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ANCIENT CHINA: A HYDRAULIC SOCIETY.

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Abstract: *In the post Second World War era the river management model of extensive river infrastructures like Dams, reservoirs, canals irrigation, weirs and locks have proved detrimental to a river. They might be advantageous in certain part of Europe or North America, where climate is quite cold and river run-off is over 200 km^3. In China, they have proved to be detrimental to river run-off as the Yellow River dried off for 750 kms before its delta. Since China is an ancient civilization and it being termed as hydraulic civilization, look to its ancient management would elucidate its continuation.*

Keywords: Dams, Dry Farming, Silt, Canals, Dikes.

Introduction

A variety of Ecosystem services and goods are provided by river basin that have led to the rise and flourishing of many ancient civilizations. These ancient civilization didn`t appear in vacuum. They evolved over a period of time struggling and adapting to the world around them. They didn't have any homogeneous environment. In fact, they had very specific environment and were rooted in particular ecologies, specific subset of natural resources and material elements of earth, air, water, and fire. They evolved in dynamic interplay with non-human world, a process full of conflict, failure and success. The Chinese civilization has been trying to manage and conquer water of Yellow River for a long period of time.

The Chinese civilization arouses first around the Yellow River, which flows *through* or *near* sub-humid country, it affords some relief from the dry climate. Being a civilization that has been termed as Hydraulic it had constructed an immense network of artificial rivers to bind together the wet and dry regions. In the past, it served as a means of transportation, a defence weapon, source of water supply and irrigation.Controlling the Yellow River, overcoming the critical problem presented by nature, has been the foundation of China's expansion and China's stability. (Worster, D. 2011: 6)

The Yellow River

It begins at Qinghai Plateau in east-central Tibet and drains a basin three times that of the Colorado River of the American Southwest. In total, the river flows over 5,400 km, passes through 9 provinces and autonomous regions and drains an area about the size of France. Much of its upper and middle basin consists of loose, highly erodible loess soils, and thus the river carries a huge load of silt, far larger than that of any river in the world.This silt deposits downstream, raising its bed higher and higher year by year. However, its run-of is seldom very large but it is a dangerous river and is also known as 'Sorrow River'. It has never wanted to stay put in its bed but has wandered over the land, shifting channels, flooding the countryside, and wreaking devastation. (Worster, D. 2011: 7), (Clapp, F.G. 1922: 3), (Zhu, Z. Et. al, 2009: 2-3)

This nature of the river provided the basis to the Chinese civilization to mature as a hydraulic society. The Chinese imperial state first emerged in the Yellow River's long valley, in the stretch that lies immediately to the west and east of the ancient capital of Xi'an. This is the area is on the southern edge of middle reach of Yellow River. The lesson that Yellow River Management elucidates Chinese rulers early on was one that they are still following today: "*If you want to gain and hold power over the people, you must gain and hold power over the natural environment. Floods must be controlled, Droughts must be mitigated, Dry lands must be irrigated, and Rivers must be used for transportation. Nature, in short, must be subdued"* this is very unlike the confusions and Taoism teachings. (Worster, D. 2011: 7)

Joseph Needham quoted from the *Kuan Tzu*, a tome dating back to the second or third century BC, which urges rulers to overcome the harmful influences of water. *A river "running wild," advises the book, "injures men. When it injures men, there arises great distress among them. In great distress they treat the laws lightly. Laws being treated lightly, it is difficult to maintain good order. Good order lapsing, filial piety disappears. And when people have lost filial piety, they are no longer submissive"* Hence the lesson all imperial states sought to absorb and use to their advantage. A stable, law-abiding, contented population cannot be achieved without controlling the wildness and the lawlessness of water flowing across the land. The chief strategy of control pursued in pre-modern China was channelization and embankment building along the river floodplains in the lower part of the middle and in the lower reaches of the river. This was to compress the tumultuous flow and move water downstream faster. There were two competing philosophies, Needham argues, over the placing of embankments or dikes and constrain the current. Civil engineers with Confucian leaning believed in establishing a tight, rigid control with high and mighty dikes built as close to the river as possible; while those with Taoist leaning advocated low dikes set far apart, giving the river more space to meander. (Worster, D. 2011: 8). Since the rise of Chinese imperial state to Mao Zedong all Chinese genius has been consumed to control the Yellow River and it formed the ground for hydraulic engineering.

In practice, ancient Chinese water projects were designed for practical needs, not according to abstract philosophical ideas. Traditional Chinese society pursued a harmonious relationship with nature and that this ethos was embodied in their water engineering projects. The much admired "take no action" philosophy advocated by Taoist philosophers was never truly followed in Chinese politics or in environmental policies. It was the Confusion philosophy, which became the foundation of the hydraulic engineering. However,the end sought by both engineering schools and throughout traditional Chinese society was one and the same. Control over water meant control over people. (Worster, D. 2011: 8-9

The Grand Canal.

Figure 1. The Grand Canal. (Zhong, X. 2010: 4)

The Grand Canal, a project that began in 486 BC and was completed around 1300 AD. (Fig. 1) It was build in 486 BC in Spring Autumn period for military utilization and was called Hangou in Yangzhou connection Yangtze river and Huai River. Also known as the Traffic River, it was a man-made waterway that ran from the Hangzhou Shanghai in south to north toward Beijing, a distance of over one thousand miles. It was the first inter linking project in the world. The ancient part of the canal lies between the Yangtze and the city of Huaiyin formerly Qingjiangin Jiangsu province, which was originally on the Huang He (Yellow River) when that riverfollowed a course much farther to the south. This section, traditionally known as the Shanyang Canal, in recent centuries has been called the Southern Grand Canal (Nan Yunhe). It was also responsible for water diversion, flood control, and irrigation. In places, the Grand Canal was as deep as thirty feet, and it could carry the very large boats, heavily loaded with grain, demanded by the imperial authorities in Beijing. Although it linked the wet area to the dry area that is rice-growing areas with cereal growing areas, the Grand Canal was not so much a means of moving food for the masses from an area of abundance to one of scarcity as it was a means of moving taxes from the periphery to the capital. (Worster, D. 2011: 9), (Mao, F. Et. al, 2014: 1), (Pletcher, K. 2012: 1) (Zhong, X. 2010: 4)

Prior to Grand Canal, canals were build for the irrigation in China, developed at Wei River basin, it is one of the principle tributary of Yellow River. Since ancient times has been known to the Sons of Ilan as "China's Sorrow." The river drained then northern slopes of the Tsing-ling range of mountains. This range, lie east-west transverse the country, is the natural great wall of China; it separates the regions of the loess to the north from regions without 'loess in the south and divides wheat-growing from the rice growing areas of China. The Wei River irrigation project is one of the earliest recorded in Chinese history. It began under the first Emperor of China, Ch 'in Shih Huang, in his first year as King of Ch'in, 246 B.C., a few years before he became Emperor. The area is a broad plain of alluvium and loess which was deposited in an ancient lake basin by water and by wind. The Wei River along with its tributaries flows through this "Cradle of Chinese civilization". The Wei-Pei irrigation project has been remade eleven times in whole or in part during the twenty centuries since that time. In addition, repairs and additions were made from time to time. This tells of a remarkable struggle to maintain productiveness of land irrigated with silt-laden waters. It is a battle with silt for twenty centuries, which was finally lost until modern power machinery, and reinforced concrete construction gave a new lease on life to this famous irrigation project. Even now, the total area irrigated under modern works is less than that once watered under ancient work (Lowdermilk, W.C. & Wickes, D.R., 1942: 210-212)

The early system irrigated about 625 square miles, or 400,000 acres, of salty alluvial plain to produce crops of millions of stacks of grain. Harvests of 14,500,000 stacks are reckoned as produced on the land irrigated by the first canal system alone. The average yield was about 36 stacks of wheat per acre. (Lowdermilk, W.C. & Wickes, D.R., 1942: 212)

It may be inferred that removal of silt was an early and constant task, though the earliest specific mention of the necessity for this is found in a report of the year A.D. 995. This report mentions the blocking of canals with silt as a thing to be yearly watched for and promptly attended to by officials in charge. Before this time the presence of silt in considerable quantities in the water used for irrigation was regarded as an advantage rather than a disadvantage by improving fertility of fields. An official of the Emperor Kao-tsung of the T‘ang dynasty articulated the advantage of silt during 649 AD and 659 AD. An ancient Chinese song has the same idea. *"In one stone of King water, there are several pecks of mud. Both irrigating and fertilizing, it makes long our growing millet, feeding and clothing the capital's vast multitudes".* (Lowdermilk, W.C. & Wickes, D.R., 1942: 212)

Good and bad silt.

The reason for appreciation of silt was that during ancient time the silt consisted of top soil rich in humus. It was eroded from slopes of drainage, deposited on valley lands and enhanced its fertility. But over the period of time when silt is derived from sub-soils and sterile substrata of soils by erosion it damages land. It consists of material made up of coarse sands; productivity of irrigated land was seriously lowered. In addition to its harmful effects, sterile material burdens a project by the necessity of its removal. Thus increasing costs, and in time endangers the project. The same was the fate of Wei irrigation project. (Lowdermilk, W.C. & Wickes, D.R., 1942: 213)

The source of silt generation in Yellow River basin is the Loess plateau. It is in the middle reach of the river. Over the past 2.5 million years, the Loess Plateau has been subjected to episodes of intensive natural erosion. The fauna, distinctive mineralogy, soil formation features, and pollen assemblages in the Holocene loess/palaeosol sequence records deposition/erosion processes as well as bio-climatic change. During early Holocene climate on the Loess Plateau had cold and dry period, a warm and wet period in the Middle Holocene and again a cool and dry period in the later Holocene. In the early Holocene, soil erosion was very weak due to very low precipitation. During the middle Holocene, the soil erosion rate was lower than the soil development rate. This was because of luxurious vegetation cover that protected the soil from erosion through water, although precipitation was high. Around 3,000 BP, the climate turned cooler and drier, leading to natural forest degradation. Sediment data in the Yellow River delta, the volume of Holocene loessic sediments on the continental shelf of the Bohai Sea and river terrace development shows that in the early and middle Holocene, sediment load in the Yellow River was about 5 x 10" tons per year. An increase in soil erosion began about 5000 BP, when hunting and pastoral life began to change gradually to sedentary life. With the rise in population, human activity started to affect the environment at a scale comparable with powerful natural processes. (Xiubin, H. Et.al, 2004: 344) (Ren, G. 2007: 120)

Yü the Great the founder of first Chinese dynasty Xia is credited with development of sedentary agriculture and gave rise to a state that promoted agricultural pursuits and was sustained by appropriating a portion of the agricultural surplus. This was achieved by his efforts in controlling the flood in Yellow River. In sum, Yü the Great was responsible for the development of the cradle of Chinese civilization. The creation of Yu the Great tale not only helped to legitimize the veneration of agriculture by later Confucian states, but also continued to inspire Chinese water-control endeavours throughout the Imperial period and beyond (People in World History:1); (Pietz, D. & Giordano, M. 2009: 103)

The Han Dynasty (206 BCE-220 CE) was one of the longest of China's major dynasties. By the time of the Han Dynasty the population rose to 60 million. To support this huge population at that time most of the grassland in the Yellow River basin were transformed into farmland. The other reason for deforestation of Loess Plateau was the appropriation of land of small farmers and they had to shift to new land in the plateau. It was concentrated in mostly in the northern part of China. Almost all lands available for cultivation had been used. In the meantime, rich landlords appropriated small farmlands formerly owned by individual peasants, and the peasants who lost their lands had to open-up land on hillsides for cultivation, largely through the destruction of forest. Most grasslands in northern China were transformed into farmland. During the reign of Emperor Han Wu-di about 0.7 million peasants were obligated to cultivate the Loess Plateau. In addition, other nomadic areas were changed to farmlands. (Chang-Qun, D. Et.al, 1998: 573) (Violatti, C. 2013: 1)

From Huang He to Yellow River

Population growth along with other anthropogenic activities also led to loss of forest cover on Loess Plateau. During the Qin and the Han Dynasties China saw massive civil construction activity. Throughout this period, the Chinese built using timber and bricks and used huge amounts of forest products. For example, the Apang Palace, constructed in the Qin Dynasty, was about 50 km long and was probably the greatest palace in the world at that time. It consumed all the forest products obtainable from the central area of Shaanxi, and timber was procured from the forests of Sichuan in the final construction stages. (Chang-Qun, D. Et.al, 1998: 573)

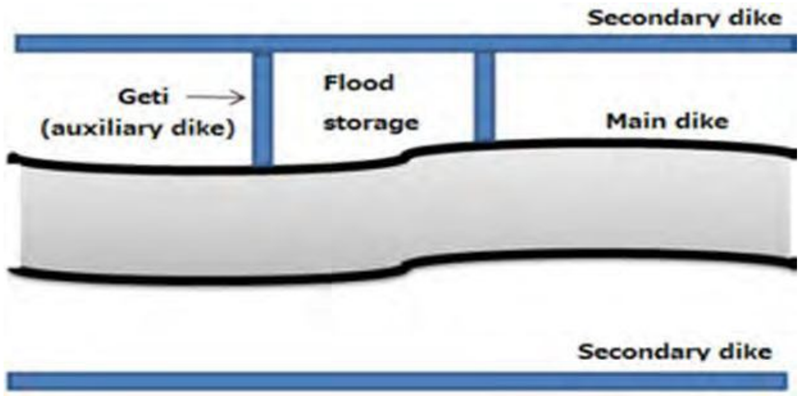
The construction of the Great Wall, a massive national defence undertaking, also resulted in considerable deforestation. For its construction, one third of all the country's labour force was compelled for its construction. Forests where the Great Wall passed were cut to heat the kilns for making bricks, cooking food, and providing warmth. The forests in many places were cut so severely that re-growth was impossible. All this lead to what loess plateau we have today. The finishing of the Great Wall further depleted the forest cover over the Plateau as the region was protected from further Mongol invasions. This improvement led to enhanced agricultural activity thus claiming more land from Loess Forest. Further question of excessive silt didn't surface in the initial year as it was top humus soil of the forest that got eroded and settles in the lower reach thus enhancing the fertility of soil. (Chang-Qun, D. Et.al, 1998: 573) (Lowdermilk, W.C. & Wickes, D.R., 1942: 213)

The anthropogenic activity mentioned above led the fall in forest coverage in the middle reaches of the Yellow River from 53% in the period of the Warring States (476 BC-221 BC) to 42% in the Qin and Han Dynasty. The reclamation of land in lower part of upper reach and beginning of Loess Plateau led to the desertification of Wulanbuhe during the Han Dynasty. Deforestation extended from the plain near the main course of the Yellow River and extended outward to its tributary and mountainside. With the increase in sediment from soil erosion, the water of the Yellow River became muddy, the riverbed in the middle course of the Yellow River rose, and the river frequently flooded and changed its course. During the 180- yr period (from 168 BC to 11 AD), the river changed its course 5 times (Chang-Qun, D. Et.al, 1998: 573) (De'er, Z. 2006: 33).

Silt Control

To control the menace of silt historical documents contain many records of artificial levee construction. These records can be traced back to the literature of the West Han Dynasty. Jia Rang, the famous river regulation expert during the West Han Dynasty, in his article "Three Schemes for the Yellow River Regulation" pointed out that the construction of artificial levees started during the Warring States Period. The illustration of plan is highlighted by figure 1.Before the West Han Dynastythe river was free of any confinements.Hence it braided, migrated and changed its course frequently, laying down tremendous quantities of sediment on the alluvial plain. At that time, the frequency of overbank flows was much higher than that after the levee construction. The flooding made it impossible for the ancient people to settle down and cultivate the land. The levee construction became a prerequisite for the regional development in the Lower Yellow River Plain.(Xu, J. 1993: 64)

Figure 2. Practice of flood Storage Creation with Leeves in Ancient China. (Huang, G. 2014: 2824)



For the duration of the Ming Dynasty (1368-1644) the confusion philosophy found its place in practice of controlling the silting of Yellow River. The theory adopted was of *"narrowing water flow by diking to scour sediment"* was put forward to guide the Yellow River regulation. The Yellow River intruded the Huaihe River Basin and took over the latter's lower channel reaches as its own outlet to the Sea during the period 1194-1855. To ensure the transport of grain to the capital through the Yellow River channel, the strategy of "storing the Huaihe River's clear water to scour the Yellow River's sediment" was put into action during the Ming and Qing Dynasties. Based on this strategy a dam was built near the confluence between the two rivers. Thereby the Huaihe River's water stage was considerably raised. A large lake was formed. All these measures gave rise to a series of far-reaching environmental effect. (Xu, J. 1993: 62)

A report by Sung Ping-liang to the throne in 1343 suggested a technique used in ancient times of closing the floodgates during the Monsoon time, when water is unusually in the King River. This would prevent the silting up of the canal. This would reduce the labour by half by operation of such gates to be opened and closed at proper times to prevent suspended mud from entering the main canal. (Lowdermilk, W.C. & Wickes, D.R., 1942: 213)

The other most regularly used method of maintaining of canal free from silt for irrigation purpose was making of new canals in parts to avoid cleaning out silt of old canals. Over the period of time the system got ruined and fell into disuse. The system was revamped after some leading man would take cognizance of the situation and secure the excavation of a new canal to take the place of the old in whole or in part. This occurred in 95 B.C. under Pai Kung in A.D. 377 under Fu Chien; in 823 under Liu Jen-shib; in 958 under He Yu-chulnui; in 1006 under the Sung Emperor, ChelntslIg; in 1072 under HouKo; in 1108 under Chao Chuani; in 1314-1318 under Wangr Chi; in 1645-87 under Hsiang Chung; in 1516-1532 under Hsiao Chung and Liu T'ien-ho; and finally in 1930-35 with the aid of the American China International Famine

Relief Commission. (Lowdermilk, W.C. & Wickes, D.R., 1942: 214) Since the Imperial period in China till Second World War the system of use and reuse continued of these irrigation canals became cyclical.

The Dujiangyan Irrigation System

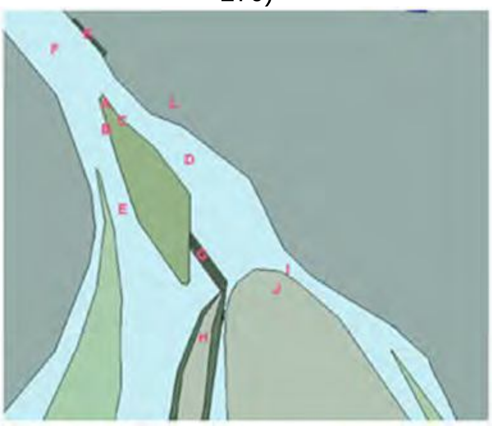
It is another fiat in the Chinese Hydraulic engineering system. It is located in the Min River, Sichuan Province, China. It is a combination of flood management and irrigation system built in 256 BC during the Warring States Period of China by the Kingdom of Qin. It is still in use today and irrigates over 5300 square kilometers of land in the region. The Dujiangyan irrigation system consists of the following three main components:

(1) The main part of this system is Yuzui or Fish Mouth, shown as ''A'' in Fig. 3. It divides the water into inner and outer streams. During floods the division between inner and outer is in ration of 40–60% of flow. The inner stream flow is for irrigation system, and the outer stream is for flushing out silt and sediment.

(2) Feishayan or Flying Sand Weir shown as ''G'' in Fig. 3 is about 200 m wide and is an outlet of water from the inner stream to the outer stream. It ensures the drainage of large sediments to reduce the water level and also ensures against flooding by allowing the flow of the water to drain from the inner to the outer stream.

(3) Baopingkou or Bottle-Neck Mouth, shown as ''I'' in Fig. 3, is the last and major part of this system. It conveys clean water to the irrigation channel and works as a check gate, creating whirlpool flow that carries away excess water over Flying Sand Weir or the narrow entrance near Bottle-Neck Mouth between Lidui Park (J) and Renzi Levee (H) (Fig. 3) to protect from flooding. Li Bing and his father's flood management vision is depended on to dredging of the inner river bed deeply to maintain irrigation water storage, while building Flying Sand Weir (G in Fig.) to reduce flood risk (''keep the weirs low and the sluices deep''). (Luo, P. Et.al 2015: 271-272) (Yingjun, W. 2005: 4)

Figure 3. Location and structure of Dujiangyan irrigation system (Luo, P. et. al, 2015: 270)



A list of five disasters namely flood, drought, wind/fog/hail/frost, plagues and pests from which the population of an area has to be protected. This would legitimise power of a ruler and help in governing people. This was the advice given for a good rulers by an early Chinese politician Guan Zhong (725 BC–645 BC). He persuaded the king of Qi country to pay attention to floods. His theory for flood control was based on the basic water character to lead it from high to low.

Unlike in the Post Second World was era the Yellow river basin was turned into food basket of China, the ancient system of flood control and irrigation was based on dry-farming technique. It is a continuum of 5,000 years of history of civilization along with framing culture. The initial cropping pattern was millet and broomcorn millet, could endure drought and had short growth periods. In the Han Dynasty, the agriculture production and the farming technologies developed very fast and the dry environment was made conducive for agriculture. Two methods of farming got developed during the dynasty.

In Yellow River basin the agriculture was facilitated by various canal irrigation projects. And these irrigation projects were result of various observation of dampness of land, river and of spring. Apart from canal irrigation well irrigation was also responsible to expansion of irrigation in ancient China. In 1975, an ancient well 4000 years old was excavated in Jiangou, Handan, Hubei. The well irrigation is of two kinds observed in China. One where irrigation canals pass and adjoining land is higher the canal. The second irrigation system was a well to exploit the underground water. The followings are the example of both surface canal irrigation and well irrigation.

The shadoof in China is known as *Jiégāo*A wooden pole with a 2.6 m long, tapering body and circular ends. There is a round arch groove at a distance of 1.66 m from the thin end of the pole. The pole was considered as the beam of *Jiégāo*and the groove would be the notch or mortise, cut into the beam to articulate the upright post like a hinge. (Yannopoulos, S.I., et.al 2015: 5039)

Hùdǒu was another common water-lifting device in ancient China (Figure 4). It consists of ropes and a container. Two ropes are fastened symmetrically at the top edges of the container, which is a wooden bucket or a wicker basket. Two persons stood face-to-face and pulled on the ropes. (Yannopoulos, S.I., et.al 2015: 5039)

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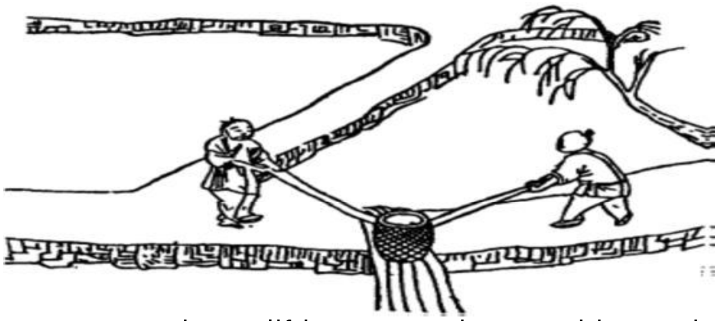
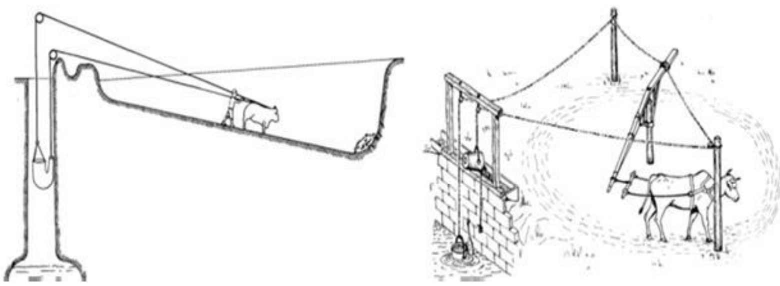
Figure 4. Hudou (Yannopoulos, S.I. et.al, 2015: 2040)



The *Lùlu*was a groundwater-lifting device in ancient China. It consisted of a wooden stand, a wheel an axle, a hand crank, and ropes. The wheel axle was the most important component. The *Lùlu* solved the problem of water lifting from deep wells. This marked a new epoch in the development and utilization of groundwater, with a series of technical innovations during the Ming and Qing Dynasties (1368–1911). Innovations included replacement of manpower by horsepower, the introduction of multiple containers and an increase in the depth of the well. (Yannopoulos, S.I., et.al 2015: 5040)

Figure 5. Cross-section view of a mohte & Circular mohte utilizing two buckets with flap-valves. (Yannopoulos, S.I. et.al., 2015: 5038)



One of the striking features of Yellow River basin management is. It has the longest and dedicated River Bureaucracy since 2nd Century BC. Imperial states, in turn, through the medium of the administrative bureaucracy, viewed water as a means of promoting agricul-ture, thereby increasing expropriation of the agricultural surplus to expand and sustain the empire.

Ancient Civilizations have graduated from Dry-Land Farming to Humid Farming facilitated by canal and check dams. In China, this shift was also observed as population shifted south of Yellow River. However, in China this graduation continued along with rainwater harvesting. According to records, as early as the Qin and Han Dynasties, people built waterlogged ponds and small reservoirs to accumulate rainwater for utilization. Water cellars and water-retention wells also have a long history. According to records, as early as the Qin and Han Dynasties, people built waterlogged ponds and small reservoirs to accumulate rainwater for utilization. Water cellars and water-retention wells also have a long history.

The earliest flood forecasting and flood warning has started since Zhou Dynasty (770 BC - 256 BC). According to the records of an important book titled ZiShuiQuan Di (entitled in English, Water Harnessing Methods) published in AD 1573, many post stations to pass on flood information were set up along middle and low streams of Yellow River and Tong Guan was the first station at middle stream and Su Qiang was the last station at outlet of Yellow River. When flood occurred at any station of middle stream the special horseman ran forward to down-stream with fast speed to bring the flood information to stations at lower stream, since the speed of horseman was faster than that of the flood movement so that people at downstream station can be informed before the time of flood arrive so as to facilitate them to take emergency measures to reduce flood disaster Wang Gong, AD 1573. (Guowel, L. 2001: 6) There are many examples applying hydrologic knowledge in ancient China that deal with irrigation, flood protection, tax and other matters. Early in the third century BC, the designer and leader of Dujiang Weir Project controlled inflow discharge of canal head according to different water level indicated by different submerged part of stone-man body. For example, he controlled inflow discharge of canal head equals to 40 % of main river discharge in flood period but 60 % in dry season for making yearly water balance in irrigated area. The example shows that in ancient China the designer of this project had quiet good knowledge on the relationship between water level and flow discharge. (Guowel, L. 2001: 7)

Another famous book with title of Lü Shi Chung Qiu (entitled in English: Master Lü' Spring and Autumn Annals) written in 293 BC, which says "Cloud and water vapor flow westward in all seasons, streams flow eastward day and night, because the atmosphere is the inexhaustible sources of water and the ground can never be filled with water. Water flow concentrates from small rills into large stream and evaporation from land water and becomes vapour. So this is called the water cycle". This gave a clear conception of hydrologic cycle on mainland of China early in 239 BC, which is still valid today (LüBuwei, 293 BC). (Guowel, L. 2001: 6)

In VIIth Century BC, Guan Zong, a famous philosopher in ancient China, divided rivers into three classes, i.e. Main River which flows directly into the sea; Branch River which flows into Main Rivers; Intermittent River, whose flow is not permanent in dry seasons such as the rivers in arid region of China. (Guowel, L. 2001: 7)

Discharge Measurement

Fan Ziyuan, an official in North-Son dynasty (AD 960-1127),build up the concept and technical term of river discharge in AD 1078 for description and comparison of water quantities of different rivers.Hefloat method measuring the flow velocity was initiated on Yellow River and Yun Ding River. The measurement of float velocity was taken with the aid of a running horse that runs after the float. Lack of technology didn't provide for field counter timer in that period, hence the velocity of the running horse could be roughly estimated. (Guowel, L. 2001: 5)

Conclusion

We can observe that Ancient China was not divorced of the water infrastructures that we find most sought after in post Second World War. It is the scope and manner in which operation of these infrastructures that differed from post Second World War China. For example for flood control presently dams and reservoirs are build on the river course. In ancient China channels, dams and alongside with artificial lakes was the practice. They were build off the river to arrest the flood flow and left the river free during non-flood months. These lakes were source of irrigation water. The ancient system of river management was holistic and sought the local remedies, very unlike Chairman Mao. Who first of all sought foreign support and suffered from narrow vision, as he wanted to get rid of Yellow colour from the river and disdained the river itself. The diversions, which were supposed to control floods, proved to be murderous for the river. As they would be required to be filled each year, as they over the period matured to provide water for agricultural use. The other conclusion that can be infrared from the Chinese experience is the important of green cover over mountain and plateaus. We can observe how population explosion even in the ancient time exhausted the green cover and how this became blessing in disguise. Though it protected Chinese civilization from foreign invasion but at same time created a dilemma which they have suffered throughout the history and present. Though in the initial years the removal of green cover generated the top soil silt rich in humus beneficial to plains fertility, but over the length of time it created a problem of declining fertility as the silt was derived from lower layers of soil consisting of sand. It not only harmed the land fertility but raised the bed of Yellow River leading to flooding in lower reaches of river. The other attribute of ancient Chinese society was the collection of rainwater for the agriculture. It existed along with the canal irrigation and other facilities provided by the center. This trait was neglected in post second world war era under Chairman Mao.

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