Enabling Factors for Universities as Key actors in Promoting Agricultural Production in the Republic of Korea

Webinar on Sustainable Agriculture in the Republic of Korea

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Outline

Enabling Factors for Universities as Key actors in Promoting Agricultural Production in the Republic of Korea

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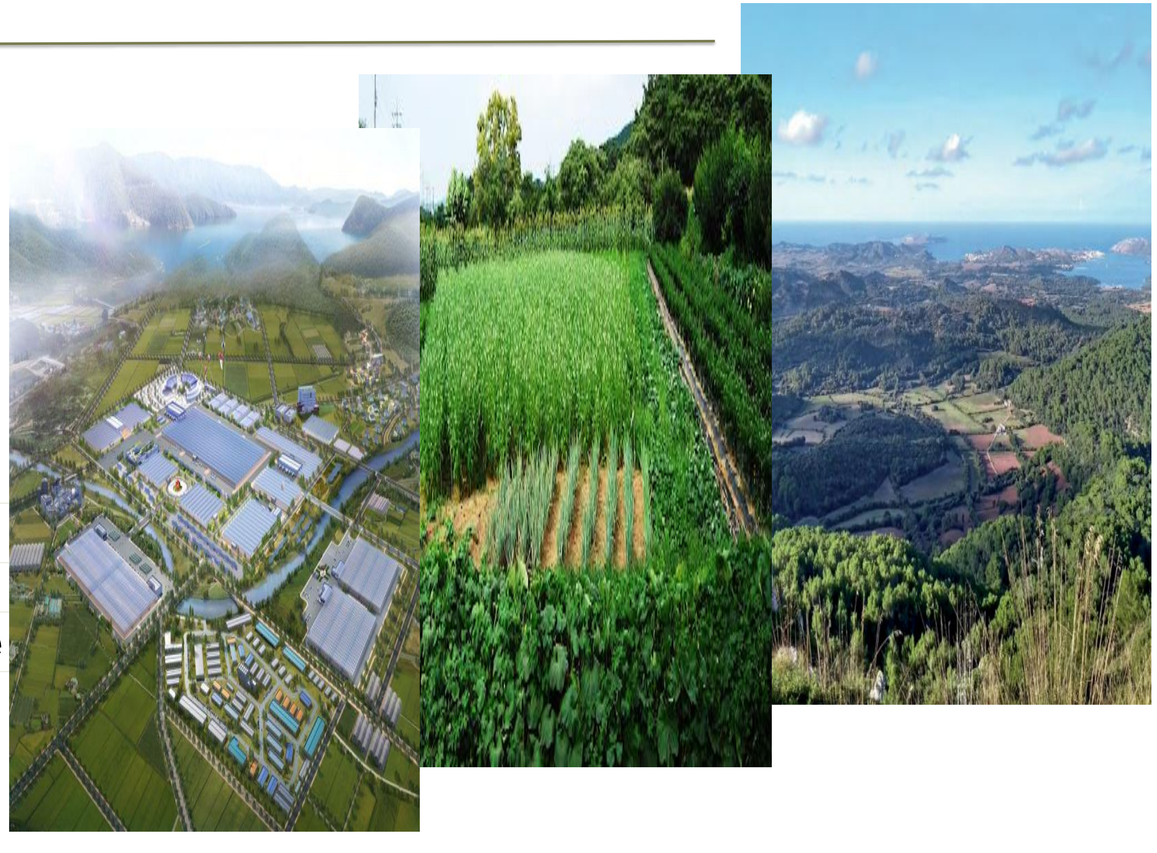
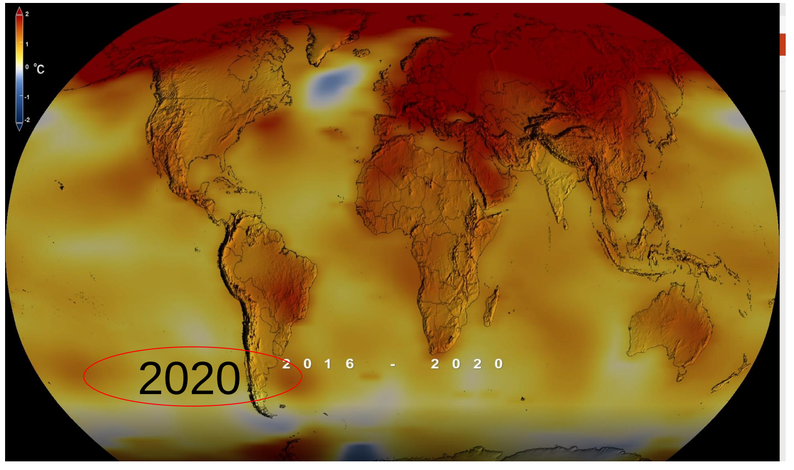


Why Promoting Agricultural Production?

NASA	✓ Global average temperatures have increased by **1.1 to 5.4** ^{o}C during last 100 years. ✓ Globally, hot days, hot nights, and heat waves have become more frequent.
IPCC	✓ **GHG** (CO_2, methane, nitrous oxide) increase, caused by fossil fuel use.
WMO	✓ **Precipitation** likely to increase in Global. globally averaged annual precipitation is **990** millimeters.
NOAA	✓ **Snow cover** is projected to contract. Melting ice causes more warming.
IPCC	✓ **Sea level** to rise to be **0.18 - 0.59** m.
Aggarwal et al.	✓ **Cereal productivity** to decrease by **10-40%** by 2100. ✓ Increased **droughts** and floods (13~20% people will face water shortage until 2025). ✓ increase **fertilizer requirement** for the same production



Note: 2020 was the second-warmest year on record, NASA and NOAA say

Figure 1,2. Global Temperature and Societal Challenges

Natural Variability impact on the Agricultural Sector

Natural Climate Variability

Changes in the agricultural climate resources (temperature, precipitation, sunlight, etc.)

Arable/Livestock Sector

Change in agricultural production
- ✓ Biological changes (blooming season, earing season)
- ✓ Quality change
- ✓ Change of areas suitable for cultivation

Changes in ecosystem
- ✓ Blights and pest
- ✓ Population migration
- ✓ Change in biodiversity

Changes in livestock production
- ✓ Biological changes (fertilization, breeding)
- ✓ Change in pasture production

Hydrology Sector
- ✓ Underground water (level, temperature)
- ✓ River flow
- ✓ Water quality of lake es and marshes, etc.

Change in productivity Change in asset value

Change in the agricultural system

Change in available water

Change in the agricultural infrastructure

- ✓ Decrease in stability of water supply
- ✓ Decrease in efficiency of water supply

Figure 3: Flow of the climate change impact on the agricultural sector
Source: Kim, Chang-Gil and et al. (2009), p.36.

Green Revolution
- ✓ Introduction of High yielding variety (HYV) of seeds.
- ✓ Increased use of fertilizer.
- ✓ Multiple Irrigation methods.

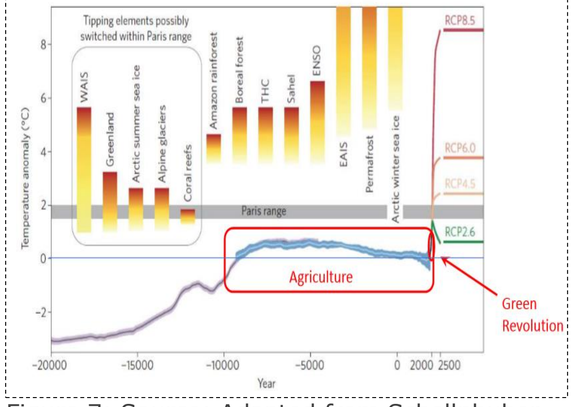
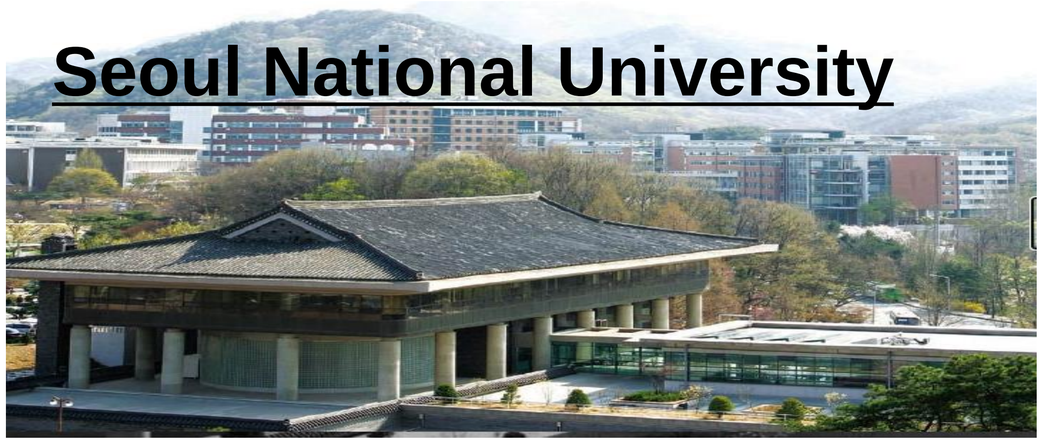


Figure 7: Source: Adapted from Schellnhuber et al. (Nature Climate Change, 2016)

Agricultural Research Institutes in Korea (Streamlined)

- The Republic of Korea has **203** universities and **136** community colleges.
- 19.9 % of GDP comes from the agricultural sector one of the most important sectors of the Korea economy
- **Literacy Rate 2008-2021 (97.97%)**



Seoul National University

15 Colleges, **12** Professional Graduate Schools

1,558 Professors,
406 Associate Professors and **3,569** other professors

27,784 Enrolled Students,
342 International Exchange Students and **3,252** other students

5,118,423 Books, **262,369** Periodicals & Newspapers and
229,931 Non-book Materials

27	5,533	31,378	5,610,723
Colleges & Schools	Faculty	Students	Library Holdings

Figure 4. Seoul National University

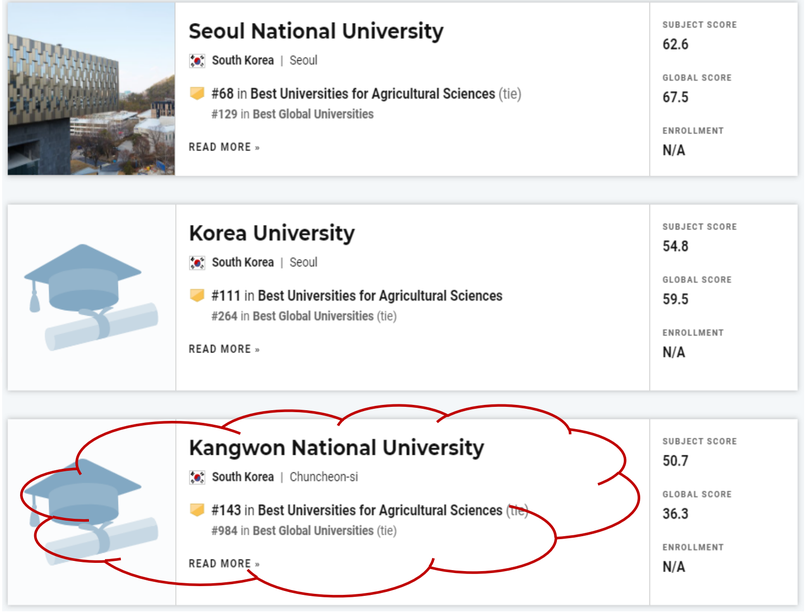


Figure 5: Best Global Universities for Agricultural Sciences in South Korea(https://www.usnews.com/education/best-global-universities/south-korea/agricultural-sciences)

Role of Agricultural Economics Research

Goal for the Agriculture Sector:

- ✓ Competitive in the Ag Sector
- ✓ Provide Health and Well-being of citizens
- ✓ **Sustainability of the Natural Resources**

Figure 6. Role of Agricultural Economics Research

How to get there using Ag Economics Research:

- ✓ **Human capacity building** using economic principles and tools to conduct research
- ✓ **Disseminating** research and policy publications

KNU Land Grant (Public) University Model

Fundamental principles:

- ✓ Accessibility of higher education
- ✓ Practical, relevant and useful education
- ✓ Research for the public interest
- ✓ Connectedness to ALL the people

Figure 7. This is the campus map of Kangwon National University

Brain Korea 21 FOUR(Fostering Outstanding Universities for Research) Program

- ✓ To support graduate students' research to foster world-class research centered universities

Functional spirit of public universities*

Functional spirit of public universities*

*remarks by W.J. Kerr, president of Oregon State University

1. The spirit of initiative—Pioneering;
2. The spirit of growth—Progress;
3. The spirit of equal opportunity for all— Democracy; and
4. The spirit of helpfulness—Service

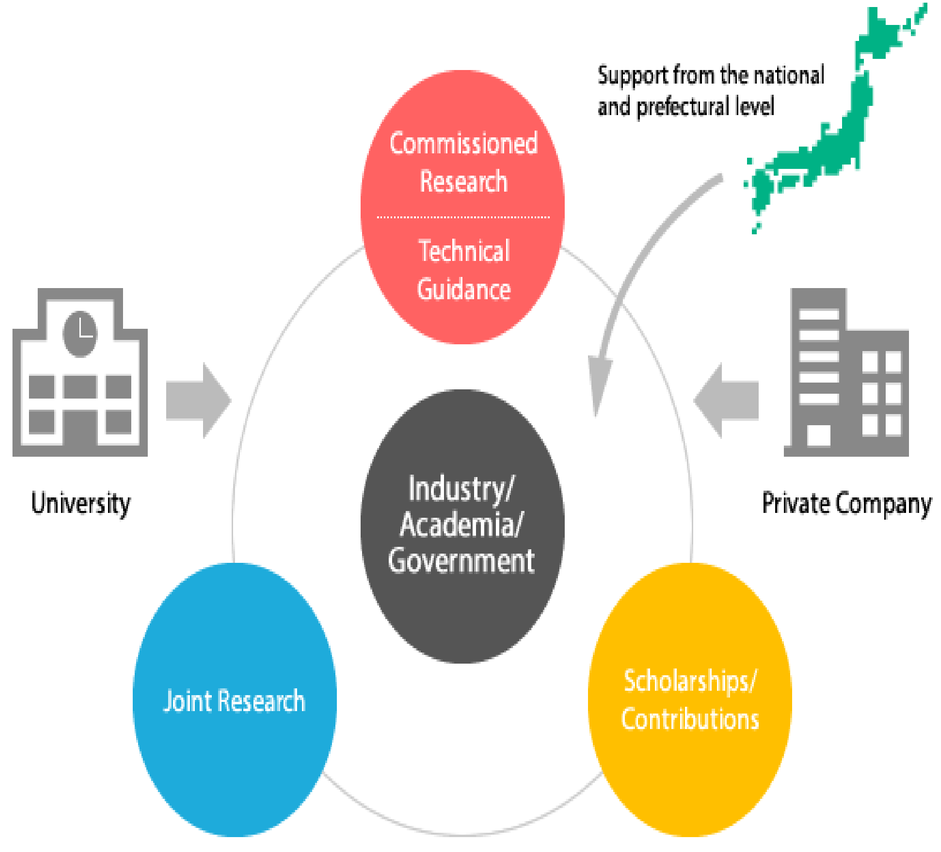


Figure 8. University research labs are the source of innovation that powers industry.

Land Grant Funding Model

❖ **Private**

Tuition, competitive grants, trade associations, business, foundation

❖ **Federal**

Formula and competitive funds for relevant basic and applied research and outreach activities

❖ **State and local governments**

Area	Vision	Mission	SDGs
Education	Inclusive development through quality education	To ensure rights to education for all by strengthening education systems in partner countries and encouraging the participation of diverse stakeholders	
Health	Ensuring healthy life and dignity for all	To contribute to the achievement of universal health objectives by improving access to quality health and medical services and care for all	
Governance	Effective and inclusive governance	To contribute to sustainable development and poverty reduction through the support of developing a system based on responsibility, inclusiveness and effectiveness	
Agriculture & Rural Development	Securing the comprehensive well-being for rural people	To contribute to the enhancement of the quality for all through the inclusive and sustainable rural and sustainable development	
Water	Water as a natural right	Contributing to sustainable development and the strengthened resilience of developing countries through reliable water supply, more efficient use of water and climate change-caused disaster risk reduction	
Transportation	Connecting people and driving the economy forward	To promote inclusive growth by assisting partner countries to lay a sustainable transport system	
Energy	Promoting sustainable development through energy	Contributing to CO_2 reduction through sustainable energy and realizing inclusive growth	
Gender Equality	Society with gender equality and women's dignity	Contributing to accomplish gender equality and sustainable development of the international society, based on the SDG's spirit of equity and universality	
Climate Change Response	Improving the quality of life in developing countries	Contributing to building capacity for the climate change response of developing countries	
Science, Technology and Innovation (STI)	Mobilizing an innovation-based economy that developing countries can facilitate through their own efforts	To support securing future growth engines for developing countries based on STI	

Figure 9. Korea Sectoral Strategies to the **SDGs.**

Enabling Factors by Agricultural Universities

Improvement of societal welfare through agricultural activities:

- ✓ Traditional knowledge
- ✓ Agricultural education evolved to include research and extension
- ✓ Peer-to-Peer
- ✓ Vocational Training
- ✓ **New technologies and innovation**

Figure 10. College Of Agriculture And Life Sciences Kangwon National University

✓ **The ultimate goal:** seamless integration of research, teaching and extension.

Objectives Promoting Agricultural Production

Overall Objective

- ✓ **Stimulate the economy of the country by getting rural and towns involved in promoting agricultural products.**
- ✓ **Work with agricultural groups to help them keep their production in line with new food trends, and teach them the principles of rural micro entrepreneurship.**
- ✓ **Ensure access, availability and stability of local agricultural products on markets.**
- ✓ **Get local authorities to help promote the idea of consuming locally, and help the country build its capacities through NbS with regard to sustainable development.**
- ✓ **Carry out studies and research on local foods and related economic sectors.**

Problems of Promoting Agricultural Production

Common

✓**Soil Erosion& Climate change** → **Drought**

Specific Problems

✓**Agriculture production specifically the major crops has been hampered from Climate Change.**

✓**Due to this seasonal variation of climate change, there has been decline on the agricultural production that has rain fed dependency.**

✓**A shrinking number of farm labors**

✓**Aging rural population (HR)**

✓**The weakening of the Korean domestic farm market**

Figure 11&12. Drought and flood Threats to human health and well being

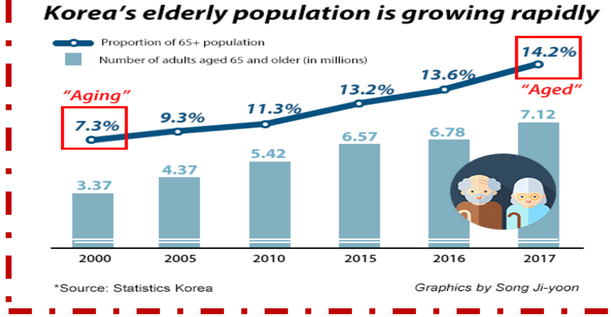


Figure 13. Korea's aging population

Korean Traditional Knowledge by Universities

- ✓ **Provides free internet search service**
- ✓ KJTK(Scholarly Article), Traditional Oriental Medicine, **Agricultural life**

Agriculture Field

- ✓ **Agricultural technique used in traditional society**
- ✓ Description for traditional cultivating method and evaluation notes for the expected value
- ✓ To link scholarly articles, patents related to agriculture
- ✓ **http://www.koreantk.com**

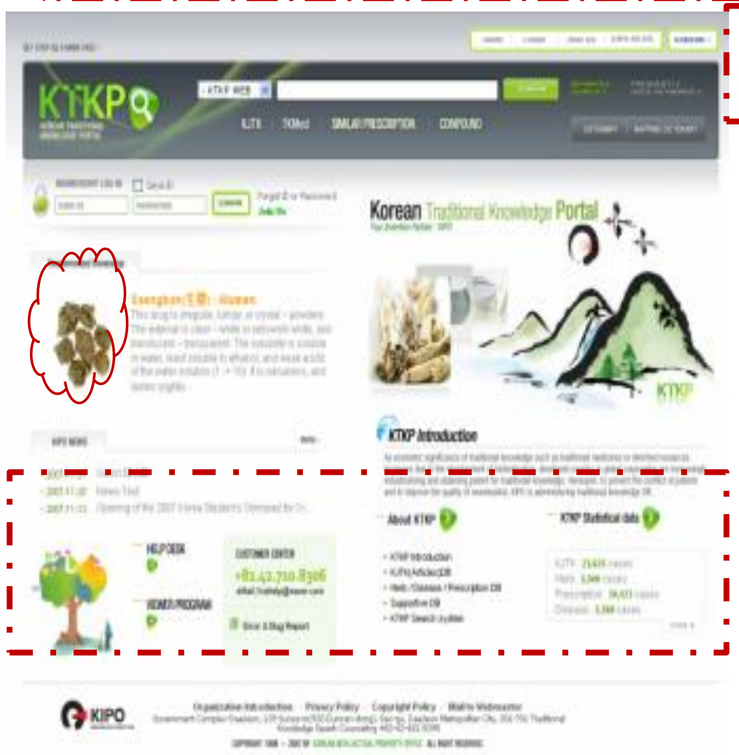


Figure 16. Ecosystem and Agriculture information

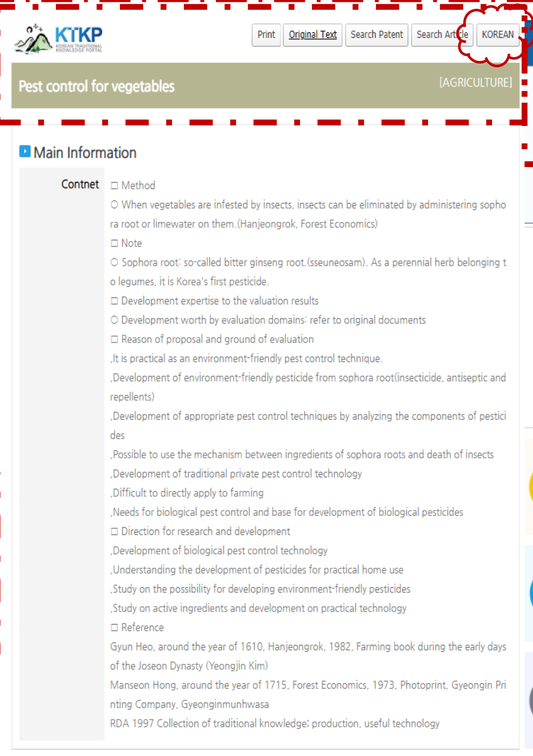


Figure 15. Pest Control for Agriculture

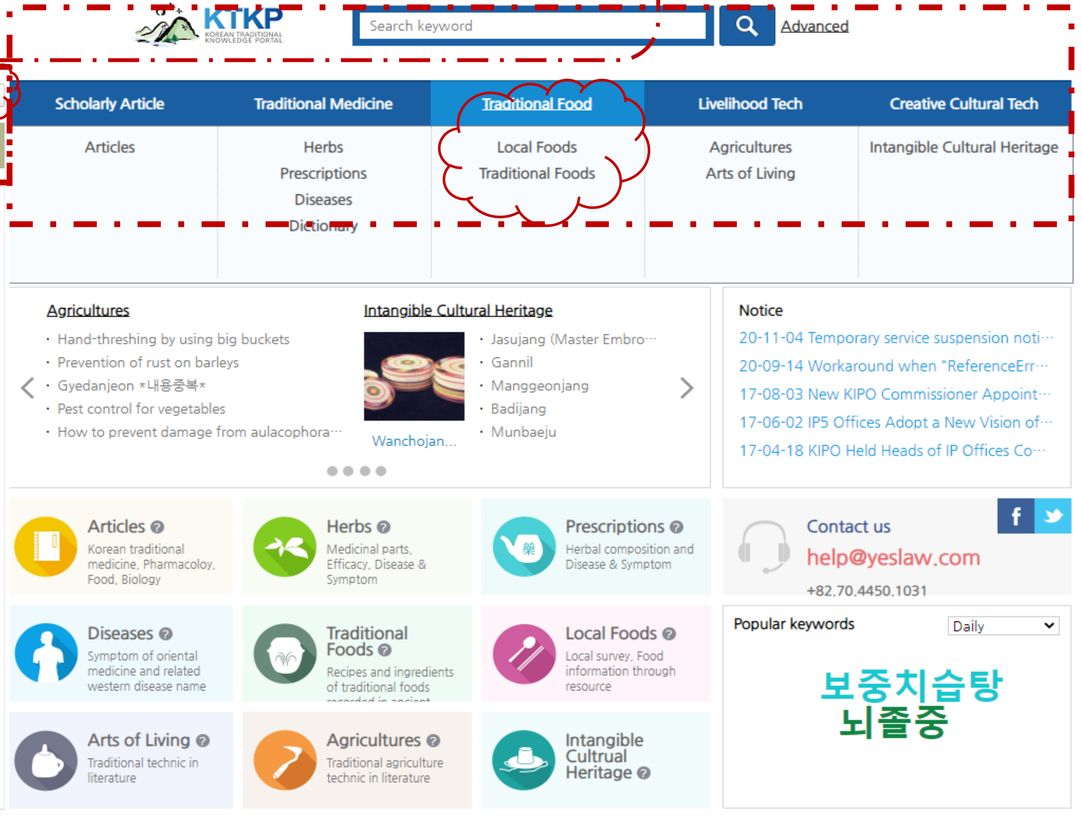


Figure 14. Korean Traditional Knowledge Portal

Agricultural education by Universities

Agricultural education in Korea is delivered through three interconnected components:

- ✓ **Classroom or laboratory instruction**
- ✓ **Experiential learning**
- ✓ **Leadership education**

Figure 17. Learning experiences take place outside of the classroom, supervised by the agriculture instructor

ER	Ecological Restoration
EE	Ecological Engineering
FLR	Forest Landscape Restoration
GI	Green Infrastructure
NI	Natural Infrastructure
EbMgt	Ecosystem-based Management
EbA	Ecosystem-based Adaptation
EbM	Ecosystem-based Mitigation
Eco-DRR	Ecosystem-based Disaster Risk Reduction
CAS	Climate Adaptation Services
AbC	Area-based Conservation

Figure 18. NbS Concepts and topics taught at Korean universities

Figure 1. Delivered through student organizations such as the National FFA Organization, the National Young Farmer Education Association, National Postsecondary Agricultural Student Organization and others.

Peer-to-Peer advisory by Universities

❖ **Combining local and scientific knowledge, they put resilience thinking into practice to feed growing populations and cope with climate change, water scarcity, market volatility, and more.**

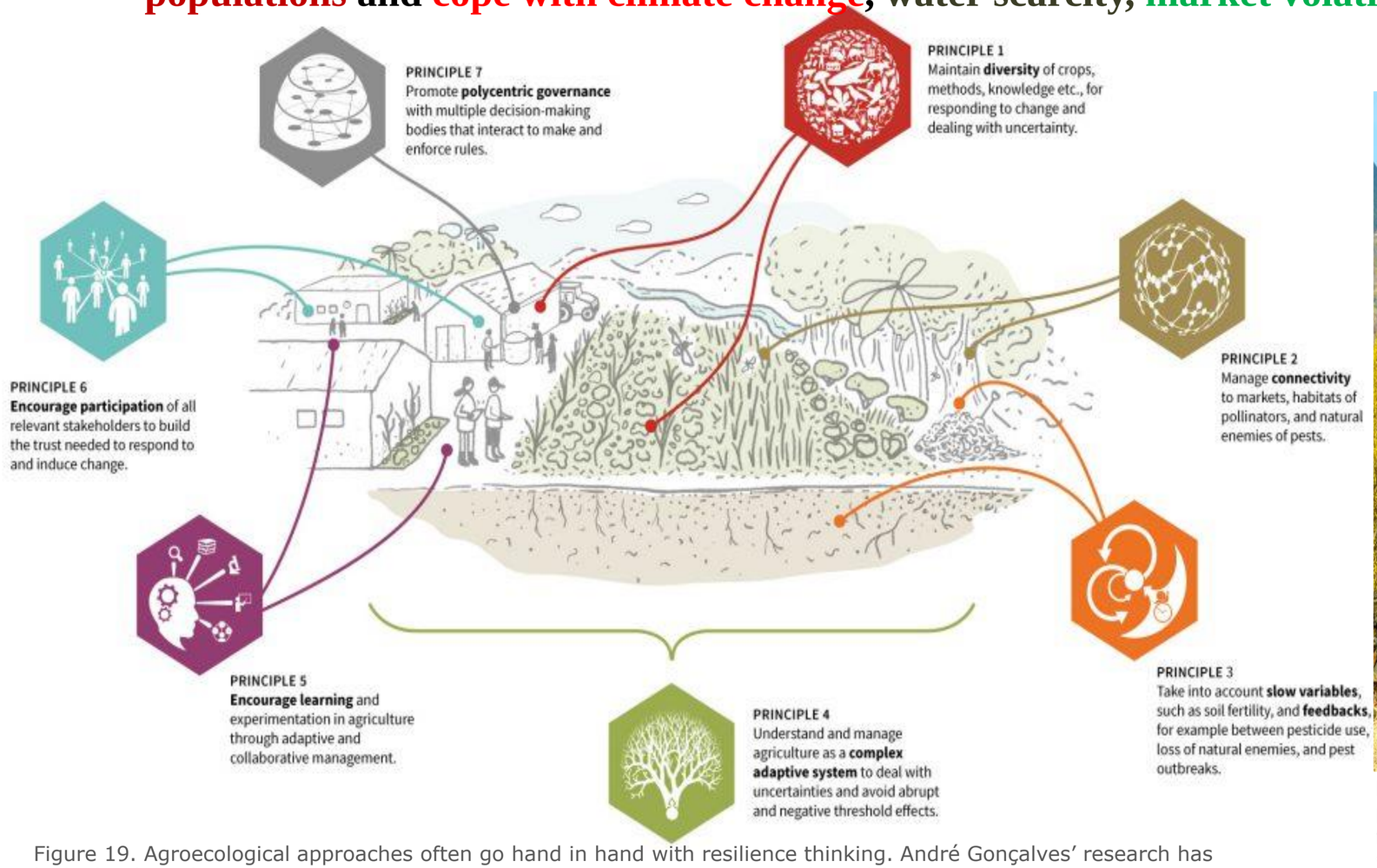


Figure 19. Agroecological approaches often go hand in hand with resilience thinking. André Gonçalves' research has looked at how the seven resilience principles manifest in practice in agroecological farming. Illustration: E. Wikander/Azote

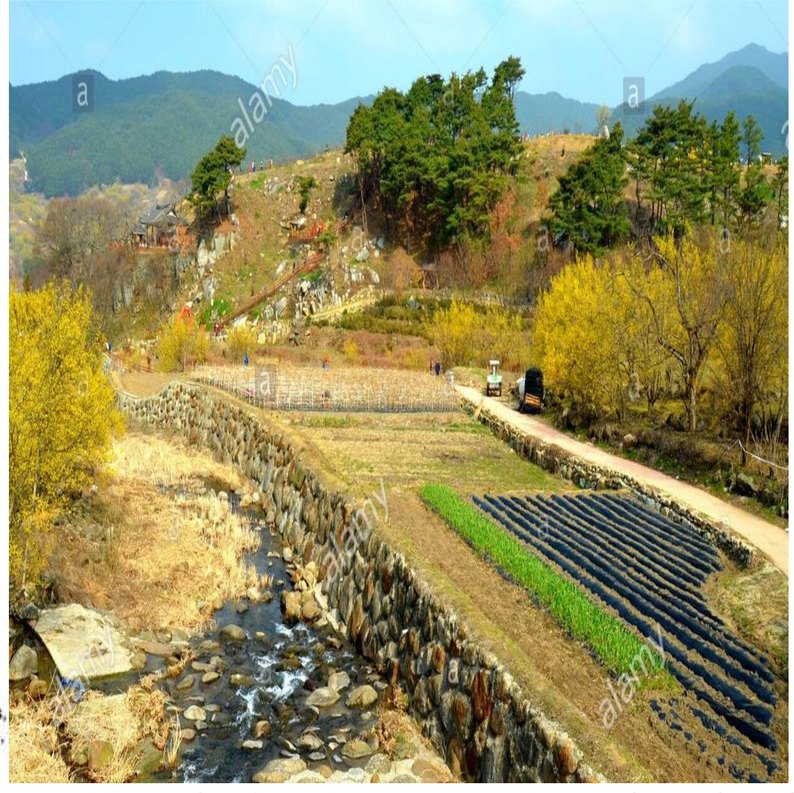


Figure 20. Agroforestry systems mix crops, trees and animals, and provide resilience by e.g. strengthening ecological connectivity with forest fragments, maintaining biodiversity and managing slow variables like soil fertility and water quality

Vocational Training by Universities

- Vocational agriculture trains people for jobs in **production**, **marketing,** and **conservation.**
- **Involves training of people to teach or conduct research in order to advance the fields of agriculture and food science.**

Figure 21. Above this, there are more environmental risks and opportunities surrounding the Korea agriculture.

Figure 22. Activities of 'Hope Village'

Figure 23. Activities of 'Hope Village'

Hope soil Village is doing those four activities.

1. Hope soil Village is meeting every Thursday in Kyungpook national university.

2. In spring and fall they donate the crop the community society.

3. They make cup-garden using reusable coffee cup to advertise urban agriculture.

4. To teach children how to cultivate the garden, they do the teaching volunteering in

every Monday.

New technologies and innovation by Universities

❖ **A case study of the local university–industry environment was conducted, and the evaluation showed that there is a positive correlation innovation networks and living lab structures.**

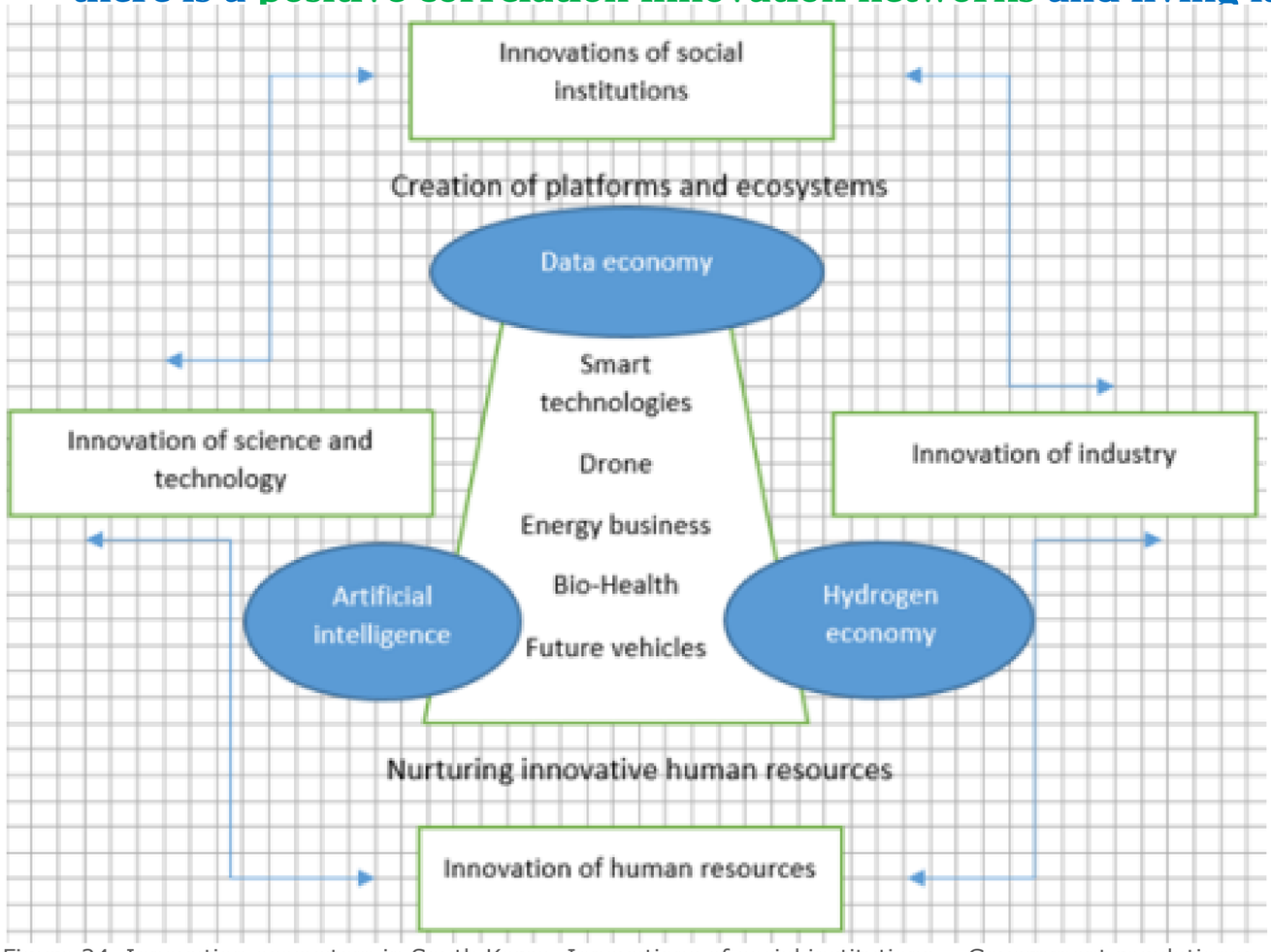


Figure 24. Innovation ecosystem in South Korea. Innovations of social institutions = Government regulations; smart technologies/drone/etc. = start-up projects. Source: Olga A. Shvetsova

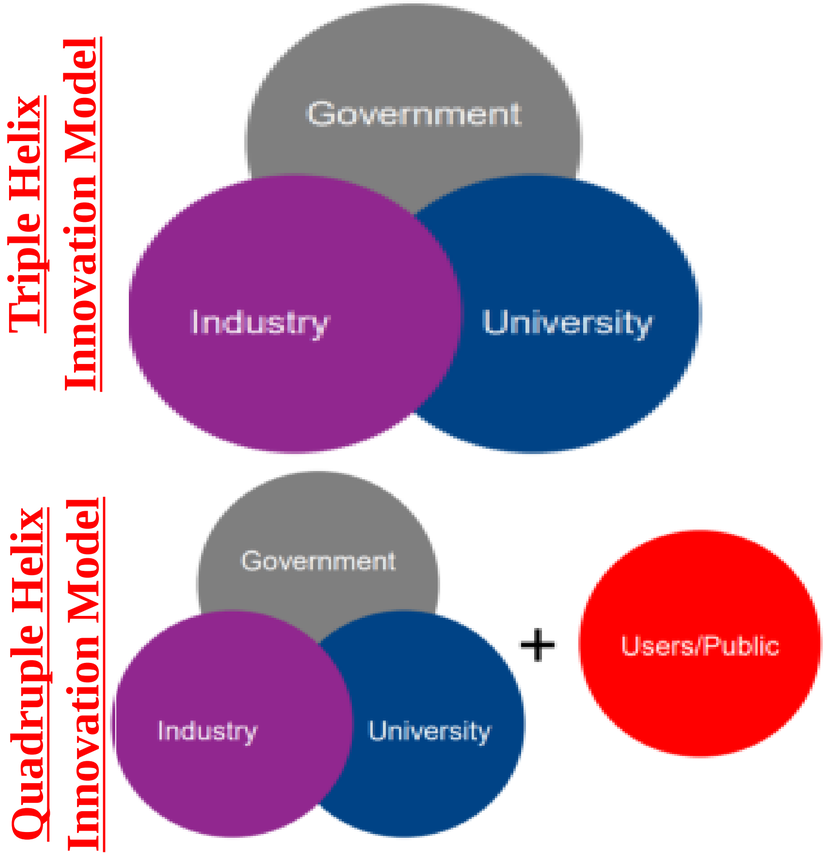


Figure 25. Types of innovation model. Adapted from source: Galvao et al and Leydesdorff

Case Studies: Nature-based Solutions Initiative universities of Korea

The Adaptation of Forest Ecosystems and Forestry to Sustainable Agriculture Production

CASE STUDIE 1

Sustainable land, forestry and biodiversity management

NbS concepts used:

- Ecosystem restoration
- Forest management
- Sustainable land use Planning

Location:

- Town of Geumsan in Chungcheongnam Province, Korea

Ecosystem type:

- Forest

Summary:

- Sustainable land and natural resources management from biophysical, socioeconomic and cultural interventions.
- It's a traditional Korean landscape management techniques, it uses ecotones transition areas between different types of landscapes conservation agriculture, and Confucian principles.
- Using rice straw after the grain harvest as ground cover and crop protection to prevent the growth of weeds and retain soil moisture during drought.
- Rice farming has adapted using the biodiverse hill forests to its advantage in a symbiotic relationship: the forests serve as green walls and windbreaks, controlling sun and wind exposure for the crop to grow to optimum yields.

Figure 26. Ginseng covered by protective black cloth structures while red pepper is planted to its right, and organic rice fields below.

Case Studies: Nature-based Solutions Initiative universities of Korea

The Adaptation of Forest Ecosystems and Forestry to Sustainable Agriculture Production

CASE STUDIE 2

Enhancing soil fertility and agricultural productivity

NbS concepts used:
- **Resilient food production**
- **Enhancing Nature And Biodiversity**
- **Sustainable land sue Planning**

Location:
- **Combination of Korean Traditional Farming, Korea**

Ecosystem type:
- **Forest**

Summary:

- **Developing Korean farming ethic combining intercropping, multi-cro pping, crop rotation, and resting periods, all rolled into one dynamic s ystem.**
- **They play shifting roles of fixing nitrogen, maintaining the soil's orga nic carbon matter, balancing microbes, feeding decomposers, and rec overing soil fertility.**
- **Preventing land degradation with a nature-based method, using bryo phytes (hair moss and liverworts), which promote soil decomposition and are planted around the roots of certain crops to prevent soil slopi ng and boost soil health and water retention.**
- **Restoring traditional Korean knowledge of soil nutrients and food fer mentation techniques by lab to create natural fertilizer and pesticide.**

Figure 27. Rice is the most valuable crop in South Korea and is water intensive.

Case Studies: Nature-based Solutions Initiative universities of Korea

The Adaptation of Forest Ecosystems and Forestry to Sustainable Agriculture Production

CASE STUDIE 3

Water management to respond to desertification

NbS concepts used:

- **Ecosystem restoration**
- **Forestry and Land use**
- **Sustainable Agriculture**

Location

- **Island of Cheongsando, Korea**

Ecosystem type

- **Forest**

Summary:

- **The gudeuljang terraces represent a land reclamation and food security strategy using endemic rice varieties and maximizing the use of land without adverse effects on the surrounding environment.**
- **Korea experience regular floods during the monsoon. Here, universities with the help of Local People have developed an agroforestry system over a period of 1,200 years through planting and cultivating.**
- **Now long adapted to the ecosystem, the trees themselves serve as barriers to the flooding of villages.**

Figure 28. Farming field with rice planted on the left, rows of crops on the right and farming slots surrounding them using green manure crops to rejuvenate the soil.

Case Studies: Nature-based Solutions Initiative universities of Korea

The Adaptation of Forest Ecosystems and Forestry to Sustainable Agriculture Production

CASE STUDIE 4

Incentivizing farming

NbS concepts used:
- Enhancing Nature And Biodiversity
- Mitigating Climate Change
- Sustainable Agriculture

Location
- Seoul's Sangdo Station, Korea

Ecosystem type
- Forest

Summary:

- Based on the crop cultivation data and environmental data, create the optimum cultivation environment to improve productivity and qualit y of agricultural goods with less use of labor, energy and fertilization.
- A key future growth engine to create jobs and optimize cultivating en vironments for crops to adapt to climate change and improve agricult ural productivity.
- Revitalizing rural areas and incentivizing youths to enter farming is a lso part of efforts to encourage and pass down sustainable and traditi onal farming practices.

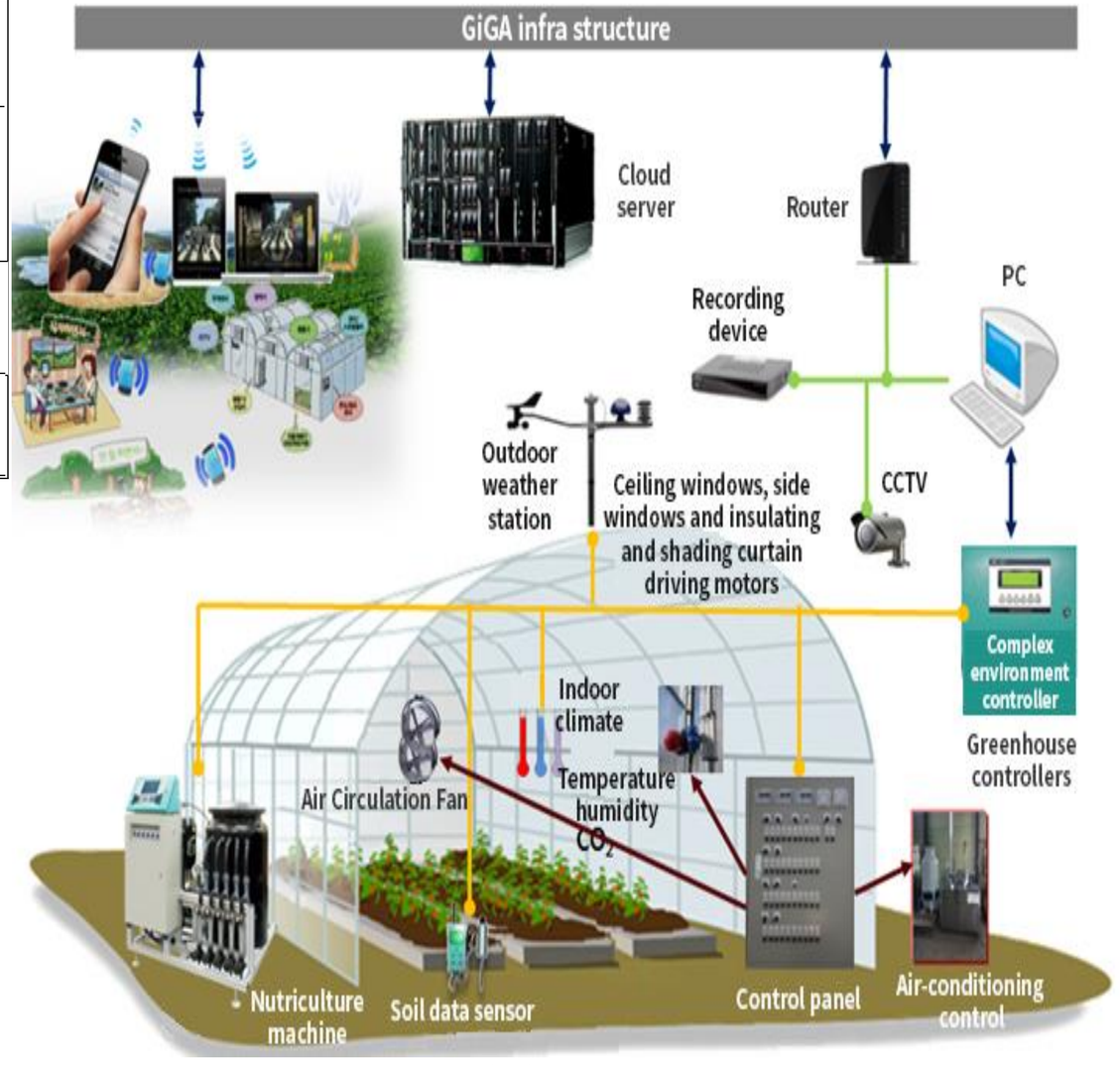


Figure 29. Smart Farm Dispersion Method.

Case Studies: Nature-based Solutions Initiative universities of Korea

The Adaptation of Forest Ecosystems and Forestry to Sustainable Agriculture Production

CASE STUDIE 5

Grassroots initiatives

NbS concepts used:

- **Inspiration and an initial approach in Nature and Biodiversity**
- **Adaptation and Mitigating Climate Change**

Location

- **Milmeori the Geumsan Gandhi Farm School in Geumsan county, Korea**

Ecosystem type

- **Forest**

Summary:

- **These are boarding school programs that bring youths from cities to experience the countryside, learn Korean organic farming, and cook plant-rich dishes from their harvests.**
- **At Geumsan Gandhi School, teachers help urban students develop their own rural enterprises, organizations or trades through their guilds**
- **This is strengthened by the school's farming class, where students learn about sustainable Korean organic farming practices and are encouraged to embark on it as a valued pathway.**

Figure 30. Shin Seong Gi of Geumsan Gandhi School preparing a field with students to cultivate cabbage and radish during organic farming class..

Looking Forward

- ✓ **Strong potential role for land grant type public institutions**
- ✓ **Provide technology** and **education program** and **socioeconomic information**
- ✓ Provide outreach to **industry** in coordination with extension
- ✓ Provide **infrastructure for reward** for excellence in research

Also a role for the government:

- ✓ **Stimulate**, **assist**, and **coordinate** a nationwide network of **regional**, **state**, and **local programs** for **technology development** and **industrial extension**
- ✓ Provide **funding for training**, **research** and **policy implementation**

Concluding Remark

- Global climate change is not a new phenomenon. The effect of climate change poses many threats; one of the important consequences are bringing about changes in the quality , quantity water resources and crop productivity.
- Agriculture in Korea is a blend of centuries-old traditions and contemporary techniques adapted to a variety of environmental conditions, making it a model to adopt in the effort to future-proof food production against climate change.
- With its emphasis on making the most of local conditions, prioritizing native crops, maximizing the use of organic inputs while minimizing waste, Korea universities offers templates for Nature-based Solutions.
- Universities and local support of farmer's livelihoods, revitalizing rural areas and incentivizing youth to enter farming are also ongoing efforts to help guarantee the generational sustainability of agriculture.
- All researches show that protecting nature is more economically advantageous than exploring it.

THANK YOU

감사합니다

This Presentation is in cooperation with:
Prof. Eun-Mi Hong
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Agricultural producers have a critical role in implementing NbS!