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Participatory action research for waste management of KSL River Kwai natural agriculture center, Kanchanaburi province, Thailand

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Abstract KSL River Kwai Natural Agriculture Center is a learning center for the implementation of sufficiency economic philosophy in agriculture by knowledge dissemination to students, government agencies, employees, companies, interested parties and the general public. The center consists of accommodation in the form of resort, agricultural garden and learning center. It found waste management still lack of effective management, discipline and responsibility, and members participation in the center. The results from three groups participation of researchers, community representatives, and staff of KSL River Kwai Natural Agriculture Center who were collaborated to diagnose common problems by providing brainstorming, meeting and to solve the problems. Waste banks, bio-composting, garbage potted plant processing and animal feed processing were involved in activities. As a result, there was a tendency to solve the problem of waste management efficiently. Members learned to work together. The amount of unused waste was compared before and after research action revealed highly significant ($p < 0.01$) decreased from 544.62 kg./week to 51.63 kg./week. In addition, it promoted the quality of life for its members and being a source of knowledge for the community.

Keywords: waste management, participatory action research, natural agriculture center

Introduction

Solid waste is one of Thailand's major environmental problems. There were approximately 27.40 million tons or 75,046 tons of solid waste per day in the country in the year 2017, increasing 1.26 percent from the year 2016 due to the population increment, urban expansion, consumption behavior of the people as well as the increment of the traveling over 30 million visitors in the year 2017. (Pollution Control Department, 2018).

While the situation of solid waste in the year 2017 in Kanchanaburi province still was one of the major environmental problem. There were more

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than 180,000 tons of waste left in the waste disposal facility, with the rate of waste more than 800 tons per day and the tendency of garbage collection was increasing continuously. Kanchanaburi provides a policy to promote the participation of all sectors in the province to manage the hazardous waste from the community, to reduce the amount of solid waste at the source, to improve the efficiency of waste utilization and to limit the use of waste.

KSL River Kwai Natural Agriculture Center is a learning center for the implementation of the philosophy of sufficiency economy with agriculture in order to encourage sustainable development by knowledge dissemination to students, government agencies, employees, companies, interested parties and the general public. The center consists of accommodation in the form of resort, agricultural garden and learning center. However,it has been found waste management still lacked of the effective management, lack of discipline and responsibility, lack of members participation in the center; therefore, the objectives of this research were to create a participatory process for waste management of the center in order to manage the center waste efficiently and the waste quantity for sustainable development.

Materials and methods

KSL River Kwai Natural Center is in Mothao Village, Chongsadao Sub-district, Muang district, Kanchanaburi province, There are covered 280 rais (44.8 hectars). It was separated the area for training building, conference, accomodation, agricultural garden, learning base area, which introduced the philosophy of sufficiency economy to deploy in daily life. The research was conducted by using participatory action research. This was a research-based approach which tailored to the circumstances of the operation, in cooperation with three groups of researchers, community representatives with 10 persons from Mothao village which was the village leader 1 person, village committee 3 persons, village health volunteer 1 person, village security team 2 persons and elderly people 3 persons, and the staffs of KSL Riverkwai Natural Agriculture Center of 19 persons who was the waiter 2 persons, housekeeping 3 persons, cook 2 persons, gardening staff 4persons, security guard 3 persons, disabled persons in the Association of Kanchanaburi province 5 persons.

The research consisted of three phases as follows:- research preparation phase was conducted by meeting for making the understanding with research participants, clarify the purposes and the benefits they would receive. Implementation phase was organized the meeting to brainstorm in order to diagnose the common problems of the center waste to exploring the amount of garbage in the center before commencing operations. The meeting was

organized to brainstorm in order to identify the ways and activities for the problem solving. The implementation of the effective waste management was participated. Evaluation phase was concerned the participants collaborated to collect the amount of garbage from the center after conducting participatory activities for comparing with the amount of waste before operation and evaluation.

Results

The results showed that participatory action research that improved the efficiency of waste management in the concept of "zero waste". The research participants created many activitiesin the center which were waste banks, bio-composting, garbage potted plant processing and animal feed processing. Waste banks: the research team jointly surveyed and set up one area as a waste bank in the center. They participated to separate the waste that can be recycled for sale to the antique shop. The money from selling waste would be accumulated in to the waste management fund of the center for sustainable environment development (Fig 1). Bio-composting: they composted vegetables waste which mixing with molasses in a ratio of 3:1 and put the microorganisms for decomposition, and incubated for 3 months as fertilizer using in agricultural farms (Fig. 2). Garbage potted plant processing: they separated the plastic bottles and tanks which could be planted in the right size for using instead of container for many kinds of planting trees (Fig.3). Animal feed processing: in case of food waste, they combined with feed ingredients used for animal feed, such as pigs, chickens, ducks, reducing the cost of animal feed in the center (Fig. 4).

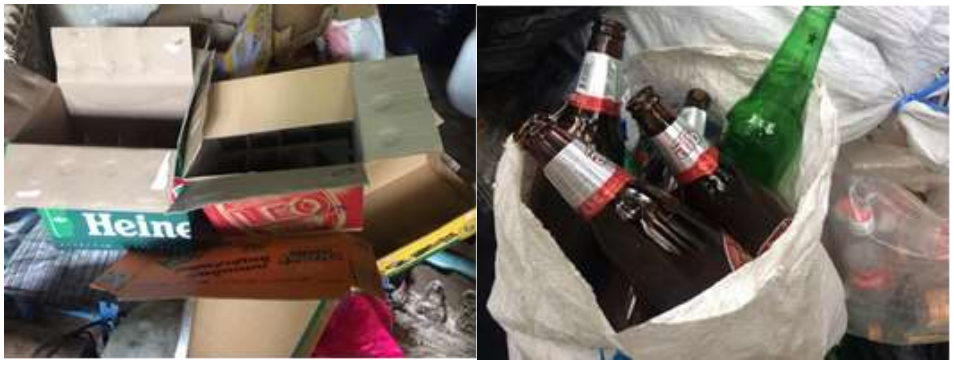

Figure 1. Waste storage in waste banks during waiting for sale

Figure 2. Fermented food waste for use as a bio-composting fertilizer

Figure 3. Garbage potted plant processing from plastic containers

Figure 4. Animal husbandry by food waste

All activities in participatory action research (PAR) were conducted to compare the center waste. They found that the amount of waste before doing activities was an average of 544.62 kg./week of unused waste, thereafter it showed that the amount of unused waste was 51.63 kg./week The amount of unused waste was significantly reduced at P = 0.01 level as shown in Table 1. The amount of waste that could not be utilized by the center after the research

was reduced to 51.63 kg. /week, which was only plastic bag waste. While the other types of waste could be used or sold as shown in Table 2.

Table 1. The amount of waste (kg./week) from the KSR River Kwai Natural Agricultural Center before and after research activities

	N	$\bar{x}$	SD	t	Sig
Pre-Research	4	544.62	52.54	19.42	0.00
After research	4	51.63	3.69		

Table 2. KSL River Kwai Natural Agricultural Center classification of waste after this research

No.	The amount of waste by weight (kg./week)						Total waste (kg./week)
	Glass Botte	Plastic Bottle	Aluminum cans	Wet Waste	Plastic Bag	Paper	
1	52.2	29.1	38.8	375.2	48.2	5.2	548.7
2	48.4	37.6	42.1	404.3	52.6	12.3	597.3
3	62.3	55.2	31.5	288.6	49.3	7.2	494.1
4	44.5	23.4	47.6	342.1	56.4	6.6	502.6
$\bar{x}$	51.85	36.33	40.00	352.55	51.63	7.83	535.68
Total							2,142.7

Discussion

The problem of waste management can be manipulated through participatory action research. There were meetings for brainstorming to find the ways to organize practical activities for reducing waste and efficient waste management. When the group was confident in order to build knowledge and develop learning coexistence in problem solving, facilitate the awareness in the importance of the activities and they were accepted. It is made sure that the operations were successful. The research team created various activities, enhanced learning process of the target groups. In addition, all stakeholders recognize the value of what drives sustainable development. This result was supported Rory O 'Brien (1998) who described the principles of participatory action research that it was a study of real situations rather than the creation or experimentation. The goal was to solve the actual problem, using social research or pilot research. In the study, there were people who take part in research for change the overall composition quickly. It must be flexible research based on the situation. It was consensus with Daungjai Pintamoon (2008) studied of solid waste management of people in Ban Sok district administrative organization, Lom Sak district, Phetchabun province, it has been found that most people have knowledge about the correct disposal of solid waste and each type of waste can be classified as well as there was public

participation in waste management. In addition, Tewa Prasuwan *et al*. (2016) studied participatory waste management of local government organizations and people community in Lang district, Rayong province. They found that the problem of solid waste management was high due to increasing population density in the area. The sources of waste come from households, factories and companies. Integrated waste management was effective to solve the problems.

In terms of quantity survey, the results showed decreasing of unusable waste after research activities; therefore, it was strong supported the practicality of the research approach. However, the researcher would like to suggest the further research should be conduct on additional uses of the plastic waste such as in areas of processing for road surface materials or oil processing etc.

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