GLOBAL ACADEMIC RESEARCH INSTITUTE

COLOMBO, SRI LANKA

GARI International Journal of Multidisciplinary Research

ISSN 2659-2193

Volume: 06 | Issue: 07

On 31st December 2020

http://www.research.lk

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GARI Publisher | Anthropology | Volume: 06 | Issue: 07

Article ID: IN/GARI/ICHC/2020/101 | Pages: 19-35 (17)

ISSN 2659-2193 | Edit: GARI Editorial Team

Received: 07.10.2020 | Publish: 31.12.2020

IMPACT OF THE CHANGING RELATIONSHIP BETWEEN MAN AND TRADITIONAL HYDRAULIC SYSTEMS: IN TERMS OF THE BELLANKADAWALA CASCADE SYSTEM IN SRI LANKA

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ABSTRACT

A 'cascade' is a connected series of village irrigation tanks organized for storing, conveying, and utilizing water. They developed in Sri Lanka to collect rainwater for agricultural and other purposes during the rainy season. Economic Anthropology is human economic behaviour depends on cultural scope. Tanks have integrated with self-sufficient social and economic system in the rural community. The rural social structure, beliefs, and customs were closely integrated with the system of paddy cultivation. The research problem of the study was the impact of the changing relationship between man and traditional hydraulic systems: in terms of the Bellankadawala cascade system in Sri Lanka. The main objective was to identify the pattern of changing relationship between man and the traditional irrigation systems. The research was carried out in the Gramaniladhari Division of 593-Kelawa of Palugaswewa Divisional Secretariat, Anuradhapura. The table of Krejcie & Morgan used to select 196 out of 404 households. The purposive sample consists of informative villagers and irrigation officials in the area. Unwritten primary data collection carried out by using general observation and semi-structured interviews. Further, both publications and e- sources were used as secondary data collection methods. Data were analyzed using narrative analysis and its focused experiences shared by people to answer the research problem. The rural economic system has been collapsed due to the gap between man and tank. Traditional farming, fishery, medicine, beliefs, and Eco human relationship have been declined. Hence, the society has been failed to reach the optimal production level.

Keywords: Cascade, Economic Anthropology, Bellankadawala, Tank

INTRODUCTION

Sri Lanka is a tropical island. It is divided into four physiographic regions: The Central Highlands, the South Western Wet Zone, and the Northern and Eastern Dry Zones. The so-called Wet Zone has an average annual rainfall more than 2000 millimetres while the Dry Zone has less than 2000 mm (Mendis, 2002, as cited in Jayatilleke, 2018). Accordingly, the hydraulic civilization of Sri Lanka had been developed in terms of lakes, making agriculture the main subsistence of the people from the ancient past. Sri Lankans could build a proud historical tradition in terms of irrigation technological wisdom, shaped by rich cultural features which are ancient more than two thousand years (Jayatilleke, 2018).

Other people of the world their hydraulic civilization had developed alongside the rivers and natural water streams. On the contrary, Sri Lankans had developed a hydraulic civilization by

building lakes constructed by the great ancestors of the country. The ancient people of Sri Lanka thought that the rainwater should be preserved in tanks (lakes) so that it can be used to cultivate their paddy lands. When it comes to current research, Horiwila tank is nourished by the two cascade systems called the 'Palugaswewa cascade system' and 'Bellankadawala cascade system'. Although, the Palugaswewa Cascade System was already widely studied by several scholars, only few studies have been conducted about the Belankadwala cascade system. Since the present researcher has observed that the Bellankadawala cascade system is also very much important to the existence of Horiwila tank, this study was carried out to study this cascade system. It is visible that Bellankadawala cascade system and surrounded area has a unique relationship between peasants and their hydro environment. However, a great relationship was come into existence with man and traditional hydraulic systems from ancient past in Sri Lanka. This interrelationship is visible even today in the country. Bellankadawala cascade system can be pointed out as a unique example that reflects this relationship even in the present society. Accordingly, this research studies the impact of the changing relationship between man and traditional hydraulic systems in terms of the Bellankadawala cascade system in Sri Lanka based on Economic Anthropological and Ecological Anthropological perspectives.

LITERATURE REVIEW

Culture, Society and Social Change

The term 'culture' derived from a Latin word. 'Cultura' derived from 'colere' and it means 'to cultivate' (Jain, 2012). That complex whole which includes knowledge, belief, art, moral, law, custom, and any other capabilities and habits acquired by man as a member of society (Tylor, 1871, as cited in Keesing, 1976). Culture is the pattern of living. Almost everyone who lives in the society have adapted to accepted living pattern. This adaptation or discipline could be introduced as the culture and it differs from society to society (Perera, 2013). Although the man has achieved the technology to land on the moon, he has paid lack of attention to seek himself and principles of his behaviour. Further, all of us study physical things beyond us. Accordingly, it is possible to study the principles of man and enhance the quality of human life through the subject field of Anthropology (Rathnapala, 2007). Pattern of human activity and symbols that have unique meanings to these activities refers to culture. Culture consists of art, literature, costumes, customs, language, religion, and religious rituals. Cultures differ from region to region in the world. Diversity in cultures results in the diversity in people all over the world. Culture includes a system of beliefs maintained by people in of the religion (Jain, 2012).

Social change is the process which occurs significant alternation in the structure and functioning of a particular social system. The word 'change' is neutral. Changes in social behaviour, social structure and socio-cultural values may be the main causative factors for social change. Timely, social systems change with the influence of ideas. It can be predicted the future state through studying the changes (Kuppuswamy, 1972). Social change may be occurred due to many causes. They are culture, conflict, ideas, demography, and environmental changes (Jain, 2012).

Culture and Economic Anthropology

The economy is a social system that produces, distribute, and consume goods and services in a society (Jain, 2012). The term 'economy' derives from the Greek word 'Oikos'. It gives the meaning of

house-based estate (Hann, 2018). Ecological factors have integrated with self-sufficient social and economic system in the rural community (Morrison et al., 1979). The word of 'Economic Anthropology' was first coined in 1920s. Early, it was used as 'Primitive Economics'. Melville Herskovits used it as the topic of a compendium in 1940 (Hann, 2018).

The paddy cultivation was the basis of rural economy in ancient Sri Lanka. The social beliefs, customs and institutions were closely integrated with the system of paddy cultivation (Morrison et al., 1979). In the 1970s, teaching of Anthropology consisted of economic anthropology, together with Kinship and Ecological Anthropology. All they were considered as a core discipline (Gregory, 2009). Major problem of the economics is the scarcity. Culture leads people to share scarce resources through economic activities. Further, culture is important for economic outcomes. As a universal factor culture effects on preferences of the people, firms and government, environment, education, material success etc (Rath, 2014).

Environmental Anthropology (Ecological Anthropology/Anthroecology)

Cultural practices affect for the improvement of human adaptation and maintaining of ecosystems. People have motivated to rethink about old methods of protecting the environment. The new ecological anthropology has merged theories with political and policy awareness. As a result of that, its efforts to seek culturally informed solutions to environmental issues. Accordingly, ecological anthropologists study the impact of cultural practices to enhance human adaptations to the living atmospheres or regional ecosystems (Kottak, 1999). Man changes the ecology of planet earth for many eras. Anthroecology studies the behavioural differences of modern human society more than prior species. Further, it studies their capability of transform the environment and the whole earth. Anthroecology theories study the interrelationship between human societies and their environments. This subject addresses the evolutionary process of socio-cultural structure and it scientifically investigates the reasons of anthropogenic environmental change (Ecotope ORG, n.d.).

Significance and evolution of traditional irrigation systems in Sri Lanka

Anuradhapura was designated as a world heritage in 1982. Ancient architectural monuments and advanced water management and irrigation system was a major reason for the nomination (Abeywardana et al., 2017). Suwarnasinghe points out Sinhala wewa (tank) has been emerged to save rainwater in the dry season since there is a limited rainfall in the dry zone (Suwarnasinghe, 2005).

Wewa is the local term for reservoir. The hydraulic civilization evolved as a network of tanks and lakes. They have spread in the dry zone from different sizes. Establishing tank clusters introduces as tank cascades (Dharmasena, 2010). The ancient hydraulic works were mainly available in dry zone. Most of them are still functioning, but some irrigation works can be seen in the wet zone (Mendis, 2002, as cited in Jayatilleke, 2018). The Sinhala term of wewa has been derived from the Sanskrit word of Waapi. According to Sri Sumanagala Dictionary, meaning of the term Waapi are a kind of reservoirs, wewa and Dam of the wewa (Soratha, 2009).

The word 'tank' is derived from the Portuguese term tanque and it was used to man-made reservoirs (Panabokke, 2009). Wewa is an artificial lake or pond with made with traditional wisdom. The word 'reservoir' means of storing water designed

with engineering knowledge (Ratnatunga, 1979, as cited in Panabokke, 2009).

Anuradhapura is in the dry-sub humid north-central part of Sri Lanka. It was the most ancient capital city of the country from the 5th century BC until the 11th century AD. A well-organized water management system was developed with the growth of population and agriculture. As a result, settlers-built tanks. Their main purpose was to store rainfall and use this water in dry season. Tank was also an effective flood prevention element. Today, it can be seen more than 10,000 ancient tanks are still functioning all over the island. They ensure the sustainability and water source of the country (Schutt et al., 2013). Sinhalese tanks were built due to limited rainfall in the dry zone though the soil is fertile to cultivate from the ancient past (Suwarnasinha, 2005). Kuveni was engaged in textile weaving near a tank. Vijaya and his seven hundred friends had thirsted and came to the tank. Vijaya finally found his way by observing the steps. However, he could not recognize the foot signs that had come out from the shore of the crew. Vijaya met Kuveni and attempted to solve the problem. This conversation was a very fresh experience for the author of the Mahavamsa. The history of this country has begun with this incident (Dalupotha, 2011).

In the written history of Sri Lanka, dating back to the first millennium BC, the existence of the three ancient kingdoms is shown, while the construction of ancient river diversion systems and storage reservoirs are recorded (Mahavamsa, 1959; Chulavamsa, 1960). The kingdoms were Rajarata or the "King's Country" and Ruhunurata, together covering most of the Wet Zone. The ancient irrigation works were mainly set in the Dry Zone, of which many are still functioning, but some ancient works are also found in the Wet Zone (Mendis, 2002, as cited in Jayatilleke, 2018).

First three lakes (Abhaya wewa, Gamini wewa, and Jaya wewa) of the country had been built by King Pandukabaya during the period between 437-367 BC Compared with other communities of the world, hydraulic civilization of Sri Lanka has unique features of its own. When considering the other people of the world their hydraulic civilization had developed alongside the rivers and natural water streams. On the contrary, Sri Lankans had developed a hydraulic civilization by building lakes constructed by the great ancestors of the country. The ancient people of Sri Lanka thought that the rainwater should be preserved in tanks (lakes) so that it can be used to cultivate their paddy lands. Thus, the hydraulic civilization of the country that commenced with small-scale lakes gradually developed into medium type and massive type lakes (Dharmasena, 2010). R. L. Brohier in his work Ancient Irrigation Works in Ceylon, states that "the massive irrigation works found in Ceylon (Sri Lanka) cannot be observed in any other country of the world" (Brohier, 1979).

Traditional cascade systems

The preparation of tank cascade systems is a subsystem of a tank that interconnected the irrigation network. Accordingly, Tanks, paddy fields, watersheds and canals are interlinked and the natural environment (Marambe et al., 2012). Village tank cascade systems are available in the North-central Province in Sri Lanka. 'A 'cascade' is defined as a connected series of village irrigation tanks organized within a micro-(or meso-) catchment of the dry zone landscape, storing, conveying, and utilizing water from an ephemeral rivulet' (Bandara, 2019) Geekiyanage & Pushpakumara have defined the cultural diversity of tank cascade systems. The main objective of the village tank was to store water and moisten dry lowland plains for paddy cultivation. Hence tank cascade systems

were begun to build and develop under with confined facilities and traditional knowledge (Geekiyanage et al., 2013).

Ancient cascading tank systems developed in South Asia to collect rainwater for agricultural and other purposes in the rainy season to be used in the dry season. Population expansion in the dry zone had affected to rapid development this water management system. Mechanism of building tank is blocking the natural drainage system in a watershed using earth bunds. Suitable landscaped are selected to cascade water to the tank series. A Japanese land system called Satoyama has similar features of this man-made socio-ecological system (Dissanayake, 2018).

Ecological Parts of the Tank (wewa)

Silt trapping small tanks (Kuluwew) and waterholes (Godawala)

Silt-trapping small tanks were built in catchment forest. Their water was not used for farming or agricultural purposes. The main purpose of them was to avoid siltation in the main tank. Hence, purified water flows into the main tank or Maha wewa. Silt trapping small tanks or Kuluwew does not have sluice gates and they were simple structures located in the forest. These tanks were very effective to enhance the groundwater level, subsurface water flow and river base flow. The water of them was allocated for the wildlife (Avsadahamy, 2003).

Waterholes or Godawala were established at the inlet of the tank. It provided water for wildlife and livestock. Sedimentation, slat filtration and conservation of macro and micro aquatic fauna were other purposes of constructing waterholes. Buffer water level in the downstream during storms is another important purpose of constructing them (Avsadahamy, 2003).

Interceptor (Kattakaduwa)

This is the area between tank bund and paddy field. Main purpose of the Kattakaduwa or interceptor is absorbance of heavy metals and salts from the seepage water. Modern science introduces this mechanism as phytoremediation. Further, it functions as a wind barrier and assists to prevent soil erosion with the root system of plants on the interceptor. It is consisted many plants such as Terminalia arjuna and Strychnos potatorum. It has been proved that the roots of these plants can purify water. Further, these plants are also available in allocated places for drinking water (Bona Diya Mankada) (Geekiyanage et al., 2013).

Tree belt (Gasgommana) and water filter (Perahana)

This the responsible part for the water purification in tanks. There are huge size trees belt in upper inundation area along the tank. Further, it functions as a wind barrier to decrease the waves in the tank. It becomes a major reason to reduce evaporation. This region creates habitats aquatic species in the flood season. This natural water filter mainly contains sedges, rattan, shrubs, and grasses remain sediments of overflow water (Geekiyanage et al., 2013).

Catchment forest (Mukalana)

The forest area of the catchment was prohibited for human activities such as deforestation, farming and cultivating. However, people of the tank villages could collect medical 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).

Check dams (Potawetiya) and soil ridges (Iswetiya)

They were used to avoid incoming sediments from the upper catchment. Further, they decreased the velocity of water. It helped to resemble marshy lands with semi-aquatic plants. Moreover, it stored excess water in the upper catchment before gradually releasing to the tank

during the dry season. The soil ridge or Iswetiya control the soil erosion by blocking sediments. And also, it is helpful to avoid siltation in the tank (Geekiyanage et al., 2013).

Allocated places for birds (Kurulu Paluwa)

Allocated places birds (Kurulu Paluwa) are an area of cultivated paddy land close to the tank bund. Sometimes, it is available at the downstream end of the paddy fields next to the nearby tank. Ancient people were able to reduce the crop damages through this (Geekiyanage et al., 2013).

Shrublands (Landa)

The upper flooding area was allocated for wildlife and livestock. Accumulation of animal dung nourishes the land, and it helped grow grasses and other plants. This shrublands (Landa) functions as a buffer among paddy fields, home gardens and forests. Further, it was very supportive to reduce the crop damage from wild animals (Geekiyanage et al., 2013).

Peasants usually go to the shrublands or Landa for their daily needs such as finding wood, handles for mamoties and choppers. People refrained from entering the Landa in the evening since they believe the impact of evil Kalukumara. Hence, girls who attained puberty recently were completely prohibited to enter this area. Villagers never had fried food before entering these premises due to the belief in the harmful impact of supernatural powers (Kariyawasam, 2019).

Tank Bund (Vew Bamma/ Vakanda)

Tank bund is the most important part of a tank. It was built in between two small highlands with soil. Ancient irrigation engineers paid more attention to construct tank bund blocking river valleys (Dissanayake, 2010). Endurance of the tank depended on the Strength of tank bund. Water capacity in tank was decided upon the size and strength of it. Some tanks constructed in between two mountains and thereby crossed the valley to bear a high capacity of water. Bund of the tank always builds taller than the water level. Therefore, the pressure of the water would be able to bear the tank. It has 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. It cannot be assumed about the strength of the bund as it remains for over ten centuries steady. It was built in the shape of a semi-circle, to bear the pressure of the water (Jayatilleke, 2018).

Stone Liner (Ralapanava)

Stone liner prevents the erosion of the bund by the water current. It is a granite stone liner which located on the inside of the tank bund. Usually, this is visible in medium and large-scale reservoirs. Further, it avoided the incoming of bulls and cows into the tank through the tank bund. Accordingly, it also safeguarded the tank from external forces (Thennakoon, 2012).

Queen's Enclosure (Bisokotuwa)

Bisokotuwa is an advance irrigational component of the tank. This irrigation part takes the shape of a square type well and is made of granite. It had been designed for the protection of the tank bund. Bisokotuwa is consisted two tunnels which located inside the tank. Main purpose of constructing this technical construction was to reduce the pressure on tank bund when the water level is very high (Kariyawasam, 2019).

Water Gauge/ Water Level Indicator (Diyakata Pahana)

In the rainy season, it was compulsory to the measure water level of tanks. Tanks were safeguarded with the Diyakata Pahana that measured the water level of the tank. When the water level was high, the sluice gates were opened to release excess water from the tank (Dalupotha, 2011).

Sluice Gates (Sorowwa)

They were designed to release water into paddy fields for cultivation purposes. Sorowwa is consisted two parts such as Mada Sorowwa and Goda Sorowwa. Mada Sorowwa is placed beneath of the tank. Accumulated mud is removed from the tank by it. The task of the Goda Sorowwa was releases water into cultivation lands and paddy fields (Kariyawasam, 2019).

Spill (Vana)

Inner spill (Ethulu Vana) and outer spill (Pita Vana) are two types of spills available in the tank. External water supply canals or other sources connect to the tank by Ethulu Vana. The mud which comes with the water remains because of the inner spill. Accordingly, this irrigation part purifies the water by avoiding sedimentation in the tank. When the water level exceeds the capacity of the tank, outer spill, or Pita Vana is used to spill over water from the tank. It is made of hard granite to ensure its endurance (Avsadahamy, 2003).

Kalingu wall (Kalingu Bemma)

Kalingu wall or Kalingu Bemma was built with the purpose of safeguarding tank water. It minimized the risk of releasing water in a sudden damage to Pita Vana (outer spill). This part is in the tank and before the Pita Vana (outer spill). Even today, Kalingu wall of Prakarama Samudraya is visible in the drought seasons. Kaligu wall has proved a traditional disaster management strategy (Avsadahamy, 2003).

Daily uses of tanks

Irrigation is the first and foremost usage of tanks. Further, tanks were also used for different purposes such as bathing, fishing, washing clothes, and bathing livestock from the ancient past. This was divided into different regions based on their purposes. Diya Mankada is the area used to be provided drinking water. The water of this area is very cleaner than other regions of the tank. People of tank villages always attempted to ensure the water quality of this area. As a result of that they do not use this premises for any other purpose. Nana Mankada is allocated for bathing. It is located away from Diya Mankada. People also got the opportunity to swim in this area since was shallow. Villagers are permitted to wash clothes in the Rada Mankada (Apillum Manakada). Boradiya Mankada is the place used to bathe animals such as bulls, cows, and buffalos (Thennakoon, 2012).

Intangible Cultural Heritage of the Tank System

Scared Places of the tank

Ancient peasants believed that tank water is protected by supernatural forces. Hence, those invisible powers were worshipped by tank village people. As a result of that sacred places were named and established for performing rituals gods. They are Panam Bedhi Gas, Sanhida and Devalaya which situated beyond the tank (Vaw Ihaththewe Devalaya) (Kariyawasam, 2019).

Panam Bedhi Gas

This type of trees can be seen near the tanks which situated in the districts of Anuradhapura and Polonnaruwa. Before commencing of the seasonal farming activities peasants select one of the tallest and hugest trees. The chief shaman of Devalaya and chief farmer get together with the peasants for making vows and tie up coins for succeeding the agricultural activities. Then they plead to God Gambara and the God who protects the tank and request to restrain ailments of cattle and request to protect farming grounds and crops from various calamities. After got harvest they perform a ritual called: Aluth Sahal Mangalya. They offer milk rice to the Lord Buddha by using the first crop and prepare some sweets using new rice and offer them to the deities with the coin which had tied at the branch of Panam Bedhi Gasa. Although Panam Bedhi Gasa has disappeared nowadays, still they offer

milk rice and sweets for the Lord Buddha and deities (Jayatilleke, 2017).

Sanhindha

Sanhindha is located close to the bathing place of the tank. Not only for agricultural purposes, but also protect from epidemics and before going to the jungle people use to make vows to the Sanhindha. In special occasions, villagers break a branch of a tree and keep it in the mid of two branches of this tree for making a vow to the deity Ayyanayake. During the sunset or night, people light a lamp for the god in their homes on Wednesday or Saturday until fulfill the vow. Villagers perform rituals near Sanhindha during the Aluthsahal Mangalya (new rice ceremony) too. People come to the Sanhindha with the shaman of Devalaya to fulfil the vow on special days such as Wednesday and Saturday. They come to Sanhinda with sweets which prepared out of new rice and keep them with banana on the special place and they boil milk. Then they prepare sugar mixed sweet milk rice and offer it to the Gods. After that, the pregnant mothers and old people are treated by remained portion (Kariyawasam, 2019).

Devalaya which situated beyond the tank (Vaw Ihaththewe Devalaya)

Devalaya is available at beyond the tank. This is a special Devalaya construct for the work relate to lake. Such type of Devalaya available to the Anamaduwa tank and Parackrama Samudraya too. To protect water for agricultural activities they perform rituals and make vows in this Devalaya. People also believe that the ancient kings who built tanks had become deities after their death. Minneriye God is one of such deity (Jayatilleke, 2017).

Beliefs in supernatural powers which strengthen the relationship between man and tank

The concept of God Gamabara (God who owned the village) is very popular in-tank villages. Villagers engage in all most every activity in their day-to-day life with the permission of this god. According to their belief, the god Ayyanamutta protects Buddhism, village tank, paddy field, animals, and trees. Bahirawa Mutta safeguards the temples, religious places, mother earth and its treasures. Goddess Paththini is responsible for epidemics such as smallpox and chickenpox (Ilangasinghe, 2009).

Concepts in-tank villages that interconnected man and traditional irrigation system

Lake villages functioned based on civilized concepts which originated itself with cultural elements and values. These concepts developed in the rural community with humanity, artistic value, authenticity, and they were a kind of mental relaxation to the rural community (Kariyawasam, 2019).

Three concepts (Thivida Dakma) of the tank village were experiencing the prior season (Pera Kannaya Athdakima), imagine the present season (Me Kannaya Sithdakima), and looking the upcoming season (Ena Kannaya Neth Dakima). Five concepts (Panchavida Sankalpa) were included tank (Wewa), pagoda (Dagaba), village (Gama), paddy field (Ketha) and jungle (Wadula). Further, seven heritages (Sathvida Urumayan) were very significant for the existence of tank villages. They were such as ten commands (Dasavida Ana Vidanayan), Buddhist culture (Baudda Sanskruthiya), irrigation works (Wari Nirmithayan), Agricultural Lifestyle (Krushikarmika Jeewana Ratawan), traditional knowledge (Paramparika Gnasambaraya), sustainable technology (Piripun Thakshanaya), language, literature, and art (Bashawa, Sahithya and Kalawa) (Kariyawasam, 2011).

Culture of tank villages was continued with the folk knowledge which inherited from practice (Perahuran), knowledge (Danahuren), experience (Kalahuran) and

availability (Athihuren) (Dalupotha, 2011).

Changing the relationship between man and tank

Tank water is very important for the environmental protection. Tank community uses it for cultivation, fishing industry, domestic needs, and livestock. Changes of traditional water management administration have affected all of them (Renwick, 2001). Water was not an economic good in traditional society. Hence, there was a limited demand for water. Population growth, development of agriculture, industrialization, decline of water source, environmental pollution in the last century caused to value water as an economic good. Now it has become a scarce and expensive resource. Further, deforestation, urbanization, environmental destruction has worst this condition. Nevertheless, traditional attitudes towards water in most developing countries did not change with the above situations (Ratnayake, 2006). The UN Convention to Combat Desertification (UNCCD) accepts traditional knowledge is very effective for drought control. This knowledge was associated with ecological, socio-economic, and cultural environment. It emerged in among people and pass from generation to generation by the experience. Further, it can be recognized as a culturally enhanced knowledge and it directly guide to reproduce local resources (Bandara, 2019).

Now, peasants of many tank villages have changed their socio-cultural and economic structures due to changing traditional irrigation systems. Water scarcity has become the main reason for the abandonment of farming and rice cultivation. Soil erosion and deposition of sediments lead to destruction of tank ecosystem. It also has accelerated the drying up canals of tanks. Edge of the cascade system has wildlife reservation. People are not allowed to enter the forest area and engage in farming practices. Presently, some lakes of the cascade systems are not functioning. Hence, village community has separated their usual lifestyles from traditional lake systems (Somaratne et al., 2005).

Different programmes had carried out for extension of paddy cultivation areas of tanks with less attention on hydrology. This was a causative factor for abandonment of tanks. Though, cultivation lands were expanded, there is inadequate water source. Therefore, the purpose of the project has been unsuccessful. The tank village people cannot repair their tanks when they destruct due to heavy rain. Hence, always they happen to expect government aids for this. This process takes a long time, and it has become a major reason for the abandonment of cascade systems (Somaratne et al., 2005).

Various Invasions from South India into Sri Lanka in 437- 367 BC was a major reason for destruction of tank cascade systems. Then, in the colonial era, tank cascade systems were abandoned. The colonial rulers neglected them. This system was the backbone of the traditional economy. Destruction of it resulted in many impacts but, it was not collapsed in the past. Further, Malaria epidemics and political uncertainty was affected for this situation. Recently, engineers believed centralized giant irrigation works are very effective than tank cascade systems. Accordingly, it was replaced large scale tanks and canals. They were used to generate hydropower. It is necessary to understand the knowledge of hydrology of an entire cascade system before any intervention. However, large agricultural wells have been excavated as a solution for water demand. Further, the density of small tanks and feeder channels is reduced for irrigation projects and settlements. This reduces the groundwater level and declines the related ecosystems (Panabokke et al., 2002).

Kidney disease and relationship with tank

There were many ancient techniques to ensure the water quality. It was a major reason to prevent Chronic Kidney Disease of unknown aetiology (CKDu) in the past (De Alwis et al., 2019). Historical man of the country got the benefits from the surface water of cascade systems. There was a proper interrelationship between social structure and natural environment in the ancient era. It is assumed that inappropriate changes of the ecosystem and modern agricultural practices have become major reasons for Chronic Kidney Disease of unknown aetiology. This study has proved that components of the cascade system are very responsible for enhancing the water quality. Wew Ismaththa (closer catchment), Thaulla (upper peripheral gentle sloping land), Kattakaduwa (interceptor) Iswetiya or Potawetiya (upstream soil ridges), Godawala (small silt trapping pond) are known as essential components of purify water and prevent Chronic Kidney Disease of unknown aetiology (Abeysingha et al., 2018).

Research gap

Relationship between man and Traditional Hydraulic Systems in terms of Bellankadawala Cascade System in Sri Lanka which has not yet been analyzed by the cultural anthropologists. Further, there are not any Anthroecological and Economic Anthropological research carried out is found. When compared with previous studies it was recognized as the research gap.

Significance of Sri Lankan tank in the world

A Sri Lankan agrarian system, the Ellanga Gammana or Cascaded Tank-Village system in the Dry Zone was designated as a Globally Important Agricultural Heritage System (GIAHS) by the Food and Agriculture Organization of the United Nations (FAO). The Cascaded Tank-Village System in Sri Lanka was recognized at the International Forum and Award ceremony for new GIAHS sites in Rome, Italy. The proposal to include the Cascaded Tank-Village System in Palugaswewa in the Anuradhapura district to the FAO list of GIAHS was submitted by the Ministry of Agriculture in 2018 (Pussegoda, 2019).

Bellankadawala cascade system is also available close to the cascaded tank village system in Palugaswewa, and it is known as a substantial element of this world heritage, for both cascade systems nourish the same main tank called Horiwila wewa. The Bellankadawala Cascade system has spread in Anuradhapura/ Palugaswewa and the main tank, namely Bellankadawala wewa (Purana wewa) is in Kelawa or Bellankadawala Village. Bellankadawala cascade system is consisted many tanks. Among them Bellankadwala wewa, Athawatunu wewa, Vidhane wewa, Rabha wewa, Bulugaha wewa, Kelawa wewa and Weerawala wewa is available in 593- Kelawa Gramniladhari division. It is considered as the study area of the research. However, a thorough study which analyzes the impact of the changing relationship between man and traditional hydraulic systems in terms of the Bellankadawala cascade system fill the dearth of research in the field.

The Research Problem

North-Central Province of Sri Lanka is a torrid zone, and it has an acrid climatic condition. Moreover, due to various reasons, cascade systems have changed; new values, new culture transformation, new technological systems, and administrative structures and modern legal code etc. are some of (Zubair, 2005). It has become a leading factor for changing the relationship between man and traditional irrigation systems. Although, farmers still use tanks for agriculture, and consume water for day-to-day activities through the

prevailing cascade systems, they have gradually moved away from these tanks without having any alternatives for their water needs. However, a controversy arises with the socioeconomic and cultural backgrounds of tank village community. Modern human activities also play a major role in changing the traditional lifestyle that existed since the ancient past. Accordingly, this attempt to solve the problem that relationship between man and traditional hydraulic systems of the country have changed due to various reasons and has it affected the traditional rural life.

Objectives

The study aims to analyze the impact of changing interrelationship between man and traditional hydraulic systems prevailed around the people from the distant past. To achieve this aim, the study attempts to fulfil the following specific objectives.

I. To investigate the causes of changing interrelationship between man and traditional hydraulic systems.

II. To identify solutions for overcoming negative changes and enhance positive changes.

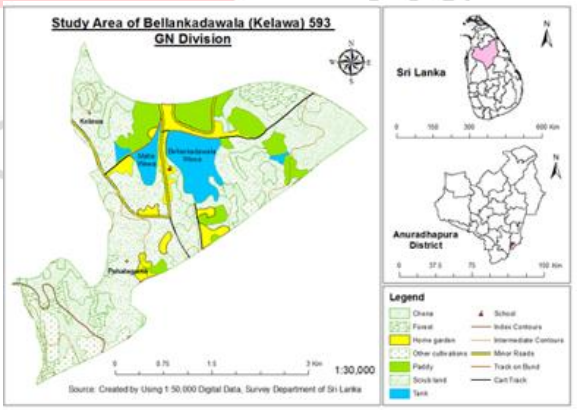
Significance of the Study

Traditional economic and ecological system is an important research area which frequently addressed by Socio-Cultural Anthropologists in the world. But also, in Sri Lanka there is a lack of research related to this scope. Traditional lively pattern in-tank villages were consisting many elements. Peasants of tank villages had maintained unity, collective consciousness, and social solidarity for the existence of their peasants' lives. Especially, collective consciousness among them was a major reason for their protection and existence. Despite regular laws, villagers maintained the social order by protecting social norms and values. These villagers always enjoyed self-sufficiency because of this traditional unity among villagers. Therefore, peasants in tank villages have mentally and physically attached to traditional irrigation systems because of the culture established around them. Thus, traditional belief system, religious practices, economic practices, customs, and symbolic meanings came into existence with this culture. Therefore, a thorough study which analyzes the impact of the changing relationship between man and traditional hydraulic systems in terms of the Bellankadawala cascade system fill the dearth of research in the field. Further, finding of this research will be beneficial to the policymaking of the country for reestablishing the rural self-sufficient economic system in the country.

METHODOLOGY

Study area

The study will be conducted at The Bellankadawala cascade (Ellangawa / Wewa) System located at 593 Kelawa (GN Division) in the North Central Province, Palugaswewa Divisional Secretariat, Anuradhapura District in Sri Lanka. Geographical coordinates of Bellankadawala is 8° 34' 0" North and 80° 24' 0" East ("Bellankadawala Map - Satellite Images of Bellankadawala", 2019). **Map**



Population

Kelewa GN Division which was selected as the study site of this research has 404 households and these families are considered as the population of this study.

Sample

The table of Krejcie & Morgan designed to select the sample size for a finite population was used for the selection of the research sample. Accordingly, 196 households out of 404 it was selected as the sample. The purposive sample of the study will sufficiently consist of villagers, informative elders, community leaders and irrigation officials in Bellankadawala or Kelawa area.

Collection of data

Collected data are categorized into four main categories: written primary data, unwritten primary data, written secondary data and unwritten secondary data. Data deals with the qualitative approach while adopting quantitative data.

This study expects to obtain written primary data via reports, information, data and maps available at Sri Lanka Irrigation Department in Galenbindunawewa, Palugaswewa Divisional Secretariat Office and GN (Gramaniladari) office in Kelawa Village. General observation and interview method based on a semi-structured interview schedule were used as unwritten primary data collection methods in this study. Related publications and e-sources were used as secondary data.

DATA ANALYSIS

Data analysis was carried out using mixed methods (qualitative and quantitative). Qualitative data were given a prominent place in the analysis. Analysis was done based on main perspectives such as relationship with tank system, knowledge related the tank ecosystem and personal attitudes towards the tank system. Hence, the analytical method of the study was narrative analysis.

Narrative analysis

Data were analyzed using narrative analysis and its focused experiences shared by people to answer the research problem. This technique was applied to understand the personal, social, and cultural experiences constructed through the sharing of knowledge. Cultural Anthropology is a subject field which deals with human culture. Most of the elements in culture are available in the form of narratives or stories. As an Anthropological method, this technique was used for understanding the cultural background, occurred and on-going changes in the traditional irrigation systems in a narrative form.

RESULTS AND DISCUSSION

Population

According to the population of the research, there are 404 families in the Bellankadawala village. It is consisted 604 males and 597 females and the total population is 1201. Most of the villagers are Sinhala Buddhist and there are only 3 Tamil women in the village.

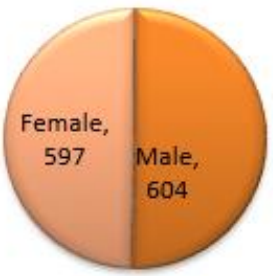


Figure 1- *Gender Based Population*
Source: Sample Survey, 2019

Village tanks and their capacities

Table 1- Village tanks and their capacities

Name of the tank	Capacity (Acre-foot)
Bellankadawala *wewa*	800
Athawatunu *wewa*	80
Vidhane *wewa*	300
Rabha *wewa*	350
Bulugaha *wewa*	90
Kelawa *wewa*	530
Weerawala *wewa*	80

Source: Sample Survey, 2019

Involving in agricultural activities is an important factor of the rural economy. It confirmed the food availability in rural society. Village tanks determined the acres of farming based on their capacity. Accordingly, 593-Kelawa Gramaniladhari division has seven tanks which sustain the village economy. Among them Bellankadawala wewa and Kelawa wewa are the massive tanks and their capacities are respectively 800 acre-feet and 530 acre-feet. All above-mentioned tanks are very important for the existence of the traditional lifestyle. It was observed that these village tanks are not well maintained as a cultural heritage by some of the villagers. It has directly influenced to decline of this traditional hydraulic system.

Occupations in the village

Table 2- *Occupations in the village*

Sector	Occupation	No No.
Government Sector	Administrative level	1
	Field and Technical officer	2
	Forces	71
	Principal/teacher	3
	Driver/Clerk	1
	Other	0
Private Sector	Administrative level	0
	Field and Technical officer	0
	Forces	1
	Garment	37
	Driver	3
	Other	17
Self-Employed	Cultivation	400
	Livestock	5
	Fishery	2
	Brick Industry	20
	Services	16
	Other Industries	17
	Other	0
Foreign occupation		18
Labor		45

Source: Sample Survey, 2019

This table shows the occupations available in the research area. Accordingly, it can be seen, 400 people engage in cultivation. The research resulted that peasants of the research area believe that traditional systems of irrigation and agriculture are a collective heritage of man which inherited from ancient past. Hence, collective consciousness is visible in many daily activities in their life. It is thoroughly visible in the cultivation process. Although there are seven tanks in the village, only two persons engage in fishery as their self-employment. This condition can be recognized as a kind of decline in this rural community. Presently, there are no peasants who engage in reed and pottery industry as their main income. Separation of man and tank is indicated by these changes in the area. However, twenty persons who engage in the brick industry can be recognized as a positive characteristic in the cascade tank village. Some respondents pointed out that villagers had migrated to foreign countries due to the abandon of traditional farming and irrigation systems. Accordingly, it can be recognized as a negative impact of changing the relationship between man and traditional irrigation systems.

Ownership of lands

Table 3- *Ownership of lands*

Acres	Highlands	Paddy Fields
0.5<	0	154
0.5-1	75	50
1-5	178	93
5>	0	0

Source: Sample Survey, 2019

According to the above mentioned Kelawa Gramaniladarai division is consisted 154 paddy fields that less than 0.5 acres. Further, there are 178 highlands between 1-5 acres which use for other farming activities. These two basic factors show some elementary forms of agriculture-based society. Results of the narrative analysis have been shown that the present generation has a lack of attention on the paddy and cultivation lands owned by their parents. Further, they have moved away from farming activities due to the current socio-cultural changes.

Land usage

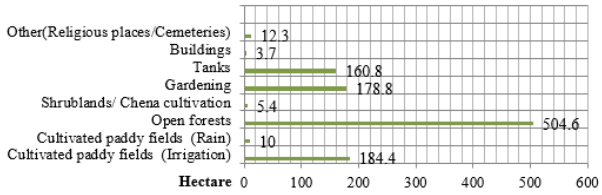


Figure 2- *Land usage in 593-* Kelawa *Gramaniladhari Division*

Source: Sample Survey, 2019

The chart illustrates the land usage in 593- Kelawa Gramaniladhari division for different purposes. Still there are 504.6 hectares of open forests in the area. From collected data there are 184.4 hectares of paddy fields that cultivate by irrigation water. It points out that the usage of tanks for people even today. According to the chart only 10 hectares are cultivated with rain. The experiences shared by people to answer the research problem were enriched with the ideology of peasants. Accordingly, it was revealed that although farmers and most of the elders' respect and attempt to protect traditional irrigation systems, the younger generation has a lack of attention on it. Tanks of the village have spread over 160.8 hectares in the area but also there are around 200 hectares of paddy lands in the area. Some old peasants pointed that their village can be more sustained by maintaining the tank system with the support of villagers.

People of this cascade tank village have a unique belief in supernatural forces. Annually, people build a shrine using items found from the forest for god Katharagama and Kadawara. Their purpose is to secure their crops and lives by obtaining blessing from these gods. Early, all most every person in the village participated for this ritual. Presently, it has been changed due to rapid social and cultural change. Belief in supernatural forces always refrain people from polluting tanks and their environment. For instance, they believed that god Kadawara as the god who punished the wrongdoers. These kinds of belief systems always ensured the relationship between man and traditional irrigation systems. As a result of changing these kinds of belief sets, the respect towards tank is decline day by day. Most of the people believe that tank water has been polluted due to natural and human activities. Hence, they have motivated to buy water from sellers. It was found that some people do not even bathe in tanks due to their negative attitudes towards the purity of the water.

Although indigenous medical practices are very common in tank villagers, they seek western medicine even for mild diseases. Natural environment of cascade tank village systems is enriched with rare medical plants for severe diseases. But also, most of the people in these areas are failed to at least recognize these herbal plants. A tank system was consisted with many elements and they had unique functions. Among them, Interceptor (Kattakaduwa), tree belt (Gasgommana) and catchment forest (Mukalana) are very significant. Interceptor (Kattakaduwa) was responsible for absorbance of heavy metals and salts from the seepage water. Tree belt (Gasgommana) was established for water purification. Catchment forest (Mukalana) was prohibited for human activities deforestation, farming and

cultivating. Further, this area consisted of medical herbs and this sensitive environment was responsible for protect groundwater level. Moreover, there were many places in a tank for different purposes such as bathing, drinking and animals. All these elements reflect the indigenous knowledge of peasants and their relationship with tank system. Presently, this knowledge and attitudes about tank system is fading due to the separation of man from tank.

CONCLUSION

Although there are many studies available on the impact of the changing relationship between man and traditional hydraulic Systems, they have not been analyzed in an anthropological point of view. Since this research is mostly related to the subfields of Cultural Ecology and Economic Anthropology, it is believed that this theme should be studied and analyzed in socio-cultural anthropological perspective. Constructing artificial tank systems can be identified as a cultural adaptation to the tropical environment. However, this cultural adaptation to the living atmosphere of people has been enriched with a vast intangible cultural heritage. Hence, early there was a strong interrelationship between peasants and traditional hydraulic systems. Bellankadawala cascade system is an ideal reflection of this relationship. Change this relationship has laid massive socio-cultural and traditional economic impacts. As a unique element of humanity, culture plays a vital role in the society. Negative impact on the culture leads to separate people from their traditional living atmospheres by changing their attitudes. Hence, understanding the socio-cultural and traditional economic impact of the changing interrelationship between peasants and traditional hydraulic systems can make people aware of its advantages and disadvantages. Furthermore, this research may be a tool for enhancing traditional knowledge of reestablishing the relationship between man and tank systems. Further, traditional domestic production level can be increased by strengthening the tank based economic structure. This study will be an avenue of establishing cultural oriented sustainable economic development for the rural cascade tank villages in the country.

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