



# **International Conference on Science and Technology for Sustainability**

**Colossal Multiple Disaster (Earthquake, Tsunami, and Nuclear Plant Accident) --- Repercussions, Countermeasures, and Future Policy Choices**

**Organizer: SCJ, Co-organizer : IAC, IAP, ICSU, UNU**

**October 9, 2013. Auditorium, Science Council of Japan**

20 min

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Session 1 "Repercussions on Agricultural Fields and Fishery Areas and Recovery from Disaster"

## Repercussions on agricultural fields and villages and the recovery from the disaster

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**Tokyo University of Agriculture and Technology, Japan**

- Precision Restoring Approaches
- Removal Machine Development
- Trials for Re-starting of People

## ➤ Precision Restoring Approaches

- Precision Thinking
- Describe variability
- Community-based Approach

## ➤ Removal Machine Development

## ➤ Trials for Re-starting of People

# Prologue: 3.11 East Japan Catastrophe

## Precision Restoring Approach By JSAM

Step 3:  
Trace the action.

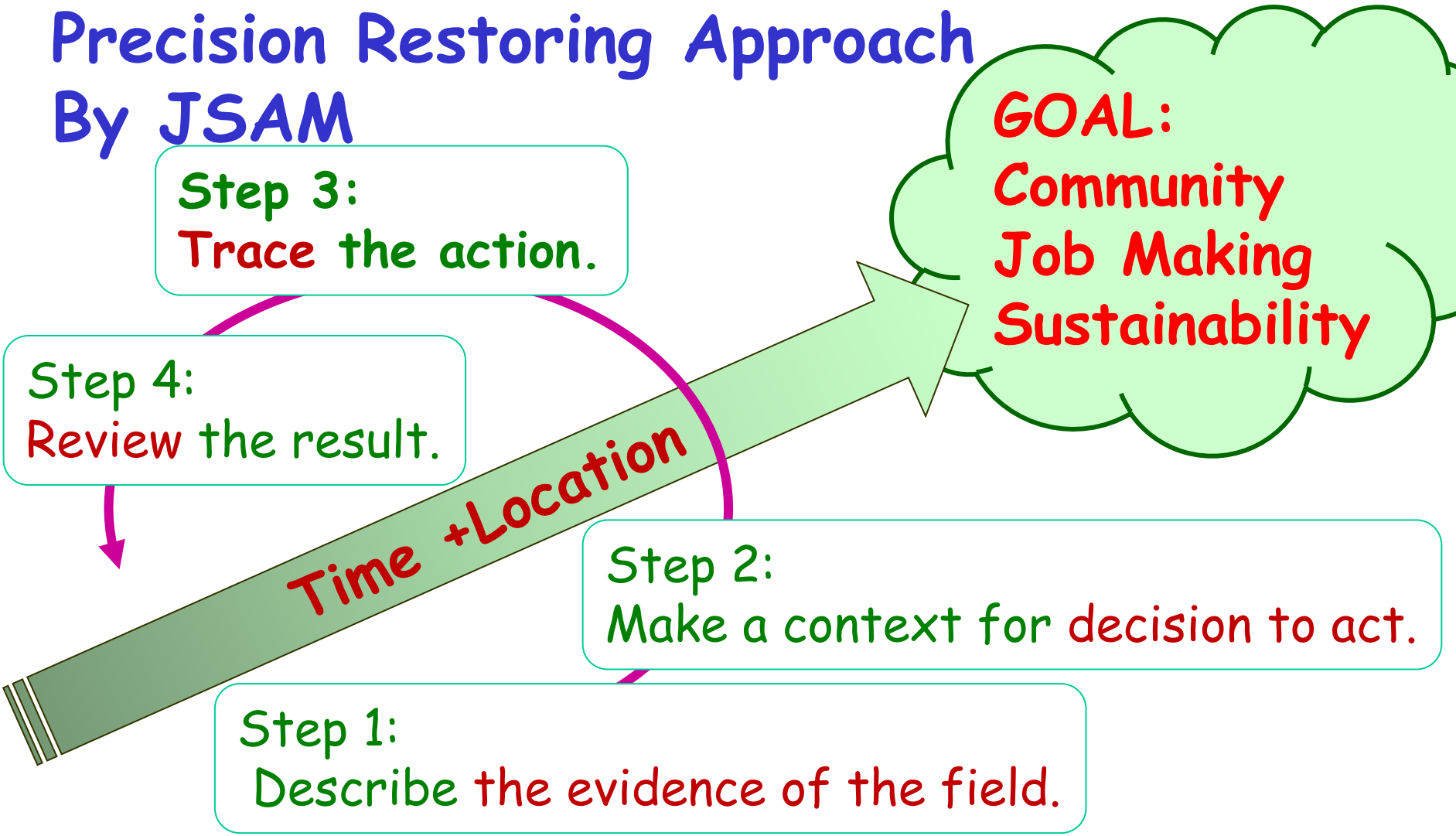
Step 4:  
Review the result.

Time + Location

Step 2:  
Make a context for decision to act.

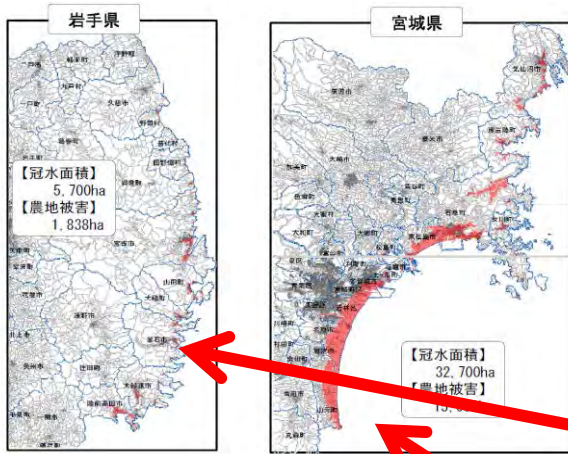
Step 1:  
Describe the evidence of the field.

GOAL:  
Community  
Job Making  
Sustainability



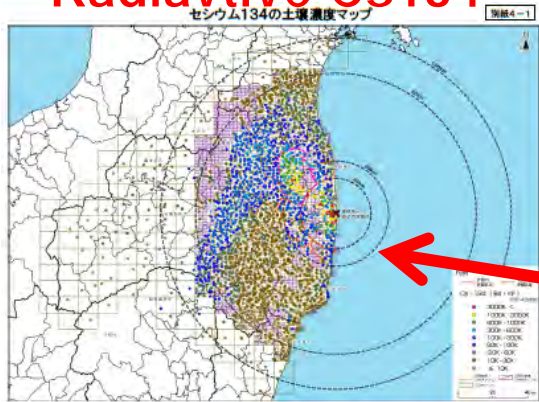
# Agricultural potential of Tohoku region.

## Tsunami



Agricultural products 1,359 billion yen, **16 %** in Japan.  
 Number of Growers 463 thousands, **16%** in Japan.  
 Ratio of growers above 65-yr 30 %, 58% in Japan.

## Radiative Cs134



Self-sufficiency: Calorie (Stat2007)	Calorie (%)	Money (%)
Aomori	110	215
Iwate	104	171
Miyagi	80	94
Akita	177	142
Yamagata	133	152
Fukushima	108	111
Japan average	40	66

Top share of produce	
Apple(Aomori)	53 %
Cherry (Yamagata)	71 %
Peach (Fukushima)	20 %
Hop (Tohoku area)	99 %

by  
 Tohoku Regional Agricultural Administration Office(Sendai)  
 Statistics 2010 of Tohoku Regional Agriculture

# Reconfirm the Evidence of Damages

## 3.11 Earthquake and Tsunami:

damaged **48 cities in 18 Prefectures**

along the 500 km coastline, 38% of the whole Japan,

made **15,781 victims and, 4,086 missing people** (Sept. 10),

induced maximum 430,000 refugees (March 16).

## Agricultural Damage reported by MAFF, March 2011:

Arable land of **23,600 ha across 6 prefectures**,

including 20,000 ha paddy and 3,600 ha upland,

occupied by 2.6% in whole Tohoku arable land,

**Lose of 1,774.6 billion yen**, composed of

Agricultural facilities            713.7 billion yen,

Agricultural produce    59.5 billion yen,

Forestry                                116.2 billion yen,

Fishery                                    895.2 billion yen.

# Walk at Site and Talk People on Disaster Paddy Kitakami, Miyagi.



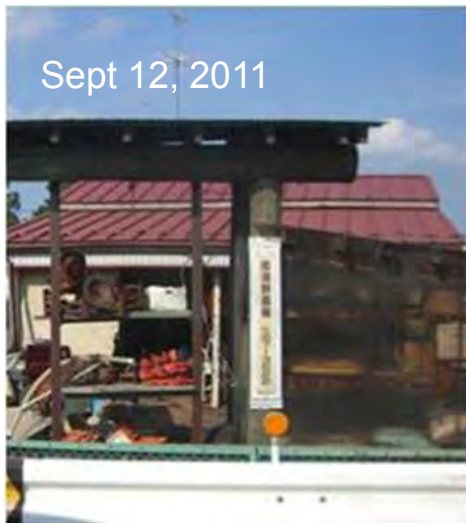
(a) Weeds control people in over-flooded paddy for the next cropping season.



(b) Sludge fully covering the paddy field with 10 cm thick.



(c) Damping rubble produced by Tsunami at 7 km from the coastline.



(d) On-service local dealer of agricultural machinery.

- # Less concern of salty sludge in the paddy
- # Need to recover transportation,
- # Need to repair drain pumps,
- # Need to recover machines and facilities.

# Walk at Site and Talk People on Disaster Horticulture Watari, Miyagi.



**(a) Strawberry packing house destroyed out by Tsunami.**



**(b) Small piece of rubble remained in the soil.**



**(c) Combine harvester scraped & drifted by Tsunami.**

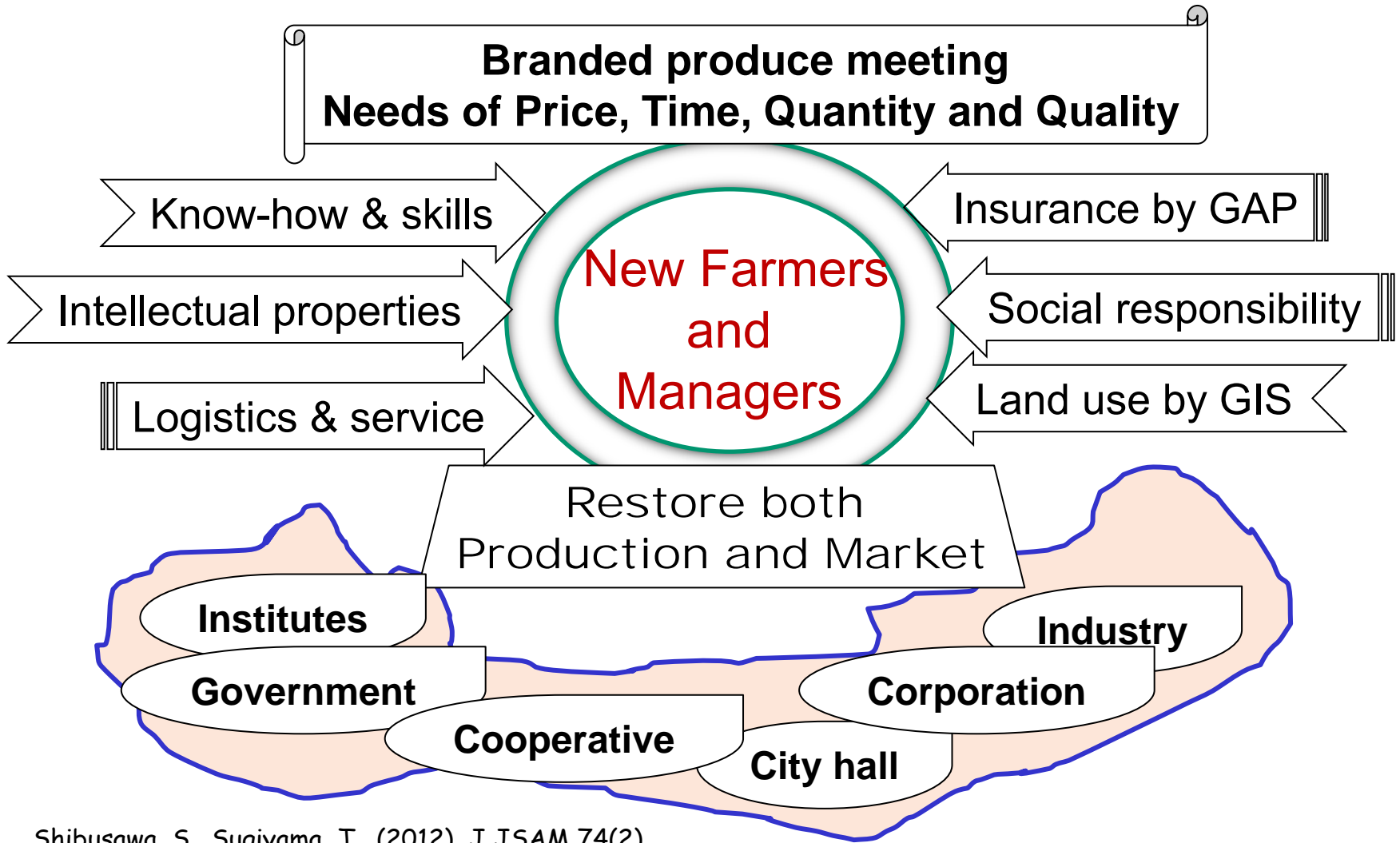


**(d) Recovering the pipe house for strawberry cropping .**

- # Need to purify the groundwater.**
- # Need to improve salty soil.**
- # Need to remove small rubble in the soil.**
- # Eager to recover the local markets.**

# Act under Constraints

## By Community: Farmers + Land use + Market + Rules





➤ Precision Restoring Approaches

➤ Removal Machine Development

- Describe the requests
- Who use the machine?
- Surface removal machines.

➤ Trials for Re-starting of People

Emergent measures for removal of radioactive materials from the arable fields of 26,000 ha, Japanese government (June 6, 2011, MAFF).



Remove topsoil precisely.

Requests from Gov.

- To shave off the top thin soil.
- Uniform cuts off the top soil.
- Removal of the upland top soil.
- Perfect soil turning by plow-in.
- Top soil collection by suction.
- Ridge cleaner and weed ripper.
- Precise work on the slope.

# Proto-type Machines for Surface-removal 75 % Reduction of Radioactive Intensity



# Surface Removal of Ridge and Slope

## 畦畔表土削り取り機

Kubota Ltd., Sasaki Corp. Ltd

- Ridge Surface Improver
  - Depth control, Soil-moving plate
- Efficiency 100 m<sup>2</sup>/hour  
Dose rate 1.37 → 0.27μSv/h  
(80% reduction)  
(1 cm height)



## 法面表土削り取り機

Kubota Ltd., Sasaki Corp. Ltd

- Off-set lawnmower
  - Depth control, Soil-moving plate
- Efficiency 630 m<sup>2</sup>/hour  
Dose rate 1.37 → 0.27μSv/h  
(80% reduction)  
(1 cm height)



# Road and Water Channel

## 農道表層剥ぎ取り機

Yammer Ltd.

- Stone Crasher Machine
- Off-set mechanism, depth control

Efficiency 500 m<sup>2</sup>/hour

Dose rate 1.38 → 0.20 μSv/h  
(85 % reduction)

(1 cm height)



## 用排水路内土砂掬い上げ機

Yammer Ltd.

- Off-set arm mechanism
- Controlled bucket shape

Efficiency 10m/13min, residue 12%

Dose rate 1.30 → 0.74 μSv/h  
(44 % reduction)

(1 cm height)



# Protected-Cabin of Tractor for Critical Uses

Enclosing chambers perfectly insulated from **radioactive** contamination



Reduced Radiation Intensity

Room: 31~41% cut

Floor: 69~70% cut

※ Under improving to 50 % cut



Reduced Radiation Intensity

Room : 87% cut

Floor : 94% cut



Reduced Radiation Intensity

Room : 43~64% cut

Floor : 90% cut



Harrow Cultivation of dried soil

## Air-clean Performance

Dust cuts at  
96.1~99.6 %

From MAFF Project: Restoring from Radioactive Contamination on Farmland

## Robot Tractor works well.



基地局車両内

Remote control work at the edges of field.  
Unmanned controlled work in the field.

- Precision Restoring Approaches
- Removal Machine Development
- Trials for Re-starting of People
  - Precision Restoring Agriculture
  - National Projects of Re-development

# Precision Restoring Agriculture Using Spatial visualization Technique on Soil-Crop Information and Values

ADS Ltd. \*

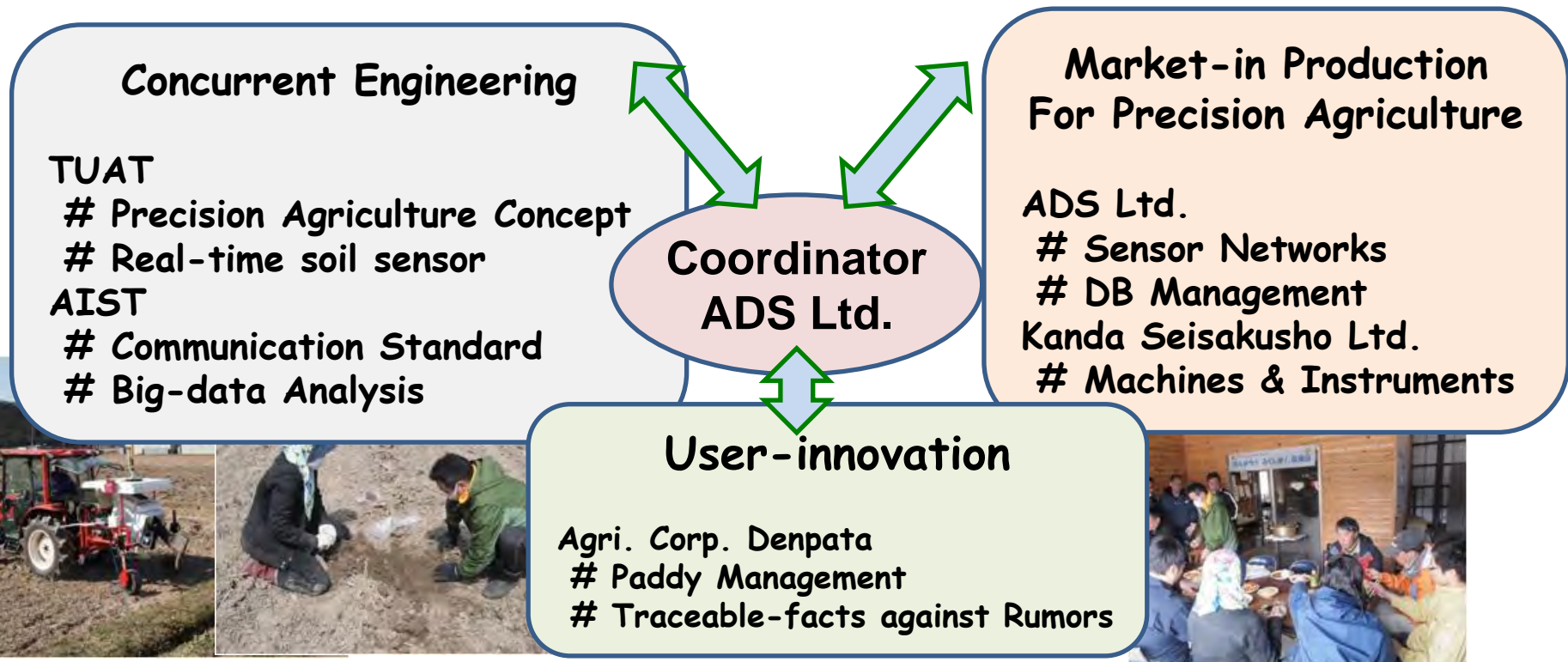
Tokyo University of Agriculture and Technology (TUAT)

Kanda Seisaksho Ltd\*

Agri, Corp. Denpata\*

National Institute of Advanced Industrial Science and Technology (AIST)

\* Damaged companies and corporation





# A Model of Precision Agriculture

*Describe the Variability.  
Big-data Visualization*

Real-time soil sensor

Application Server



Revise the machine.

3D Data

Visualization of  
Non-linguistic  
Knowledge

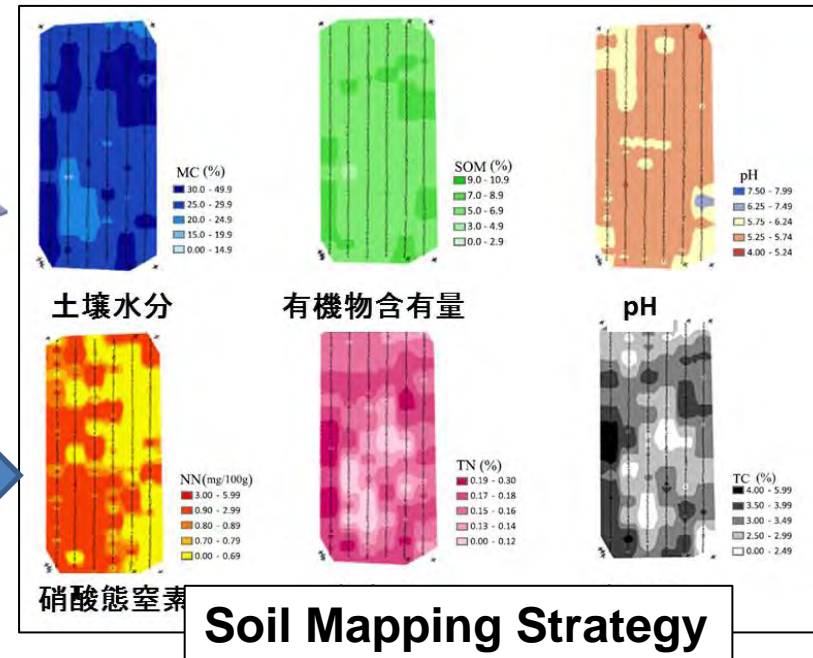
Sensor Posts

Common ICT Protocol

Operator Device

Sensor Posts

Decision Making for Actions



Soil Mapping Strategy



# Experimental Study on Technologies of Land-extensive Farming (Comprehensive Res.)

**Miyagi Pref.**

NARO/Tohoku Agricultural Research Center  
Memberships: NARO/ARC, NARO/HARC, BRAIN, Miyagi ARC, Ishikawa ARC, Kubota Ltd, Yanmar Ltd, Yanmer Heli & Agri Ltd, Sugano Ltd, NEC Ltd, E-lab Exp. Ltd.



**Damaged Farm Land**



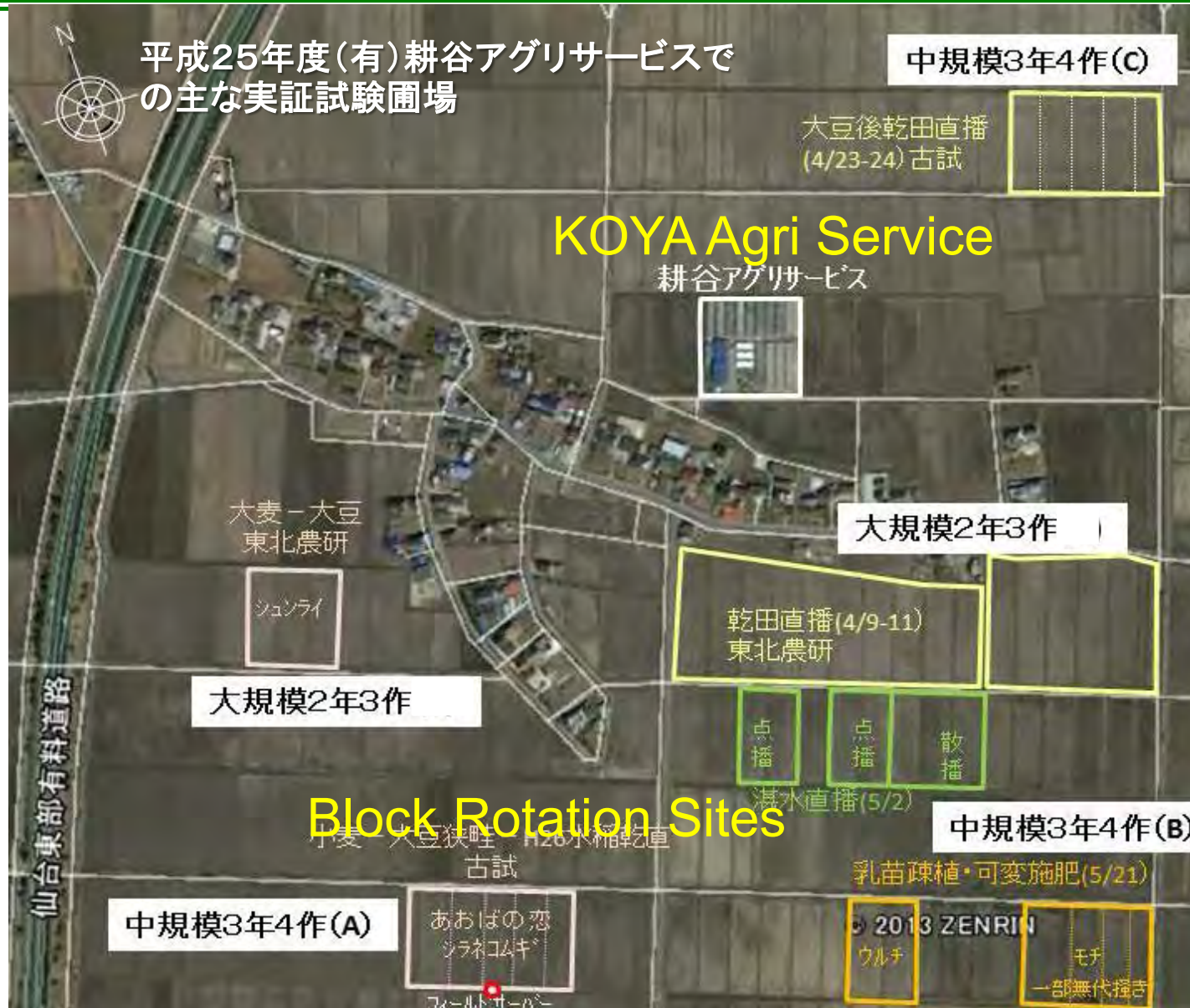
**Damaged Irrigation Facility**

## Keywords of Re-development

- # High Value-added
- # Cost-reducing Strategy
- # Diversification Management

- # Big-scale Paddy Farming
- # Big-sized Field & Big Machine with Controlled High Efficiency.
- # Profitability with Steady High Yield

# KOYA Agri Service Co. has joined the project.



# Business Development Campaign of Advanced Technology for Restoring Agriculture and Community (2012-2017)

## Experimental Study on Cost-effective and High-quality Management in Big Greenhouse (Comprehensive Res.)

NARO Institute of Vegetable and Tea Science  
Memberships: NARO/TARC, NARO/HARC, NARO/KARC, NARO/ARC, NIRE, Miyagi ARHC, Iwate ARC, Yamagata ARC, Fukushima ARC, Tokyo ARC, Miyazaki ARC, Keio Univ., Tohoku Univ., Okayama Univ., Chiba Univ., Kinki Univ., Ishiguro Ltd, Kaneko Seeds CLtd, Toyohashi Seeds Ltd, Panasonic Ltd, Arysta Life Science Co., Geosystem Ltd.



Multi-task Greenhouse



Strawberry



Tomato



Thank You for Your Attention.