Building Resilience through Digitalizing Agriculture

- Innovating Agriculture by Opening & Utilizing Big Data -

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I. 4th Industrial Revolution and Agriculture

Digital Transformation based on Data·AI

**Intensifying Competition**
as national and corporate competitiveness depends on utilization of data

**Transition to Digital Economy**
'National AI Strategy (2019)', 'Activation of Data and AI Economy (2019)', 'Korea New Deal (2020)'

- **Korea**
  - Korea's potential & strength

- **NEW**
  - New way & strategy

- **Deal**
  - National Strategy Transformation & Future

Global Transition to Digital Agriculture

**Multinational Company**
Growing investment
- Global investors put $6.4 billion in Agtech (2019)

**Japan, Europe**
Developing data-based technology for each sector

Current Issues

- **Growing damages by abnormal weather**
  Agricultural loss:
  - (15) 67.8 billion won → (17) 362.5 → (19) 1140.8

- **Low birth rate & population aging**
  Rural population:
  - (14) 2.75 million → (19) 2.25 million
  - 45% of city/county facing extinction (Statistics Korea)
  Young farmer under 40:
  - (14) 9,947 → (19) 6,859 households

- **Countries reinforcing policies for food security**
  FAO warns a new virus, 'starvation virus', would threaten humanity (2021)

Big Data & AI as an alternative for Sustainable Agriculture
Ⅱ. Vision & Goal

**Vision**
Sustainable Agriculture by Data-based Digital Agriculture

**Goal**
Improve agricultural productivity, convenience and environment by digital agriculture

**Strategy**
- **Build data ecosystem** for collecting, utilizing and sharing data
- **Digital innovation** in production by automation & AI
- **Support supply chain, consumption and policies** through digital agriculture

**Programs**

- **Data Ecosystem**
  - Collect and manage data
  - Build AI service platform
  - Open and share data

- **Digital Innovation in Production Tech.**
  - Base tech. for automation & AI
  - Digital tech. for breeding
  - Digital tech. for grain production
  - Digital tech. for horticultural crops
  - Digital feed management tech.

- **Support Distribution & Consumption & Policy**
  - Support decision-making on crop selection, distribution & consumption
  - Support rural & agricultural policies
1. Data Collection & Management

Goal
Increase collection, standardization and quality management for research & on-farm data

Data type
- Production: Soil, Climate, Disease/Pest, Cropping
- Distribution: Traceability, Wholesale price, Export statistics
- Consumption: Consumption, Brand, Food & Nutrition, Public health

Agricultural data have various factors (weather, region, variety), so standardization and systematic management are important!

The Government must play a proactive role.

- Increase data collection
  - Research: ('21) 20 → ('25) 250 (accumulative)
  - On-farm: ('21) 14 items 406 farm households → ('25) 30 items 1,000 farm households

- Standardization of agricultural research data & ICT devices
  * Standardized a registration form for research data on green-bio (with Ministry of Science & Technology)
  * ('20) Standards of private sectors (SPS) 8 cases, Korean industrial standard (KS) 2 case → ('21) SPS 10, KS 4 cases

- Quality Management for the entire data lifecycle
  * Agricultural research services, technology centers operating a day for data management
2. AI Service

- **Goal**
  
  Support farmer’s decision-making through AI service

- **AI Service Platform Structure**

  - **Data source**
    - Internal: MAFRA EA data, Smart farm data hub, Big data center
    - External: Big data platform, Dam & SNS data, Data from private sector

  - **MAFRA’s Integration Big-data Platform**
    - 01. Collection & Storage
      - connect, Meta-data, storage, security
    - 02. Pre-processing & Classification
      - Cleaning Unidentifiability, Quality management/Classification
    - 03. Analysis
      - Analysis tool, model, Visualize

  - **Service (problem solving)**
    - Data portal, Data Free Zone, Service model, Data sharehouse, Gov data platform

  - **RDA’s R&D Data Platform**
    - AI model & service development, Policy support, Agricultural and research data

- **Further apply AI models for productivity and growth management to crops in open fields and livestock sector**

  - **Greenhouse**
    - (’20) Tomato → (’21~) Strawberry, Paprika, Melon, Cucumber, Watermelon, Chrysanthemum
  
  - **Open field/Livestock**
    - (’21~’23) rice, wheat, soybean, onion, cabbage
    - (’24~) 5 including apple, Korean native cattle, milk cow

- **Decision-making support model for crop/site selection and shipment**

  Support to select crops and build marketing plan by connecting big data on soil, weather and consumption
3. Data opening, sharing & utilization

**Goal**
Support start-ups & cooperate with other organizations

**Current agri. start-ups in Korea**
Farm8 (plant factory), nThing (smart farm), AIS (growth management), etc.

- Support start-ups and cooperate with relevant organizations by opening and sharing data
  * Open bigdata on weather, soil, disease, pest: ('20) 143 cases → ('21) 241 cases
  * Data for AI learning in the agricultural and livestock: build image database of pest/disease, etc.

- Data Center for systematically storing, managing & sharing
  * (Phase 1) Field Data Center → (Phase 2) Research Data Center → (Phase 3) Integrated Platform

- To promote of local agricultural research services/technology centers as a regional hub for collecting and sharing data
3 Programs & 10 Tasks

1. Digital Technology for Grain Production

Goal
Enhance food self-sufficiency and save labor

Field application

- **Rice**
  - Drone seeding/disease control, and self-driving machinery for labor saving
  - Precision tech. for stable production to respond to abnormal weather

- **Wheat**
  - Recommend a flour variety (for noodle) based on weather/soil data
  - Precise management of each growth phase for improving productivity and self-sufficiency

  - (*'22~) 20% yield increase model

- **Soybean**
  - Precision fertilizer recommendation and water management for each growth stage to improve productivity
  - Early warning service for abnormal weather

Apply field trial test to counties/cities first, and then spread across the nationwide
III. 3 Programs & 10 Tasks

2. Digital Technology for Stable Supply & Quality of Horticultural Crops

**Goal**
Stabilize demand-supply of vegetables
* kimchi cabbage, radish, onion, garlic, pepper, etc.

**Field application**

- Early yield forecast using drone or satellite image for stable supply
- Forecast the yield of major onion producing area
- Technology for storage, processing & inventory management
- Recommend the suitable site/crop to prepare for the climate change
- Technology for new value-creating crops

Apply field trial test to counties/cities first, and then spread across the nationwide
III. 3 Programs & 10 Tasks

3. Digital Technology for Precision Livestock Farming

- **Goal**
  Prevent diseases and enhance productivity

- **Farm Application**
  - Predict estrus, fertilization and delivery time for each cow
  - Data-based Precision Feeding Technology for meat quality and productivity
  - Develop Korean automated feeder, milking robot
  - Data-based optimal growth and disease prevention model based on feed intake or activity
  - Selecting abnormal individual through image analysis, intelligent management

- **Application**
  - Apply field trial test to counties/cities first, and then spread across the nationwide

- **Species**
  - Hanwoo Milk Cow
  - Swine
  - Poultry

- **Locations**
  - Pyeongchang
  - Cheonan
  - Pig
  - Milk Cow
1. Decision-making on Crop & Distribution & Consumption

**Goal**
- Replace oversupplied crops with profitable introduced crops
- Support consumer choose agricultural products

**Field Application**
- Recommend profitable crops for each region by linking data on soil, climate and profitability
- Personalized healthy diet
- Research on the relation between food, health and genetic factors (with MOHW)
2. Support for Rural Community and Policies

Goal
Inspect farmers’ compliance of fertilizer use regarding direct payment policy

Policy support using drone, satellite
Check farm’s compliance and predict demand-supply using satellite

- Settle direct payment system by checking farms’ compliance of fertilizer use by crop
  * Connect the information on soil, farm management and fertilizer sale

- Develop an integrated hazardous substances management system
  * Hazardous materials: pesticide, heavy metal, food-poisoning bacteria

- Predict fallow/abandoned land and support new farmers with customized management model
IV. Key Achievements Of Digital Agriculture

Establish the foundation for promoting agriculture

Agricultural R&D integrated platform

- Combining agricultural and lab. Data R&D integrated platform
  - Expand/standardize data collection for major
    - Data collection (’21, 15item 300farm), group standard (’21, 5item)
  - Establishment of specialized data (’21, Aug.)
  - Building a digital lab. (’21, 20 sites)

Ag. AI service development and provision

- Developing a productivity model, service
  - Model for improving by factor analysis of excellent farm house, *tomato, strawberries, paprika, etc.*

- Effectiveness of smartfarm AI service
  - smartfarm (avg. 4.7ton/10a) vs. 6.0ton/10a product (28% ↑)
  - At 10a, 12thousand income increase (1.3ton10a increase)
    - The last 3 years (’18~’20) avg. wholesale price (9.5$/kg)

〈ag field data like as smartfarm〉 〈weather research facilities etc.〉 〈smartfarm guide service〉 〈smartfarm improvement model〉
IV. Key Achievements Of Digital Agriculture

Digital Agriculture Technology

Food dig. tec. reduces labor / increases convenience

- Drone utilization tec. to reduce labor costs:
  - (sowing) uniform spraying
  - (pest control) auto-driving and scattering reduction
    * efficiency: 0.25hr/ha, vs. power sprayer labor 87.5%, cost 95.3% down

- Remote irrigation control for labor saving and reduce the greenhouse gas
  - Irrigation monitoring, control for rice growth monitoring
  - Construction cost 50% ↓, labor saving 30%

- Development of auto driving rice transplanter and distribution
  - Location by CAN(RTK-GPS), steering, driving control
    * Labor saving and reduce personnel expense 50%
IV. Key Achievements Of Digital Agriculture .......................... Digital Agriculture Technology

Horticulture·livestock digital tec. to support and demand stabilization and realize localization

Crop prediction using dron·satellite
- Growth status and crop prediction using dron and satellite
  - Open field crop additional fertilizer recommendation
  - Agricultural land observation information system.
  - Cabbage cultivation area, growth abnormalities etc.
- Meteorological administration long-term weather forecast data
  - Probability outlook about temp. rainfall etc.

Milking robot
- Securing industrial property rights milking robot
  - Recognition of nipples, manipulator, cup etc.
- Digital milking system
  - Integrated management of the entire device of robot milking system.
  - Data sharing with RDA cloud

〈recommendation map〉  〈cabbage composition analysis〉  〈web. service〉

〈milking robot〉  〈milking cup〉
V. Implementation Plan

Cooperation system to create an ecosystem for digital innovation in agriculture

Build network with other government organization (e.g., MAFRA, MSIT) to promote digital agriculture

Cooperate with relevant government organization for data collection, connection and utilization for early establishment of agro-data ecosystem (production-distribution-consumption)
VI. Expected Outcome

**Farmer**
Transition from experience and intuition-based decision-making to Data-based Tech.

- Help ICT-savvy young or beginning farmers start new business and successfully settle in rural life
- Increase farmer’s income by enhancing productivity/quality and assisting marketing

Realizing sustainable agriculture - rural community by increasing convenience, productivity and income

**Consumer**

Promote Consumption through price stabilization & traceability system

- Contribute to stabilizing price by reducing price fluctuation of agricultural commodities (e.g., vegetables)
- Make reliable and trustworthy production and distribution system for agricultural products

Promote the consumption of domestic farm produce

**Corporate**

Innovate Technology by liking data on production, distribution & consumption

- Create new business model by opening and using agricultural data
- Create jobs to revitalize rural community

Promote the innovative growth of relevant industries by linking data in value chain
Thank you!!

Q & A

Rural Development Administration