Current state of Smart Agricultural Mechanization in the Republic of Korea

2022. 5. 27.
Current state of agriculture of Korea

- **Ratio of farm households (%):**
  - 20,189 thousand (total population)
  - 14,416 thousand (farm households) 71.4%
  - 51,745 thousand (population)
  - 2,215 thousand (farm) 4.3%

- **Avg. age of farmer:**
  - avg. age of workers 42.6 years
  - 2005: 61
  - 2010: 62.3
  - 2015: 65.6
  - 2019: 68.2

- **Ratio of 65 years old:**
  - based on the population 14.9%
  - 2005: 29.1%
  - 2010: 31.8%
  - 2015: 38.4%
  - 2021: 46.8%
# Smart Farm Promotional Strategy of Korea

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Securing global expansion capabilities through the development of Korean smart farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggestion</td>
<td>Improvement of farmhouse productivity and expansion of overseas markets by developing a global-level Korean style smart farm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP I</th>
<th>Development and distribution of Korean smart farm configuration modules (‘15~’16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP II</td>
<td>Advancement and commercialization of smart farm technology suitable for our soil and climate (‘16~’17)</td>
</tr>
<tr>
<td>STEP III</td>
<td>Entering and expanding the global market of Korean smart farms (‘17)</td>
</tr>
</tbody>
</table>
Smart Farm Innovation Valley of Korea

**Gimjae**
- **Size**: 21.3 ha
- **Crops**: Lettuce, Eggplant, Asparagus, Cucumber
- **Specialization Strategy**
  - Functional crops
  - ICT technology
  - New seed varieties

**Sangju**
- **Size**: 42.7 ha
- **Crops**: Strawberry, Tomato, Melon, Cucumber
- **Specialization Strategy**
  - Ag. Robot,
  - Pest research
  - Plant export

**Goheong**
- **Size**: 33 ha
- **Crops**: Strawberry, Tomato, Melon, Tangor
- **Specialization Strategy**
  - Subtropical crops
  - Korean Smart farm
  - Resident participation complex

**Milyang**
- **Size**: 22.1 ha
- **Crops**: Paprika, Tomato, Banana, Papaya
- **Specialization Strategy**
  - Nano industry integration
  - Export strategic items
  - Energy saving
Advanced unmanned automation demonstration complex (1/2)

Data flow

AI based Korean precision farming system (To-be)

Data Collection platform

Weather data

Measuring data (terrain, growth, cultivation)

Outdoor data

Sensing data of field

Water level, Temp.

Soil temp., humidity, EC, PH

Soil Moisture Sensors

Data flow

Working map
Protein
Yield
Nutrient
Soil topography

Store data by type

Big DATA / AI

Smart operation

- Tillage/transplanting
- Optimal path
- Harvest time
- Water management
- Fertilizer, pesticide
- Irrigation
- Vehicle

Portal service

Market place

Public Information system

Data governance (lifecycle management)

Tillage/transplanting /harvest plan

Optimal path

Harvest time

Water management

Fertilizer, pesticide

Irrigation

Vehicle

Working map
Protein
Yield
Nutrient
Soil topography

Automatic irrigation under weather info.

Optimum path, Variable rate application

Automatic transplanting, VRA

VRA Image collection

Moisture content, Protein, yield
Advanced unmanned automation demonstration complex (2/2)

1. **Intelligent platform**
   - Integrated control/decision making
   - Productivity improvement

2. **Unmanned automated agri. equipment**
   - Auto driving/control
   - Labor saving

3. **Build data foundation**
   - Standardization system
   - Intelligent data dam
   - Intelligence/automation/informatization

---

1. **Intelligence**
   - 통합관리
   - AI/빅데이터
   - Cloud

2. **Automation**
   - 방제 드론
   - 시비 드론
   - 농기계 관리
   - 자율 주행
   - 제초로봇

3. **Informatization**
   - 영상촬영
   - 수위센서
   - 생육측정 센서
   - 환경센서
   - 5G / LTE

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Advanced unmanned automation demonstration complex

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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

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(’19)

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) 2.75million →(’19) 2.25million
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

**Collection**

- 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**

- Standardization of agricultural research data & ICT devices
  - Standardized a registration form for research data on green-bio (with Ministry of Science & Technology)

  - Statistics (accumulative)
    - ('20) Standards of private sectors (SPS) 8 cases, Korean industrial standard (KS) 2 case → ('21) SPS 10, KS 4 cases

**Quality Management**

- Quality Management for the entire data lifecycle
  - Agricultural research services, technology centers operating a day for data management

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Agricultural data have various factors (weather, region, variety), so standardization and systematic management are important! The Government must play a proactive role.
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.dataplatform
      - Manager
      - Info. System
      - Farmer
      - IT developer
      - Public

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

- **Program 1 | Build data ecosystem for digital agriculture**

  - **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 bigdata 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.

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

**Regional hub**
- To promote local agricultural research services/technology centers as a regional hub for collecting and sharing data

[Diagram showing progression from 10 companies in 2021 to 30 companies in 2023 to 100 companies in 2025]
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*
  - Precision fertilizer recommendation and water management for each growth stage to improve productivity

- **Soybean**
  - Early warning service for abnormal weather

Apply field trial test to counties/cities first, and then spread across the nationwide
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)
### IV. Implementation Plan

<table>
<thead>
<tr>
<th>VISION</th>
<th>Implementation of World’s Best Digital Agriculture for Human</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOAL</td>
<td>Securing Agricultural Competitiveness and Sustainability through Digital Transformation of Agriculture</td>
</tr>
</tbody>
</table>
| DIRECTION | ➢ Digital Innovation of Agricultural Technology using Data and AI  
            ➢ Spread of Digital Agricultural Technology through Digital Ecosystem |

| KEY WORK | ① Smart Farm  
Development of Smart Farm Optimal Environment Control System  
② Open-field Precision Agriculture  
Development of an open-field precision farming system  
③ Agriculture Robot  
Autonomous mobile Machinery and agricultural robots  
④ Agricultural Weather Forecast  
Agricultural weather forecast and early warning service for meteorological disasters  
⑤ AI Pest Diagnosis  
AI Pest Diagnosis Service  
⑥ Smart Livestock  
Livestock management and disease early detection service  
⑦ Digital Breeding  
Construction of Data-based digital breeding system  
⑧ Agricultural Management  
Data-based agricultural management diagnosis service  
⑨ Rural Regeneration  
Development of digital-based rural space regeneration model  
⑩ Technical Consultation Chatbot  
Development of agricultural technology guide chatbot service |

| FOUNDATION CONSTRUCTION | ① Data construction for AI learning  
② Construction of digital agricultural infrastructure  
③ System improvement, Establishment of cooperation system  
④ Manpower training, Culture creation |
Digital Transformation of Korean Agriculture

Securing AI-based agricultural sustainability and leading future agriculture

<table>
<thead>
<tr>
<th>Agricultural Producer</th>
<th>Distribution / Consumer</th>
<th>Government / Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision production management</td>
<td>Sales/Distribution/Consumption</td>
<td>Policy/Corporate</td>
</tr>
<tr>
<td>• Smart farm environment management</td>
<td>• Agricultural products shipment adjustment</td>
<td>• Rural space regeneration</td>
</tr>
<tr>
<td>• Precision amniotic moisture management</td>
<td>• Agricultural management analysis</td>
<td>• Technical consultation chatbot</td>
</tr>
<tr>
<td>• Livestock breeding and disease management</td>
<td>• Promotion of agro-food consumption, etc.</td>
<td>• Agtech companies, etc.</td>
</tr>
<tr>
<td>Automation/Robots/Breeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Robots and autonomous machinery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Weather and pest diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• digital breeding</td>
<td></td>
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</tr>
</tbody>
</table>

Al-based agricultural decision-making support and related industries development

Agricultural Cloud Service Platform

- Image Processing
- Data Labeling
- Data Analysis
- Machine Learning
- AI Learning
- AI Diagnostics

- Optimal Environmental Control
- Growth Diagnosis
- Pest Detection
- Production Forecasting
- Decision Support

Agricultural AI

Ag. Bigdata Model

Construction of agricultural big data using satellites, robots, drones, etc.

<table>
<thead>
<tr>
<th>Environment / Management / Safety</th>
<th>Growth / Pest / Post-harvest management</th>
<th>Seed / Nutrition / Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Soil (tension, etc.), Weather (temperature, etc.)</td>
<td>• Crop growth (growth length, etc.)</td>
<td>• Varieties (climate), price (wholesale market,</td>
</tr>
<tr>
<td>• Safety (agricultural work, labor burden, etc.)</td>
<td>• Pests by crop (powdery mildew, etc.)</td>
<td>Food nutrition (food ingredients, etc.)</td>
</tr>
<tr>
<td>• Ag. business, Ag. product income</td>
<td>• Livestock specifications and diseases, etc.</td>
<td>• Agri-food consumption (Items, Amount, etc.)</td>
</tr>
</tbody>
</table>

Satellite Robot Drone Autonomous mobile Facility Sensor Camera
V. Expected Outcomes

**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 linking 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**
VI. Recommendations for other countries

1. Establishment of government-level basic plan
   - Divided into fields such as vegetables, food crops, fruit trees, and livestock etc.
   - Developing the necessary skills for each step for the approach

2. Creating a trial complex
   - Smart farm technology demonstration (equipment, sensor etc.)
   - Farmhouse education and test (pilot project)
   - (if necessary) rental business for a certain period