

# Participation in Waste Management Process in the Initial Stage for Reducing Wastes in Naratkwai Community, Nakhon Phanom Province, Thailand

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## Abstract

At the present time residents Naratkwai Community (NC), Muang District, Nakhon Phanom are suffering from increasing quantities of waste and negative impacts on obnoxious odors, polluted water, ugly views, which cause complaints from local residents. Hence, the aim of this study is to investigate a participatory process of waste management at source in order to decrease the waste in NC by using planning as a guided cooperative learning process, inquiry, subgroup meeting, brainstorming, conclusion, presentation and trial. It was found that before project implementation, NC produces 3.5 tons of waste per day and the waste is dumped at a nearly saturated landfill. Thus, it caused overflow trash bins and troubled locals. The problems help locals to learn from a real life situation. The locals participated in the process to formulate guidelines for problem solving under limited budget and time. A conclusion from the meeting was to run a recyclable waste bank (RWB) at Village No.11, Ban Naratkwai. Most of residents are highly cooperative. At the beginning, there are 190 members of the RWB. Most of resident sell their waste to the bank instead of selling their waste to private purchasers with tricycle as they did in the past. The reason is that the RWB provides better welfare to its member such as dividend, funeral expense support, loans etc. It was found that the RWB operation could decrease the waste about 7,640 kilograms after it had operated for 2 months. The RWB could extend carrying capacity of the landfill.

**Keywords:** Nakhon Phanom, Naratkwai sub-district, Waste management, RWBs and community participation

## Background

Waste management by public sector, local governments and private agencies is crucial to generate sustainable waste problem solving.

According to the system, upstream process is to reduce waste quantity from sources and waste segregation; the midstream process is to lessen waste quantity and deliveries and the downstream is to use appropriate approaches for waste management, to lessen energy use and to produce energy from the waste (Prapawarin Nachampa, 2014). People's participation in waste management means the process, which the government promotes, supports, gives the people a chance to participate in waste management in their communities in order to meet the government's objectives and policies on waste management.

Efficient waste management should focus on waste reduction at source (Piyaruks Pradappetcharat et.al, 2010). To reduce the amount of waste by Recyclable Waste Bank (RWB) operation for one month, the operation can decrease the waste at the landfill by 465 kilograms. The process of the bank was to let the people to be its members. The members segregated their waste before disposal and consigned their recycle waste to the bank. The problems and obstacles for the operation were the majority of community's member was not the bank's members because the purchase price at the RWB was lower than the price at junk shops and the price was uncertain. The bank should stimulate and advertise for waste separation or increase welfare for its members. It should provide incentives for the people in communities to be its members.

Naratkwai Sub–district with the area of  $3 \times 10^7$  m<sup>2</sup>, the locals live in their 1,982 extended family households. The sub–district has 11 villages with the population of 7,413 (unregistered population is not included). Some important places in the sub–district are Nakhon Phanom University (NPU), schools, Buddhist temples, a health promoting hospital etc. The places produce waste. At present, waste from communities in the district tends to be increased (Patchayathan Kinnares,

2017). Causes of waste increase are community expansion, and unregistered population increase. The unregistered population is students and personnel of Nakhon Phanom University at Naratkwai Sub–district Campus. The community expansion caused rapid increase of private dormitories, food shops, and various shops. Factors influencing waste amount are consumer's behavior changes such as having fast foods, eating out, and drinking water from plastic bottles. Waste from the communities consists of organic waste, recyclable waste, general waste and hazardous waste. The waste cannot be reused because of the littering behavior of locals in communities. Most of locals litter all their non–separated waste in their trash bin. Naratkwai Sub–district Administrative Organization (NSAO) is responsible for waste collecting and landfill. The waste then is dumped at Nakhon Phanom Municipality Landfill at Ban Sukkasem, Photak Sub–district, Muang District, Nakhon Phanom. Some villages manage their waste by outdoor burning or illegal dumping on public lands, which cause direct and indirect environmental quality such as obnoxious odors, polluted water, and ugly views. In addition, it increases greenhouse gases, which cause global warming and affect people's health. To solve the problem, it needs to decrease waste at sources, which will create more effective waste management at upstream, midstream and downstream under essential locals' participation.

A workshop was set on October 11<sup>th</sup>, 2015 (as shown in Figure 1). Fourteen participants are community leaders, NSAO



**Figure 1** The atmosphere of sub–group meeting on October 11<sup>th</sup>, 2015 at NSAO

officers, NPU's representatives, at NSAO office. The objectives of the workshop are to hear problems and to discuss on waste increase problems, which cause overflowing waste, obnoxious odors, ugly views, and germ breeding areas. At the end of the workshop, it can be concluded that Naratkwai Sub-district produces 3.5 tons of daily waste, community waste needs to be managed urgently because there were complaints of overflow waste bins, obnoxious odors, polluted water, and plastic bottles scattered over roads. Furthermore, landfills will be saturated in the near future. The participants proposed that there should have a guideline for effective waste at source decrease with sustainable people's participation.

The first public hearing on waste in community was held on March 24<sup>th</sup>, 2016 at NSAO. Fifty participants from public sectors, community leaders, shops, private sectors, NSAO's officers, NPU's representatives were invited to attend the hearing (as shown in Figure 2). The hearing aimed to review problems and obstacles of waste management in the area. It can be concluded that 1) NSAO waste collecting unit did not collect waste everyday so there were overflow waste bins; 2) Overflow waste bins caused obnoxious odors, polluted water, and ugly views. The obstacles were 1) Local dumped general waste in waste bins; 2) There were not enough waste bins. The participants proposed the NSAO to solve the waste problems urgently. They also proposed that they needed a RWB, compost making training, incinerators etc.



**Figure 2** The atmosphere of a forum to express opinion, to review problems and obstacles and to have a cooperative learning from a real situation on March 24<sup>th</sup>, 2016 at NSAO

To solve the problems, the researcher has joined community stakeholders to formulate a plan by using an operational research, which provided public participation. The process began with problem identification, problem-solving guidelines so the locals reviewed their waste situation, reflected data; express their opinions, created guidelines for self-reliant waste management. The process helped participants consisted of technicians, community researchers, community leaders, government agencies, and private agencies to learn together so it help develop the potential and ability of locals to manage community waste of Naratkwai Sub-district, Muang District, Nakhon Phanom effectively and sustainably.

## Study area

A pilot village study was selected from the brainstorming session on June 2<sup>nd</sup>, 2016. Under criteria for selecting a village for effective waste management, the village must be a strong community with strong leaders. It has unity in the community, and visionary leaders. The pilot village for this study is Village No.11, Ban Naratkwai, Naratkwai Sub-district, Muang District, Nakhon Phanom (as shown in Figure 3).

## Research methodology

This study employed a community participatory process to decrease waste at sources at Naratkwai community. The research interventions consist of cooperative learning about situations, brainstorming, concluding, presentation, and trial. The steps of the interventions are as follows:

### 1) Cooperative learning about waste situations

A forum for sharing ideas was held on May 4<sup>th</sup>, 2016 at the community hall of Village No.11, Ban Naratkwai (as shown in Figure 4). The 50 participants comprises locals, community leaders, representative of agencies, NSAO, NPU's technicians, shop owners, stakeholders. The aim of the forum was to reflect data from the first public hearing, to review causes of continuous waste increase, to express impacts of waste on locals. NPU's technician presented their study on waste factors of Naratkwai community. The technicians acted as mentors of the forum.





**Figure 5** The atmosphere of the first brainstorm session to formulate a regulation for waste management and to select a pilot village on June 2<sup>nd</sup>, 2016 at NSAO

at-source decrease at the community. The guidelines were formulated under budget and time constraint. The forum concluded that there should be a recyclable waste bank to decrease waste and to promote locals to segregate the waste. The NPU's technicians acted as advisors of the forum.

**3) The second brainstorming on June 5<sup>th</sup>, B.E.2016** (as shown in Figure 6) was held at the community hall. The target group is 20 locals and community leaders of the pilot community and technicians from NPU. The objective of the brainstorming is to encourage the participants to discuss on structure and roles of the operating committee (OC) of a RWB and to formulate regulations of the RWB. Then the participants elected the OC to operate. The NPU's technicians acted as mentors to make a successful activity.

A conclusion and presentation from this cooperative learning, after the technicians collected data from the forum process, data was reported back to participants. After the participants approved a proposed model consisted of a structure, roles and function of the OC and RWB regulations, the model was first on trial on June 12<sup>th</sup>, 2016.

Steps of forum arranging:

1) The forum mentors (NPU's technicians) and participants introduced themselves.

2) To build up a good rapport, local dialects were used in the forum.

3) Hand raising was used as a sign to express opinion and to vote accompanied by writing some comments on a given small card provided by the mentors.

Tools for the forum arrangement comprise observation, inquiry, brainstorming, and note taking for some data from the forum.

## Results

Appropriate design for waste management should recognize that the quantity and factors of waste are essential. Pachchayathan Kinnares (2017) studied waste components of Naratkwai Sub-district before the implementation of the RWB, the study found that the components of waste in communities depended on climate, seasons, and way of life so waste in each province was different so quartering method should be the best way to study components of waste in communities.

The major components of waste from Naratkwai Sub-district, Muang District, Nakhon Phanom was recyclable. There was no hazardous waste as shown in Table 1.



**Figure 6** The atmosphere of the second brainstorm session to found a recyclable waste bank in the pilot village on May 4<sup>th</sup>, 2016 at the village hall, Village No.11, Ban Naratchakwai

**Table 1** Waste components in Naratkwai communities

Detail	Weight (kg.)	Percentage
Recyclable waste	2.6	56.52
Food waste	1.3	28.26
Hazardous waste	–	–
General waste	0.7	15.22

**Note:** Waste component analyzed by Quartering Method

In order to investigate a guideline for waste at sources decrease, the researchers used community tools consisted of planning as a guided cooperative learning process, inquiry, subgroup meeting, brainstorming, conclusion, presentation and trial in the community. From the forum, it was found that:

– **The situation of waste in Naratkwai Sub–district, Muang District, Nakhon Phanom** due to the second forum arranging on May 4<sup>th</sup>, 2016, the objective is to employ real situation cooperative learning, to reflect waste problems of the community obtained from the first problem review forum and impacts of waste on the community. The forum outputs can be concluded that NSAO is burdened with upstream duty (to provide trash bins for communities), midstream duty (to collect and deliver waste) and downstream duty (to dispose the waste). Naratkwai community produces 3.5 tons of waste per day, which will be delivered to dispose at landfills at Ban Sukkasem, Photark Sub–district, Nakhon Phanom. The

total cost for waste management of NSAO such as fuel cost, wages, maintenance, electric fees is 90,000 baht per month or 1,080,000 baht per year. According to waste disposal behavior of local or general waste disposal behavior, it is an obstacle for the agency to reuse the waste. Some households burn their waste outdoor whereas some illegally dispose the waste in public areas. In addition, the community faces overflow waste bins, obnoxious odors, polluted water, and ugly views so locals raise a complaint. In the forum, participants agreed to formulate a guideline to decrease waste at sources, which was proposed in the first meeting– to run a RWB, to make compost from food waste, and to build an incinerator in order to lessen the problems.

After the waste situation was recognized, a brainstorming session was run on June 2<sup>nd</sup>, B.E. 2016 in order to select a pilot village and to select an appropriate model to solve waste problems of Naratkwai Sub–district communities. Criteria for decision–making were waste components, local strengths, community leaders, vision of community leaders on waste management. The results from the session were:

1) A pilot village, Village No.11 was selected by locals, community leaders, NSAO’s representatives. The criteria for selecting the pilot village were 1) strong community visionary leaders, 2) community strengths, and 3) unity of the locals.

2) After choosing an appropriate guideline for the community to decrease waste at sources and recognizing the

major recyclable component of the waste, the participants propose to run a RWB. The major component of the community waste (56.52 %) was recyclable so successful waste management could lessen 56.52 % of waste. The waste could be sold or reused and it generates revenue for RWB's members. The incentive can increase the number of members so it helps decrease the quantity of waste to be dumped at the landfills.

– **Results from the second brainstorming session on June 5<sup>th</sup>, B.E. 2016** were the structure of the RWB, roles and functions of RWB's OC, RWB's regulations, an OC elected by locals from the pilot area. Every activity was based on the community participation.

After the brainstorming session, the RWB was run under the participation of locals and local agencies. The bank causes systematic waste separation, waste storage, then junk shops will purchase the recyclable waste.

– **According to the plan for waste-at-source decrease by RWB setting**, the implementation consisted of six steps as follows:

**Step 1:** The RWB was founded by the community for the community. There were steps of a committee selection by locals in Village No.11, Ban Naratkwai. The structure, role and functions of the RWB's OC were clearly specified. To

achieve the goal, technicians from NPU acted as mentors during the OC's implementation period. Details about the OC and its function are shown in Figure 7.

**Step 2:** To launch the RWB's regulations run by the RWB's OC selected by locals in Village No.11, Ban Naratkwai, it is the duty of the OC to propose the regulations to the village forum. The proposal for the regulation aimed to give details of the regulation to locals in pilot area and to ask for approval. If most of the locals in the forum approve the regulation, the OC will handle the regulation. The details are shown in Figure 8.

**Step 3:** To contact connections to purchase waste from Naratkwai RWB and to lessen transportation cost, NPU's technicians handled the coordination.

**Step 4:** NSAO and 11 village headmen advertised the services of RWB at Village No.11, Ban Naratkwai as shown in Figure 9.

**Step 5:** The RWB is operated to sell or purchase waste on specified time and day as shown in Figure 10–12.

**Step 6:** The RWB launches a monthly report about the number of members, circulating fund etc. and accommodate the report as an agenda in the village monthly meeting on the 4<sup>th</sup> day of every month.

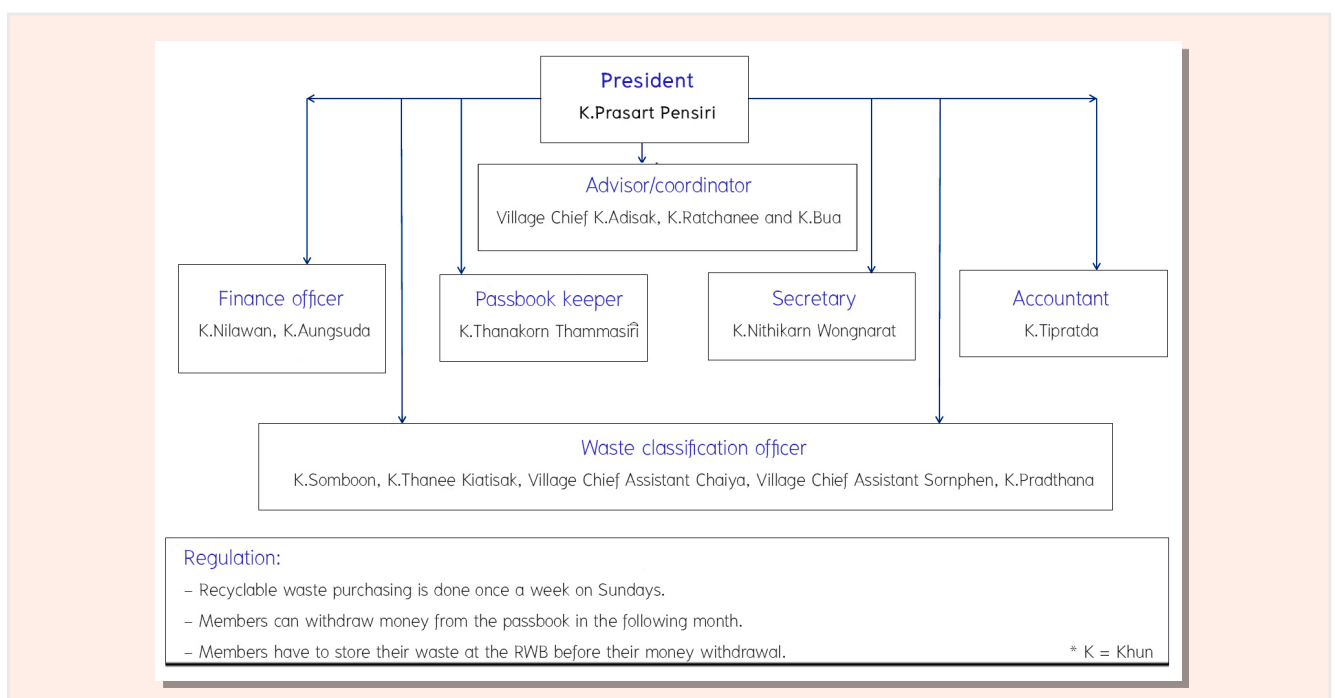


Figure 7 The RWB's Operating Committee organization chart

## The RWB's Member Regulations

1. Recyclable waste purchasing is done once a week on Sundays.
2. Members can withdraw money from the passbook in the following month.
3. Members who open the RWB's account will have the following privileges:
  - 3.1 Receive 10% percent dividend yield once a year
  - 3.2 5% of the yield participated in the project
  - 3.3 10% of the yield for management fees
  - 3.4 Funeral expense for 500 baht per RWB's account
  - 3.5 Soft loan is available in case of
    - The member makes a deposit into his account at least 300 baht.
    - The member has to consign his recyclable waste at the bank at least twice a month.
4. The member should sell his recyclable waste to the RWB every week.

Figure 8 The RWB's Member Regulations

Order	Item	Price (THB)	Purchase price (THB)	Order	Item	Price (THB)	Purchase price (THB)	Order	Item	Price (THB)	Purchase price (THB)
<b>Paper</b>				<b>Lead</b>				<b>Plastic</b>			
1	Card board	4	2.8	1	Soft lead	28	19.6	1	Mixed	8	5.6
2	Waste paper	2.2	1.54	2	Solid lead	22	15.4	2	Paradise plastic bottle	19	13.3
3	Inked paper	5.5	3.85	3	Small size battery	23	16.1	3	Clear plastic	8	5.6
4	Mixed inked paper paper	3	2.1	4	Large size battery	24	16.8	4	Hard plastic	1.5	1.05
5	Newspapers	6	4.2	5	Black large size battery	22	15.4	5	Blue PVC	6	4.2
6	Paper carton	2	1.4	6	Stainless	20	14	6	Gray or Yellow PVC	-	-
7	Cement bag	-	-	<b>Rubber</b>				7	Wire insulator	-	-
<b>Iron</b>				1	Boots	7	4.9	8	Linoleum	-	-
1	Thick iron	5.5	3.85	2	Shoes	1	0.7	9	Green plastic tube	2	1.4
2	Iron rail	4.5	3.15	3	White rubber band	6	4.2	10	CD	3	2.1
3	Mixed iron	5	3.5	<b>Aluminum</b>				<b>Bottle</b>			
4	Cast iron	8	5.6	1	Thin aluminum	35	24.5	1	Fish sauce bottle (Whole case)	20	14
5	Iron rod (more than 1 meter)	7.5	5.25	2	Thick aluminum	36	25.2	2	Fish sauce bottle (each)	1	0.7
6	3/8, 1/2, or 5/8 inch diameter iron rod (more than 1 meter)	7	4.9	3	Aluminum radiator	22	15.4	3	"Leo" Beer bottle(whole case)	10	7
7	3/8, 1/2, or 5/8 inch diameter iron rod (more than 1 meter)	4.9	4	4	Pan	22	15.4	4	"Chang" Beer bottle(whole case)	10	7
8	Suspension (more than 1 meter)	8	5.6	5	Screen	39	27.3	5	"Hongthong" bottle(whole case)	15	10.5
9	Oil filter( unburned)	1	0.7	6	Intact	40	28	6	"Hongthong" flat bottle(whole case)	13	9.1
10	Coffee can- zinc	2	1.4	7	4-piece brake pad	25	17.5	7	"Saengsom" bottle	6	4.2
11	Refrigerator condenser	12	8.4	8	Aluminum-zinc alloy	35	24.5	8	Sauce bottle(whole case)	6	4.2
12	Refrigerator with condenser	5.5	3.85	9	Stopper	18	12.6	9	Whisky bottle(whole case)	6	4.2
13	Refrigerator without condenser	2	1.4	10	Aluminum-iron alloy	12	8.4	10	Small rice wine bottle(whole case)	21	14.7
14	Washing machine with condenser	5.5	3.85	11	Copper-gill radiator	70	49	11	"Chang" Beer small bottle(whole case)	10	7
15	Washing machine without condenser	2	1.4	12	Wire screen	12	8.4	12	"Hineken" Beer big-small bottle	6	4.2
16	Small size fan	20	14	13	Blind	15	10.5	13	285 bottle (whole case)	14	9.8
17	Big size fan	30	21	14	Can	30	21	14	"Singha" Beer bottle	4	2.8
18	Computer monitor	60	42	15	fragment	12	8.4	15	"Sponsor" glass bottle	-	-
19	Television	2	1.4	16	Mag wheel	40	28	16	Carbonated water bottle	1	0.7
<b>Copper</b>				<b>Kapok</b>				17	Small soda bottle	1	0.7
1	Perfect insulated copper wire	140	98	1	Kapok fiber	10	7	18	Small soda bottle with box	105	73.5
2	Black insulated copper wire	131	91.7	2	Kapok seed	1.5	1.05	19	Big soda bottle (each)	4	2.8
3	Naked copper wire	122	85.4	3	Duck feather	-	-	20	Big soda bottle with box	120	84
4	Dynamo copper wire	120	84	4	CC	-	-	21	White broken bottle per kilogram	1	0.7
5	insulated electric wire	15-30	10.5	5	Cashew nut	-	-	22	Red broken bottle per kilogram	1	0.7
<b>Brass</b>				6	Rice dry grain	-	-	23	Candle fragment	10	7
1	Thick brass	95	66.5					24	Use lubricant/oil	-	-
2	Thin brass	80	56								
3	Radiator brass	70	49								
4	Brass fragment	50	35								
5	Brass cartridge	92	64.4								

Figure 9 Purchasing and selling price list of recyclable waste on June 12, 2016 at Village Hall, Village No.11, Ban Naratkwai



**Figure 10** The atmosphere of a network forum consisted of NPU's researchers (1), NSAO's administrators (2), and a junk shop owner (3)



**Figure 11** The atmosphere of waste purchasing by a junk shop mobile unit at Naratkwai RWB on June 13, 2016



**Figure 12** The atmosphere of community participation at Village No.11 on June 12, 2016

### Overall operation of the RWB

The RWB operated on June 12<sup>th</sup>, 2016 and there were 190 members. For their one month operation (June 2016) it could lessen the quantity of waste to the landfills because member separated their recyclable waste (3,764.44 kilograms) and sold them to the bank. It is clearly seen that the community saved 3,764.44 baht to dispose of the waste. The cost for waste disposal was 1 baht per 1 kilogram of waste. The

cost was calculated from data on <http://news.thaipbs.or.th/content/1090> as shown in Table 2 and Figure 14.

The overall operation of the bank in July 2016, it could lessen the quantity of waste to the landfills 3,875.80 kilograms so the community saved 3,875.80 baht. The cost for waste disposal was 1 baht per 1 kilogram of waste. The cost was calculated based on <http://news.thaipbs.or.th/content/1090> as shown in Table 3 and Figure 15.

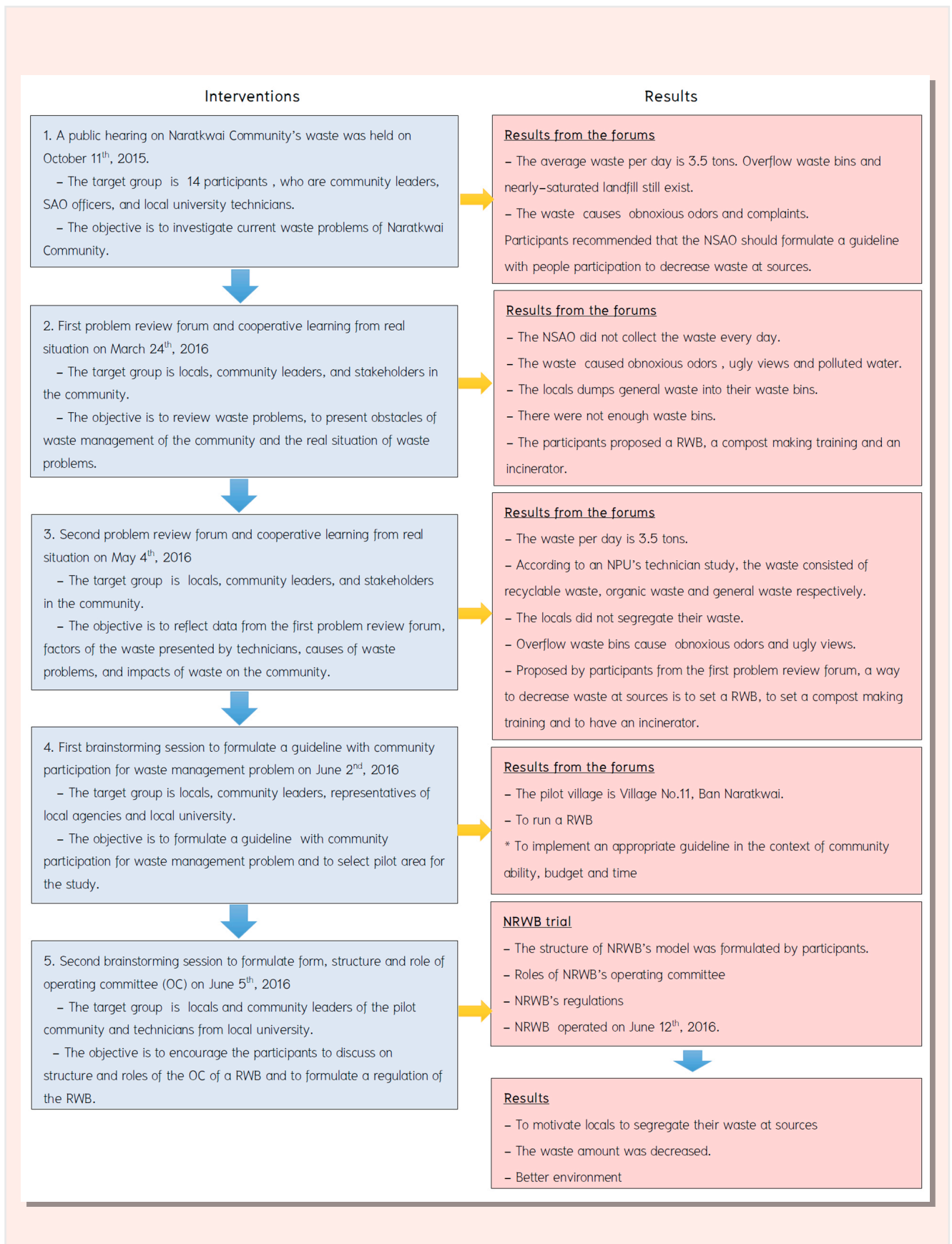


Figure 13 Conclusions

It can be concluded that after the bank has operated for two months it could encourage its member to segregate recyclable waste from general waste. The quantity of recyclable waste was 7,640.20 kilogram or it could save 7,640.20 baht. The bank operation can lessen number of trips to the landfills, the fuel use, the cost of waste disposal, the quantity of waste to the landfills, and the environmental problems of communities. In addition, it can also lessen methane release.

**The project, “The Participation in Waste Management Process in the Initial Stage for Reducing**

**the Waste in Naratkwai Community”, brought overall success, to create personal accountability.**

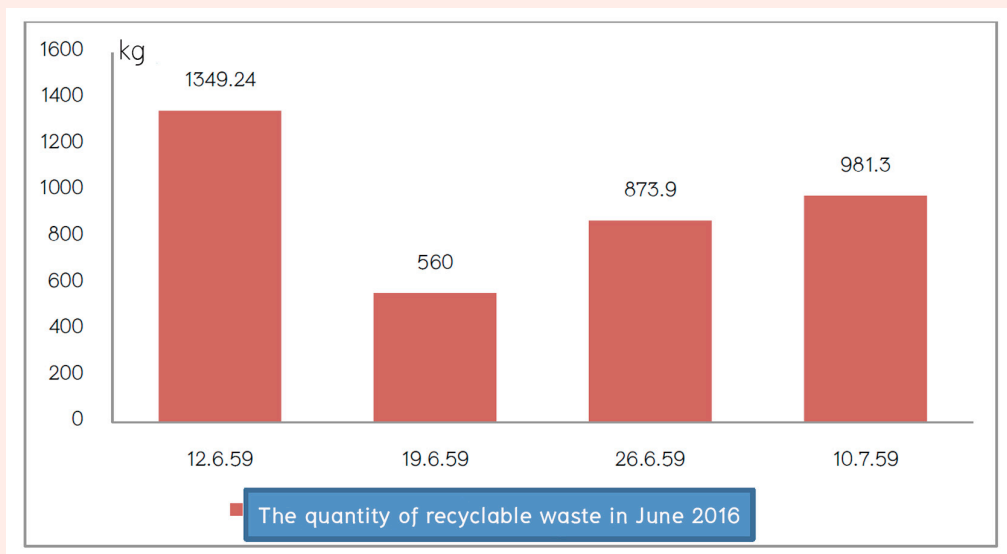
The RWB run at Village No.11, the pilot village, stimulates more local interests. The locals collect some discarded stuff such as detergent paper boxes, plastic shampoo bottles, plastic liquid soap bottles, CDs, candle wax scraps etc. They sell their discarded stuff every week at the RWB. In addition, parties has supported these sustainable activities. NSAO helped advertise the RWB at Village No.11 and usually sell its recyclable waste to the bank. Baiyoke, a junk shop mobile unit, regularly buy

**Table 2** The quantity of waste decrease in Naratkwai Community in June 2016

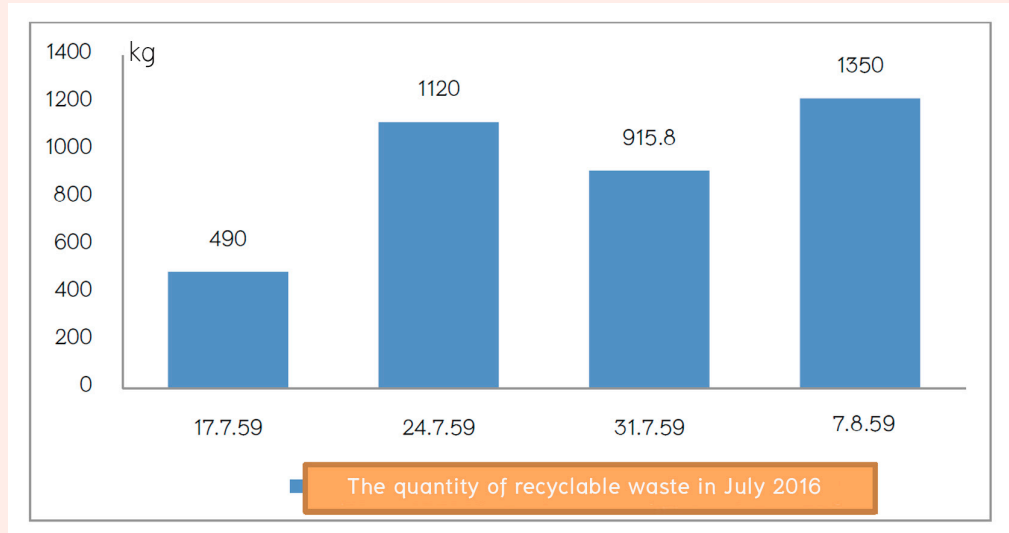
Date	June 10 <sup>th</sup>	June 12 <sup>th</sup>	June 19 <sup>th</sup>	July 10 <sup>th</sup>	Total
Quantity (kg)	1,349.24	560	873.9	981.3	3,764.44

**Table 3** The quantity of waste decrease in Naratkwai Community in July–August 2016

Date	July 17 <sup>th</sup>	July 24 <sup>th</sup>	July 31 <sup>st</sup>	August 7 <sup>th</sup>	Total
Quantity (kg)	490	1,120	915.8	1,350	3,875.80



**Figure 14** The quantity of recyclable waste storing at RWB, Village No.11, Ban Naratkwai during June 12–July 10, 2016



**Figure 15** The quantity of recyclable waste storing at RWB, Village No.11, Ban Naratkwai during July 17<sup>th</sup>–August 7<sup>th</sup>, 2016

recyclable waste at the bank's storage. NPU initiated the project and provided the pilot area with technical support in order to build sustainable waste management.

In the future, the RWB's OC will provide a mobile unit to advertise recyclable waste bank for every village in Naratkwai Sub-district and to campaign waste separation in every village.

## Discussion

According to the study, "The Participation in Waste Management Process in the Initial Stage for Reducing the Waste in Naratkwai Community, Nakhon Phanom", it was found that the intervention for this study consisted of community tool application, planning for co-construction and peer-coaching, questioning, observation, buzz group, brainstorming, conclusion, presentation and trial. The forum outcomes are: 1) the model village –Village No.11 Ban Naratchakwai, 2) an appropriate model for waste decreasing at sources under limited budget and time and a recyclable waste bank operation. In accordance with the theory of Thawit Yapanant (2012), the bank was operated under community and agency participation, brainstorming for bank's operational plan. The bank helped

systematic waste separation, segregated waste depositing in the bank, waste purchasing from junk shops. Thawit Yapanant (2012) studied participatory operational research on waste management model construction of Song Sub-district Municipality, Song District, Præ and found that the process which gave stakeholders in the communities to be informed, to analyze problems, to express opinions, to construct a model for waste management and to set a recyclable waste bank. There was a working group to cooperate with households in communities, which segregated household waste, deposited the waste at Buddhist temples, to deal with junk shops to purchase waste of the group. The segregated waste was sold every month.

Considering the strength of Naratkwai Recyclable Waste Bank (NRWB), it is the working group elected by the locals from a pilot village, visionary community leaders on waste decrease at sources, supportive parties such as NSAO, the largest junk shop in Nakhon Phanom, and NPU. In addition, the provision of NRW's welfare for its members from the pilot village helps to increase the number of members. During its 2-month operation, there are 190 members, 7,640 kilograms of recyclable waste. The 7,640 kilograms of recyclable waste

reflects the decrease of waste to be dumped in the landfill, which corresponds to Piyachart Silapasuwana's theory (2014). The theory informs us that if a household has segregated its waste for one month, the waste to be dumped into the landfill is 162 kilograms. Without the intervention, the waste would have been 648 kilograms. If every household segregates its waste, the waste to be dumped into the landfill is 6,828 kilograms. Without the waste segregation, the waste would have been 24,292 kilograms to be dumped in the landfill. It is obviously seen that running a recyclable waste bank gives efficient waste decrease, which helps lessen the waste to be dumped in the landfill.

## Conclusions

According to the study "The Participation in Waste Management Process in the Initial Stage for Reducing the Waste in Naratkwai Community, Nakhon Phanom", the researcher employed planning as a guided cooperative learning process and community tools such as inquiry, observation, sub-group meeting, brainstorming, concluding, presentation, and try-out.

## Recommendations

- 1) Some waste at sources such as organic waste, hazardous waste could be reused.
- 2) Local governments should promote the locals to participate environmental management in communities. They should participate in legislative drafting, monitoring and evaluating stage.
- 3) Satisfaction of the locals from the project should be evaluated.

## Acknowledgements

We wish to thank Research and Development Institute for granting a research fund (Research Contract No.002/2559) and parties of people at Naratkwai Sub-district, Naratkwai Sub-district Administrative Organization, Baiyoke Junk Shop, and Nakhon Phanom University for support and cooperation.

Translated from the original version in Thai by Pachchayathan Kinnares.

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