

# Effective Model of Community Wastewater Management with Participation of People in Bang Pu Municipality, Samut Prakan, Thailand

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## ABSTRACT

The objectives of this research were 1) to study the level of relationship towards the effective model of community wastewater management, 2) to study the causal relationship of the public sector, thinking participation, joint operation, monitoring and evaluation of results, and co-beneficiation affecting the effectiveness of community-based wastewater management, and 3) to study the effective model of community wastewater management with the participation of people in Bang Pu Municipality, Samut Prakan Province. According to the research results, the variables in each aspect were positively correlated with the statistical significance at level .001. It was found that 1) joint operation, public sector, monitoring, and evaluation of results, co-beneficiation, and thinking participation affect the effective model of community wastewater management, respectively, 2) explain the relationship path that the government has the most direct relationship with the participation. It is followed by the direct impact with the joint operation, co-beneficiation, monitoring and evaluation of results, and effectiveness of community wastewater management, respectively. It indirectly affects the effectiveness of community wastewater management, monitoring and evaluation of results, co-beneficiation, and joint operation respectively. 3) The effectiveness of community wastewater management with participation affects the government sector, thinking participation, joint operation, monitoring and evaluation of results, and co-beneficiation. It could be explained that when the management is made in accordance with such guidelines, it will result in the success factor of effectiveness of community wastewater management with participation.

## Keywords

thinking participation, joint operation, monitoring and evaluation of results, beneficiation, wastewater management

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

## Introduction

The water pollution or wastewater is the condition of water being contaminated with undesirable substances or sewage. The contamination of impurities changes the properties of the water in a condition that cannot be recycled. It also causes danger and disease for those who use it or live close to the wastewater. In general, wastewater can be categorized from the main sources including; 1) municipal wastewater which is the wastewater generated from daily activities and occupations of people living in the community such as wastewater from cooking and washing to wash all the dirt in the household and various types of buildings, 2) industrial wastewater which is the wastewater generated from industrial processes since the procurement of raw materials, raw material washing, production process, cleaning of equipment and machines as well as cleaning the factory. The industrial wastewater will have different characteristics depending on the type of industry and the production process. 3) Agricultural wastewater is the wastewater generated from agricultural activities covering the cultivation and animal husbandry. The wastewater from cultivation contains chemical fertilizers in the form of nitrogen, phosphorus, potassium and pesticides as well as herbicides in the form of toxin. 4) Natural wastewater is caused by the decomposition of plants and animal waste in the form of organic matter. When they flow into water, they are decomposed by microbial transformation. This causes the oxygen content of the water source to decrease until causing the sewage problem (Department of Environmental

Quality Promotion and Environmental Research and Training Center, 2012, Page 4-1).

According to the current study from the data collected across the country (Water Quality Management Bureau, 2017, Page 3), it is discussed on the comparative proportion of each type of wastewater occurring. Most of which accounts for 80 percent and it is anticipated that the municipal wastewater will remain in such a way for a long time due to the expansion of the city and the increasing population. At the same time, there are limitations in the management of those involved. Inefficient municipal wastewater management system and management still lack readiness in many areas due to the aforementioned problematic conditions (Water Quality Management Bureau, 2017, Page 3). The impact on health and sanitation are discussed. Generally, pathogens found in wastewater that cause human disease are bacteria, viruses, protozoa, and parasites. The source of these pathogens is from human and animal feces mixed with wastewater (Department of Environmental Quality Promotion, n.p., Page 1). It is also discussed about the environmental and social impacts. Municipal wastewater causes soil, water and air pollution problems which are the common sources of epidemic disease, cholera, dysentery, and are the breeding ground for various disease-causing insects. This leads to the nuisance, emission of foul smell causing the loss of scenery, economic losses, loss of some fish species, reducing number of aquatic lives, and causing the changes in the ecosystem in the long run, etc.

From the aforementioned problems, it is found that the urban area or sub-urban communities surrounding Bangkok

which is the metropolitan area is clearly affected area contextually inferred following the social structure and management. Besides, Samut Prakan Province is another area that has been affected all the time, especially the Bang Pu Municipality, Mueang Samut Prakan District, due to the surrounding context of the traditional area. There were various wastewater problems including agricultural wastewater, natural wastewater, industrial wastewater. According to the 2019 survey of Bang Pu Municipality, it is found that municipal wastewater which is an important problem at present needs to be addressed urgently and continuously (Bang Pu Municipality, 2019, Page 3). This is in compliance with Water Quality Management Bureau (2017, Pages 1-2) stating that most of the water pollution is caused by community wastewater. It is caused by the daily activities of the people living in the community and occupational activities such as wastewater resulting from cooking and cleaning household. Dirt and various types of buildings all contribute to wastewater from water use. Although some houses are treated with septic tanks or by using small prefabricated septic tanks, the effluent from these ponds or septic tanks is then drained into canals or public drains which eventually flows into rivers, canals or natural water ways. In addition, many urban communities do not have a good wastewater management system causing the wastewater to be drained into public sewers. The water source is then deteriorated. The black polluted water is emitted with bad smell until being unable to use.

Therefore, in order to help reducing water pollution problems emitted into water sources in the future and to prevent wastewater from being drained directly into the water sources, the wastewater from communities should be properly managed. This can start from the source of wastewater from houses first. If each house can dispose wastewater properly, the wastewater from the community would not be a big problem for the country any longer. However, the management of the community wastewater problem cannot be solved entirely by the people. It also needs the cooperation of the personnel in the management of community wastewater. It requires the role and duties of the law, an agency or government organization that is involved in cooperation with community wastewater management. Nevertheless, the management of municipal wastewater by local officials or relevant authorities still has practical limitations such as law enforcement mechanisms, knowledge, understanding, skills, expertise, and proficiency to perform the job or the formulation of policies, plans, projects, monitoring of results. There are still some limitations and lack of clarity. Thus, if such community wastewater is managed appropriately and the cooperation is achieved, the participation in the public sector, non-governmental organizations or civil society will increase the effectiveness of community wastewater management.

## Research objectives

1) To study the level of relationship towards the effective model of community wastewater management, 2) to study the causal relationship of the public sector, thinking participation, joint operation, monitoring and evaluation of results, and co-beneficiation affecting the effectiveness of

community-based wastewater management, and 3) to study the effective model of community wastewater management with the participation of people in Bang Pu Municipality, Samut Prakan Province.

## Research conceptual framework

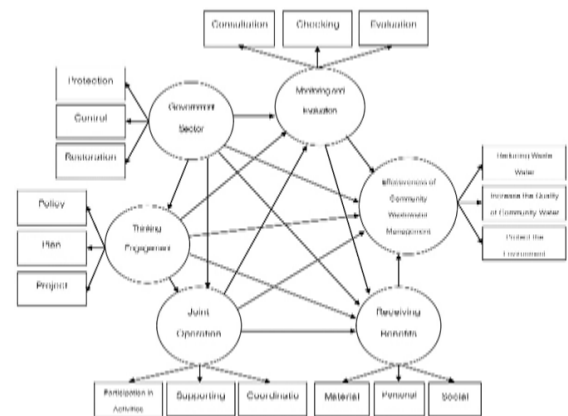


Figure 1 Model of effectiveness of community wastewater management with public participation

## Research Methodology

**For the quantitative research,** the sample group is from people living in Bang Pu Municipality area. The data was collected from the persons aged 18 years and over using stratified sampling. The sample size was calculated using multivariate statistical analysis and structural equation modeling (SEM). The sample group was proposed about 20 times the empirical variable (Grace JB, 2008, p.15). The conceptual framework of 18 variables was defined by the researchers using a sample of 360 persons.

The research tool was a questionnaire about government, participation, thinking participation, joint operation, monitoring and evaluation, co-beneficiation, and effectiveness of community wastewater management with public participation for 90 questions in the 5-scale assessment. The IOC is individually from 0.5-1.00. The reliability for the entire questionnaire was .972. The results were analyzed by using descriptive statistics and structural equation models to test the relationship between the latent and observed variables and the relationship between independent and variable variables using LISREL program.

**For the qualitative research,** the key informants were administrators / community leaders consisting of; 1) 3 Thai Baan Sub-District Community Leaders, 2) 3 Thai Ban Mai Sub-District Community Leaders, 3) 3 Bang Pu Sub-District Community Leaders, 4) 3 Bang Pu Mai Sub-District Community Leaders, and 5) 3 administrators of Bang Pu Municipality, totaling 15 people. The tool was a structured interview form with the open-ended questions. The data was collected through in-depth interviews with individual key informants. The obtained data and the contents were analyzed. The opinions were categorized. The main points and secondary points were set to support quantitative research and create an effective model of community wastewater management with public participation.

## Results

1. The level of effectiveness of community wastewater management with people participation was at the highest level of 4.58 followed by the joint operation, government sector, monitoring and evaluation of results, receiving benefits, thinking engagement for 4.57, 4.56, 4.49, 4.48, and 4.39, respectively.

2. The path of relationship can be explained that the government sector has a direct relationship with thinking engagement at the highest level of 0.67 followed by direct impact on the joint operation, receiving of benefits, monitoring and evaluation of results, and effectiveness of community wastewater management with people participation for 0.67, 0.65, 0.47, 0.39 and 0.30 respectively. This indirectly affects the effectiveness of community wastewater management with people participation, monitoring and evaluation of results, receiving of benefits, and joint operation for 0.58, 0.51, 0.37 and 0.21 respectively.

The thinking engagement has direct relationship with the joint operation at the highest level of 0.32 followed by direct impact on receiving benefits, monitoring and evaluation of results, effectiveness of community wastewater management with people participation for 0.32, 0.22, 0.18 and 0.13, respectively. This indirectly affects the effectiveness of community wastewater management with people participation, monitoring and evaluation of results for 0.18 and 0.15 respectively. However, it does not indirectly affect receiving of benefits of 0.11.

The joint operation has direct relationship with monitoring and evaluation of results at the highest level of 0.45 followed by the direct effect on the effectiveness of community wastewater management with people participation and receiving of benefits for 0.45, 0.33 and 0.24, respectively. This indirectly affects receiving of benefits for 0.26 but it does not indirectly affect the effectiveness of community wastewater management with people participation of 0.07.

The monitoring and evaluation of results has direct relationship with receiving of benefits at the highest level of 0.58 followed by direct effect on the effectiveness of community wastewater management with people participation for 0.14. However, it does not indirectly affect the effectiveness of community wastewater management with people participation of 0.08.

Receiving benefits has direct relationship with the effectiveness of community wastewater management with people participation of 0.14.

3. Model of effectiveness of community wastewater management with public participation in the area of Bang Pu Municipality, Samut Prakan

### 3.1 Quantitative research

3.1.1 For the public sector on prevention, control and remediation, it is found that prevention, control and remediation are important to the government sector with statistical significance at level 0.01. The relationship can be described as 76%, 90%, and 78%, respectively.

3.1.2 For the thinking engagement in policy, work plan, and project, it is found that the policy, work plan, and project are important to the thinking engagement with statistical

significance at level 0.01. The relationship can be described as 74%, 77%, and 82%, respectively.

3.1.3 For the joint operation in the participation of activities, co-promotion, and coordination, it is found that the participation of activities, co-promotion, and coordination are important to the joint operation with statistical significance at level 0.01. The relationship can be described as 64%, 47%, and 49%, respectively.

3.1.4 For the monitoring and evaluation of results in consultation, investigation and reporting of results, it is found that the consultation, investigation and reporting of results are important to the monitoring and evaluation of results with statistical significance at level 0.01. The relationship can be described as 75%, 79%, and 79%, respectively.

3.1.5 For receiving of benefits in materials, personal, and social benefits, it is found that materials, personal and social benefits are important to the receiving of benefits with statistical significance at level 0.01. The relationship can be described as 77%, 67%, and 62%, respectively.

3.1.6 For the effectiveness of community wastewater management with people participation in terms of the reduction of the amount of wastewater, increase of the quality of community water, and the preservation of environment quality, it is found that the reduction of the amount of wastewater, increase of the quality of community water, and the preservation of environment quality are important to the community wastewater management with people participation with statistical significance at level 0.01. The relationship can be described as 81%, 69%, and 63%, respectively.

### 3.2 Qualitative research

3.2.1 For the public sector on prevention, control and remediation, it is found that people and communities should be encouraged to participate in the control, prevention and remediation the community wastewater pollution problem. The people should participate in making decisions in community wastewater management. At the same time, relevant government agencies must adopt the ideas, guidelines for practices under the community wastewater management plan to formulate action plans for implementing concrete results with a focus on proactive integrated management under the cooperation of all sectors. Moreover, the communities and people have the ability and readiness to manage wastewater by themselves. They are able to examine and evaluate the operational performance. People and communities have knowledge, understanding and participation in making decisions in conformity with government's guidelines for practices.

3.2.2 For the thinking engagement in policy, work plan, and project, it is found that everything must be related to the implementation whether the community wastewater management will be a good practice or not. Most of them have the opinions that for the municipal wastewater management, the government agencies and the public sector have to jointly implement policies, work plans, and projects altogether taking into account the continuity in the operation. It is also found that political policies at the local level have an impact on the formulation or operation of the wastewater management organization.

3.2.3 For the joint operation in the participation of activities, co-promotion, and coordination, it is found that the joint operation is possibly the activities and promotion including



the coordination which is critical to wastewater management. As a result, the people or those involved will be recognize and aware of the problems that are common and will understand the role of participation in the operation.

3.2.4 For the monitoring and evaluation of results in consultation, investigation and reporting of results, it is found that such three components are important to the community wastewater management with public participation. For the consultation on the opinions, exchange of learning on the wastewater treatment before or after such water emission, the mentioned learning will lead to the common awareness. The results must be reported when the wastewater is found or is neglectful discharged. This is because such characteristics will affect the inspection jointly by both the public sector and the government or related agencies.

3.2.5 For receiving of benefits in materials, personal, and social benefits, it is found that materials or technology are important to management because it is the fundamental factor of wastewater management. Besides, technology should be easy to find, cheap, and use low budget. However, municipal wastewater management of communities needs to adopt innovations and technological development in wastewater management including modern technology tools and equipment in community wastewater management.

3.2.6 For the effectiveness of community wastewater management with people participation in terms of the reduction of the amount of wastewater, increase of the quality of community water, and the preservation of environment quality, it is found that the reduction of wastewater amount is an important factor or a main goal of wastewater management. Therefore, when local authorities or communities take action to contribute to the reduction of wastewater, it will continue to lead to management of other factors such as the use of legal and regulatory measures to control pollution from the source and control the implementation of community wastewater management. This is for being effective for compliance with law enforcement as well as raising awareness of environment and pollution.

From the above findings, the model of effectiveness of community wastewater management with people participation can be described that the municipal wastewater management for all agencies, public organizations, private sectors and people sector must be realized and adhered to the common goal of community wastewater management efficiently and effectively. The wastewater released into the environment must be of quality that is or better than the law or does not cause adverse effects to humans and the environment. The management of such community wastewater must begin at the point of origin that causes wastewater and the structured management must have a sequence of steps. The model of effectiveness of community wastewater management with people participation is called "Top to bottom and bottom to top model". It is a form of relationship that affects each other from top to bottom and from bottom to top. This opposite effect can lead to success or outcomes in municipal wastewater management including the effectiveness of community wastewater management, government sector, joint operation, monitoring and evaluation of results, receiving of benefits, and thinking engagement as shown in Figure 2.



Figure 2 Top to bottom and bottom to top model

## Discussions

1.1 The public sector affects thinking engagement. It can be explained that when there is an increasing number of operations in the government sector, it will inevitably result in the increase of joint operation.

1.2 The public sector and the thinking engagement affect the joint operation. It can be explained that when the operation of the public sector and the thinking engagement increase, it will result in the increase of joint operation.

1.3 The public sector, thinking engagement, and joint operation affect the monitoring and evaluation. It can be explained that when the operation in the public sector increases, it will result in the increase of monitoring and evaluation as well. The thinking engagement affects the monitoring and evaluation. It can be explained that when the thinking engagement increases, it will result in the increase of monitoring and evaluation. The joint operation affects the monitoring and evaluation. It can be explained that when the joint operation increases, it will result in the increase of monitoring and evaluation as well.

1.4 The public sector, thinking engagement, joint operation, and monitoring and evaluation affect the receiving of benefits. It can be explained that when the operation in the public sector increases, it will result in the increase of receiving of benefits. The thinking engagement affects the receiving of benefits. It can be explained that when the thinking engagement increases, it will result in the increase of receiving of benefits. The joint operation affects the receiving of benefits. It can be explained that when the joint operation increases, it will result in the increase of receiving of benefits. The monitoring and evaluation directly affect the receiving of benefits. It can be explained that when the monitoring and evaluation increases, it will result in the increase of receiving of benefits.

1.5 It can be explained that when the operation in the public sector increases, it will result in the increase of effectiveness of community wastewater management with people participation. The thinking engagement affects the effectiveness of community wastewater management with people participation. It can be explained that when the thinking engagement increases, it will result in the increase of effectiveness of community wastewater management with people participation. The joint operation affects the effectiveness of community wastewater management with people participation. It can be explained that when the joint operation increases, it will result in the increase of effectiveness of community wastewater management with people participation.

people participation. The monitoring and evaluation affects the effectiveness of community wastewater management with people participation. It can be explained that when the monitoring and evaluation increases, it will result in the increase of effectiveness of community wastewater management with people participation. The receiving of benefits affects the effectiveness of community wastewater management with people participation. It can be explained that when the receiving of benefits receiving of benefits increases, it will result in the increase of increases, it will result in the increase of effectiveness of community wastewater management with people participation.

## 2. Discussion on the values of the theoretical concepts

2.2 For the values of concept and theory, this research requires literature review to select the variables resulting from the theory of pattern recognition and validation with empirical data, respectively. This causes the data collection to be done prudently and reasonably. The researchers must be well versed in the texts and principles of theory in relation to variables. The researchers must select the variables or relevant key elements appropriately including the format guidelines that represent relationship between variables or elements consistent with the theory. They must be able to examine the relationship structure with the actual collected data in order to confirm the model created by the researchers whether it is consistent with the empirical data that was collected or not. It can be knowledge for those involved or those who are interested to study. This will be a guideline for increasing the efficiency of community wastewater management with public participation. This research can explain the conformity with the concepts and theories that have been reviewed and can be discussed as follows.

### 2.2.1 Value in the relationship of variables

The prevention, control and remediation are important to the public sector significantly. It can be noticed from the remediation to have the high level followed by the control and prevention, respectively. The results are correspondent to the qualitative research results and agree with the concept of the Pollution Control Department (2018, Page 2).

The policy, work plan, and project are important to the thinking engagement significantly. It can be noticed from the project to have the high level followed by the work plan and the policy, respectively. The results are correspondent to the qualitative research results and agree with the concept of the Water Quality Management Bureau (2006, Page 67-68).

The participation of activities, co-promotion, and coordination are important to the joint operation significantly. It can be noticed from the coordination to have the high level followed by the co-promotion and participation of activities, respectively. The results are correspondent to the qualitative research results and agree with the idea of Khomsan Laosinlapacharoen (2020) and Department of Local Administration (n.p., Page).

The consultation, investigation and reporting of results are important to the joint operation and monitoring and evaluation significantly. It can be noticed from the investigation and reporting of results to have the high level followed by the consultation, respectively. The results are correspondent to the qualitative research results and agree with the concept of the Pollution Control Department (2556, Page 1).

The materials, personal, and social benefits are important to the receiving of benefits significantly. It can be noticed from the materials to have the high level followed by the personal and social benefits, respectively. The results are correspondent to the qualitative research results and agree with the concept of Chaidetch Changphien (2020).

The reduction of the amount of wastewater, increase of the quality of community water, and the preservation of environment quality are important to the community wastewater management with people participation significantly. It can be noticed from the increase of the quality of community water to have the high level followed by the reduction of the amount of wastewater and the preservation of environment quality, respectively. The results are correspondent to the qualitative research results and agree with the concept of Knod Water (2020, p.1).

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