Characteristics and Values of Irrigation
Historical Sustainability in China

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I. BACKGROUND

Typical East Asian Monsoon Climate on complex and various landform

2.1 origins: 3000 B.C.-476 B.C.

- Legend
  - King Yu tamed the flood: Start an new era of water conservation and irrigation
  - Archaeological discovery
    - Liangzhu (around 3000 B.C.): rice field site, 10,000 kg carbonized rice
    - Shang Capital (around 1500 B.C.): irrigation for trunk and branch canals
    - Yanzhuang Tombs in Han dynasty (around 200 B.C.): well irrigation model
  - Written Records:
    - Oracle bone script (around 200 B.C.): 甽, means irrigation system of ditch and canal in farmland
    - Western Zhou Dynasty (1100-771 B.C.): appointed officials in charge of irrigations (With records in The Rites of Zhou)
    - King You of Zhou Dynasty (?-771 B.C.): ruined the rice field due to his tyranny (With records in The Book of Songs)

II. BRIEF IRRIGATION HISTORY OF CHINA

2.2 The first boom of irrigation construction: 475 B.C.-100 A.D.

- Quebei Lake designed by Sun Shu’ao (613 B.C.-591 B.C.)
  - Irrigation area: >5000 ha
  - Agricultural area in middle reaches of Huai River
- Dujangyan Irrigation System designed by Li Bing (256 B.C.-251 B.C.)
  - Agricultural area in Yangzi River: Shan He Weir, Bai Qi Canal
- Zhengguo Canal (246 B.C.)
  - Irrigation area: around 2300 ha
  - Agricultural area in the central Shaanxi Plain: Chengduo Canal, Cao Canal, Longshou Canal
- Exploration in Northwest and North China
  - Karez in South Xinjiang, water diversion irrigation in the Hexi Corridor
  - Canals of Zhaocai River, Zhao, Irrigation Canal
II. BRIEF IRRIGATION HISTORY OF CHINA

2.3 Eastern Han Dynasty—Northern & Southern Dynasties: 25 A.D.—589 A.D.

- Huai River Basin
  - Middle reaches: Hongzi River as the center
  - Lower reaches: Bai Zhuo and Caotie rivers and open-up land
- Jiangnan area
  - Jiangnan: Chishan Lake in Jiangong, Liang Lake in Dayang
  - Eastern Zhejiang: Jiahu Lake in Shaoxing, Dongshan Lake in Ningbo
- Southern Zhejiang: Tong Li in Lishui
- Nanyang Irrigation System: Tangji River region
  - Zhao Xinchao: Lu Men Yi, Quan Lu Fu (HBC 338C)
  - Gu Shi: improved Nanyang Irrigation System (580 A.D.)
  - Gu Yu (222 A.D.): improved Nanyang Irrigation System (second time)

2.4 Prosperous Development Period: The Sui and Tang dynasties and Song Dynasty 581 A.D.—1279 A.D.

- Rapid development of irrigation projects in Southern China
  - Posts in the Taihu Lake area: Tenghe and Lianhe Posts
- Bai Juyi: Jianguo promotes most of the agricultural areas of the nation
- Coastal regions of Zhejiang and Fujian: Tuzhao River, Malinghe, with storing flood water and drainage
- Improvement of Northern China’s irrigation Projects
  - Song Dynasty: weaving irrigation in the east and west stream area
  - Northern China: Proud and post irrigation in Bayang Pond Lake
- Development of water laws in ancientChina
  - Masonry projects: block, dam and canal
  - Promotion of waterwheel and scooped water-wheels
  - Widespread application of irrigation rules for crop and quantitative management of irrigation and drainage
  - Regulations: Shou Shu (Shu: The laws of irrigation and water conservancy in Northern Song Dynasty and Wangen: The irrigation system in Shanghuai)

II. SUBSTAINABLE CHARACTERISTICS AND VALUES OF HISTORICAL IRRIGATION

2.5 Stable and fast development: Yuan, Ming and Qing Dynasties 1271 A.D.—1911 A.D.

- New irrigation areas
  - Yangtze valley: the rapid development of polder in Dongting Lake
  - The Yangtze River: the development of polder in Dongting Lake
  - Coastal regions of Jiangsu & Zhejiang: seaward construction
  - Irrigation in capital regions of Qing Dynasty: Wuhan expansion and improvement
  - South and frontier: Xingiang, Yunnan, Guangxi
- Systematic planning of valleys and regions: integration and coordination
  - Central management of flood control, irrigation, drainage, salt alkali control
  - Lower regions of Taihu Lake: drainage, shipping, flood control and polder
  - Yellow River valley: flood control, water diversion and weeping irrigation

II. SUBSTAINABLE CHARACTERISTICS AND VALUES OF HISTORICAL IRRIGATION

3.1 Relationship Between Engineering and Environment

- Low-impact development mode
  - Mild ways to collect/divert water
- Environment-friendly traditional materials
- Adaptation to local condition
  - Natural diversity in different regions
  - Various layouts, types, structures and materials of irrigation schemes in ancient time
- No strong limits on thinking and technology in traditional society
- Beautiful irrigation agriculture landscape
III. SUSTAINABLE CHARACTERISTICS AND VALUES OF HISTORICAL IRRIGATION

3.2 Project system and structure characteristics
➢ Systematic planning
   - with great vision and systematicness
   - components of the system work as an organic whole
➢ Architectural structure design
   - the traditional materials such as stones and wood are more environment-friendly and have no negative impact on soil and rivers in the long term

3.3 Fair and effective irrigation management
➢ Two aspects: project management and water management
➢ Government-led and private-sector participation
➢ Reconstruction of annual repairing system

3.4 Advancing with the times
➢ Irrigation structures are "living" heritages
➢ Environment and society is always changing

IV. CONCLUSIONS
• The origin and development of irrigation engineering sometimes are of historical significance, which represent the evolution and spread of civilization of the regions.
• The continuation of projects is the continuation of management and culture accumulation, which reflect the wisdom of ancient people to deal with the relationships between human and water
• The empirical knowledge and engineering philosophy reflected in these heritages can serve as a valuable reference for contemporary irrigation construction and development.
• To learn history wisdom and maintain irrigation civilization, it is necessary to protect the ancient irrigation heritage as the start, which may be the best example of sustainable development.