



# SMART FARMING

## The Convergence of Traditional Agriculture with ICT

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**ETRI**



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# Background



# It's a "Smart Farm"

- ❖ According to the FAO(the farming and agricultural organization of United Nation)
  - a number of effects of climate change on agriculture
  - strongly recommended that all farming sectors equipped with innovative tools and digital technologies to counter the climate changes which can reduce crop yields.

FAO and the Sustainable Development Goals





# It's a "Smart Farm"

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## ❖ The future of agriculture

- a convergence of the agriculture and the ICT technologies such as computer science, mobile communication and Artificial intelligences.
- increase the quality and quantity of agricultural production by sensing and monitoring automatically even intelligently. Consequently, we don't need to rely on the farmer's guess or experiences for the best time to plant or harvest
- forecasting the crop yields is also possible for farmers to make a decision when and how much crop to harvest, resulting the best financial returns

## ❖ In globally, nowadays fresh, healthy and organic food is highly demanding



# It's a "Smart Farm"

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## ❖ Less dependence on environment

- For the steady production of high-quality vegetables all year round by artificially controlling
- To control the facilities promoting the optimal growth environments by collecting information for the growth management of crops

## ❖ Automatic Optimization of environment for crops growth

- Gathering environment information from various sensors and providing appropriate control functions using various actuators
- Optimizing indoor parameters(light, temperature, humidity, and CO2 density as well as outdoor temperature, sun light, wind and rain)
- Controlling actuators(roof vents, side vents, shading screen, cooler, heater, supplemental light, CO2 generator, water supply, irrigation)



# As-Is vs. To-Be of Farm

## As-Is

### ❖ High price & maintenance cost due to discontinuity

- Labor intensive agriculture
- Import foreign products
- Divided know-how by companies and farms
- Insufficient inter-operability
- Stand alone, absence of a common platform
- Absence of growth data based on big data

## To-Be

### ❖ Low cost farming through connected platform

- All facilities farm
- Sharing growth data based on agricultural knowledge
- Real time monitoring and control by providing an open platform
- Automation and standardization of environmental controller
- Sharing information and knowledge between farmers



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# Smart Farm Technology





# Technologies for Smart Farm

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## ❖ IOT, internet of things

- Useful and powerful for connecting all the information from the field
- Farmers with integrated view of activities and intelligent farming
- Controlling the environment for the best condition

## ❖ Big-Data

- Collecting and managing the data from vast amounts of sensors
- Data analysis for the best timing and best condition to maximize the agricultural production

## ❖ Integrated Management System

- S/W platform to operate “Smart Farm System”

## ❖ Sensor technology

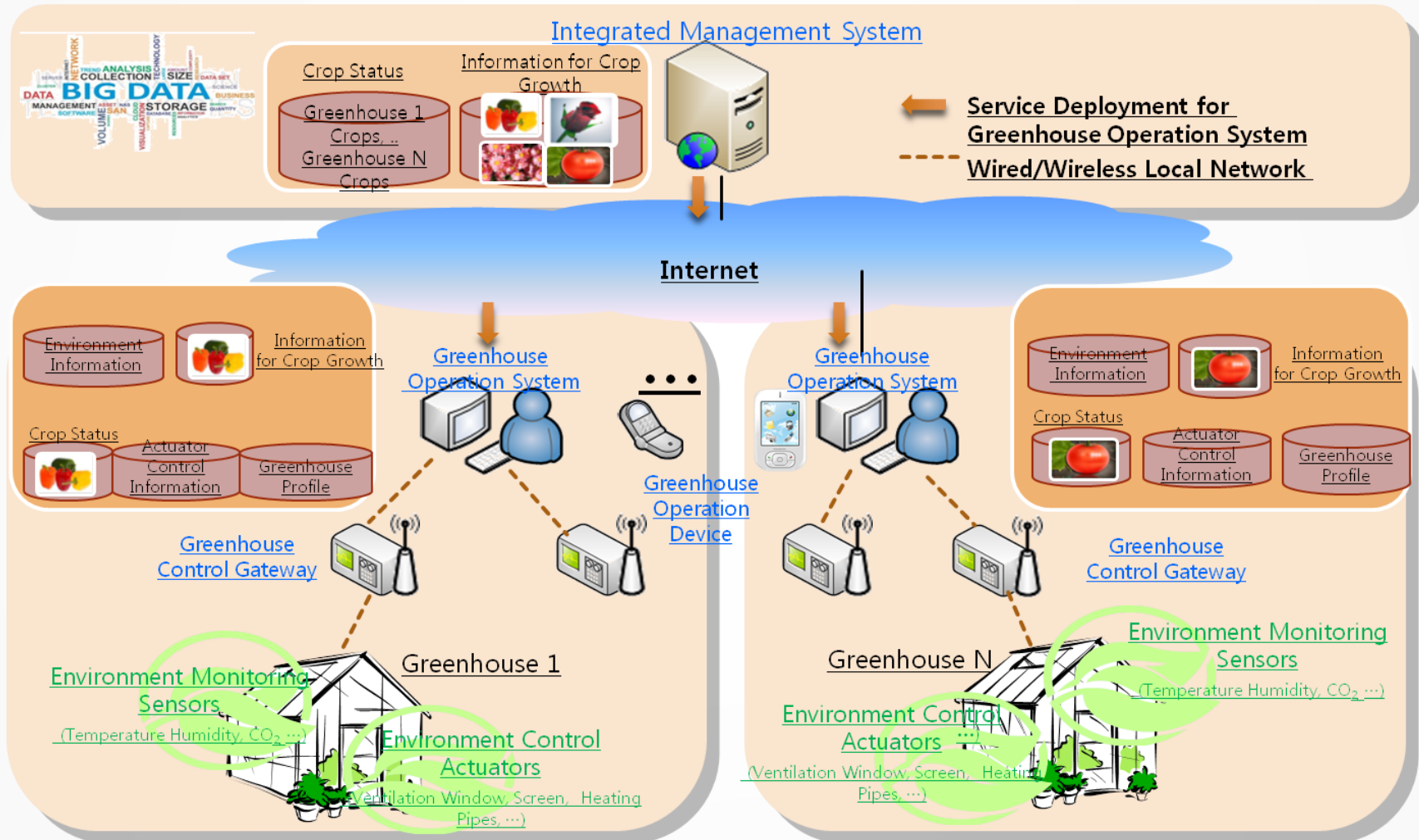
## ❖ Farming Equipment

- Irrigation
- Fertilizer supplier

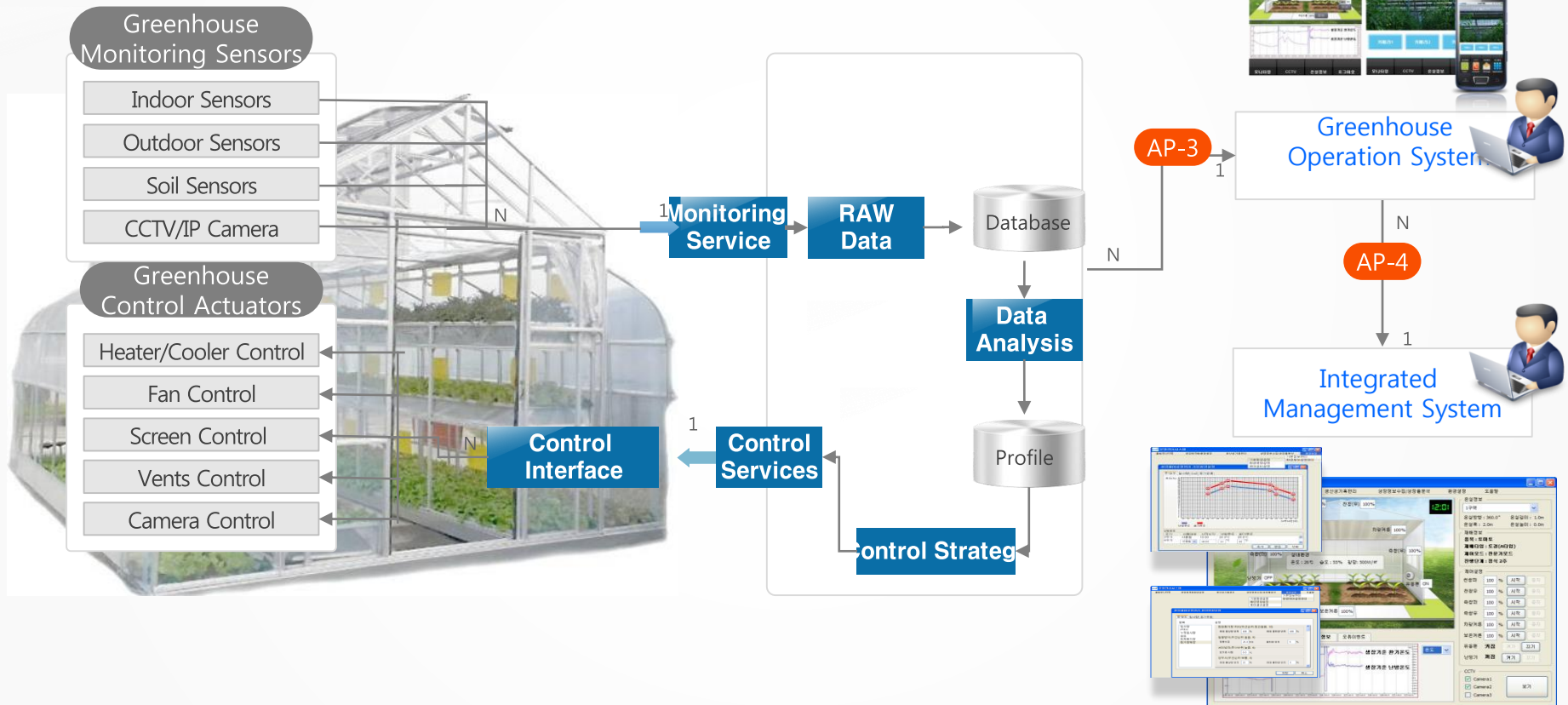
# Smart Farm Technology



# Smart Farm Technology



# Smart Farm Configuration





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# Project Study

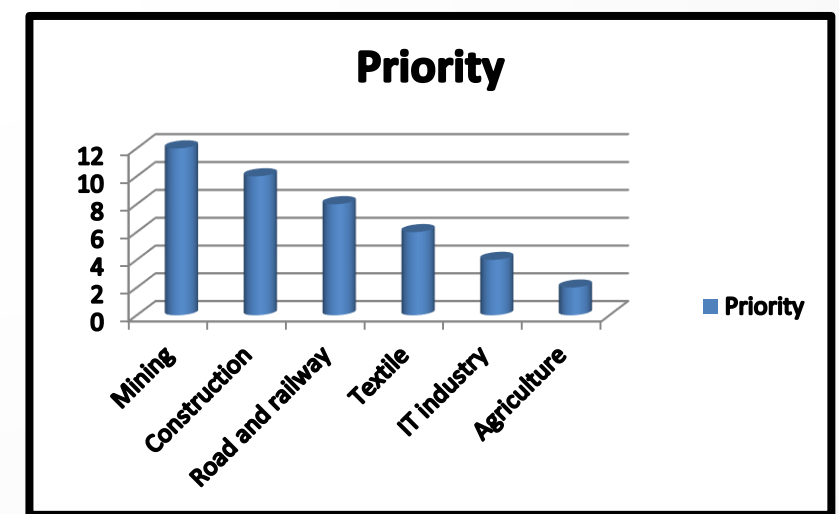
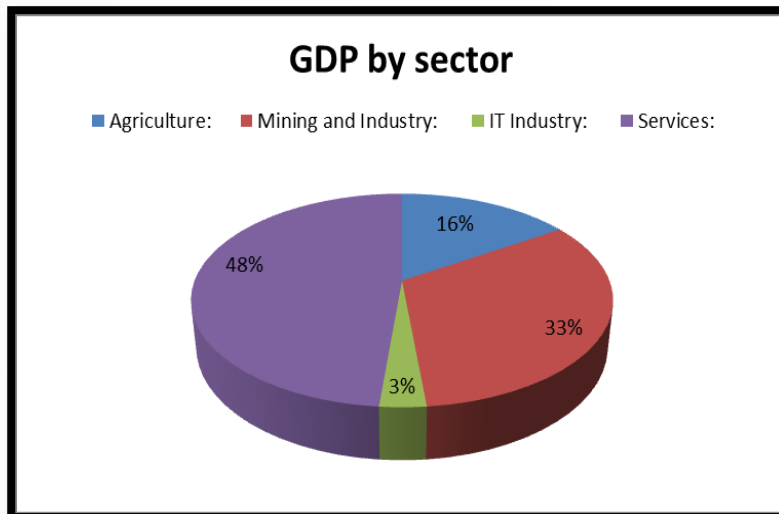
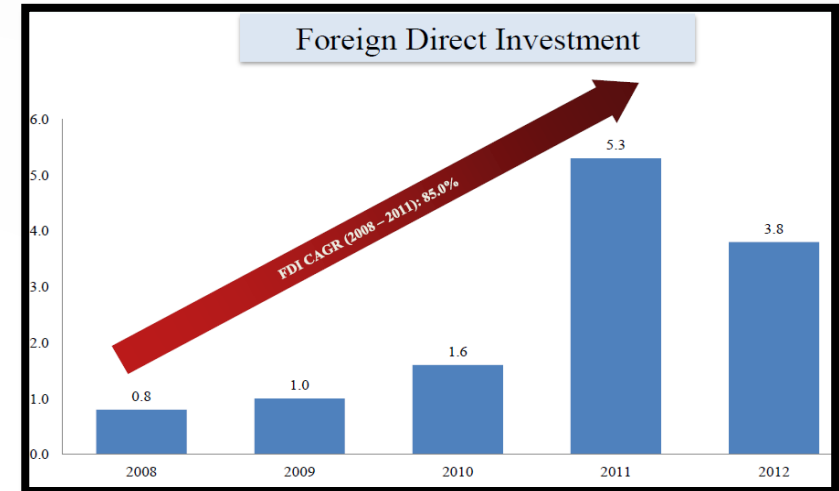
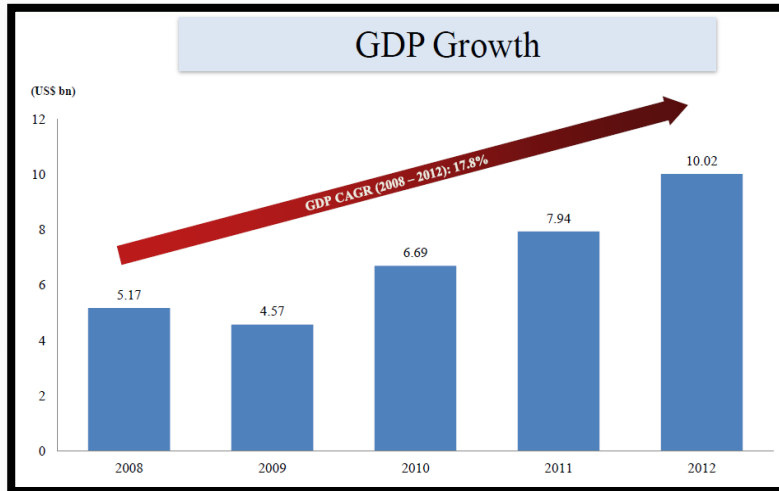
## Smart Farming in Mongolia

# Country Profile of Mongolia

<b>Territory</b>	1.56 million sq.km
<b>Population</b>	3 million
<b>Population density</b>	~2 people per sq.km
<b>GDP</b>	12 billion USD
<b>Agriculture in GDP</b>	16% of GDP, (Ministry of Food and Agriculture official news of 2014)
<b>GDP (per capita)</b>	4,096 USD
<b>Literacy rate</b>	98%
<b>Agriculture Labor force</b>	33.5%
<b>Agriculture growing season</b>	95 – 110 days
<b>Agriculture common crops</b>	corn, wheat, barley, and potatoes
<b>Agriculture husbandry</b>	40 million (sheep, goats, cattle, horses, camels, and pigs. )



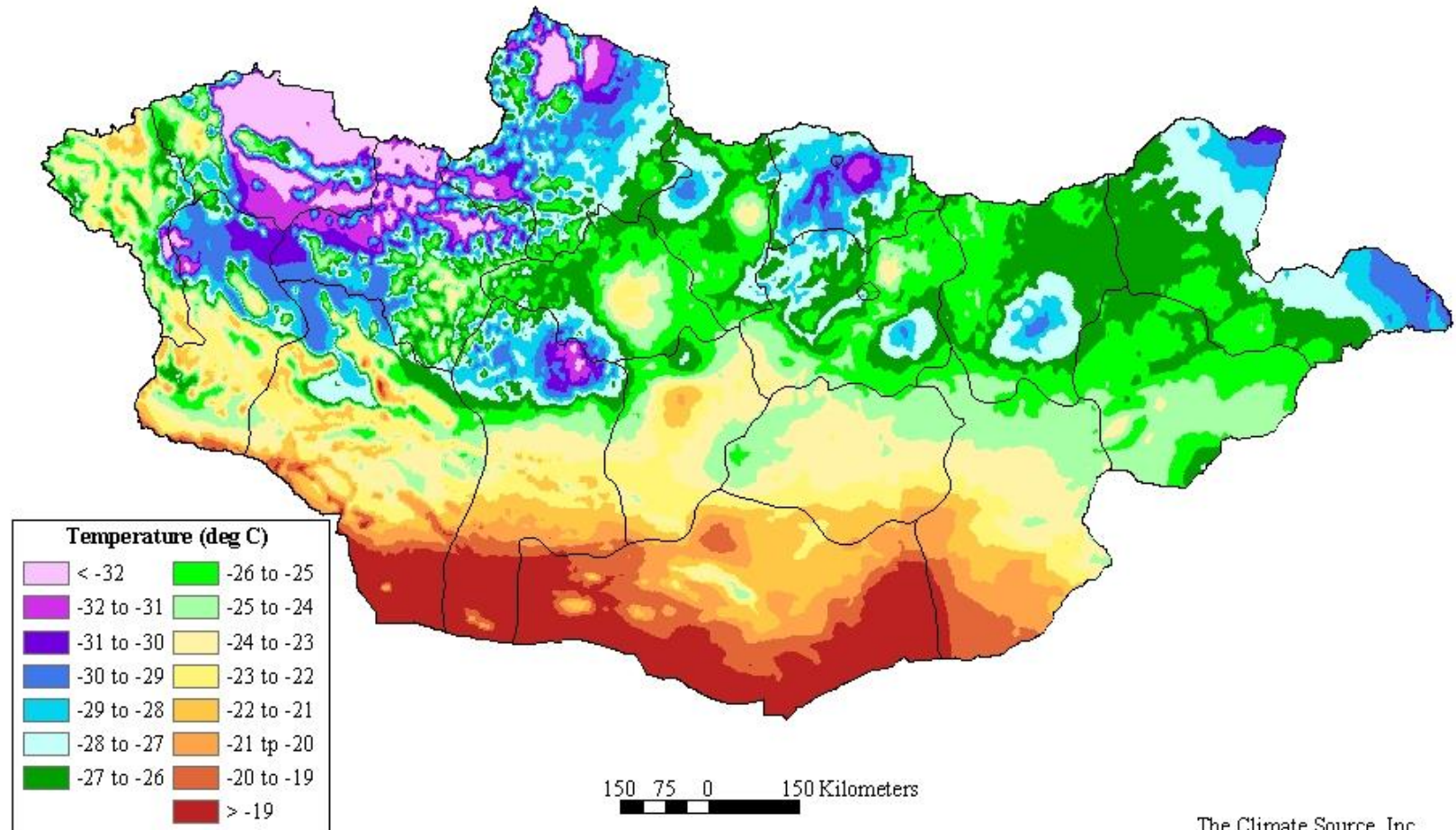
# Economic indicators





# Weather Environment

PRISM 1961 - 1990 January Mean Minimum Temperature, Mongolia



Map Created: November 2002

Copyright (c) 2000 - 2002 OSU Spatial Climate Analysis Service

The Climate Source, Inc.  
[www.climatesource.com](http://www.climatesource.com)



# Project background



Due to severe climate conditions, Mongolia has difficulties in cultivating fresh vegetable and establishing farming –oriented agricultural nascent.



Mongolian society traditionally having highly meat consumption on daily life eating, and demand of fresh organic vegetable is increasing nowadays



Vegetable cultivation period is four to five months (usually during May to September)



Demand of Mongolian companies including organic and fresh vegetables and fruits



# Project background

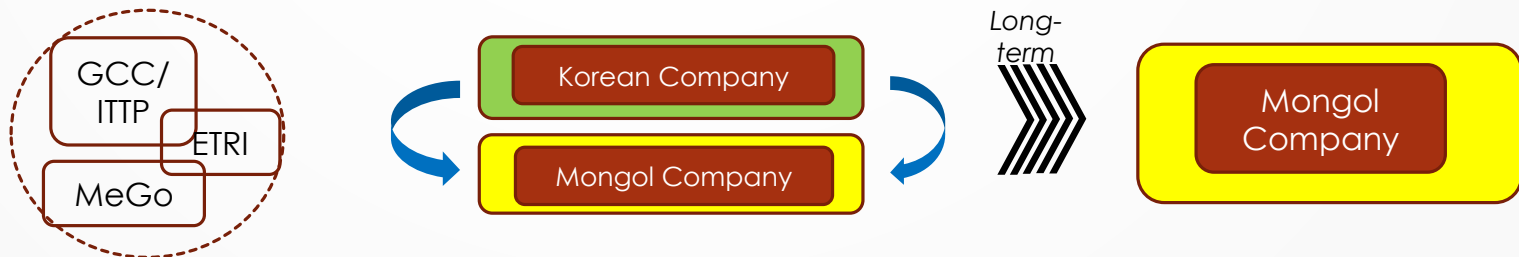
- ❖ **Business Talk for industrial revolution in Mongolia**
  - Late 2015
- ❖ **ITTP, GCC, ETRI, MeGo, Mongol companies**
  - ITTP & MeGo : Country agent
  - GCC : Global Commercialization with regional hub
  - ETRI : Technology Provider
  - Industry : Korea & Mongolia
- ❖ **On table**
  - 20 technologies at the beginning
  - Market and Demand forecasting
  - Affordable project cost
  - Aggressive players for both side (ETRI & Mongol Company)
  - First Trial : smart farming
- ❖ **Mongolian government policy**
  - Began to promote on supporting greenhouses to provide cultivation during winter and to provide storehouses.

# Step Approach and Business Model

- ❖ **Phase 1 : Feasibility (done early 2016)**
- ❖ **Phase 2 : Pilot Test at Mongolia**
  - Technology Transfer(Green House Operation S/W & Control System)
    - ETRI => Mongol Company
  - Workbreakdown for Pilot from Mongolia
    - Green House and Facilities (Water supply, Electricity, Cabling & Wiring, Heater, Blower, Fan, Thermal Screen, Actuators, etc.)



## ❖ Phase 3 : Localization



# Greenhouse site

## ❖ Greenhouse at Batsumber, Mongolia

- Located at 64.5km north of Ulaanbaatar

Before Construction  
(July, 2016)



Under Construction  
(September 2016)



Finished  
(November 2016)





# Greenhouse site

## ❖ Greenhouse at Batsumber, Mongolia



# PLC and Sensors



<PLC & Controlbox >



<Inside Sensors>



<CCTV>



<Soil Sensor>



<Whether Station>



# Control box and Actuators



<Controlbox & Electric panel >



<Heater>



<Thermal Screen>



<Ventilation fan>



<Air circulator fans>

# Hydroponics with Nutrient Delivery System



<Hydroponics and soil cultivation>

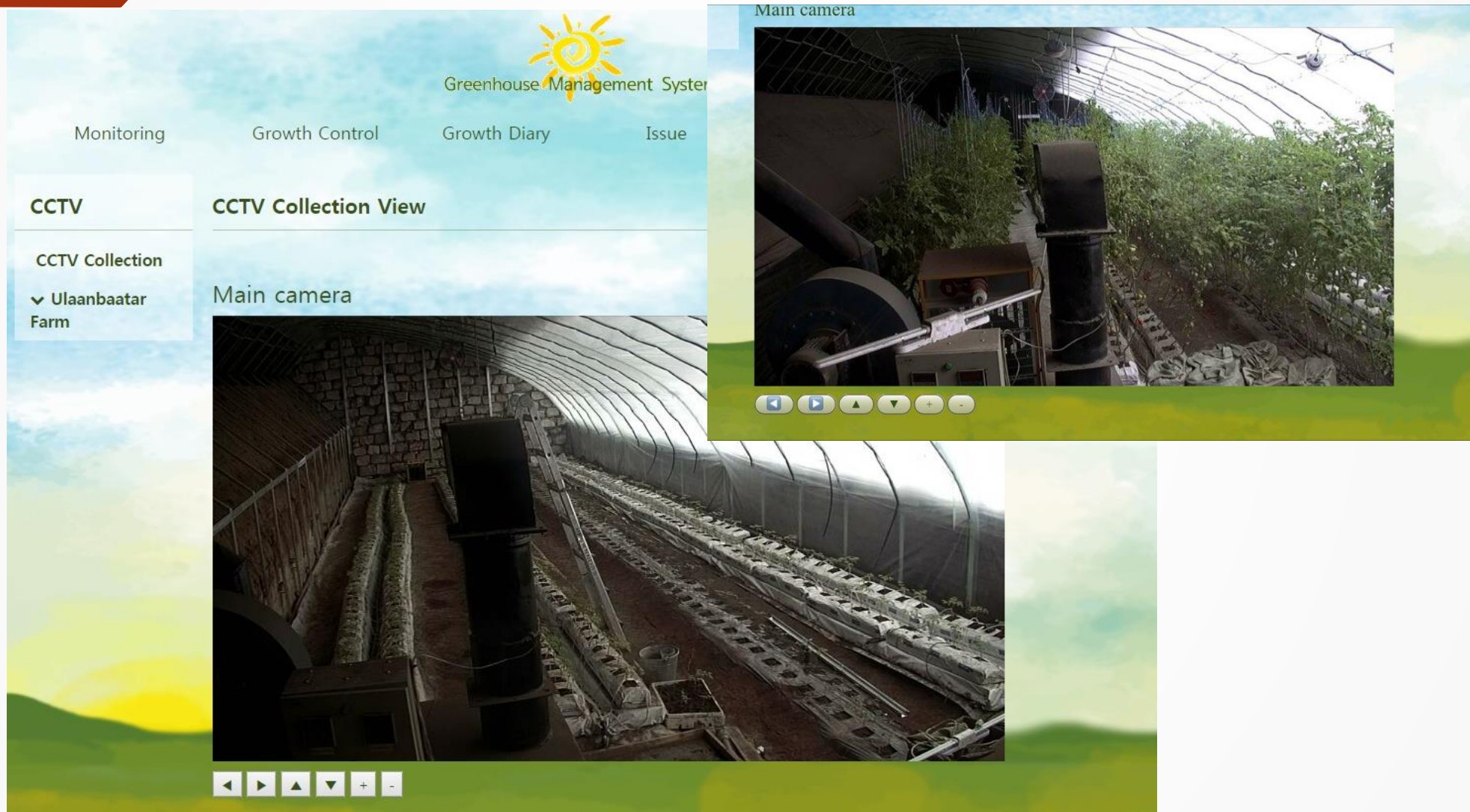


# Hydroponics with Nutrient Delivery System





# Remote Monitoring - CCTV





# Harvesting



Tomatos



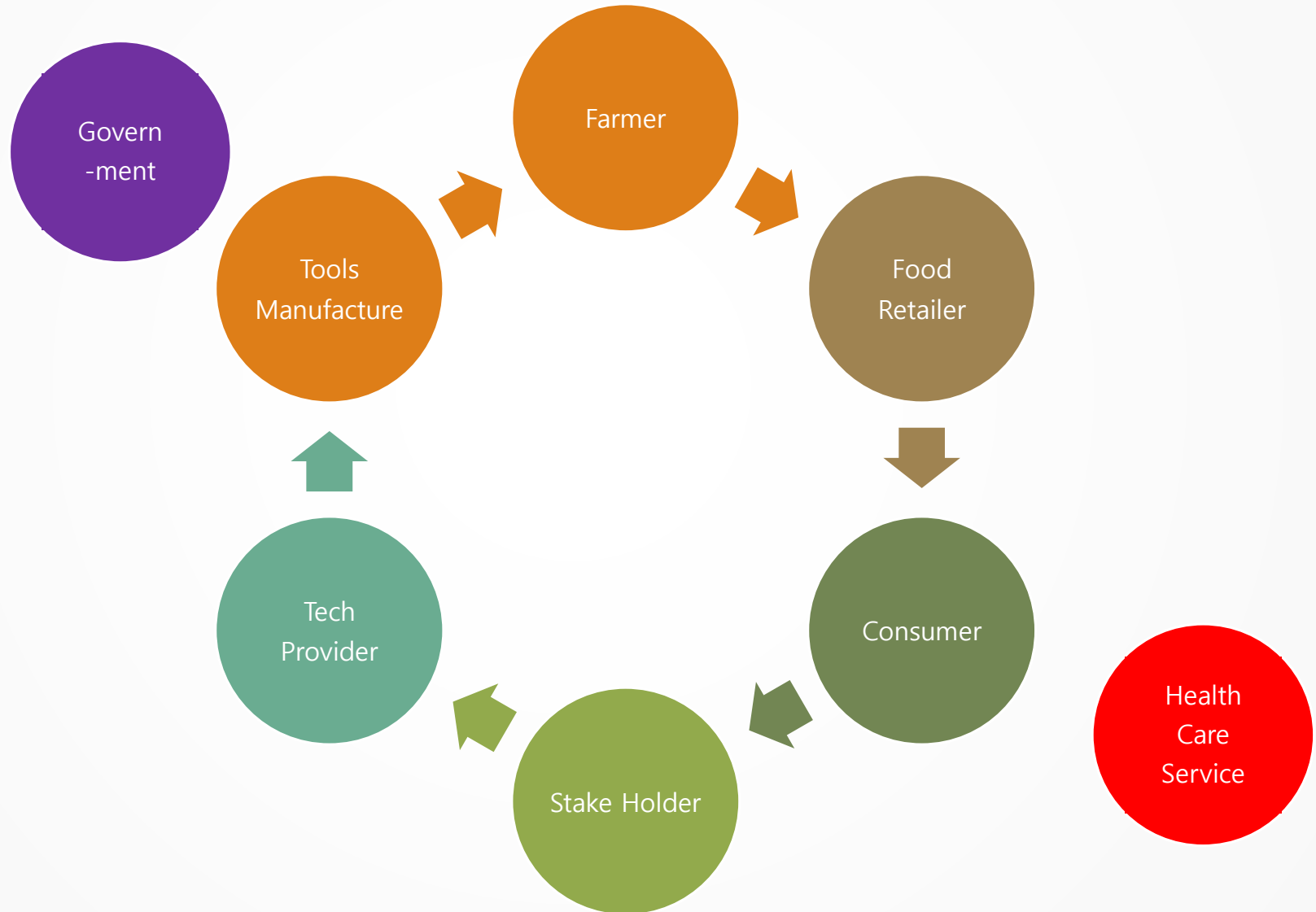
# Remote Monitoring – Web page



<Greenhouse Management System – Web (Nov.18, 2016)>



# Ecosystem for Smart Farm





# Business Opportunity

## ❖ Showroom for agricultural industries

- Gov., Venture Capital, Large company, Foreign investors, etc.
- Foster the achievement of the project
- Promote on supporting greenhouses to provide cultivation during winter and to provide storehouses in Mongolia
- Contribute the economic growth of Mongolia

## ❖ Spreading and accelerating SF to....

- Farmers
- other players like an investors, stakeholders

## ❖ The investment

- Specially to the small and medium sized farm
- By partnerships and collaboration from ecosystem
  - Technology provider, tools manufacturers, farmers, food retailers, consumers and stakeholders. along the value chain

## ❖ Government's role



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**On-going,  
Coming- soon**



# For Outdoor Farming

## ❖ Drone for agricultural chemicals

- Deploying in Korea
  - Safety and precision
  - Convenience and High speed
  - 24 hour control(day/night)
- Video clips

### Precision RTK GPS

High-Precision Real Time Kinematic GPS with Position Accuracy in Centimeters, Dual RTK GPS Antenna heading feature.

### Flight Controller

High-precision aerial map based flight plan function  
It is equipped with self-developed software to ensure safety in flight and control, With evolving system through continuous updates and support.

### Batteries

Great energy dens capacity  
High performance Smart Lithium-Polymer batteries.

### High efficient Motor & Propeller

Using high efficiency motors to lift heavy payload  
Powerful Momentum Generation with 32-inch Carbon Prop

### Intelligent Nozzle

Uses proven high efficiency nozzles from US Spraying systems  
Maximizes the efficiency of pesticides through fine uniform spraying  
Intelligent spray density adjustment with respect to flight speed.

### Wide Stance Landing Gear

Landing gear that provides a stable landing for any terrain





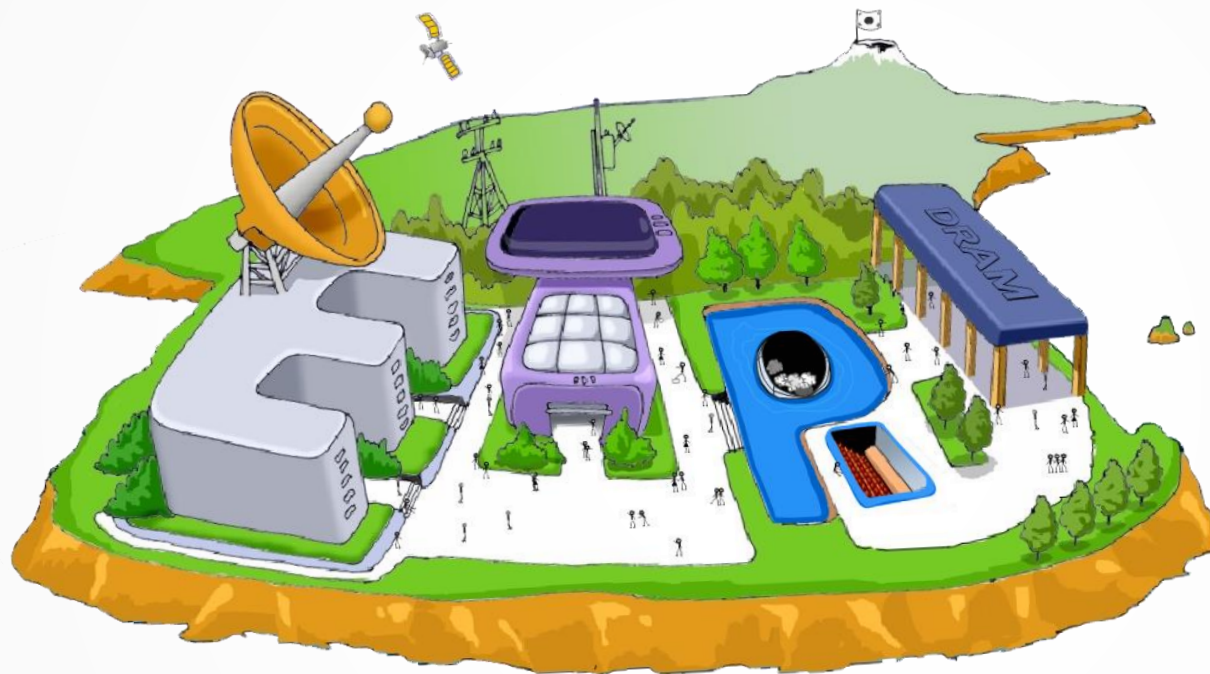


# For Outdoor Farming

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- ❖ **Low powered long distance wireless communication chip technology based on IoT**
  - Low powered wide area wireless technology for underground grid system development based on IoT to sense, anticipate and counterattack any disaster in early stages

# Q&A



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