



SHARING THE RIVER MANAGEMENT EXPERIENCES IN KOREA: PAST, PRESENT AND FUTURE

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1. INTRODUCTION

Korea had suffered turbulent shifting in economy and riverine life during the last half century. The economy status can be explained with growth of Gross National Product (GNP): from 53\$ in 1953 to 20,000\$ in 2014. The waterfront landscapes are also changed dramatically. The authors would like to share our experiences and set new paradigms in river management with the results of river managements in Korea with time.

2. HISTORY IN RIVER MANAGEMENT

The amount of annual average rain water in Korea is 1,357mm ('81~'10). It is greater than that of the average annual precipitation of the world. However, the precipitation per capita is lower than the precipitation per capita in the world average.

About two-thirds of precipitation is concentrated in summer. Most of rain water flows to sea through rivers because of the fact that the river gradient is steep due to the mountainous geographical nature. About 31% of the total water is thrown away to sea. If evaporation loss is added, the amount of water for actual use is only 27%.

Just after the Korean war (1950-1953) the nationwide difficulties in economy and political status result the worst conditions in river management. No trees in the mountains and no drainage system lead frequent and

serious flooding and droughts. Some pictures in presentation will show the sceneries at Korea in 1960's. As the strict laws were legislated which prohibits the tree loggings at the mountains leads the country in green, the conditions of water resources were getting better and the mountains were heavily covered with trees now.

Followings are the description of four major rivers in Korea.

- The source of Han River comes from Geomnyong pond, Geumdae Mountain, Taebaek-si, Gangwon-do, Korea. It was originated from Korean 'Hangaram' and 'Han' with a meaning of Big, Wide and Long. It's also called Arimul (Arisu or Arigaram) as an archaic word. It is located in the middle of the Korean Peninsula and it is the largest river based on the amount of running water. Length of water path = 514.8km, Area of basin = 26,018 km².
- The source of Nakdong river comes from Hwangji pond, the east of Chuneebong, Hambaek mountain, Taebaek-si, Gangwon-do, Korea. It is the second largest river in Korea. It was originated from the name "The East of Garak" and Garak means Sangju. Length of water path = 521.5km, Area of basin = 23,817 km².
- The Source of Geumriver comes from Ddeunbong Spring, Sinmu mountain, Jangsu-eup, Jeollabuk-do, Korea. From old times, it was also called Bidanriver because it was beautiful like silk. It is the

third largest river in Korea after Han river and Nakdong river. Length of water path = 395.9km, Area of basin = 9,810 km².

- The Source of Yeongsanriver comes from Yongso falls, Yongchubong, Damyang-gun, Jeollanam-do, Korea. From old times, the land was rich and it was a major transportation point connected with the ocean. Length of water path =136km, Area of basin = 3,371 km².

Followings are the flood control time line in Korea:

- 1962; Publish 'Hydrologic data in Korea'/ Create 'Water resources Policy Bureau'
- 1965-1974; 4 major river basins survey
- 1974; Han river Flood Control Office established and operated flood forecasting and warning facility
- 1979; Enactment of hydrologic measurement service regulations
- 1980; Enactment of the river design guideline
- 1987; Nakdong river Flood Control Office established
- 2000; Integrated flood forecasting and warning system development
- 2005; Hydrological investigation advance five-year plan making/The river information center of Han River Flood Control Office established
- 2009; beginning of construction of The four major river restore project/Biseulsan rain Rader observatory established/ Hydrological investigation master plan making
- 2012; Decided as a presidential country on hydrological service group

Water Management Information System(WAMIS) is operated since last decade. The Portal system based on the Internet, built for providing service including water resources information scientifically collected, created, and processed for water related organization.

Master Plan for Water Resources information is divided into 3 parts to store

reliable data; 'Basic information analysis system', 'Operation support system', and 'Policy decision support system'. The system provides 10 fields (Hydro/Meteorology, Basin, River, Dam, Ground water, Water use, etc.) and 300 items. And search information is consisted local autonomous entities (256), basin (117), and river (National rivers/Regional river).

3. RIVER MANAGEMENTEXAMPLES

3.1. Han river

Munbal Bank (B = 2 km, H = 2.0 ~ 14 m, Q = 37,000cms, L = 5 km) suffered from frequent failure/scouring/erosion.

Lower Bank Line(LBL) intrudes more than 150m last 10 yrs.Development of middle bar in river separates the flow in two ways. Therefore, the rightward flow hits Munbal IC and scours Munbal bank. The road(Jayoo-ro) next to the embankment is the most heavy traffic lines in Korea. It means the failure of the road could lead catastrophic accidents and cause hundreds of casualties. Historical review showed that development of alternate bars has been observed periodically since 1901. (MLIT, 2013) And it was found that the waterways were narrowed to construct theJayoo-ro. That is human activities restrict the way what nature want to go.

3.2. Nakdong river

Haepyung water intake structure(WIS) locates at left side of Nakdong river near to Gumi industrial city. Before the construction of Haepyung WIS, Gumi WIS had been constructed in 1983 at the right side of the river. But the Gumi WIS suffered difficulties in water intake since the thalweg moved to the left side. Therefore, Haepyung WIS newly constructed at the right side of the river in 1993. But the Haepyung WIS also had suffered from other difficulties since the river divided in two ways, so that the water level for the intake cannot be maintained. Frankly speaking, we didn't know where the river wants to run.

3.3. 4mrrp

Four major rivers restoration project (4MRRP) has being carried out in Korea between 2009-2012l. The river rehabilitation projects, 0.57 billion m³ of sediment was dredged and 16 weirs were constructed along four major rivers. The cross section of the rivers had been widened and deepened during the 4MRRP. The channels are suffering deformation since the most of natural shaped channel had been aligned in straight with trapezoidal cross sectional shapes.

Filed surveys were performed along the tributary from confluent point to upstream direction up to 30-50 times of tributary width. Investigation of geometry of plane and cross section, angle between tributary and main channel, bed material, longitudinal slope of tributary, bank erosion, bed erosion/siltation, sand bar formation and etc. were included in the check list. Field survey showed the bank erosion and head cut phenomena propagated to somewhat long range and the speed of propagation was faster than expected.

3.4. Cheonggye stream

The overviews of representative successful urban river restoration project are:

- Period : July 2003 ~ September 2005
- Scope : A 5.84km section extending from the heart of downtown to tributary
- Budget : 349,423 million won / Actual amount spent by September 2005: 386,739 million won due to design changes, and additional work.
- Main water supply resources: underground waters from nearby subway

stations, the Hangang, and water from Jungnang Sewage Treatment Station

4. CONCLUSIONS

The short - term and long-term changes due to the human activities on river system were presented. Some of them were improved but the others were not. From the lessons of river management in Korea and worldwide river management paradigms, it was found that we should keep in mind for the river management is what the appropriate human attitude to the Nature is:.

- Keep Ecological Democracy:

Consideration of non-spoken beings like future generations and non-human beings / Agreeing the premise: Water for people (or right) not for profit

- Principles of Water Management Ethics :

Equal respect for human dignity / Equity and proportionality / Solidarity / Common good / Right relationship or responsible stewardship / Inclusive and deliberative participations / Provides room for the river adaptability

As a conclusion, the river management paradigm should consider the improvement of adaptability to changes in the global environment and apply diverse types of sustainable river basin management.

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