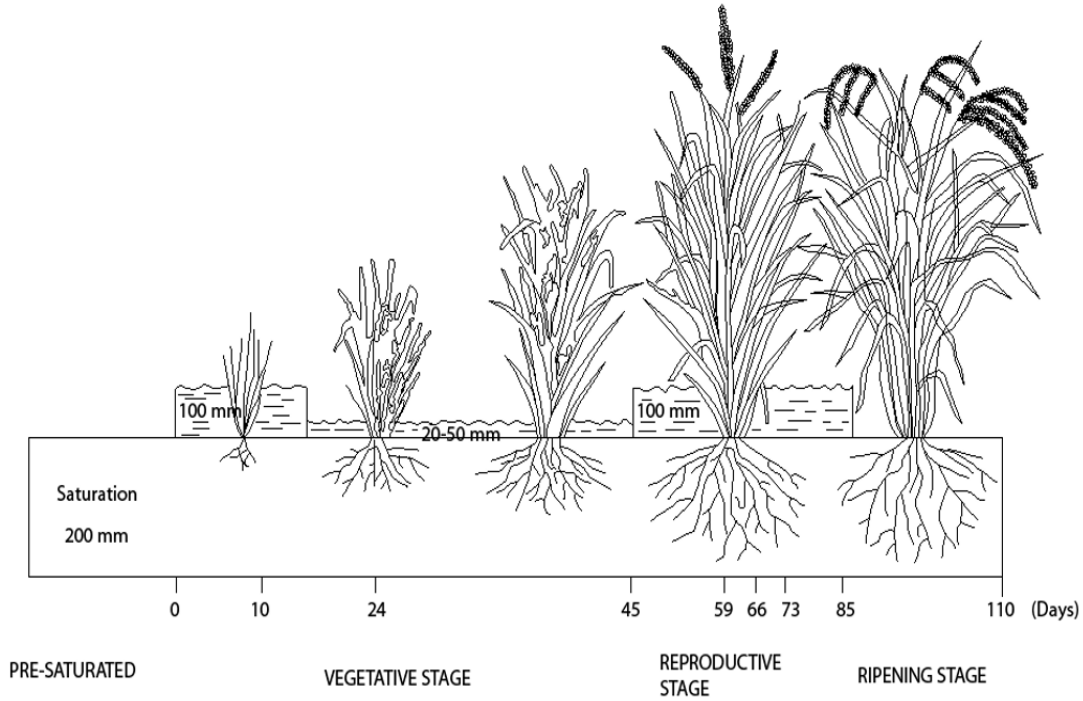
(c)

(a) Different soil pH vs. paddy development. (good pH 5.5-6.5)
(b) Paddy development due to inefficient nutrient absorption (pH < 5.0)
(c) Leaf colour chart (by IRRI)

Source: In Science of the rice plant, vol. 2 physiology. Food and agriculture research center, Tokyo, Japan, Hiroshiki Tanaga (1995).

Motivation: Water Level

Water Level	Yield
1cm	80%
15 cm	50%



source : Jabatan Pertanian Kedah

A sensor box of Midori Cloud

E padi
Midori Cloud
Agrosense
E Kakashi
IRIS

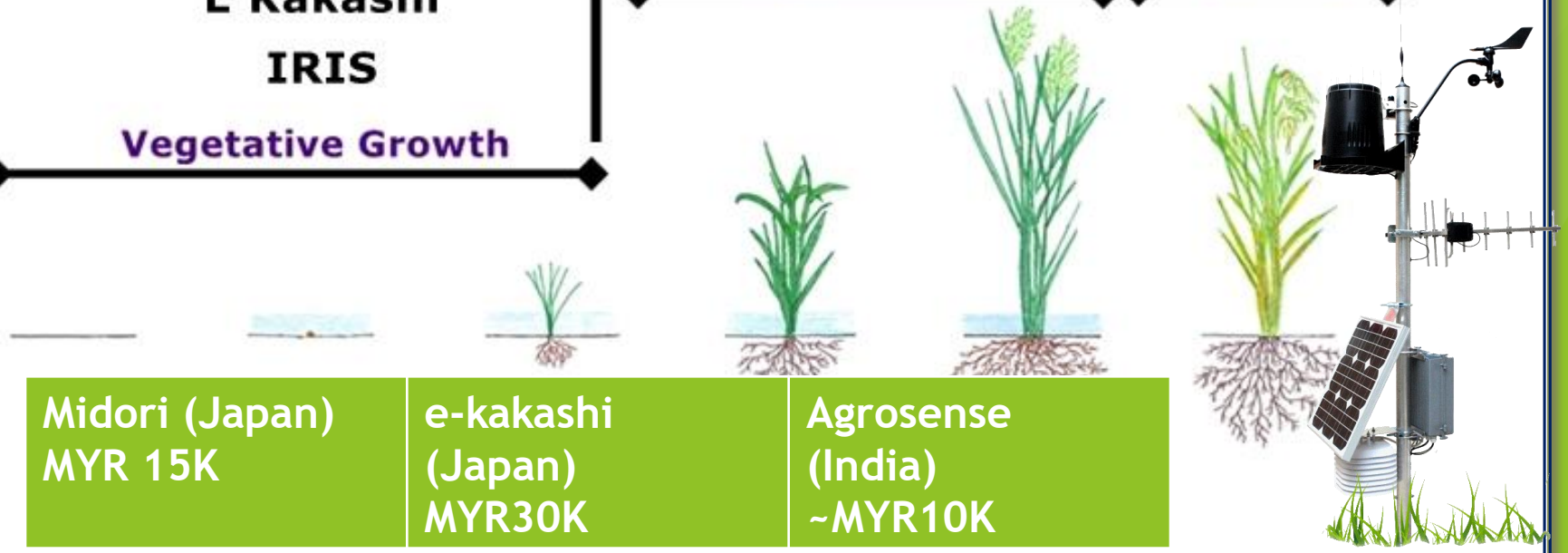
Vegetative Growth

E padi
Midori Cloud
Agrosense
E Kakashi
IRIS

Reproductive

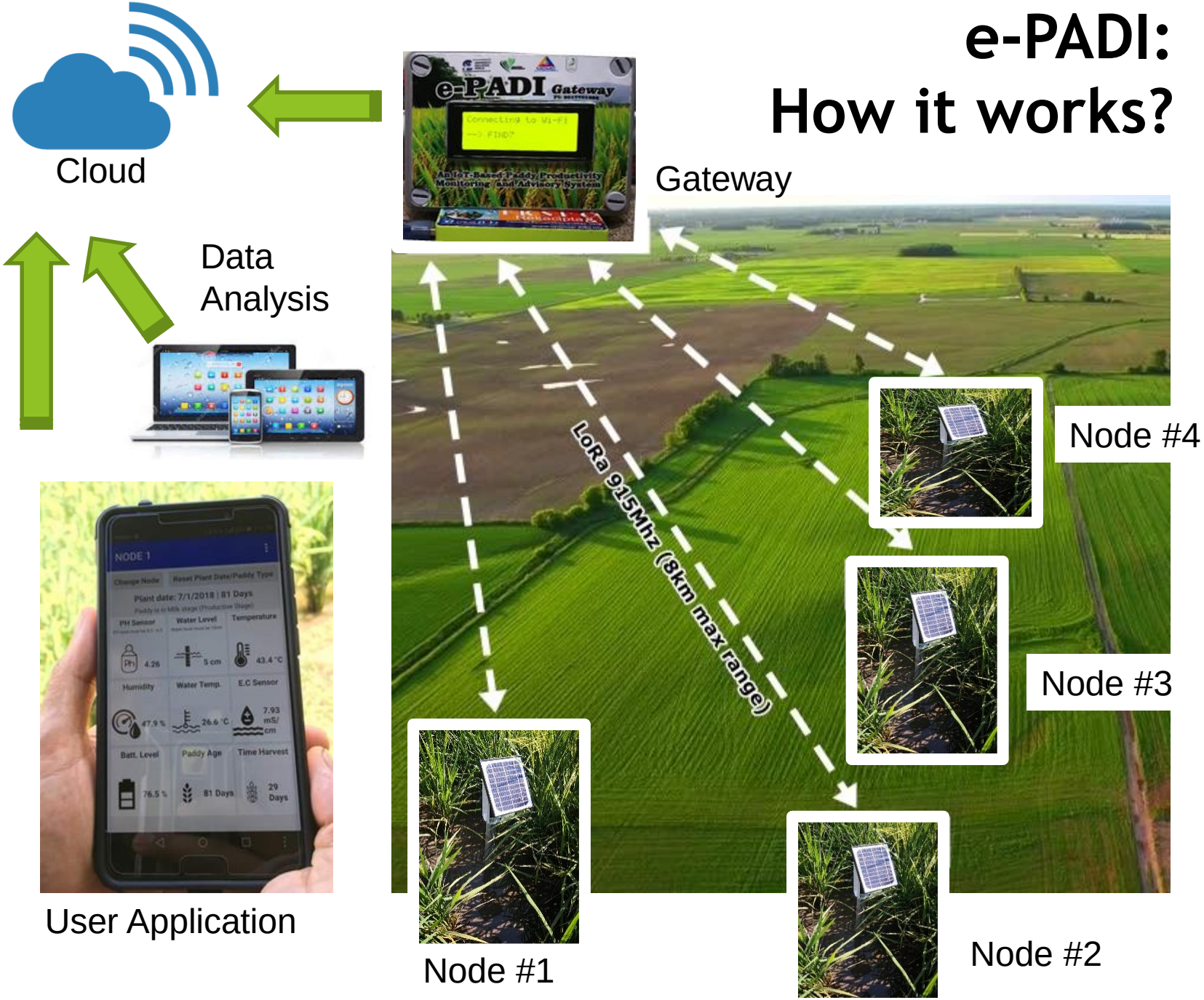
E padi
Midori Cloud
E Kakashi

Ripening



Midori (Japan) MYR 15K	e-kakashi (Japan) MYR30K	Agrosense (India) ~MYR10K

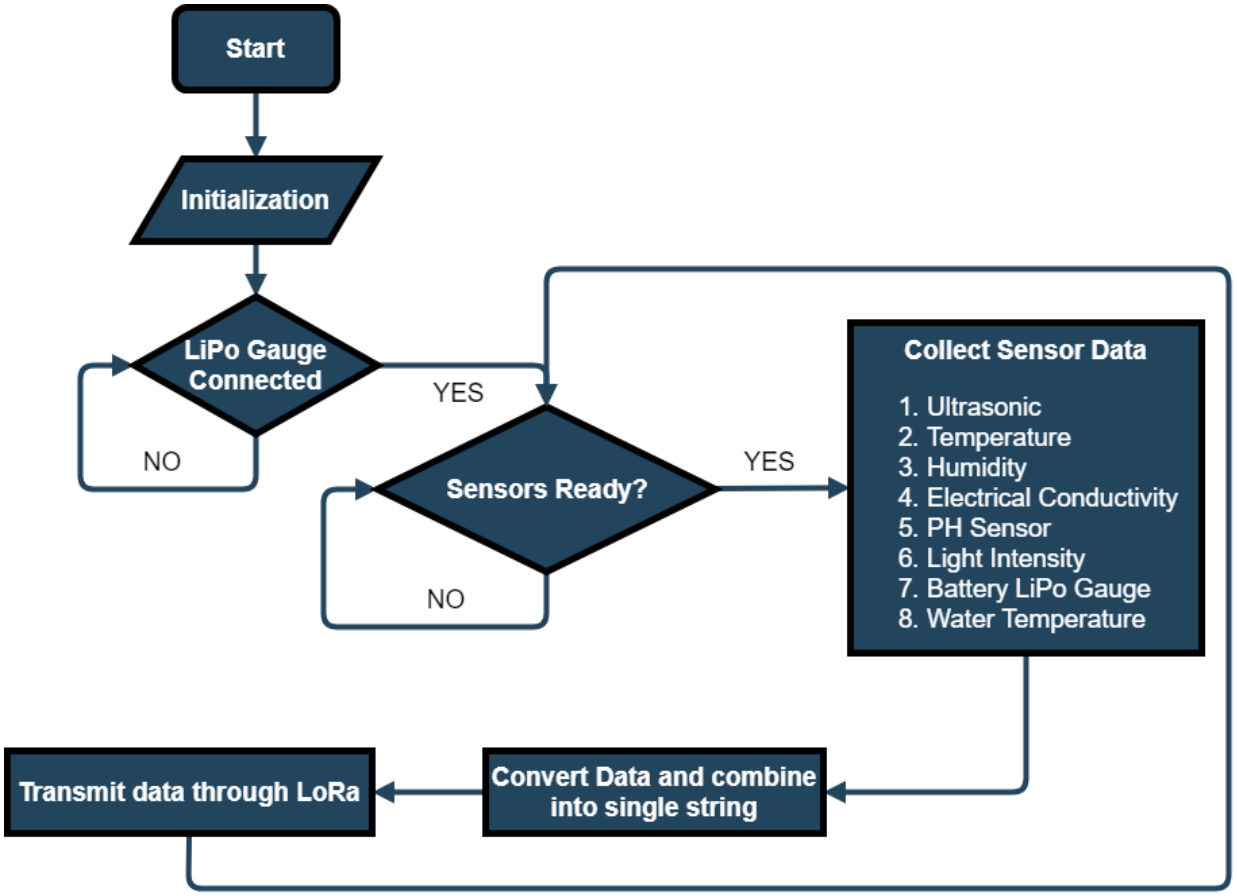
e-PADI: How it works?



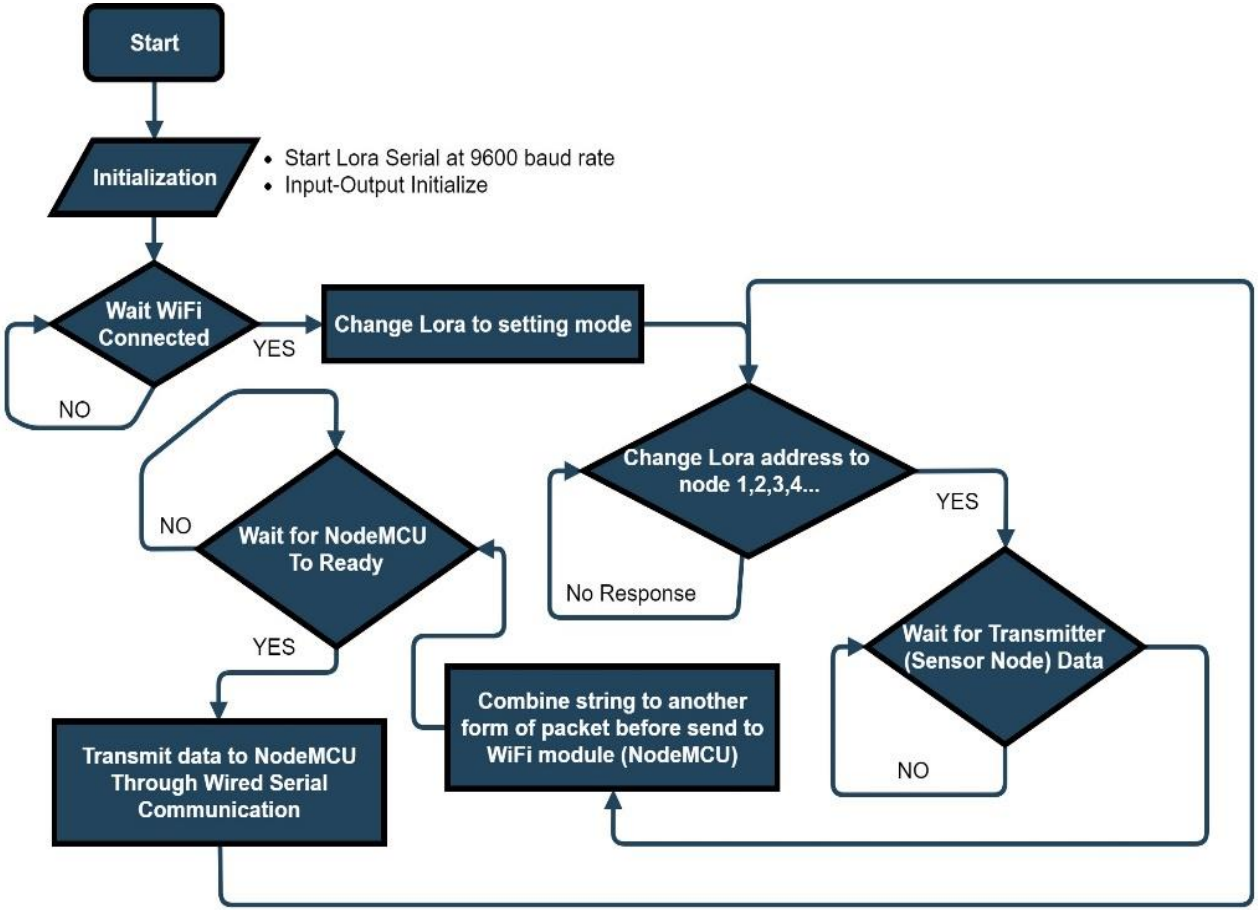
e-PADI Specifications

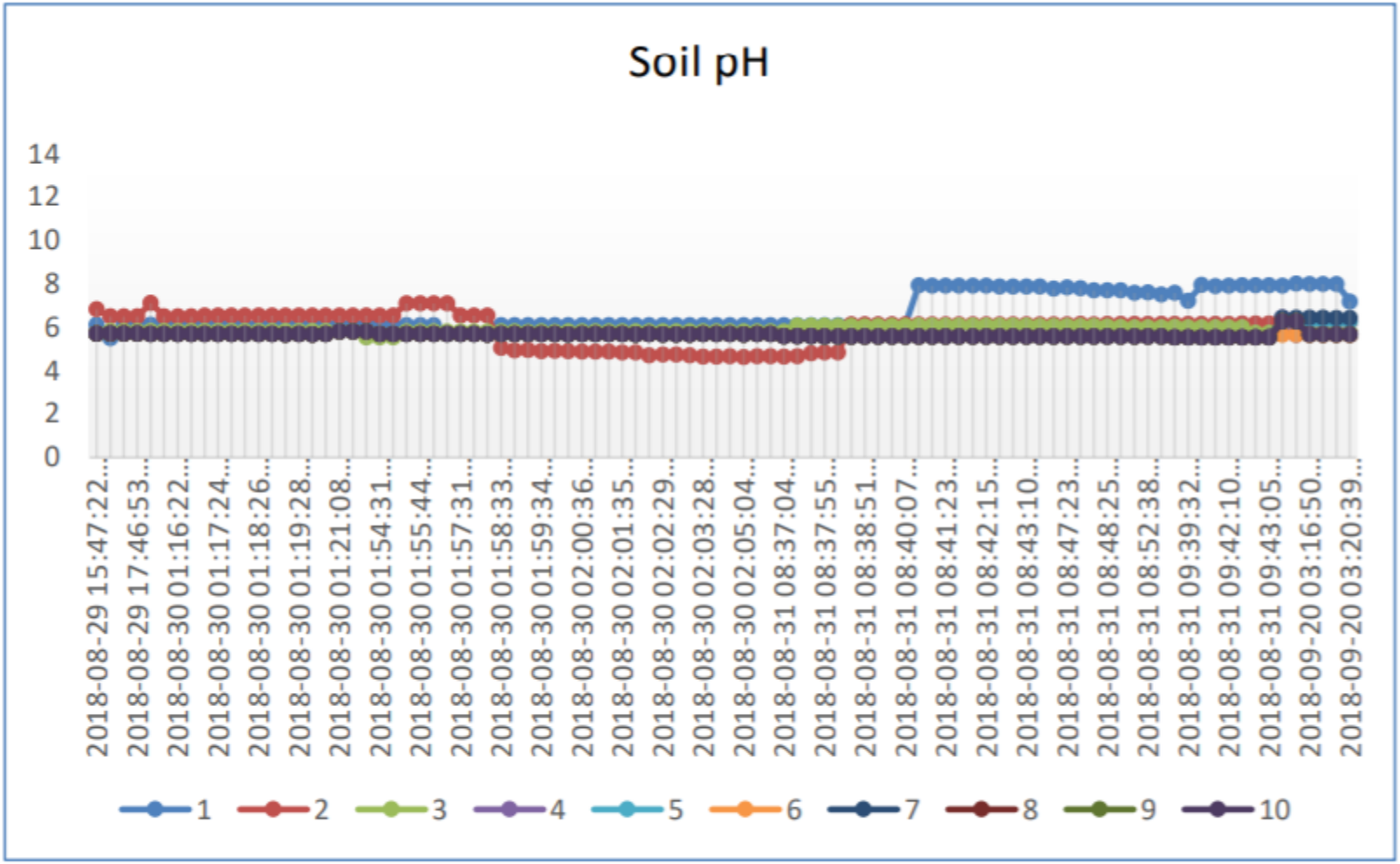
Operating Voltage	5V DC
Processor operating frequency	16 MHz
Power consumption (e-PADI system) Gateway (GW) Sensor Node	~ 1W
Measured parameters	✓ Soil PH (good paddy PH 5.5 – 6.5) ✓ Water Level (for different paddy development stage) ✓ Water temperature ✓ Soil EC (good paddy EC 0.1- 2.0 mSiemen/cm) ✓ Environment temperature and humidity ✓ Light Intensity ✓ Battery level
Maximum measuring range (from GW to sensor nodes)	8km to 13km
LoRa frequency band	915 MHz (900~931 MHz)
Communication topology	Star-network
Number of Gateway	1
Number of Sensor nodes	10

e-PADI sensor node

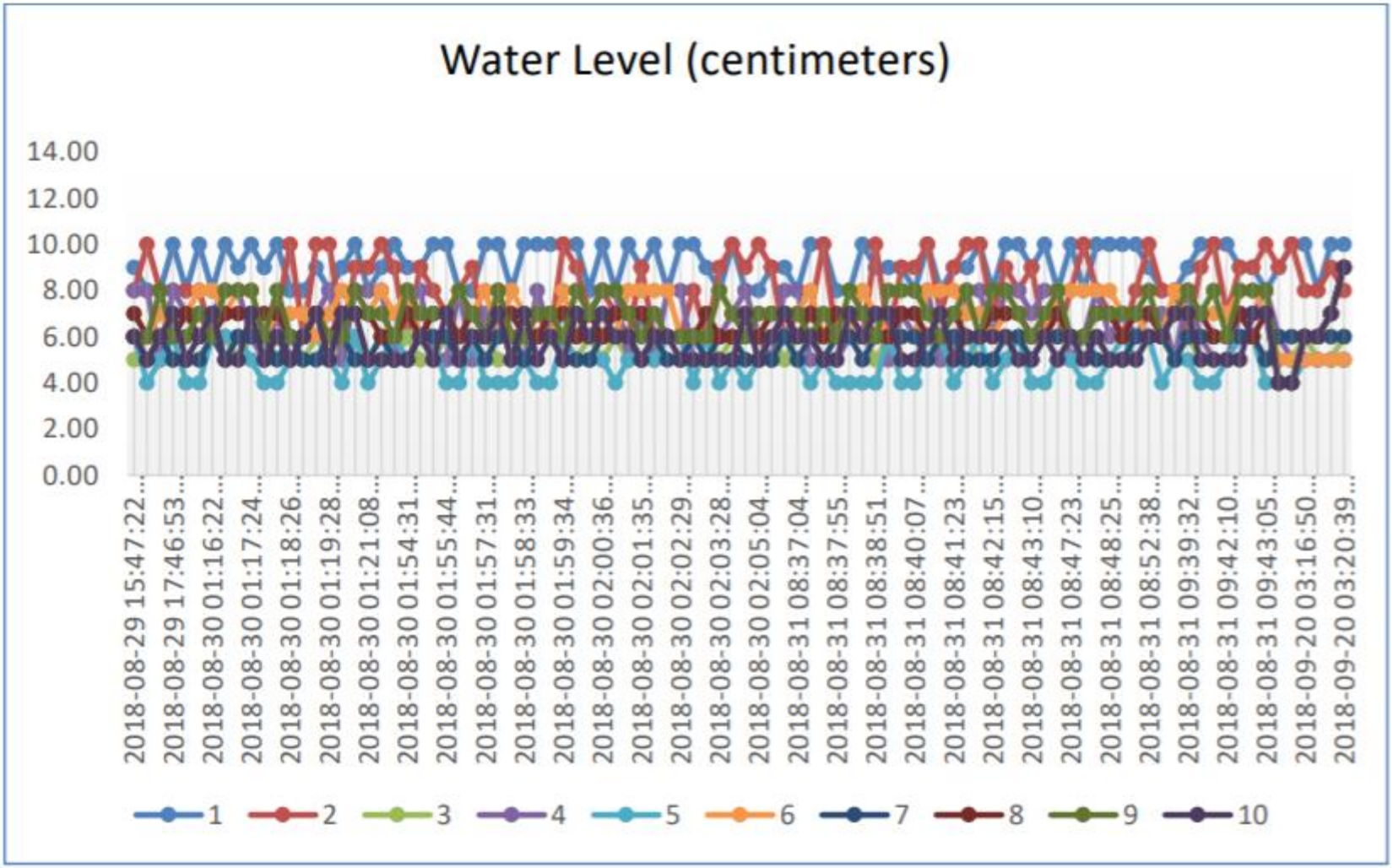


e-PADI Gateway :

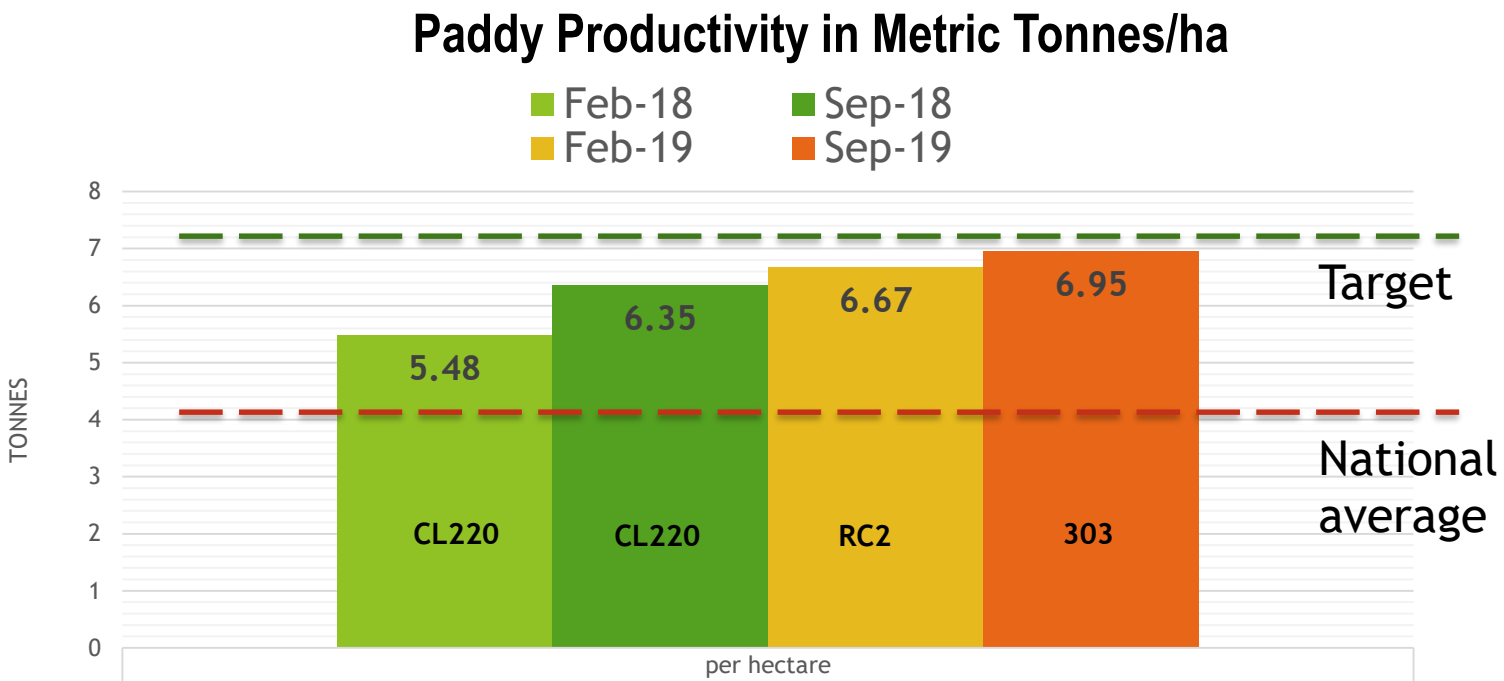




Continous variables (soil pH) measurement on node 1-10

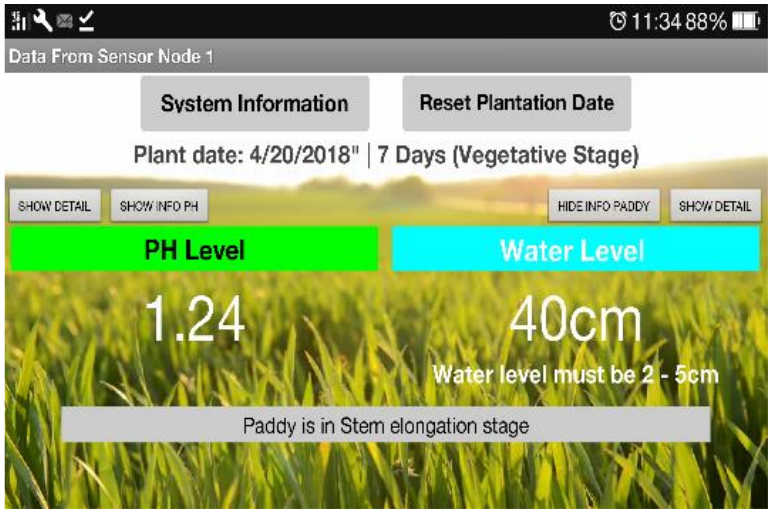


Continous variables (water level) measurement on node 1-10



	per hectare
Feb-18	5.48
Sep-18	6.35
Feb-19	6.67
Sep-19	6.95

e-PADI Ver. 0 (2017)

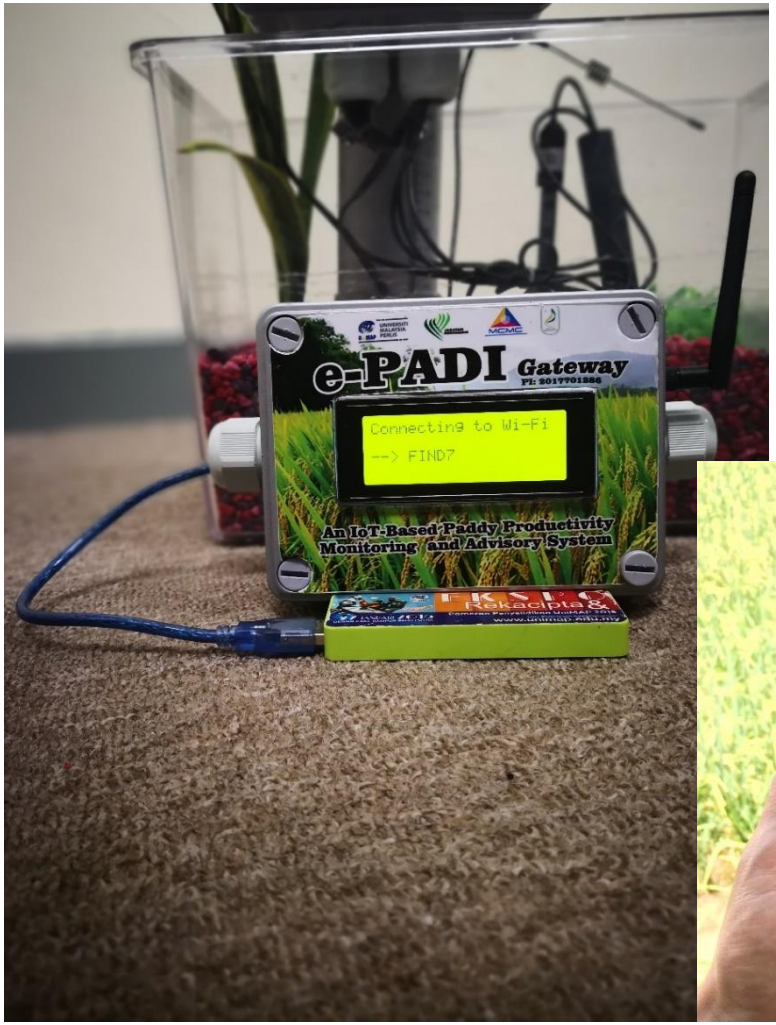


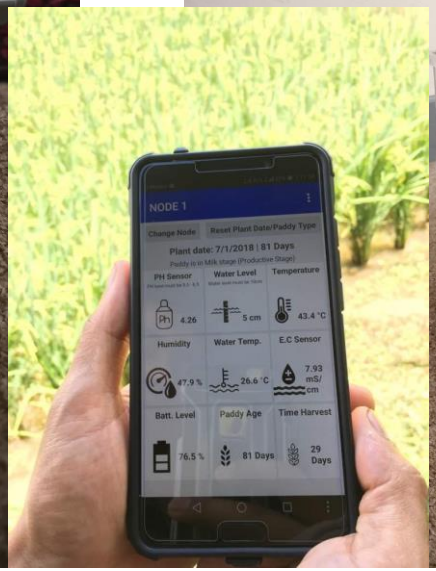
Testing#1
e-PADI Ver. 0 (2017)

Batu 19, Kampung Sena, Kuala Nerang Kedah

[MASDAR Agro]

e-PADI Ver. 1 (2018)





Test#2 e-PADI Ver. 1 (2018)

CELCOM 9:18 AM 71%

MTSFB
Yesterday at 3:10 PM ·

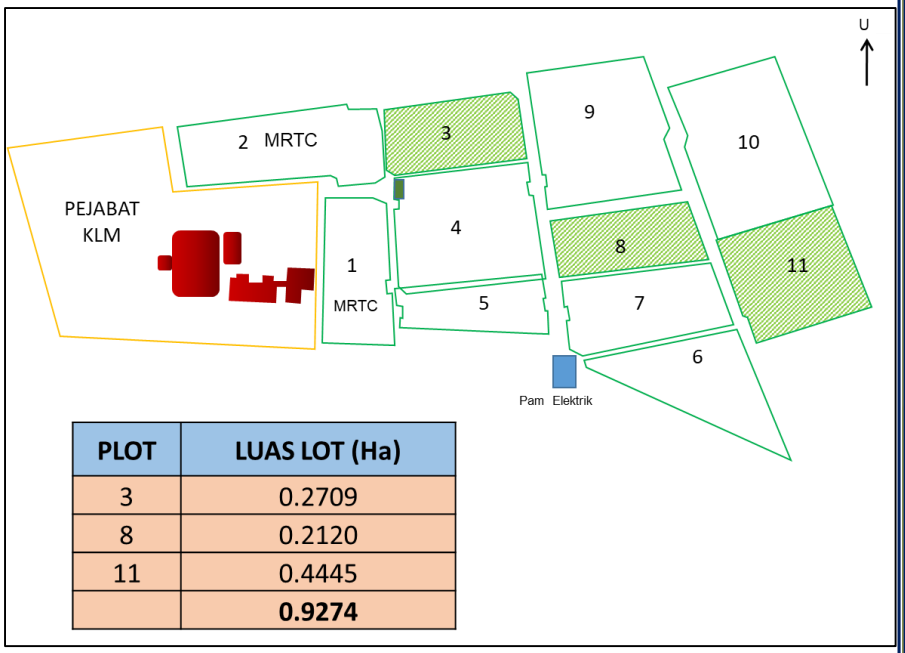
Site Visit to e-PADI Project at Batu 19, Kampung Sena, Kuala Nerang, Kedah. e-PADI is an IoT-based paddy productivity monitoring and advisory system using a Wireless Network Protocol.

Dr Mohd Nazrin Md. Isa from UNIMAP leads the briefing and demonstrate the project progress to Tuan Haji Aisharuddin Nuruddin and Encik Ismail Osman from MCMC and Puan Zaleha Abu Bakar ,MTSFB General Manager.

Date :20 September 2018
Venue : Batu 19, Kampung Sena, Kuala Nerang, Kedah

Next Plan….PADISensE

- Kompleks Latihan MADA Alor Serdang Kampung Selarong Panjang, 06800 Simpang Empat, Kedah
- Plot **3, 8 dan 11**



PLOT	LUAS LOT (Ha)
3	0.2709
8	0.2120
11	0.4445
	0.9274

Current Status (PADISensE)

Region A

Entities

Entity name	Entity type	address	latitude	longitude
Field A	Asset	Kampung Selarong Panjang, 06800 Simpang Empat, Kedah	5.980315	100.386117
Field B	Asset	Kampung Selarong Panjang, 06800 Simpang Empat, Kedah	5.979833	100.386822
Field C	Asset	Kampung Selarong Panjang, 06800 Simpang Empat, Kedah	5.979507	100.387683

Page: 1 Rows per page: 10 1 - 3 of 3

Dashboards > PADISensE

nazrin
Customer

Region A > Field A

PADISensE Entities Realtime - last minute

Entities

Entity name	Entity type	Humidity	Temperature	lightLevel	waterLevel	Battery	ec	ph
Device A-1	Device	53.00%	22.50C	28.00LUX	22.00cm	61.80%	0ms/cm	8.85
Device A-2	Device	52.90%	22.40C	27.00LUX	22.00cm	61.80%	0ms/cm	8.77
Device A-3	Device	53.80%	22.40C	28.00LUX	22.00cm	61.80%	0ms/cm	8.77

Page: 1 Rows per page: 10 1 - 3 of 3

Current Status (PADISensE)

Challenges

"The Future of Farming is about **higher productivity** and **more efficient use of land, water and fertilizer.** When everything from sensors to field equipment has the ability to report data back to a central wireless "location", the possibilities for better management of crop production, as well as farm operations, are almost endless".

Source: Kverneland

"….efficiency connectivity from a **wide range of sensors** with **long battery life** over **reliable, low cost, secure, licensed spectrum".** Source: Huawei-market assessment

Investor view: 4G and 5G farming

"Sensors with computer vision at a granular level can dramatically improve the identification of plants that need extra care. Some of these sensors can be connected to tractors and harvesters and analysed at the edge. However for full field analysis, one would need a 4G/5G network to upload and analyse data in the cloud. A full-stack yield optimisation solution would have sensors, high bandwidth connectivity, and AI-powered analytics.

"With the low cost of mobile devices, farm workers can be more productive if they can communicate with their managers, get instructions, complete tasks, and capture images. Field force automation technologies focused on farmers and workers can significantly improve productivity on the farm. To provide full coverage of a farm, a cloud-connected 4G/5G network is required.

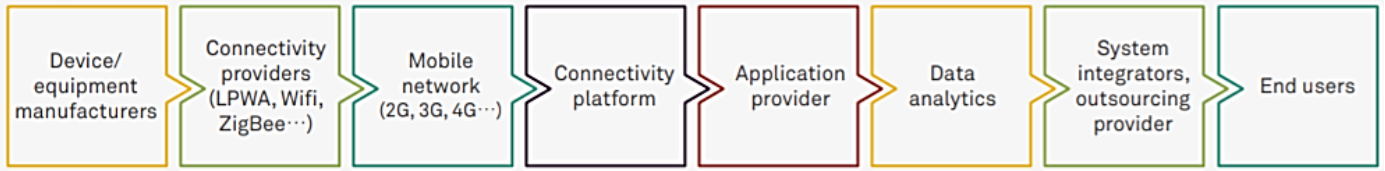
"Harvesters use power and automation to rapidly harvest in the field. However fruits and vegetables still require intense human intervention to pick and pack. Farm robots powered by sensors and AI can identify the right produce to pick and can work day and night. As labour costs increase and immigration becomes restrictive, farmers will be pushed to seek robotic solutions to their harvesting needs."

"For full field analysis and predictions, a 4G/5G network is required to upload and analyse data in the cloud"

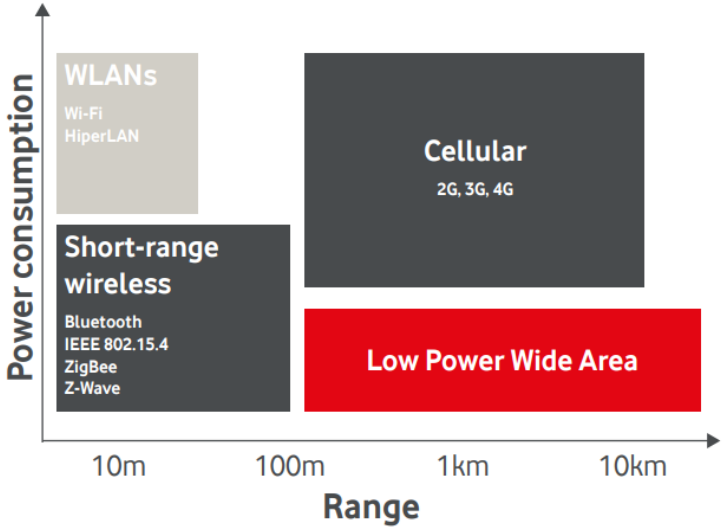
Upal Basu, partner, NGP Capital (pictured)

Challenges

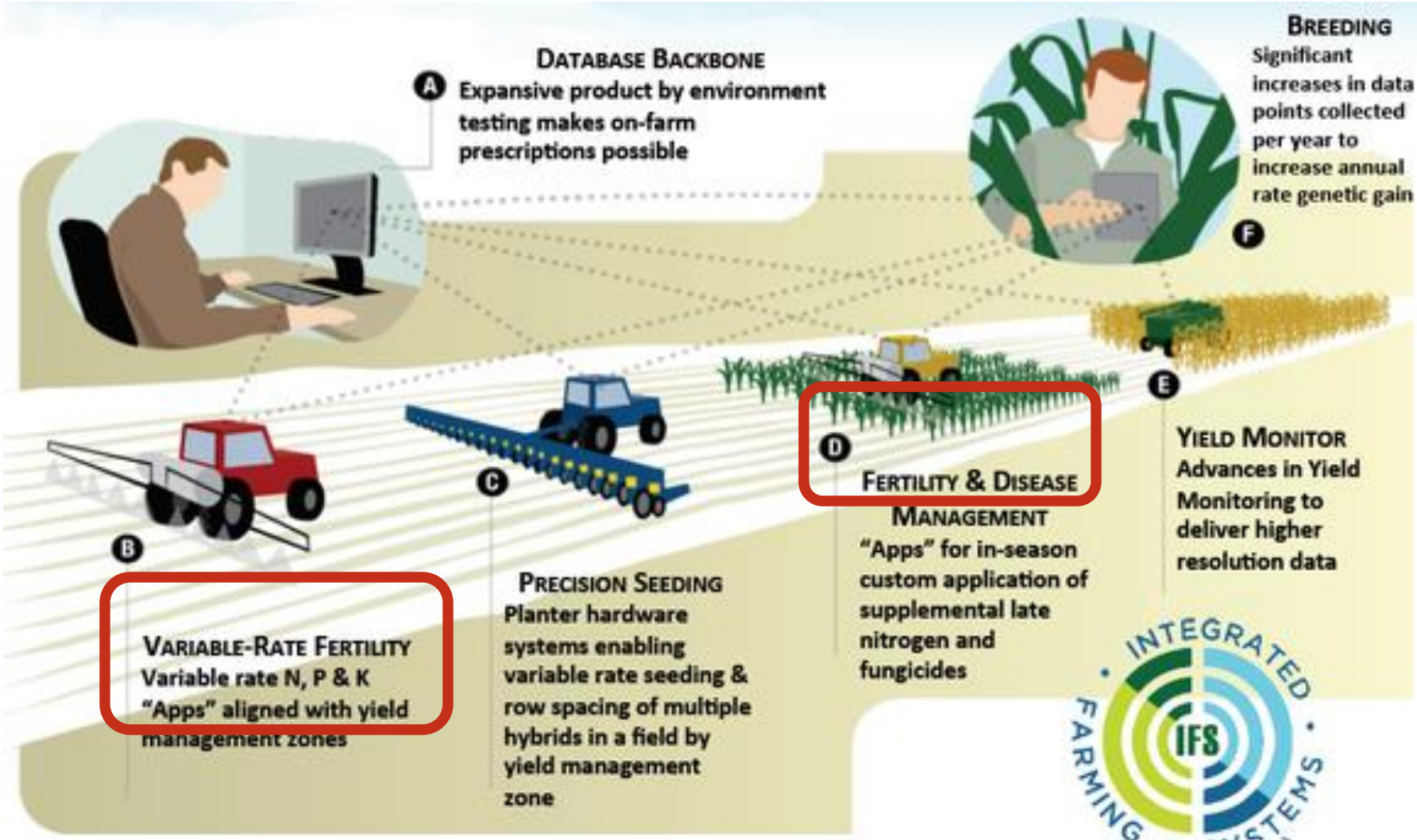
- Sensors : cost vs. reliability, maintenance and life span
- Low power sensor nodes vs. real-time monitoring
- Data intensive computation (IoT + AI)
- Different communication protocols



- Weather and geographical location
- Protected vs open field agriculture
- Higher speed and Higher demand



Precision Agriculture: The way forward…



Source: Monsanto


рахмат
danke
謝謝
ngiyabonga
شكراً جزيلاً
Баярлалаа
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barka
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tapadh leat
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grazzi
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nanni
nandri
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köszönöm
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хвала
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gràcie
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terima kasih
তোমাকে ধন্যবাদ
감사합니다
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ευχαριστώ
merci