The Live Weir Innovation at Chi River Watershed, Chaiphum Province, Thailand

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ABSTRACT

The drought crisis and a long period of low rain affect many areas of Thailand. Chaiphum Province is another area that has been widely affected. The provincial governor has declared the drought areas in 16 districts, resulting in efficient water management and integration in many sectors, especially the educational institutions that must be the source of academy, research and innovations in solving problems for local communities. The university has responded to the royal policy consistent with the strategy in local development by using knowledge and innovation to be partnership for developing the local. Therefore, this research aimed to construct the live weirs from the community participation in the watershed areas, and to establish the awareness in conservation of natural resources and the rules of the live weirs for the community. This research was the participatory action research. The results found that the live weirs help to strengthen economy, society and environment of the community. The results showed that in terms of the economy, it supports the implementation of the sufficiency economy philosophy together with organizing the activities for living, creating careers and generating income for the households. As for the society, it encourages people to love, have unity and participate in public activities; and creates awareness in the rehabilitation of natural resources and environment. In terms of the environment, it has also been rehabilitated. The live weirs help slow the water flowing. So, water is absorbed and replenished at the watershed. This helps balance the ecosystem and restore biodiversity to the environment. As for other aspects, the university is recognized by communities and organizations from academic services and local development. This creates a good image of Rajabhat University which is in accordance with the intention of the University of local development

KEY WORDS: INNOVATION, LIVE WEIR, WATERSHED

INTRODUCTION

The global climate change crisis has affected the quality of life and the well-being of the world population. The water crisis is the risk that the world has to face in the 21st century. Also, 80% of the world population is at

risk of water security, including flooding and severe drought crisis (Internationals Educational, Scientific and cultural Organization: searched online on January 18, 2020). For Thailand, there was severe drought crisis in 2019. The government announced the drought crisis areas in 20 provinces (Daily News Newspaper, January 18, 2020). Regarding the topography of Chaiphum Province, it consists of forests and mountains up to 50% of the provincial area. So, it is an important source of watersheds in the northeastern region, such as the Chi River, the Chuen River, the Phrom River, the Lam Sa Phong River, the Lam Patao River and many other streams. However, from the analysis of spatial demand, it has been found that the demand of water resources is the first priority since most people are engaged in agriculture such as planting rice, cassava, sugarcane,

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corn, large chili, vegetables and fruits. The demand of water for agriculture and consumption is approximately 1,400 million cubic meters.

But, the water storage capacity of the major dams and reservoirs such as Chulabhorn Dam, Lampa Town Dam and Huai Kum Reservoir is only 340 million cubic meters, and 310 million cubic meters are from natural water resources. So, there is a lack of 750 million cubic meters of water for living and occupations (Chaiyaphum Provincial Office, 2018). Due to the drought and a long period of low rain, there is severe shortage of water for consumption and occupations in Chaiyaphum Province. There is also the shortage of raw water for tap water production in many areas. In addition, the surface water sources become dry and cannot be used as a source of water for people's consumption. For these reasons, the related agencies have alleviated the suffering of people by distributing water for consumption. The government has also allocated the budget to help those affected by the drought (Chaiyaphum Province, 2020). The provincial governor of Chaiyaphum Province has declared 16 districts as the drought disaster areas (National News Bureau of Thailand, retrieved from <http://thainews.prd.go.th> on August 7, 2019).

The management or stabilization of the water system, including supply of drinking water, management of rain-fed agricultural areas, management of water resources in the rain-fed agricultural areas, conservation of watersheds, flood prevention, solving waste water problems and development of small water resources projects and solar water pumping projects must cover all dimensions: economic, social and environmental dimensions (Office of the National Water Resources, 2020). Since Chaiyaphum Province is the source of the Chi River and the Chuen River that flow through many provinces in the northeast. The stabilization of water security must cover all systems, including the rehabilitation of watersheds, increasing of watershed areas and establishment of cooperation among all sectors in constructing the water management system. Chaiyaphum Province has recovered 3,100 rai of the watershed areas from the intruders (Tat Ton National Park, 2019). For the conservation and restoration of the watershed areas, it has been collaborated with all sectors to increase the forest area by reforestation in 1,700 rai and building 113 live weirs on Lo-yai Forest, which is the area of the Chi River watershed and its branches (Chaiyaphum Provincial Office, 2020).

According to the situations mentioned above, Chaiyaphum Rajabhat University has operated under the strategy of Rajabhat University on local development and academic services for local communities in order to develop Area Based Community Collaboration Chaiyaphum Model in 6 areas, consisting of education, occupation, society, culture, health and environment. There were 4 target areas in 2019 fiscal year, namely Mueang District, Khon Sawan District, Khon San District and Phakdi Chumphon District. Building a live weir is an activity that supports the development in many aspects, including

environmental, economic, social and cultural aspects because the construction process helps to drive the participation of the people in sharing ideas, planning and having cooperation. Also, once the process is complete, the people in the area have water for consumption and agriculture. There is stability. The society is pleasant and the environment is beautiful in accordance with the goals of the city of happiness. In addition, it is also a place for students in various fields to learn and practice in the creation of live weirs and understand the process of working with other people and have experiences from the living classroom in the local community.

Research Objectives: To construct the live weirs from the community participation in the watershed areas, and to establish the awareness in conservation of natural resources and the rules of the live weirs for the community

RESEARCH METHODOLOGY

Constructing a live weir is to integrate knowledge and innovation with local wisdom to solve the water shortage problem in the dry season and help slow down the water flowing during the rainy season. It is the restoration of the ecology and environment of forests and rivers in the community. People in the community must have knowledge and understanding of natural resources for sustainability. The operation is divided into 6 stages.

1. Creating knowledge and understanding: At this stage, the community members have to acknowledge the problems together in order to find out the solutions and raise awareness in participating in the operation. The experts or "the teachers of weir construction" help raise awareness in the community.
2. Survey of areas and material preparation: It is the survey and the selection of the areas suitable for building weirs in the river. The community, the leaders, the teachers of weir construction and Rajabhat University prepare and provide sufficient materials in the area for construction.
3. Operational planning: It is a systematic working process preparing people and labor to work appropriately.
4. Operating procedure: It is the stage of mobilizing all sectors to participate in the construction.
5. Creating community rules or weir maintenance regulations: In order for the community to own and use the weirs sustainably, the regulations must be established with the consultants from Rajabhat University and the teachers of weir construction.
6. Selecting the committee: In this stage, the representatives from the community in the form of a committee are needed for coordinating with relevant agencies.

The research results

The Feature of Live weir

1.The live weir concept: A live weir is another innovation that arises from the thinking process and local wisdom, leading to the construction of the weir to slow down the

water by raising the water level to a certain level and allowing it to flow through the weir crest or penetrating through to the bottom at all times. This principle will cause circulation and fill the air for the river, so the water flows like living water. The water in the live weir is not rotten like that of in the concrete weir or general weir. In addition, aquatic animals can pass through the water. This results in open ecological restoration caused by the flow of water that sweeps various nutrients and debris onto the front of the weir and the surrounding area. For these reasons, there is an abundance of living things, such as shrimp, shellfish, crabs, fish and various aquatic plants. It is also the natural breeding area of plants and animals. It is the replenishment of the ecosystem that has returned to balance with a variety of lives, including people's lives, animals' lives and various plants that support the river ecosystem back to the stream of life. It is the true natural river with the wisdom and philosophy of life.

The development projects that do not study the true impacts and concern about ecosystem, especially the water source ecosystem, inevitably have long-term disadvantages that are difficult to fix. Sometimes, the development projects starting by using money or budget do not cause sustainability. Instead, they cause weaknesses and destroy the confidence that is the traditional wisdom until the environment and the way of life of many people are affected. For example, the river dredging project is like speeding up the flow rate of water until the upstream or the upstream forest cannot absorb water or the ability to absorb water from the source is reduced, so, the water is rapidly runoff and there is flooding in the rainy season because the delay system is destroyed. It also results in drought and dryness in various rivers during the dry season. This problem is seriously increasing day by day. Some of these phenomena are due to the lack of understanding in the ecosystem and the environment.

Constructing a live weir is, therefore, the way of water management that uses the wisdom by slowing down the flow of water so that water can be contained throughout the year. Constructing a live weir is obtained from a simple idea that is to use mechanisms to delay the flow of water by using materials from the local area and nature to create a stream that does not dry out and constantly replenish water. For this reason, it causes fertility and restoration of the environment and the climate conducive to the living things to return to balance and biodiversity. The most important thing in constructing a live weir is having the knowledge about nature. That is, understanding soil, water and forest, as well as various organisms in nature that systematically sustain or are related to each other is needed.

Or, simply speaking, it is "understanding of the nature and sympathizing with the ecosystem". Foreign materials such as cement, steel and nails are not used for construction, but natural materials such as bamboo, sand and rope are used instead. This is the main part for

building a live weir. Another important part is the spirit of the villagers or the community that must be given to the live weir construction. It is the attachment to the weir. They have to work together in constructing the weir. They also have to realize the benefits from the weir and understand the purposes of the construction and the goals that they have to live life with the weir until the support system with endless reliance is created.

2. the live weir components: consist of (1) the body of the weir will block the water and allow the water to flow through it at the same time. (In the area with great flood, the body of the weir should be longer than the width). (2) the ecological stairs at the front and the back of the weir will help the fish and aquatic animals to travel across and can reduce the impact of water on the weir. (3) the elephant ears (the boards cut to a right angle to fit into corners) help to hold and strengthen the weir and the planting of banyan or local trees so that the banyan roots can replace the bamboos on the elephant ears and help better hold the weir structure. And (4) the triangular parts prevent water shock and support the elephant ears and ecological stairs.

3. the live weir materials: the purpose of building a live weir to encourage the participation of the people in the community who realize the problems and the benefits together. Therefore, in providing the materials for construction, there is a request on the cooperation to support the materials in the area, including bamboos, fertilizer sacks for filling sand and ropes. It focuses on the minimum use of foreign materials. The materials for building a live weir are as follows. (1) Sand: calculated from width x length x height. (2) Sack: based on the sand ratio: the sack = 1: 40. (3) Nylon rope number 5: calculated from the length of the weir x 10 (kilograms). (4) Straw rope: based on the ratio of straw: sack (1: 20 pieces). And (5) Bamboo: based on the size of the body of the weir (not including other components). For example, if the body of the weir is 3 x 1.5 x 2.9 meters, 250 - 300 bamboos are needed. If the body of the weir is 3.3 x 3.6 x 4.8 meters, 350 - 400 bamboos are required.

The live weir impacts: For the live weir construction under the local development strategies by implementing the royal policy into practice, Chaiyaphum Rajabhat University followed up and evaluated the results after the completion of the construction. The interviews with people in 5 villages having the live weir construction were administered. The details are presented as following:

1. Economy: the community economy is supported according to the sufficiency economy philosophy. Farmers can produce food and it is the source of the family income since there is enough water for doing agriculture, planning crops and raising animals and fisheries.

- Paddy field, corn, vegetables and fruits.
- Raising poultry and cattle.
- Tilapia culture in floating cages.

2. Society: the community members love each other and have unity, and careers. They accept social rules more, realize the common good, have awareness in preserving natural resources and create collaboration tradition and culture in the community.

- Maintaining the weir together.
- Allocating water use according to the community rules.
- Using mutual sustenance from the river under the community rules.
- Weir-merit making tradition.

3. Environment: the river is fertile. The community ecosystem is maintained. The upstream forests have been absorbed. The watersheds are abundant. The soil has better water holding capacity. There is biodiversity along the river which is the source of food for people.

- Fish and natural aquatic animals.
- Vegetables along the waterfront.
- Forest, trees and shades along the waterfront become the habitats and breeding areas of aquatic animals.

4.Others: Chaiphaphum Rajabhat University has been accepted by the community, resulting in being the academic resource. It also leads to the creation of the academic cooperation network. It is the training area for students, which can respond to the national development strategy and the strategy of Chaiphaphum Province for being the city of happiness.

Picture 1: Workshop on knowledge transfer, preparation of living weir construction, creating understanding and participation of people in the community and organizing the community forum for construction the living weir for people in the community.

CONCLUSION AND DISCUSSION

The live weir construction project of Chaiphaphum Rajabhat University under the local development strategy is an integrated activity from many sectors. The government, the private sector and the public sector have brainstormed for knowledge and local wisdom to create the community innovation in solving problems in accordance with the sufficiency economy philosophy and consistent with the provincial development strategy and the mission of Chaiphaphum Rajabhat University, especially Area Based Community Collaboration Chaiphaphum Model (ABC-6D), which can improve the

quality of life of people in terms of economy, society and environment leading to sustainability.

It is also a model for natural resource management through the participation process of every sector. Consistent with the research of Pamornrat Sutum (2019) the study is a qualitative research consisting of in- depth-interview, focus group discussion and in-field workshop about the Nam Rad Forest - Ma Loh Canal located at Baan Tamniab and Yan Yao sub - districts. Term of “Nam Rad” means water spreading throughout the head watershed forest, so it named “Nam Rad Forest” after the physical appearance of the highland forest surrounded by massive mountains with abundant tropical rainforests absorbing water which resulted in enough natural water flowing throughout the year.

Picture 2: The living weir construction activity by the community participation, the village headmen, the government organizations, Sub-district Administrative Organization and Chaiphaphum Rajabhat University.

The water was the surface water spreading around the forest area as the source of many watersheds including Ma Loh Canal that has nourished the two sub - districts. The head watershed forest - Ma Loh Canal had changed dramatically from 50 years ago; then the ecosystem abounded with plant varieties, animal species and

medicinal plants. The Ma Loh Canal was the clean water source for communities' consumption and farming. Currently, the head watershed forest - Ma Loh Canal is encroached and destroyed. Forest area and biodiversity are decreased; MaLoh Canal's water condition is dirty, turbid and shallow and is used for refuse and waste disposal. Water ecosystem balance is disturbed; the number of plant varieties and aquatic animals reduced and some species have become extinct. Communities recognized the value of Nam Rad Forest - Ma Loh Canals they relied on for living in the past. Currently, both physical environment and biodiversity have been changed and affected people in communities' way of life.

Picture 2: Workshop on knowledge transfer, the preparation of the living weir maintenance regulations and creating understanding and participation of people in the community.

Communities have defined the future as “beautiful canal, clear water and abundant forest”, designed a management instruction by emphasizing creating conscious mind for conservation and restoration and obtained resources co-management of communities in practices defining the network and establishing rules of resources utilization for sustainability. As the same way of research results of Rattana Krainara (2019) found that the lessons learned of this study from the water management by Life dam at Ban Na Not Village, Kampang Sao Sub-district, Muang District, Nakhon Si Thammarat Province aimed to investigate the community context leading to water management by Life dam and to visualize the knowledge of water management by Life dam based on geography, nature, and community culture. The research collected data by participant observation, in-depth interviews, and focus group sessions.

The research findings revealed that the villagers at Ban Na Not Village changed from the subsistence production to commercial production affecting agricultural water management. Furthermore, the government water management could not reach the community. As a result, the community sought the self-reliant water management by studying the problems, solving them, until becoming Life dam. Life dam was the creation of new knowledge based on local wisdom. In the application of Life dam under the context of different ecological communities,

the community needed to study water system, water map, community water course, and community resources. Through self-reliance, Life dam was valuable and instrumental in environment and community dimensions as well as the negotiation tool with the government.

This research constructs the weirs that improve the absorption efficiency of watersheds and the good ecosystem restoring abundance to nature, the nearby communities have water for living and farmers have sufficient water sources for agriculture. The recovery and conservation of water and forest resources are operated systematically under the community rules or the weir maintenance regulations. It also is able to create love, unity and participation in activities to make strong society and culture which was source of learning and practice for students to expose real experiences. Live weir construction activity is beneficial to the community. It allows the community to have water for consumption, especially for agriculture. So, the economy of the community is strengthened. Therefore, Chaiyaphum Rajabhat University should continue and expand this activity to other areas by creating cooperation with the province, and the agencies in the areas in an integration form in order to cover in all areas. This will be directly and indirectly beneficial to the local community sustainably.

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