

## AN ANTHROPOLOGICAL STUDY OF TRADITIONAL IRRIGATION, TECHNOLOGICAL WISDOM AND ECO-CIVILIZATION IN ANURADHAPURA, SRI LANKA

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**Abstract:** The hydraulic civilization of Sri Lanka had been developed in terms of the tanks in the country. Agriculture is the main subsistence of Sri Lankans from the ancient past. Sri Lankans could able to build a proud history with traditional irrigation technological wisdom which shaped by rich cultural features of the ancient period. Hydraulic civilization in Sri Lanka has unique features of its own. The main income of the Pemaduwa people is paddy, dry and mixed cultivation and fishing. These people still have intimate relationships, practicing environmental protection methods and performing various cultural activities and social practices related totanks. The ancient bureaucratic system was not in practice and it had replaced by the present administrative system. The Objectives of this research are to study about the indigenous irrigation wisdom in terms of traditional technical knowledge, administration, management and environmental protection systems in the ancient irrigation civilization of the country. The present study has conducted in the Villachchi region in Anuradhapura district, which named as 'MahawewbendhiRajjyaya' (the country where massive tanks were built).

**Keywords:** Traditional Knowledge, Tanks, Sri Lanka, Hydraulic Civilization, Environmental Protection.

### INTRODUCTION

Sri Lanka is an island of about 65,000 sq.kms, some 30 km off southern India between 6° and 8° north latitude. The land rises gradually from the coastal plains towards a south-central hill massif (whose highest point is Pidurutalagala 2524 meters, msl) and from which springs all the major rivers, of which the Mahaweli Ganga (river) is the longest. The island gets the benefit of two monsoons; the north-east monsoon, between October and March brings rainfall to the whole island, while the southwest monsoon, between April and September, is intercepted by the south-central hill massif, and blows as a dry wind over the northeastern area. Hence, Sri Lanka is divided into four physiographic regions, the central highlands, the southwestern wet zone, the northern and eastern dry zones. The so-called wet zone has an average annual rainfall in excess of 2000 mm while the dry zone has less than 2000 mm (Mendis, 2002).

In a written history of Sri Lanka, dating back to the first millennium B.C., the existence of the three ancient kingdoms is shown, and construction of ancient river diversion systems and storage reservoirs is recorded (Mahavamsa, 1959; Culavamsa, 1960). The kingdoms were Rajarata or the king's country and Ruhunurata, together covering most of the dry zone. The ancient irrigation works were mainly in the dry zone, of which many are still functioning, but some ancient works are also found

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in the wet zone (Mendis, 2002).

According to Deraniyagala, the water heritage of Sri Lanka comprises two elements, the natural heritage and the man-created (cultural) heritage. The latter did not come into prominence until the dawn of the historical period at ca. 500 B.C. Its antecedents consist of the pre-historic period (Stone Age) from over 125,000 to 1000 B.C, followed by the proto-historic period (Early Iron Age) at 1000 to 500 B.C. (Deraniyagala, 1996, as cited in Mendis, 2002).

The hydraulic civilization of Sri Lanka had been developed in terms of reservoirs and agriculture is the main subsistence of the people from the ancient past. Sri Lankans could able to build a proud historical tradition in terms of irrigation technological wisdom shaped by rich cultural features which are older than two thousand years.

According to the historical records first two reservoirs (*Jaya Vewa* and *AbhaVewa*) had been built by king Pandukabaya during the period between 437-367 B.C. Compared to other communities of the world, hydraulic civilization of Sri Lanka has unique features of its own. When we consider the other people of the world their hydraulic civilization had developed in terms of the rivers and natural water streams. But Sri Lankans had developed hydraulic civilization in terms of the tanks which were constructed by the people of the country. An ancient people of Sri Lanka had thought that the rain water should be preserved by constructing tanks (*Vewa*) to cultivate their paddy lands.

Thus, hydraulic civilization of the country had commenced of small tanks and it had been gradually developed until medium type and massive type of tanks from 3rd century BC and it marked a unique landmark of the hydraulic technological wisdom of the country. Brohier(1979)wrote in his book titled: ‘Ancient Irrigation Works in Ceylon’, “the massive irrigation works which are available in Ceylon (Sri Lanka) couldn’t be seen in any other country of the world”.

Tanks and cascade system hold the special status of the irrigation culture in Sri Lanka. It was enriched by traditional technical knowledge, administrative, water management, and environmental protection system, etc. Therefore, the socio-cultural features were gradually enriched by the hydraulic civilization of the country.

According to the recorded history, the country was divided into three parts called: *Ruhunu*, *Maya*, and *Pihiti* in the first century A.D. The ancients had used high technology for storing and diversification of water in rivers and tanks to the various directions of the country.



Figure-1:Map of Ruhunu, Maya, Pihiti (“Maya Rata”, 2009).

Some parts of the Anuradhapura region (presently North – Central province) was belonged to the dry zone and region of *Pihiti*. On the other hand, most parts of the region of *Ruhunu* also belonged to the dry zone. But no water scarcity had emerged in the region of *Maya*, as it was situated in the wet zone of the country. But even in the wet zone, we could see some ancient water tanks. These water tanks were also built for the purpose of storing water. Tanks which had been built in the dry zone served the purpose of diversification of water in the agricultural grounds and also to use stored water during the off season of the territory.

### Objectives of the study

The Objectives of this research are to study about the indigenous irrigation wisdom in terms of traditional technical knowledge, administration, management and environmental protection systems related to the numerous tanks in the country. Presently, the study of intangible cultural heritage has been a striving effort of anthropologists all over the world. Not only the social scientists, but also the other

scientists also draw their keen attention to understand traditional knowledge for solving various questions related to the technology and the environment which cannot be dealt with existing knowledge of their science. As ancient knowledge in traditional irrigation technology and ecological protection in Sri Lanka has advanced features, this would be a timely productive study it for the benefit of mankind.

### **Research area**

The present study has conducted in the Villachchi region in Anuradhapura district which belongs to North- Central province of the country. This entire province named as '*MahawewbendhiRajjyaya*' (the country where built massive tanks). Although the etymological meaning of Villachchi (Vill+Achchiya) is five or seven tanks, however, four tanks only can be seen nowadays. Villachchi region presently consists of seven headmen divisions (*Grama Niladari Kottasa*) and seven farmers' organizations which operate for cultivating activities on them.

This research was carried out at the 362 Pemaduwa divisions among them. The subsistence of the present villagers also linked with lakes of the region. The total number of families at Pemaduwa division is five hundred and thirty three (533).

Entire areas of Villachchi were covered by forest until 1956. After 1956, people those who resided at Southern and North- Western parts were resettled in this area by the government of Sri Lanka. The village called Elapathgama was one of the areas of Villachchi. After populating this area, the *Vedda* people (Indigenous People in Sri Lanka) those who lived there were assimilated to the main stream of the society.

Villachchi tank was built by king Vasaba in 66-110 A.D. According to the legends of the peasants in this region, *Kuda* (Small) Villachchi and *Maha* (Big) Villachchi tanks had respectively reconstructed by Princess Ashoka Mala and Prince Saliya during 161-137 A. D. Saliya was son of Great King Dutu Gemunu, and he got married Princess Ashoka Mala. Although *Kuda* Villachchi tank was bigger than a *Maha* Villachchi tank, small tank called as *Maha* Villachchi and big tank called as *Kuda* Villachchi. The reason was to mark respect to patriarchy and pay tribute to Prince Saliya, such opposite meanings were accorded by the ancient people.

Questionnaire, interviews and participant observation methods were employed for the data collection. Twenty five (25) key informants were interviewed, including farmers, fishermen and officers who are related to the irrigation tanks and canals. Additionally, fifty (50) questionnaires have been filled from respondents those who live in the area. Finally, researchers participated in the events to collect data which are associated with the rituals and beliefs of the tanks and tankh villages. Thus, researchers could able to accumulate information on intangible cultural heritage which connect with traditional knowledge of irrigation technology, cultivation and environment.

### TRADITIONAL KNOWLEDGE OF IRRIGATION TECHNOLOGY

The ancient traditional irrigation technological knowledge and ecosystems of Sri Lanka are a classic example of man's active adaptation to nature. Therefore, water heritage of Sri Lanka is a topic of worldwide interest. The statement of the king Parakramabahu I (1164-1197 A.D.) was a good example to prove it. It is as follows:

"In the realm that is subject to me . . . there are but few fields that are dependent on rivers with permanent flow. . . . Also by many mountains, thick jungles and by widespread swamps my kingdom is much straitened. Truly, in such a country not even a little water that comes from the rain must flow into the ocean without being made useful to man" (*Mahavamsa* or The Great Chronicle of Sri Lanka, as cited in Mendis, 2002:70).

Irrigation is only one function of these systems, conservation and utilization of rainfall being their main purpose. Rainwater is conserved in reservoirs and in the soil itself. These ancient reservoirs have earth embankments, some higher than 100 ft and are equipped with sluices and spillways. According to the British colonial engineer Henry Parker who worked in Ceylon (Sri Lanka) between 1870 and 1901, the valve-pit or valve-tower of 19th century Europe, was invented by the ancient Sinhalese, more than two millennia ago (Mendis, 2002).

"Since about the middle of the last century, open wells, called 'valve towers' when they stand clear of the embankment, or 'valve pits' if they are in it, have been built in numerous reservoirs in Europe. Their duty is to hold the valves, and the lifting gear for working them, by means of which the outward flow of water is regulated or totally stopped. Such also was the function of the 'bisokotuwa' of the Sinhalese engineers: they were the first inventors of the valve-pit more than 2100 years ago." (Parker, 1909, as cited in Mendis, 2002:70).

Likewise, huge water tanks which had been built by Sinhalese kings were extremely wonderfully constructed. Therefore, studying about the indigenous knowledge of traditional technological wisdom, eco civilization and well organized water management system is part of the unique heritage of this country.

Water tank has the following main parts :

*Vekanda* (bund of the tank)

*Ralapanawa* (wall inside the tank made out of hard rocks)

*Vana* (Spill) i. *Ethuluvana*

ii. *Pita Vana*

*Sorovwa* (Sluice) i. *GodaSorovwa*

ii. *MadaSorovwa*

*Bisokotuwa* (More Complex Sluice)

*PotaWeti/IsWeti* (fence made of grass)

*Diyaketapahana* (water measuring scale)

*VewPitiya/ VewThaulla* (ground of the tank)

*Poshaka Pradeshaya/ Vew Ihaththawa*(catchment area of the tank)  
*Kalingu Bemma*(Kalingu wall)

### **Vekanda (Bund of the tank)**

Sustainability of the tank depends on the Strength of *Vekanda*. The capacity of the water bearing would be decided upon the size of the bund of the tank. But some tanks could be able to bear more water capacity because it had built in between two mountains and thereby crossed the valley. Bund of the tank always builds taller than the water level. Therefore, the tank can bear the pressure of the water. It is made of clean soil. One foot of the soil pressurized until one inch by using the animals' feet. Respectively goats, bulls and finally elephants were used for the task. We can not imagine the strength of the *Vekanda* as it still remains during over ten centuries steady. To bear the pressure of the water, it was built in the shape of a semi-circle.

### **Ralapanawa (The wall inside the lake made out of hard rocks)**

*Ralapanawa* is a parallel wall which constitutes the inside of the bund of the lake made out of hard rock (*Kalugal*). Because of wind, waves of water always touch the bund of the lake. Due to this continuous process bund would be damaged. Therefore, ancient people used hard rocks and constructed a wall around the inner side of the bund. This was not constructed using any kind of plaster. It was made out of hard rocks by interlocking each other.

### **Vana (Spill)**

There are two types of *vana* as follows:

*EthuluVana*(Inner Spill)

*Pita Vana*(Outer Spill)

Water which comes from outside to the tank is purified by *Ethulu Vana*. Inner spill acts as a guard of the tank. The mud which comes with the water remains inside the *EthuluVana* and water only releases into the tank. When the water level is more than the capacity of the tank, *Pita vana* is used to spill over water to the canals. It is also made out of hard rocks. Therefore, it could not be shaken even by the water. When the water is released by *Pita vana*, the village had not been flooded by the water. As this water came to the natural streams or canals and it circulated all over the farm grounds in the villages.

### **Sorovwa (Sluice)**

There are two types of Sluice (*Sorovwa*) as follows:

Madasorovwa

Godasorovwa

*Sorovwa* has been constructed for delivering water to the farming grounds.

Water releases to the canal through the *Sorowwa*. The canal has been constructed beneath the bund of the tank. In the ancient period timber or stones had used to construct *Sorowwa*. Further, tubes made out of clay had used for distributing water from the tank to the farm grounds in the ancient period. *Madasorowwa* constructs at the deep end of the tank. When the mud filled in the tank, this sluice use for emptying whole water of the tank and necessary action would be taken to clean the tank.

*Godasorowwa* is constructing on high to the *Madasorowwa*. *Godasorowwa* had used for releasing the water from the tank to farming grounds to get done the day to day activities of farmers.

Apart from these two, another type of *Sorowwa* called *Ketasorowwa* which built in the small tanks to release water from tank to farm grounds.

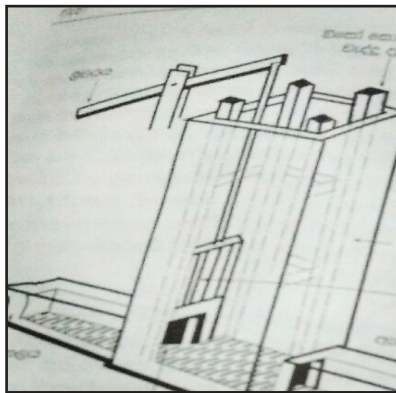
### ***Bisokotuwa*(More complex sluice)**

The Sinhala word *Bisokotuwa* is a compound of *Biso*, queen and *kotuwa* enclosure, meaning literally, a “queen’s enclosure” (Jayawardhana, 1986).

*Bisokotuwa* was a wonderful construction which had made for the protection of the bund of the tank. Due to construction of large tank, water capacity of the tank also very high. Therefore, the bund of the tank happened to bear huge pressure of water. To avoid that pressure people had constructed square type well with two tunnels inside the tank.

One side of the tunnel has a huge hole towards water level. Through this hole, water entered inside the *Bisokotuwa* and fills it. This filled water come through a next tunnel which construct from *Bisokotuwa* to the outside of the tank.

To proceed the process large plank had used as the gate of *Bisokotuwa* and it can be operated by a lever. Due to this wonderful construction bunt of the lake had been protected as people could able to release, control and stop water through this excellent technology. First to second century A.D., this marvelous construction had come up with the tanks, according to the records of British engineer Henry Parker.



**Figure: 2 - Simple Geometrical Design of *Bisokotuwa* (Avsadahamy, 2003).**

To build new sluice of *Randenigala* tank, the place was marked by engineers in the decade of 1980. The wonderful incident was the ancient sluice (*Bisokotuwa*) had found in the same place, and it was difficult to understand that how did ancient people measure, the proper location according to the ancient scales.

### ***Pota Weti/Is Weti***

*PotaWeti/Is Weti* was a fence, made out of grass, to purify water. The grass had grown like a long fence on the inner side of the bund. As this is a natural fence, mud remains on the tip of the grass and only purified water was collected inside the tank.

### ***Diyaketa Pahana (Water measuring scale)***

People were used *Diyaketapahana* to measure the water level of the tank. This is another good example of the knowledge of water management of the early people in this country. They were used stone post for it. *Diyaketapahana* is seen in small lakes for which they use the wall of the bund to measure the water level.

### ***Vew Pitiya /Vew Thaula (Ground of the tank)***

This is the intermediate zone between *Vew Ihaththawa* (catchment area) and water storage of the tank (Kariyawasam, 2019). From the ancient period, people used to plant trees, i.e. Honey tree (*Mee Gasa – Madhuca longfolia*), Arjun tree (*Kumbuk gasa – Terminalia arjuna*)etc. as they believed that the water is purified and enhanced by these flora, such practices ensured the sustainability of the tank.

### ***Poshaka Pradeshaya/ Vew Ihaththawa (Catchment area of the tank)***

The catchment area (The forest area) was prohibited for human activities such as deforestation, farming and cultivating. However, the people of the tank villages were allowed to collect medicinal herbs from the forests for the preparation of indigenous medicine. Conservation of this environment directly affected to protect groundwater level and gradual release of water to the tank during the dry season (Hitinayake et al., 2008).

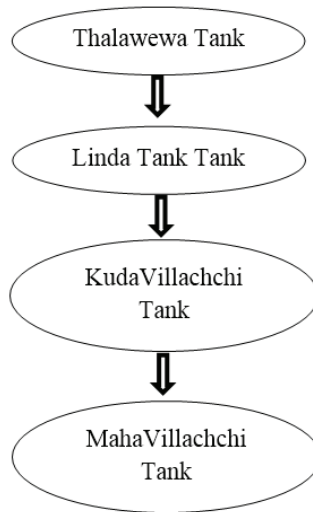
### ***Kalingu Wall (Kalingu Bemma)***

*Kalingu* wall had been constructed to protect the *Pitavana*. It always constructs somewhat beneath but before the outer spill. In case of any damage to the outer spill, villages could be destroyed by water flood. Therefore, the ancient people would able to avoid such kind of disasters as they had taken precautions by using their technical knowledge.

## **WATER MANAGEMENT THROUGH VILLACHCHI CASCADE SYSTEM**



Cascade means, one tank connects to the next tank through a canal system. Thus, water of one tank falls into another tank and excess water can be protected without wasting each and every drop. Eg The MahaVillachchi irrigation system had constructed according to this technique. Water in the Thalawewa tank comes several k.m., through a tunnel and it goes to Linda tank. When the water filled in the Linda tank, it comes through a tunnel and enters into the KudaVillachchi tank. Further excess water is again released from the KudaVillachchi tank to MahaVillachchi tank.



**Figure: 3 - Villachchi Cascade System**

Water capacity of the MahaVillachchi tank is 32,500 acres. Thousand six hundred and fourteen acres are being cultivated by right bank and thousand fifty acres are cultivated by the left bank of this tank. MahaVillachchi is consisted of two sluices, number of water distribution canals and field canals.

In the year 2018, the 'Food, Agriculture Organization' (FAO) of the United Nations Organization has announced three Agricultural Heritage Zones as world heritages of the world. These zones situated in three countries, namely; Sri Lanka, Japan and Norway. Twelve lake villages (12) which have cascade systems at Palugasvewa District Secretary (DS) Division of the country have been selected as world heritage by FAO of UNO and these all tank villages became worldwide interested (Pussegoda, 2019).

### **SAFEGUARDING ENVIRONMENT - PAST AND PRESENT**

Ancient eco-civilization was established through the hydraulic civilization of the country. In the construction of a tank, Sinhalese had to remove huge volumes of soil. By using this soil they constructed a Buddhist pagoda in the vicinity of a tank.

A temple of Gods was also built just near the reservation of the tank. In order to get rains and prosperity, people made vows in this temple. Further, the ancients believed that huge trees near the tank were occupied by deities. Therefore, they planted huge trees surrounding the tank. These beliefs helped to maintain the sustainability of the tank and the environment. Honey tree (*Mee Gasa*) is considered as the 'fertile tree of the nation' from the ancient past. It is one such tree planted around the tank, in order to protect the tank as well as to increase the fertility of the paddy fields. The excreta of the bats who consume the fruits of the Honey tree makes the soil fertile.

All those actions were used to safeguard the environment around the tank. As shrine places were situated just near the tank side, people never make the surrounding area filthy. Due to planting of huge trees around the tank, it was naturally protected. Because of the above mentioned belief they never cut trees near the lake and always dedicate to protect them. Finally, in case of performing any kind of redundant or repulsive activities performed by the peasants against the protection of the tank or tank side, they were severely punished by local court called 'Variga Saba'. There is a legend as to a ruling by King Devanampiyatissa (307-267 B.C.) to impose the death penalty for those who cut down a 'Honey Tree'. It revealed us how much Sinhalese rulers understand the importance of 'Honey Tree' to protect the water tanks of the country. Through these types of actions, the ancients could be able to conserve and to keep safe the whole environment of a tank and paddy fields in the past.

Presently, peasants and local council make several actions to safeguard tanks and tank sides of the village. Seven farmers' organizations which include one representative from each field canal form a society to take necessary actions for conserving the tank. Huge trees are being planted surround the tank and banned and prohibited to cut them. Heavy vehicles are not allowed to travel through the tank bund. To avoid environmental pollution, they operate a waste management system nowadays. By keeping different coloured bins on the tank bund to collect wastage, Provincial Council made a good effort, to protect environmental pollution of the tanks. To memorize the responsibility of the community, Provincial Council displays catching statements to keep the surroundings of the tank clean.

### ***KEM KRAMA*: TRADITIONAL KNOWLEDGE RELATING TO FARMING ACTIVITIES**

As irrigation technology has been dealing with farming activities of the peasant, it is important to know about the traditional knowledge relate to cultivation activities too. In fact, these two have an inseparable connection with each other.

Farmers believe some unseen powers bring devastation to the farm grounds. There are many shamans' available in Villachchi to perform rituals to avoid calamities which are done by these unseen powers. Farmers spray blessing water (*Pirithpan*) to the farming ground for avoiding the effects of evil mouth and evil

eyes of the people. Further, they erect four splinters at four corners of the farm ground, which are about one and a half feet and hang pieces of old saffron robe for getting blessed of triple gems.

Next, farmers dive into the deep end of Villachchi tank and bring quartz to deposit them four corners of the farm ground. Sometimes after chanting blessing verses, they spread out pure sand which has taken from deep sea water. Further, farmers used to wake up at dawn. They uprooted the infected plants from the ground and put them on the street for trampling by the villagers. And they also take a coconut stalk and erect them in several places. Then the insects fly and they attract to the gum of the coconut leaf base. Finally, these creatures attach to gummy leaf base and died them.

And also, early morning farmers spread ash all over the farm ground without speaking any word. To avoid infection of one creature called '*Kola paluwa*' (devastator of leaves), farmers spread cow dung all over the farm ground. Moreover, farmers erect splinters at several places in the paddy field and keep the rotten fish on it. Due to the smell of flesh, birds attract to the paddy field and they attack the flies of the ground. Instead of using chemical insecticides, these are the natural process which they follow for controlling insects which attack to the farming grounds.

In addition, farmers ignite coconut husk and keep them on splinters and placed them at some points in the paddy fields. Nowadays, they keep tires at four corners of the farm land and ignite them to avoid creature attacks.

## CONCLUSION

Hydraulic civilization in Sri Lanka has unique features of its own. Other hydraulic civilization developed centering around the rivers and natural water streams. But Sri Lankans had developed their hydraulic civilization in terms of the tanks which built by the hands of the great ancestors of their traditional wisdom. The main income of the Pemaduwa people is paddy, dry and mixed cultivation and fishing. Therefore, these people still have intimate relationships with tanks. Not only ancients, but the peasants nowadays also perform many practices to safeguard the tank, tank side and environment. Although the ancient bureaucratic system was not in practice at present and it had replaced by the present administrative system which operates by the government officers who attached to the department of irrigation and provincial council. Farmers still have their own methods to respect the water tanks by performing various cultural activities as well as social practices.

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