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## EVALUATION OF MULTI-FUNCTIONALITY OF IRRIGATION AND DRAINAGE SYSTEMS IN KOREA USING AHP



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## Presentation outlines

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- 1. Water resources development in Korea**
- 2. Irrigation management system in Korea**
- 3. Assessment of multi-functionality**
- 4. O&M cost share**

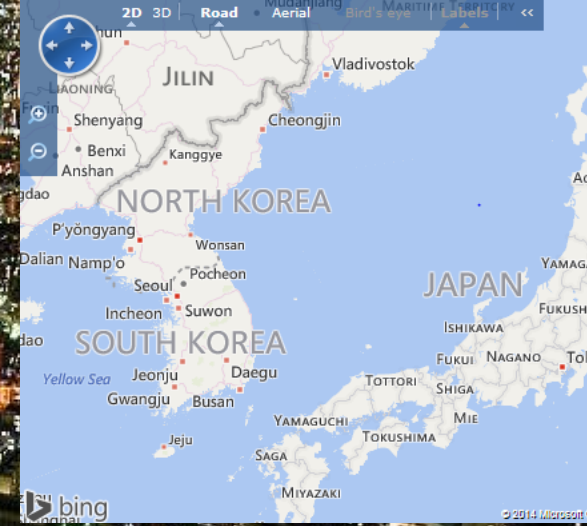
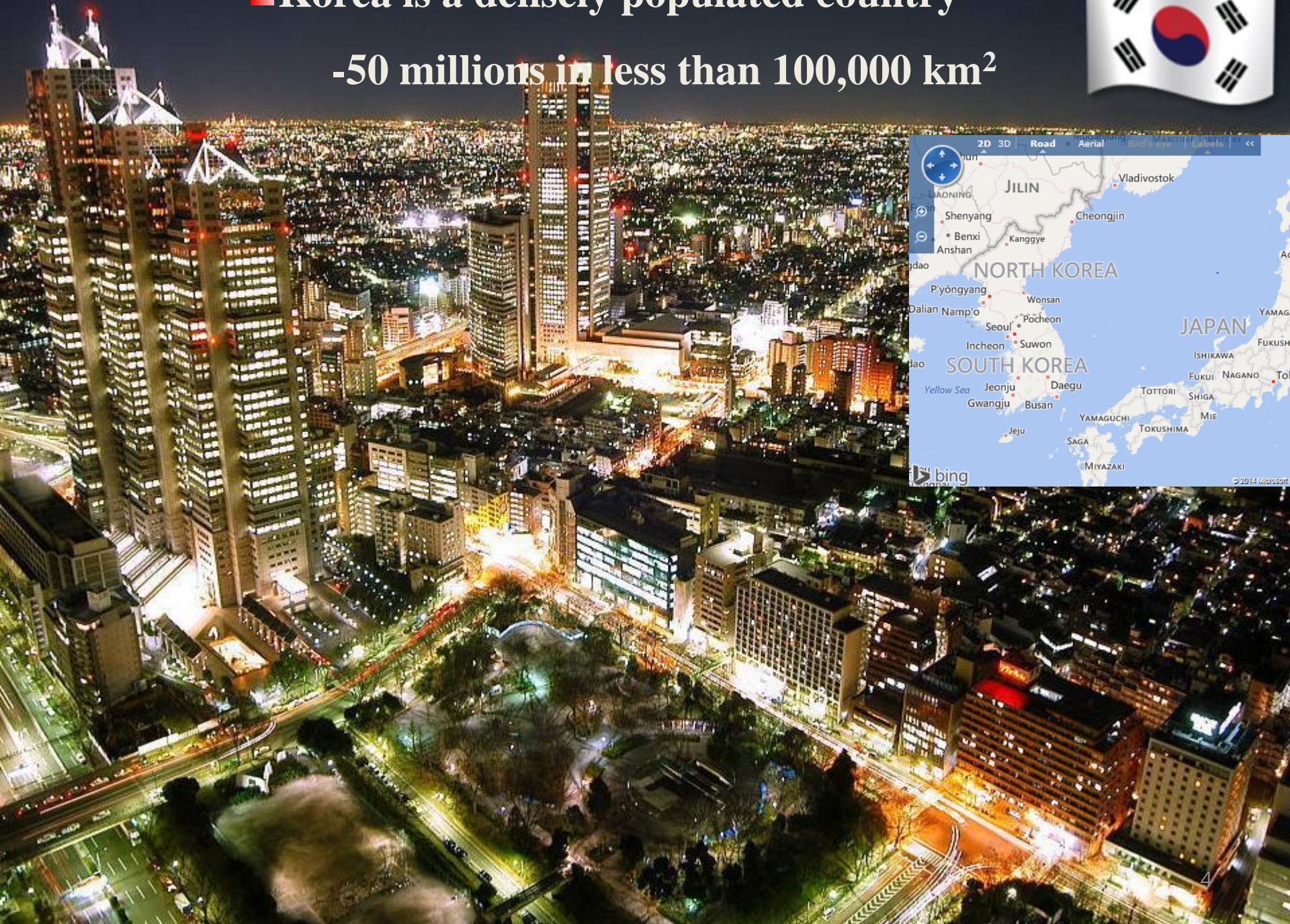
## Objective

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The objectives of this study are identification of multi-functionality of agricultural water, irrigation and drainage systems and assessment of beneficiaries' reasonable cost sharing for irrigation and drainage facilities management in Korea based on analysis of benefit using AHP method with surveying expert opinions.

■ Korea is a densely populated country

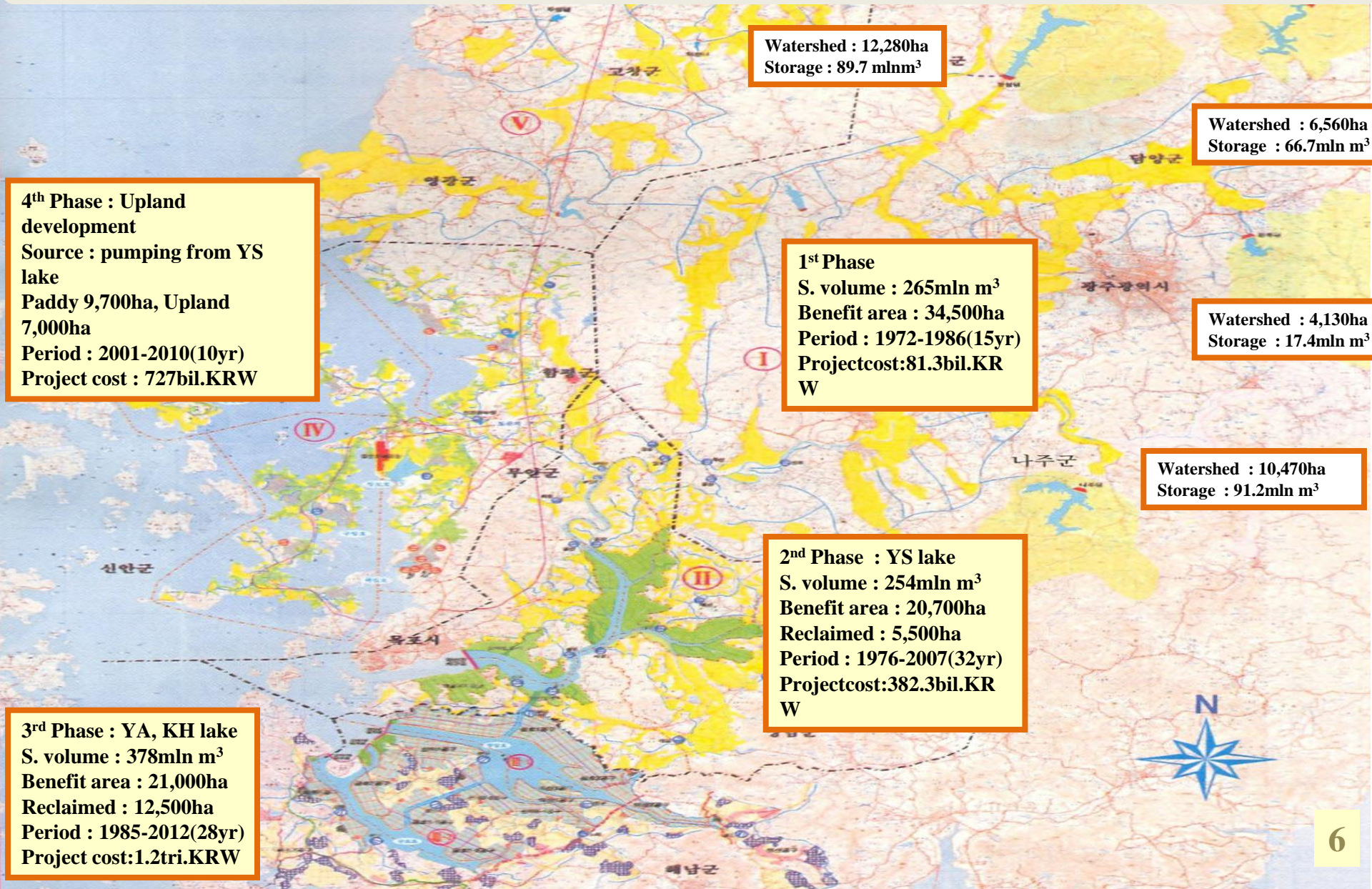
-50 millions in less than 100,000 km<sup>2</sup>



# Rural and Agricultural Development in KOREA



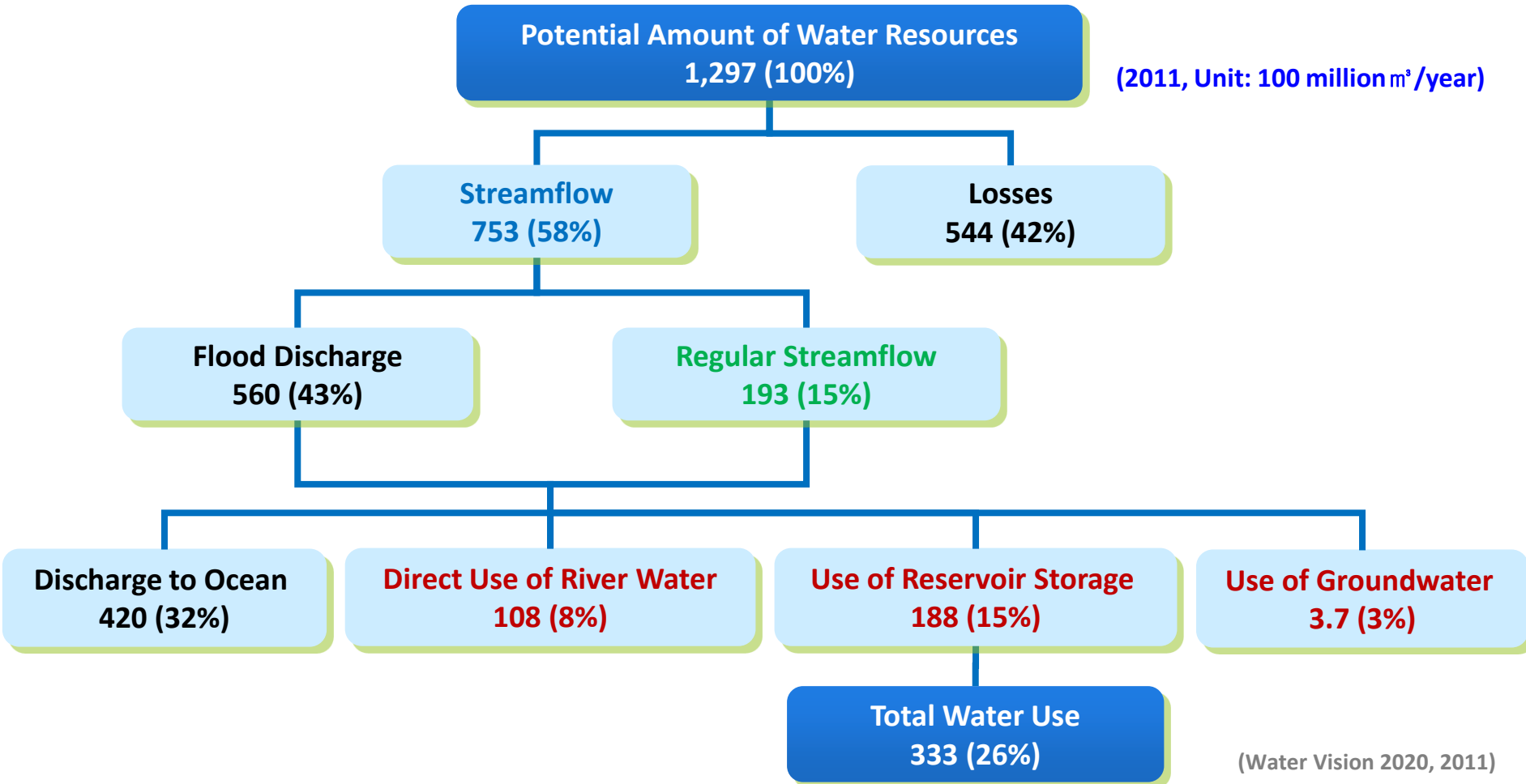
# Yeongsangang Comprehensive Irrigation Project : Case of successful IBRD loan



## Agricultural infrastructure Development



# Present Water Resources Potential of South Korea





# Irrigation & Drainage Facilities



**Reservoir**  
17,649 places, 453,010 ha  
KRC(19%), Local government(81%)



**Pumping & Drainage Station**  
7,729 places, 2,264,517 ha  
KRC(55%), Local government(45%)



**Weir & Others**  
44,837 places, 121,628 ha  
KRC(13%), Local government(87%)



**Canals**  
185,942 km  
KRC(53%),  
Local government(47%)



**Sea Dikes 153**



71. 토마토 비닐 멀칭기 작업



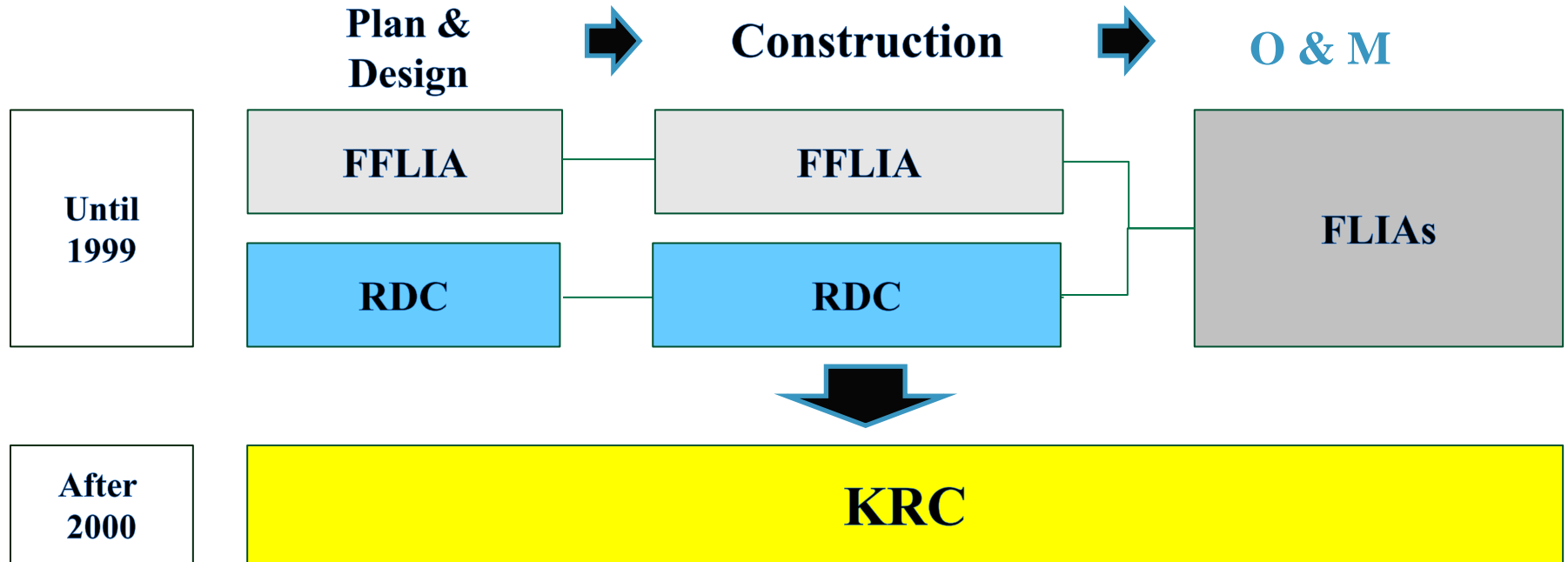
81. 순물방수기를 이용한 농약 살포



106. 고령기 배추 포장제를 이용한 수확작업



# Irrigation management system change



\* **FFLIA** : Federation Farm Land Improvement Association

\* **RDC** : Rural Development Corporation

\* **FLIAs** : Farm Land Improvement Associations

\* **KRC** : Korea Rural Community Corporation

**FFLIA, RDC, KRC are same as public company(Agency)**

## KRC is...

- A reliable **government-run organization**  
under the Ministry for Food, Agriculture, Forest and Rural Affairs
- A public enterprise that  
Development of agricultural water resources and water management,  
flood control, ground water development, irrigation and drainage,  
farmland consolidation, farmland bank, etc.



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# Korea Rural Community corporation (KRC)

Introduction of KRC

## 1. General



Establishment

December, 1908

Activities

Rural Development Sector  
Consulting services

Annual Budget

4 Billion US\$

Employee

Over 5,000 specialists

Head Office

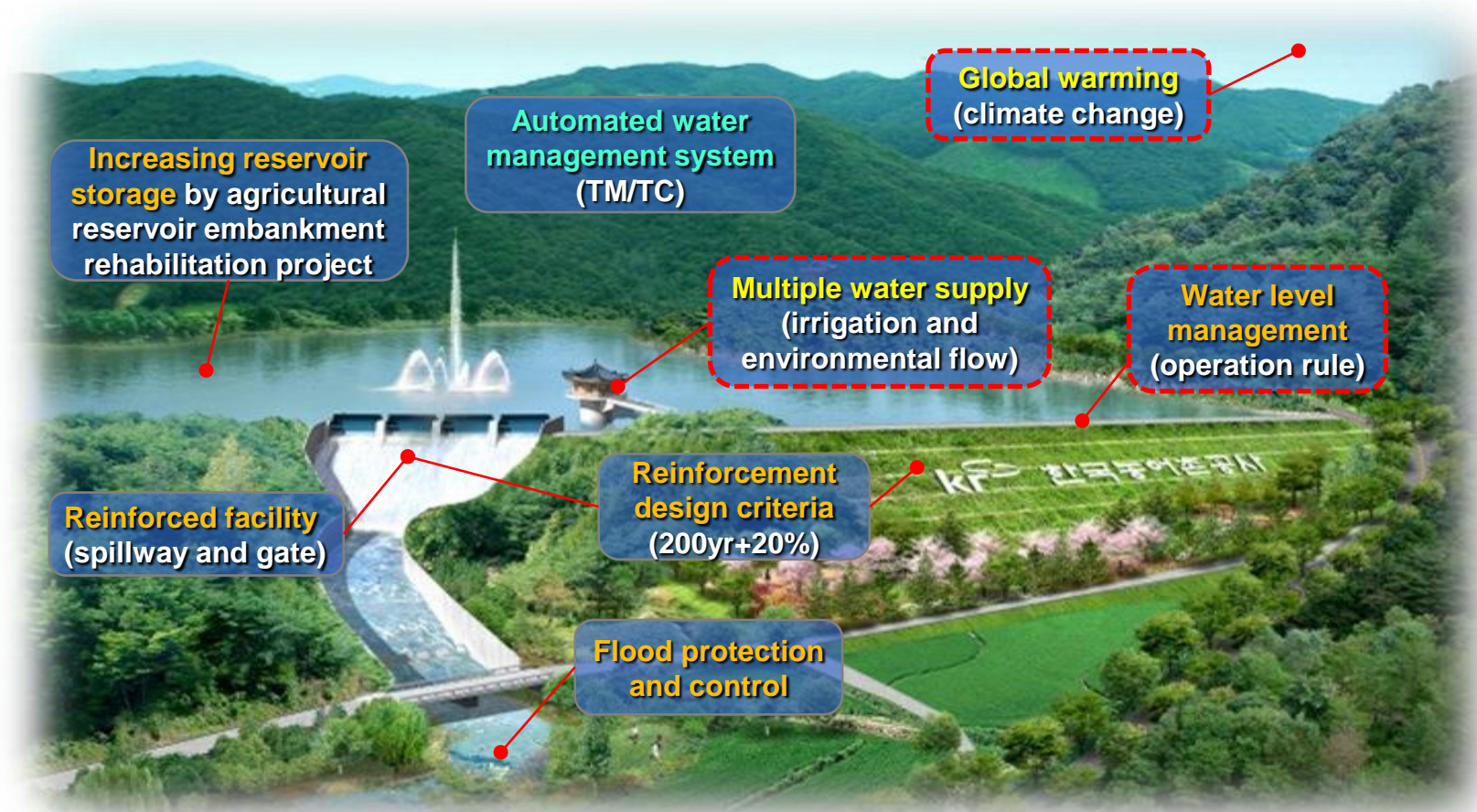
Naju-si, Chonnam-Province

Web-site

<http://www.ekr.or.kr/>

Experts : (engineering) civil, geology, electric, mechanics, architecture, environment  
(sociology) agriculture, agro-economics, agro-sociology, agrology

# Remodeling irrigation system by KRC

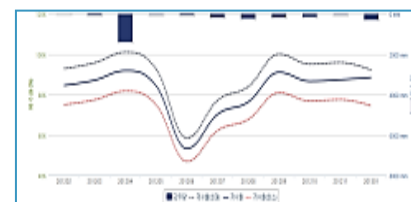
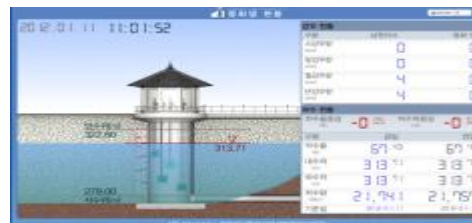
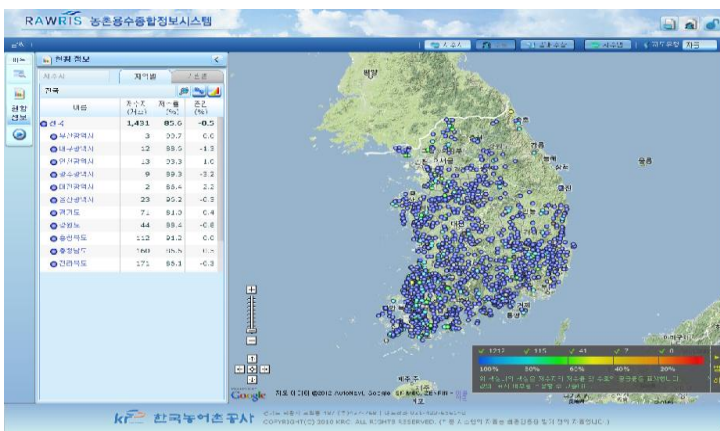




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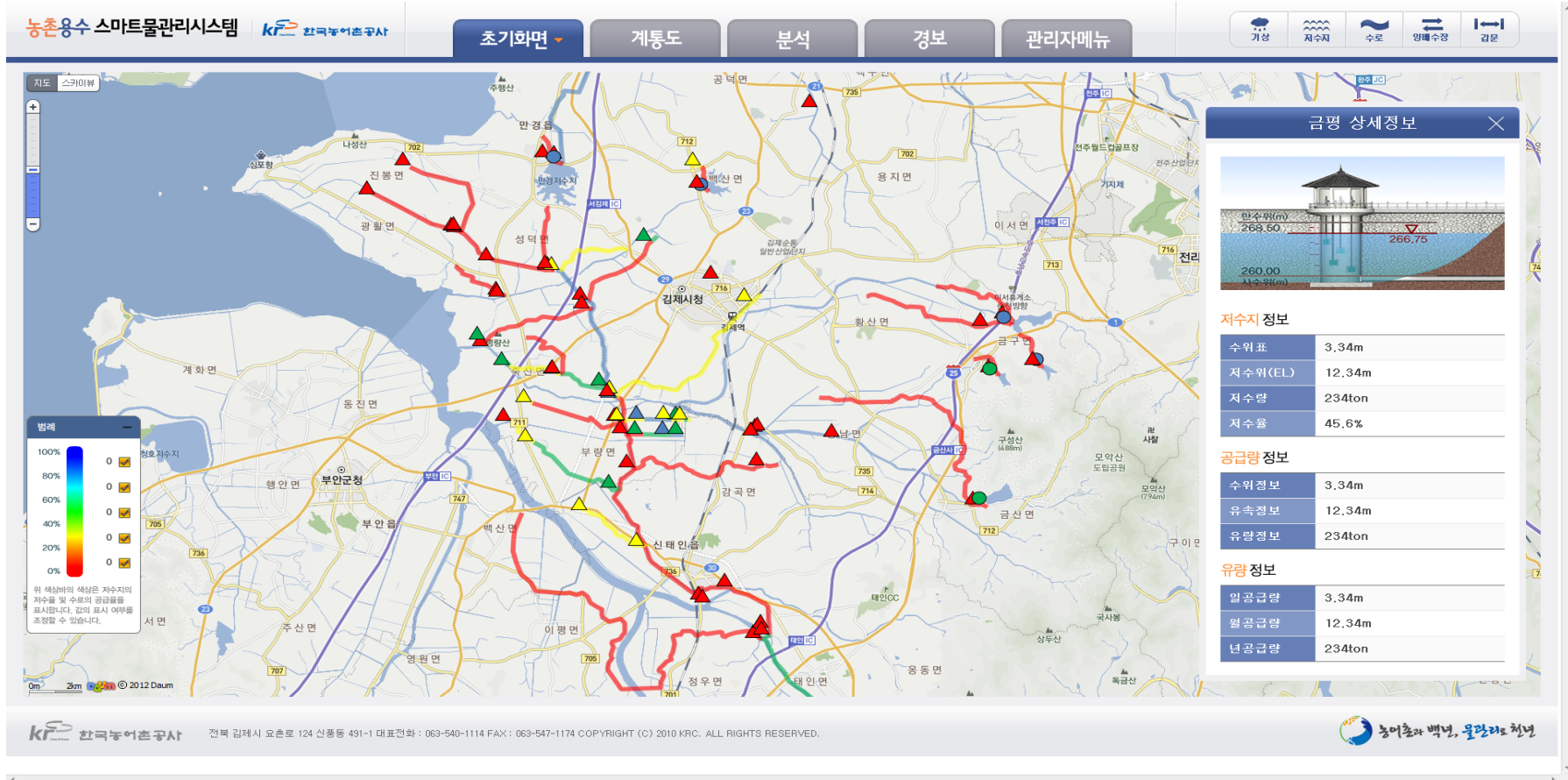
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# ICT based Water Management System of KRC



## Smart Irrigation Management System (SIMS)

- Main control screen



# Amenity and Countryside Remodeling

Amenity and Eco-friendly infrastructure

## Landscape Amenity – Pumping station



## Eco-friendly structure – Irrigation Canal





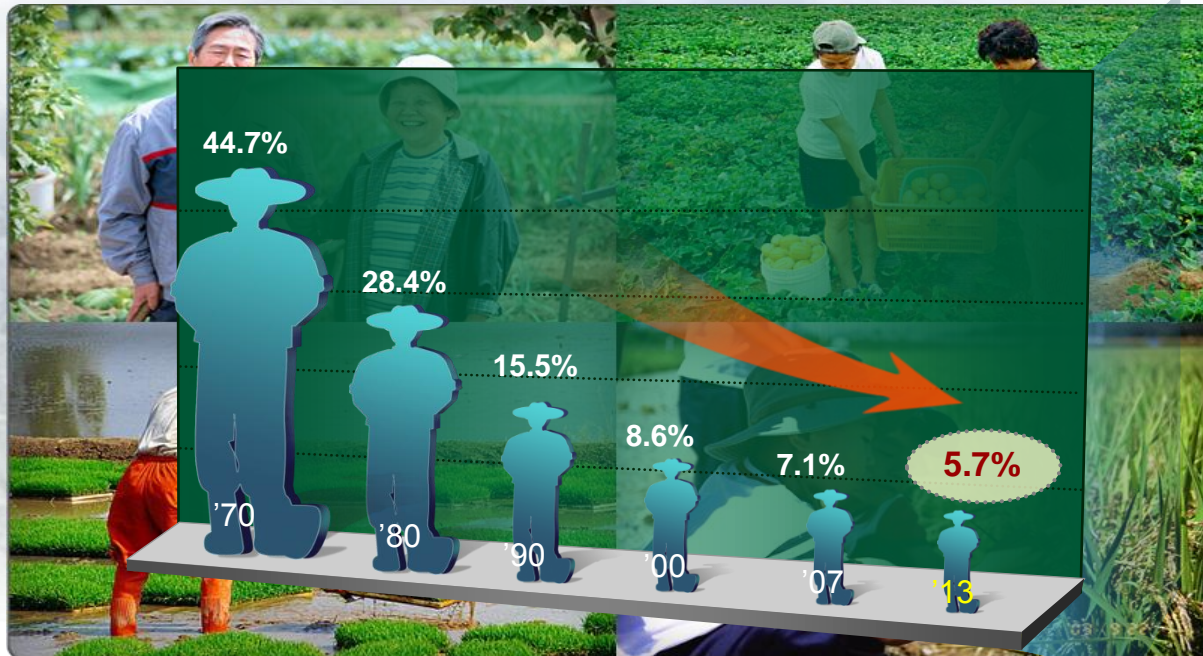
# Korea Rural Community corporation (KRC)

## O & M Agricultural Facilities



# Korean agriculture and rural circumstances

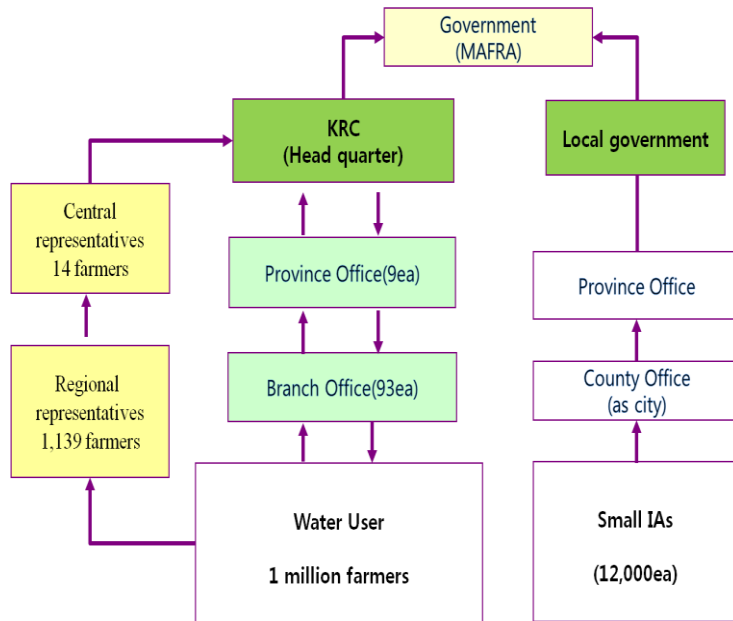
- Total population is 50.2 million head.
  - Farm population is 2.8 million, 5.7% of total population(2013)
  - The employment proportion of agriculture has shown rapid decrease from 44.7%(1970) to 5.7%(2013).



Source : Lee (2015)

# Irrigation management system change

## After 2000, Public Irrigation Management



- **KRC nominate Central & regional representatives.**
- **Farmer don't have authority of decision making**
- **Farmers are exempted from paying water fees. (Gov 50%, KRC 50%)**
- **Farmers participation for labor supply sharply decreased (30% =>10%)**

Year		2000	2002	2006	2008	2013
Cost of O&M (million US\$)	Water fee	-	-	-	-	-
	government	64	121	153	150	124
	KRC	150	122	158	209	215
	<b>Total</b>	<b>214</b>	<b>243</b>	<b>311</b>	<b>359</b>	<b>339</b>

Lee (2013)

- ❖ Elaborated Questionnaire:
  - Functions of agricultural water and facilities
  - Beneficiary of each function
  
- ❖ Surveying Expert Opinion: 11 experts
  - water resources, irrigation, rural development,  
Ag-economy
  
- ❖ Analysis method: AHP (Analytic Hierarchy Process)
  - Multiple-criteria Decision-making



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# Classifying Function after survey of experts

Initial	Replace	Add	Modified
Food security			Food security
River maintenance water supply			River maintenance water supply
Domestic and industrial water supply			Domestic and industrial water supply
Aquaculture			Aquaculture
Landscape			Landscape
Tourism/ recreation			Tourism/ recreation
Ground water recharge			Ground water recharge
Diversity of species	Ecosystem conservation		Ecosystem conservation
Water purification			Water purification
Air temperature control	Climate change mitigation		Climate change mitigation
		Balanced development of country	Balanced development of country
Enjoying folk culture	Folk culture preservation		Folk culture preservation
		Fostering emotion	Fostering emotion
		Place of environmental education	Place of environmental education
Flood control			Flood control
Firefighting water			Firefighting water
Small scale hydro power generation			Small scale hydro power generation



Category	Sub-category
Agricultural water supply	Food security
Multipurpose water supply	River maintenance water supply
	Domestic and industrial water supply
	Aquaculture
Environmental conservation	Landscape
	Tourism/ recreation
	Ground water recharge
	Ecosystem conservation
	Water purification
	Climate change mitigation
Fostering social culture	Balanced development of country
	Folk culture preservation
	Fostering emotion
	Place of environmental education
Disaster prevention and Energy	Flood control
	Firefighting water
	Small scale hydro power generation



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## Functionality of agricultural water and irrigation and drainage systems and its relative weight

Functionality				Final weight
Category	weight	Sub-category	weight	
Agricultural water supply	0.466	Food security	1.000	0.466
Multipurpose water supply	0.269	River maintenance water supply	0.298	0.080
		Domestic and industrial water supply	0.608	0.163
		Aquaculture	0.094	0.025
Environmental conservation	0.136	Landscape	0.197	0.027
		Tourism/ recreation	0.104	0.014
		Ground water recharge	0.205	0.028
		Ecosystem conservation	0.285	0.039
		Water purification	0.146	0.020
		Climate change mitigation	0.063	0.009
Fostering social culture	0.070	Balanced development of country	0.170	0.012
		Folk culture preservation	0.345	0.024
		Fostering emotion	0.305	0.021
		Place of environmental education	0.179	0.013
Disaster prevention and Energy	0.059	Flood control	0.673	0.040
		Firefighting water	0.128	0.008
		Small scale hydro power generation	0.199	0.012
<b>Total</b>	<b>1.000</b>		<b>5.000</b>	<b>1.000</b>

## Fair share of O & M cost

**Beneficiary of each function was counted and fair share of O & M cost was determined.**

**Central Governmnet 40 : Local Governmnet 25 : Local Resident 15 :  
Farmer 10 : Other User 10**

	Year	Share(%)					
		Nation (Central Government)	Local Government	Local people	Water User (Farmer)	KRC	Other user
KREI	2000	50	20~30	-	10~20	10	-
Jung et al	2004	50	10	-	15	25	-
KRC	2013	40	30	-	10	20	-
<b>This Study</b>	<b>2014</b>	<b>40</b>	<b>25</b>	<b>15</b>	<b>10</b>	<b>-</b>	<b>10</b>

## Conclusion

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- ❖ The multifunctionality of irrigation and drainage systems was analysed and result (total 1.000) is as follows; 'Agricultural Water Supply' is 0.466, 'Multipurpose Water Supply' 0.269, 'Environmental Conservation' 0.136, 'Fostering Social Culture' 0.070, 'Disaster Prevention and Energy' 0.059.  
- Agricultural and other purpose water supply is still main function.
- ❖ The rational ratio of cost sharing for management of countryside water by beneficiaries is proposed as follows (100% in total); National people (Central government) 40, region (Local government) 25, local (village) residents 15, farmers 10, and other users 10.  
- Charge of water fee and share of O&M cost for farmers are suggested.



**Many thanks for  
your attention !!!**

