



Research article

Exploration of wastewater management behavior for enhancing water conservation in urban area, Thailand

Wanjai Lamprom¹, Surasak Jotaworn^{1,*}, Nuttakit Iamsomboon¹, Pimnapat Bhumkittipich¹, Issara Siramaneerat¹ and Anong Rukwong²

¹ Social Sciences, Faculty of Liberal Arts, Rajamangala University of Technology Thanyaburi, 39 Moo 1, Klong 6, Khlong Luang Pathum Thani 12110, Thailand

² Physical Education Department, Faculty of Liberal of Art, Rajamangala University of Technology Thanyaburi, 39 Moo 1, Klong 6, Khlong Luang Pathum Thani 12110, Thailand

* **Correspondence:** Email: surasak_jo@rmutt.ac.th; Tel: (+66) 897394941.

Abstract: While millions of people around the world die from natural water infections per day because of insufficient wastewater collection systems to cover all communities, 80 percent of used water is still released to the river in Thailand nowadays. As a result, the wastewater management (WWM) behavior of people is critical to water conservation. WWM, on the other hand, was fraught with high expenses and inconvenient installation, and earlier research had paid little attention to it. Thus, this research aims to study the socio-economic, cognition, opinions, and perception of information factors for analysis further of the factors affecting the WWM of people in urban areas, Thailand. This study applied multiple regression analysis from questionnaires survey of nine communities in Krathum Baen municipality, Samut Sakhon Province which is a semi-industrial area, crowded settlement, and risen wastewater unexpectedly along the Tha Chin River. The findings reveal that people in study areas have a moderate level of cognition and opinion toward WWM behavior. Perception of information was the best variable to describe the people's WWM behaviors in urban areas. Addressing the empirical results could contribute to water conservation planning, people engagement, and appropriately promoting WWM behaviors related to urban people.

Keywords: factor affecting; urban area; wastewater management behavior; water conservation

1. Introduction

The global urban population has expanded considerably in the last 60 years, growing from 28.8 percent in 1950 to 50.8 percent in 2011. According to UN-HABITAT projections, the world's population is predicted to rise by 2030 and will be concentrated in metropolitan regions. The fastest-growing urbanization rates are in Africa and Asia [1]. In 2020, the world faced several challenges, including a high population density in cities, the acceleration of climate change's effects on the world population, and the COVID-19 epidemic. One of the issues that need attention is water resource management. The worldwide epidemic emphasizes the importance of having consistent access to clean water, not just for drinking but also for handwashing to maintain personal hygiene [2].

While the urban areas confront several challenges, securing the urban freshwater supplies is a critical concern for governments worldwide [3]. According to the Human Mortality Report by WHO and UNICEF, 1.8 million people die from natural water infections per day. The main reason that water supplies were contaminated was the community sewage because of insufficient wastewater collection systems to cover all communities. Moreover, there were many communities located and living on the waterfront, estuary, and delta which resulted in water sources being contaminated by bacteria and pathogens [4]. Stakeholders should be involved in these issues and discover effective strategies to manage water resources, as well as provide education about water resource management to individuals in adjacent areas. This strategy will result in long-term growth for both the community and the environment. Human beings can be considered one of the most important factors in solving problems if they behave responsibly enough to ensure that their environment is sustainable [5]. The attitudes, beliefs, and norms that contribute to environmental conservation behaviors can decide these outcomes [6].

The current water resource situation of Thailand is still facing problems in various issues such as water shortage, water quality deterioration, flood problems, and ineffective wastewater management. The amount of wastewater released from households is approximately 80 percent of the amount of used water. It was estimated from the number of residents with a total wastewater volume of 150 liters per person per day. Also, it includes the amount of wastewater released into the environment from urban areas with water use facilities and generates wastewater into the river easily [7]. Water resources are typically an issue in metropolitan areas with significant industrial and commercial expansion. The Krathum Baen municipality, Samut Sakhon Province is a rapidly urbanizing region. This area contributes to Bangkok's growth and expansion, particularly in the industrial and community sectors. There were a large number of immigrants from different regions in the municipal territory. It resulted in a slew of environmental issues that are only getting worse, particularly with wastewater. Various economic activities along the Tha Chin River, including agriculture, fish ponds, and factories are regarded as a significant environmental concern. Before discharge, there was a lot of unregulated wastewater from the community, households, and restaurants. Also, wastewater from Bangkok that flows through important canals such as a Phasi Charoen Canal flows into the Tha Chin River. The relevant standard in the 5th category of surface water quality was identified for the Tha Chin River water quality data: It is only used for transportation and is not suitable for human consumption [8].

The concept of the environment is important due to human behavior that leads to its impact. Solving environmental problems, therefore, depends on the understanding of human behavior mainly. Individual actions can alleviate environmental problems. If most people are concerned about the environmental impact such concerns can be extended to individual actions to conserve the

environment. Based on those problems statements, this research aims to study the socio-economic, cognition, opinions, and perception of information factors that have an opportunity to affect the wastewater management behavior (WWM) of people. Finally, the results of this study can create a guideline to propose to the local government for enhancing the water conservation that is suitable for people in urban areas.

2. Materials and methods

2.1. Literature

2.1.1. Existing wastewater management

Southeast Asia has encountered serious WWM challenges in suburban areas, such as dramatically underperforming systems in locations with very impermeable soils or high groundwater levels. Groundwater is the primary source of fresh water, and it must be protected to support economic activities for tourism and ensure the safety of people's water supply [9]. However, the treatment plants currently may now be limited by desludging, poor quality of equipment and grease traps, and lack of study on decomposing microorganisms. These issues may manifest themselves at the same time [10]. Effective WWM is required to protect the environment and public health from this emission. According to an analysis of official complaints from adjacent communities, as well as previous studies [11,12], significant environmental harm has happened or will occur, showing that the existing WWM is inefficient.

Wastewater from houses in Thailand is caused by water utilization activities of residents in the house such as bathing, excretion, cooking, washing, etc., which have different wastewater flow rates, volumes, and characteristics. According to various activities, the amount of wastewater discharged from houses is approximately 80 percent of the total water used [5]. Wastewater contains pollutants that are physical and chemical objects, most often organic substances such as food waste, detergents, soaps, feces, and urine, or living organisms at a level that makes the water source unable to be taken to be useful in every need [13].

When community wastewater is discharged, it can affect the quality of natural water resources and the environment. Wastewater should be treated to change the condition of wastewater to be suitable enough for the receiving source of water. The main aim of community wastewater treatment is to reduce the Chemical Oxygen Demand (COD) value, the amount of suspended sediment, and the number of coliform bacteria. There are several wastewater treatment technologies available, the methods chosen must be based on the features and pollutants of the wastewater in order to benefit the community [14]. Household wastewater should be treated to lessen the severity of water contamination by constructing a water treatment system that employs simple and appropriate technologies. It also encourages households to take part in wastewater management. The management of households' wastewater require the generated wastewater from all activities in the house to flow into the treatment process, while the treatment process requires low construction and maintenance, a short time installation, and easy control [5]. For domestic wastewater management, there are two rules to follow: (1) Communities without an integrated wastewater treatment system should treat their wastewater using primary equipment such as grease traps and septic tanks, followed by a small wastewater treatment system to ensure that the wastewater is of good quality before being released into the seepage pond or public sewer. (2) The community group uses an integrated wastewater treatment system, many

households are treated with primary equipment similar to the prior type, but there was a sending wastewater pipe collection to combine as the cluster wastewater treatment system before releasing into public water sources.

Even though the concept and the subsidization of the wastewater management system are sufficient for encouraging people in Thailand to participate nowadays, it is still finding out a lot of households that were not interested in and unplanned to install the wastewater management system in their house [5]. Furthermore, continuous lack of cooperation among relevant agencies for environmental quality monitoring, as well as political command or involvement requirements. It becomes a reason for the ineffectiveness of entities tasked with environmental preservation [15]. As a result, it is vital to obtain direct feedback from people, particularly in the urban areas with acceptable water quality and easy access to wastewater treatment systems.

2.1.2. Factors affecting wastewater management behavior

Apart from the challenges above of WWM technology and implementation, it is obvious from the existing problems that there is a need to understand the factors that influence people's performance in WWM. Understanding these important factors are essential for developing effective strategies to increase WWM sustainability [16]. While the technique, system, and finance parts of WWM are frequently recognized as priority problems, other considerations such as knowledge, perception, and institutional concerns are supporting the above important factors effectively [17]. In previous investigations, numerous theoretical frameworks were constructed to explain the factors that influence human behavior. One of the important frameworks was the proposed theory of planned behavior (TPB) [18]. The TPB found that three elements that influence an individual's behavioral intentions were knowledge, attitude, and perceived behavioral control. These factors were used to predict whether an individual would perform a certain activity. The TPB should be utilized to discover the components that impact WWM behavior since it has been successful in describing a variety of environmental behaviors [19].

However, the previous researches conducted by the WWM in Thailand were separate in diverse aspects. For example, the integration of technical, financial, and social factors for successful wastewater management in suburban areas [20], the way of life and community settlement factor toward WWM behavior in Tha Jin river, Nakhon Pathom province [21], the cluster, linear, and scattered community settlement influenced the different WWM behavior in Thailand [22], the public communication through television and in-person impact to solve pollution problems in Tha Chin River [23], the perception of news and information can describe the changes in water use and WWM behavior of people in Uttaradit Province [24], and the living duration of people in Pak Khlong Wat Pradu community has an influence on environmentally responsible behavior especially the historical river in Ratchaburi province [25].

This study decided to apply applicable theories for filling the gap and increasing academic outcomes in Thailand based on the reviewed literature. Thus, the relevant factors to describe relationships are socio-economic (i.e. gender, age, education, living duration, marital status, family members, location, and income) as well as Cognition, Opinions, and the Perception of Information factors. These factors will be examined to find the influence factors on WWM behavior in urban areas for creating a guideline of water conservation enhancement in Thailand further. It is crucial to recognize the important behavior before discharging wastewater into the river [26].

2.2. Study area

This study selected 9 communities in Krathum Baen Municipality, Samut Sakorn Province in Figure 1, including the Tha Mai, Anghong Village, Ban Talad, Thaklang, Sala Luang Tathong, Pae Kong, Donkaidee Temple, Anghong Watergate, and Wat Don Kai Dee intersection in the Krathum Baen district. This district is located on both sides of the Tha Chin River in the north of Samut Sakhon Province. The province is around 14 kilometers away, with an area of about 128.75 square kilometers. Due to its proximity to Bangkok, this area has been influenced by the expansion of urban settlements and industrial plants. In both economic and social aspects, the communities in this area share an excellent relationship with Bangkok. As a result, it has an impact on the population and community expansion. Local people in the Krathum Baen area were agriculture 44%, employees 10%, industrial workers 32%, and traders and others 20% [8].

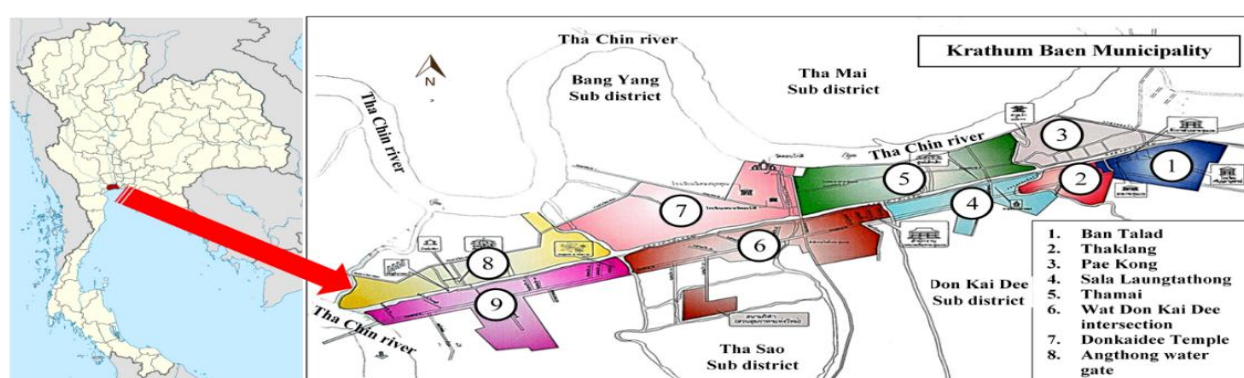


Figure 1. Study area.

2.3. Population and sampling

The population in Krathum Baen municipality, Samut Sakhon Province were 6263 households, they were sampled by using the Yamane formula, which set the sampling error at .05 significantly. A total of 404 respondents applied systematic random sampling (Table 1) from 9 communities with a range of age between 18–70 years. Importantly, they must also be residents of Krathum Baen municipality and the head or representative of each household.

Table 1. Population and samples. [8]

Community	M	F	Total	HH.	Sample	%
Thamai	681	777	1458	712	50	12.4
Anghong Village	618	813	1431	699	46	11.4
Ban Talad	449	470	919	449	29	7.2
Thaklang	594	678	1272	621	40	9.9
Sala Luang Tathong	420	467	887	433	28	6.9
Pae Kong	694	754	1448	707	46	11.4
Donkaidee Temple	804	918	1722	841	55	13.6
Anghong watergate	698	778	1472	719	47	11.6
Wat Don Kai Dee	896	1071	1967	961	63	15.6
Total	5854	6726	12576	6141	404	100.0

2.4. Methodology

This is a quantitative research that uses a cross-sectional study. Questionnaires are the main tool for gathering data for determining relationships between factors and providing water conservation suggestions for people in urban areas. The research process is divided into 2 parts:

- Part 1 Research Design: This section begins by reviewing cognition, opinions, perception of information, and wastewater management behavior concepts and theories to design the questionnaire for the current environmental situation.
- Part 2 Analysis and Findings: This section summarizes and synthesizes the novelty result to identify acceptable strategies for encouraging people in urban areas to manage their wastewater.

2.4.1. Data collection method

This research is a collaborative project with several institutions. The questionnaire survey was carried out by 3 experts of educational institutions: the environmental researcher of Laem Phak Bia, Environmental Research and Development under the Royal Initiative, and the Rajamangala University of Technology Thanyaburi. Data collection was conducted between October 1, 2019, and September 30, 2020. At the same time, the researchers used the observations method and some interviews to obtain additional information for supporting the analysis. The design of the questionnaire was adapted from the previous studies both in Thailand and International researches. There were 6 aspects that synthesized from literatures: socio-economic [16,17,20], cognition [18,21], opinions [19,22], perception of information [23,24], and the WWM behavior [23–25]. The questionnaire was examined by 3 experts to check the completeness and the correctness to cover the structure, the content, and the language used to understand the respondents. Three experts consider the accuracy of the content and determine the Item Objective Congruence Index (IOC) value to verify the appropriateness of each question. The study protocol was approved by the research ethics committees of the Rajamangala University Technology Thanyaburi (RMUTT_Rec No. Full 08/63). The completed revised draft questionnaire was used to experiment with a similar group of target samples for 30 respondents to find the Cronbach's Alpha Coefficient.

The head of the family was the first person recruited for data collection, followed by their spouse or other economically important person of the household such as their wife, parents, and their kids. If the recruited cases cannot identify their position in the house, it will consider the age of the respondent which should be greater than 20 years old.

2.4.2. Data analysis

This study used the coding sheet to check the completeness of the questionnaires and bring the data to be processed by computer with a program for social science research (IBM SPSS Statistic Version 23.0). The applied statistics for this study state through the following:

1. Descriptive statistics were the frequency, percentage, mean, and Standardized division (S.D.). It is used to analyze and report on demographic factors, socio-economic factors: gender, education level, gender, age, education level, marital status, household status, number of children, number of household members, migration, length of stay Location of the house, occupation, income, knowledge, understanding, opinions, receiving the news.

- 1.1. Knowledge level of people on wastewater management is 0–1 in this study. The score for the

correct answer is 1 point and the wrong answer is 0 points. 0–6 scores indicate a low degree of knowledge, 7–15 score indicates a medium degree of knowledge, and 16–20 scores indicate a high degree of knowledge.

1.2. The opinion level on WWM behavior, the criterion rating range is calculated by the formula below [27].

Score Range Rating = Highest Score - Lowest Score

Class Interval = $2-0 = 0.66$

Therefore, the criterion determines the level of opinion as follows; a low level of opinion is rated between 0 points, the moderate opinion level is rated between 1 point, and a high level of opinion is scored between 2 points.

2. Advance Statistics used to test the research hypothesis was a Multiple Regression Model for enhancing water conservation. The indicators of WWM behavior included using sewerage, seepage pond, garbage sieves, and grease traps. The question about WWM behavior is a closed-ended question to choose "Do and not doing or Use and not using". Finally, the rate of the independent variable's capacity to explain or predict the influence of the dependent variable was taken into account.

3. Results

3.1. Socio-economic exploration

The socio-economic factor comprised with gender, age, education level, marital status, income, and family member (Figure 2). The respondents in this survey were female more than males accounted for 57.2% and 42.8 percent, respectively. The average age was 52.9 years with the highest respondents' age range was 60 years old up (36.3%), followed by the age range at 50–59 years (24.8%), respectively, while the age range 15–29 years was the lowest respondent only 6.8%. In terms of education, respondents were mostly educated at the primary level, accounted for 27.5%, followed by bachelor's degree accounted for 21.3%, and upper secondary school (or Vocational Certificate), accounted for 17.3%, respectively. Some uneducated respondents participated in this survey at 3.5%. The marital status, respondents were mostly married and lived with their spouses at 54.5%, while single and widowed status was 29.0%, and the divorced and separated status was 16.5%, respectively. The average income of respondents was 14656.7 baht per month averagely, the majority income range was 15000 baht per month, accounting for 65.8 percent, followed by the range 15001–30000 baht per month accounted for 18.8 percent, only a small percentage of income range (135001–150000 baht per month) at 0.2 percent, respectively. In addition, some respondents have no income because their unemployed status accounted for 8.9 percent. The average family member from all respondents was 4 members, the highest range of family members was 4–6 people (54.9%), followed by 1–3 people (35.9%), and the least was 10 people up (3.4%).

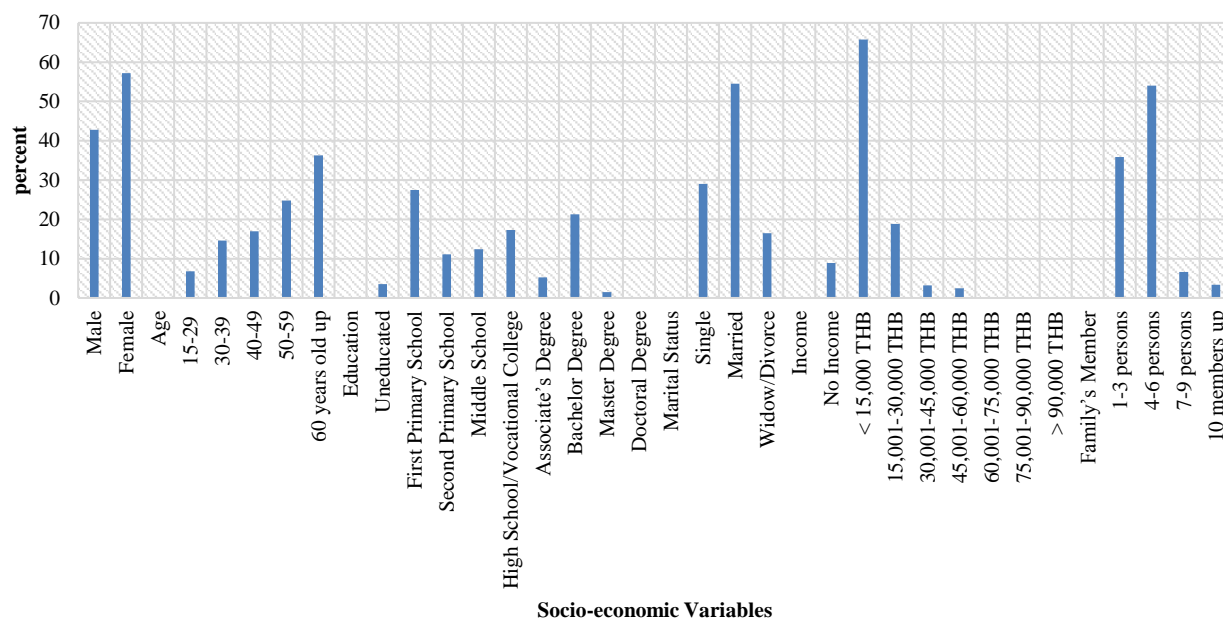


Figure 2. Socio-economic survey.

For the living duration and the location of people in Krathum Ban municipality (Table 2), most respondents were born here and did not migrate, accounting for 67.3 percent, followed by living in this area less than 5 years at 7.1 percent, and the least were two groups of people lived in this area around 11–15 years and 16–20 years at 3.6 percent equally. Location, most houses of respondents were adjacent to the water sources such as rivers, canals, and swamps at 37.6%, followed by 100 meters away from water sources at 28.7%, and more than 100 meters away from water sources at 28.2%, respectively.

Table 2. Living duration and location survey.

Demographic Characteristic	No.	%	Locations	(n=404 people)	
				No.	%
Living Duration			Adjacent to water sources such as rivers, canals, and swamps	152	37.6
Born and live without migrating	256	63.5	within 100 meters away from the water source	116	28.7
Lower 5 years	29	7.1	more than 100 meters away from water sources	114	28.2
6–10 years	20	4.9			
11–15 years	15	3.6			
16–20 years	15	3.6			
21–25 years	16	3.9			
26–30 years	18	4.3			
31 years up	22	5.2			

Notes: Lowest = 0; Highest = 65; Average = 10 years

3.2. Cognitive testing

This section shows the result of knowledge and understanding on WWM behavior of people in Krathum Baen municipality Samut Sakhon Province through 20 questions of WWM behavior. The cognitive level determination was based on numerical quality assessment: correct answers were 1 point and wrong answers were 0 points.

Table 3. Cognitive on WWM behavior survey.

(n=404 people)			
Cognitive Level	Points	Number	Percentage
Low level	0–6	2	0.5
Moderate level	7–15	236	58.4
High level	16–20	166	41.1

Notes: Lowest = 0; Highest = 20; Average = 14.6; Cognitive level = Moderate.

Table 3 shows the overall cognitive level of people that all respondents had a moderate level of WWM behavior at 58.4%, followed by a high cognitive level of WWM behavior at 41.1%. Only 0.5% of the respondents had a low cognitive level of WWM behavior.

3.3. Opinion exploration

Opinion on WWM behavior is a closed-ended question with one answer from three options: disagree, agree, and uncertain. The questions have both positive and negative characteristics. The level of opinion on WWM behavior can be classified into 3 levels based on the formula score ranges: Level = Highest Score–Lowest Score/ number of floors. Thus, a low opinion level on WWM behavior is equal to 0.00–0.66, a moderate opinion level is 0.67–1.32, and a high opinion level is equal to 1.33–2.00.

Table 4 shows the positive result of the opinion of WWM. There were overall moderate opinions on WWM behavior. Wastewater treatment fee that people should pay for the environment was the highest opinion agreement at the average moderate level (1.18), followed by the legislative measures will help to create a more accurate WWM behavior than dissemination of knowledge (1.04), and every home should have a wastewater treatment system such as garbage trap, grease trap, and seepage pond, etc. (1.02), respectively. For the lowest opinion agreement level, the wastewater treatment system should be applied only to business operators or industrial sectors at 0.52.

Table 4. Opinion on WWM behavior survey.

(n=404 people)

Opinion toward WWM Behavior	Opinion Level			Average	Level
	Agreed	Not sure	Disagree		
1. Effluent from bathing can be discharged into the Tha Chin River.	159 (39.4)	139 (34.4)	106 (26.2)	0.86	Moderate
2. Cooking is one of the processes that cause wastewater from the household. You can play a part in reducing wastewater generation.	64 (15.8)	308 (76.2)	32 (7.9)	0.92	Moderate
3. The wastewater treatment system should be enforced only by business operators or the industrial sector.	216 (53.5)	164 (40.6)	24 (5.9)	0.52	Low
4. Taking care of the sewers is the duty of the municipality, not the duty of the people	206 (51.0)	132 (32.7)	66 (16.3)	0.65	Low
5. At present, every home should have a wastewater treatment system such as a garbage trap, grease trap, seepage, etc.	45 (11.1)	302 (74.8)	57 (14.1)	1.02	Moderate
6. The discharge of wastewater from the household can still be done, not causing the Tha Chin River to spoil.	223 (55.2)	131 (32.4)	50 (12.4)	0.57	Low
7. Wastewater treatment fees are what people should pay to have a good environment.	73 (18.1)	182 (45.0)	149 (36.9)	1.18	Moderate
8. Effluent is something that everyone has to take responsibility for.	28 (6.9)	348 (86.1)	28 (6.9)	1.00	Moderate
9. At present, the Tha Chin River is not rotten and can support the wastewater from the community.	212 (52.5)	111 (27.5)	81 (20.0)	0.67	Moderate
10. Legislative measures will help the behavior of wastewater management more correctly than disseminating knowledge.	62 (15.3)	260 (64.4)	82 (20.3)	1.04	Moderate

Notes: lowest = 0 Highest = 2 Average = 0.85 Level= Moderate

3.4. Exploring the perception of information

This section will investigate the frequency of receiving the WWM information of people in Krathum Baen municipality Samut Sakhon Province. It was found that respondents have the opportunity to receive news on WWM from various sources (Figure 3).

Figure 3 presents the overall channels that people perceived the news on WWM. Social media channels were an important mechanism that people frequently receive. Facebook was an important source of receiving the news at 32.2 percent, followed by Television at 29.7 percent, Line at 20.5 percent, and News broadcast tower 12.4 percent and other channels such as flyers (6.2%), banners (5.4%), and newsletters (3.7%) were fewer receiving channels on WWM behavior.

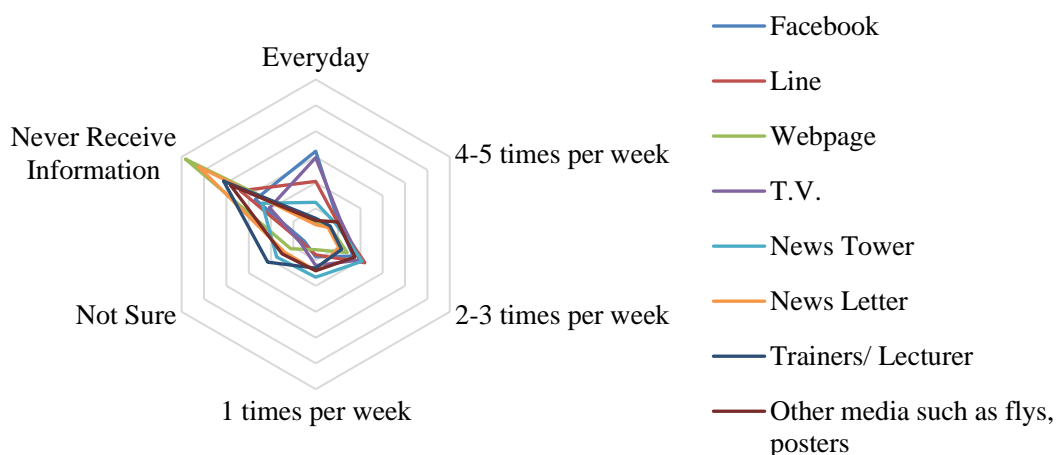


Figure 3. Frequency of perceiving WWM information.

3.5. Wastewater management behavior exploration

Wastewater management behavior of people in Krathum Baen municipality is currently classified into using sewerage, seepage ponds, garbage sieves, and grease traps (Table 5). Most respondents were positive about WWM behaviors to practice properly when the sewerage is required.

Table 5 shows that respondents will not throw solid waste into the sewers accounting for 53.7 percent and regularly check or take care of their sewers near the house to avoid clogging accounting for 53 percent, respectively. For the seepage pond, respondents will not leave things that are difficult to digest or decompose such as plastic, sanitary napkins, into the toilet (51.7 percent), followed by not pouring food waste into the toilet (50.2%). Water from the toilet should be preliminarily treated with the seepage as much as possible (49.5%) and not pour substances toxic to microorganisms into the seepage such as concentrated alkali, concentrated toilet cleaner, etc., (43.8%), respectively. In terms of the garbage sieve, most respondents were not removing the sieve whether temporarily or permanently at 32.9 percent, followed by not breaking or pushing the garbage to flow through the sieve 32.4 percent. Also, regularly scooping out the garbage that is trapped in the front of the sieve to discard at least once a day at 30.2 percent and attach a garbage trap before draining the wastewater out of the household at 26.2 percent, respectively. The respondents bring water from hand washing, bathing, washing, and rainwater to flow into the grease trap at 57.2 percent, followed by removing the grease from the grease trap by scooping them into sealed containers and combining them with municipal waste to dispose at 55.9 percent. Finally, it is a regularly inspect the drain from the grease trap, if there is a large amount of fat, lumps or stains must be scooped out more often than before at 49.3 percent.

3.6. Factors affecting

This section was finding the relationship between independent variables (i.e. socio-economic, cognition, opinions, and perception of information) of respondents in Krathum Baen municipality and the dependent variables (WWM behavior). Multiple Regression was used to study the factors that effective in describing the WWM behavior of people in Krathum Baen municipality, Samut Sakhon Province. It was found that none of the pairs of independent and dependent factors were highly correlated to cause violations of multiple regression analysis. It was a preliminary indication that the results can be useful in the study without any problems.

Table 5. WWM behavior survey.

(n=404 people)

Wastewater management behavior	Frequency of Information Perception					
	Everyday	4–5 times per week	2–3 times per week	1 time per week	Rarely	Never
1. Sewerage						
1.1 Do not throw solid waste into the sewer.	211 (52.2)	36 (8.9)	34 (8.4)	13 (3.2)	9 (2.2)	101 (25.0)
1.2 Regularly check and take care of the sewers near the house to avoid clogging.	217 (53.7)	50 (12.4)	61 (15.1)	13 (3.2)	12 (3.0)	51 (12.6)
1.1 Do not throw solid waste into the sewer.	214 (53.0)	43 (10.6)	31 (7.7)	12 (3.0)	10 (2.5)	94 (23.3)
2. Seepage pond						
2.1 Water from the toilet should be pre-treated with seepage.	200 (49.5)	37 (9.2)	65 (16.1)	8 (2.0)	12 (3.0)	82 (20.3)
2.2 Do not throw difficulty digesting stuff or decompose: plastic, sanitary napkins, into the toilet.	209 (51.7)	34 (8.4)	32 (7.9)	4 (1.0)	6 (1.5)	119 (29.5)
2.3 Do not pour food waste into the toilet.	203 (50.2)	42 (10.4)	28 (6.9)	4 (1.0)	8 (2.0)	119 (29.5)
2.4 Do not pour toxic substances toxic into the seepage: concentrated alkali and concentrated toilet cleaner	177 (43.8)	40 (9.9)	40 (9.9)	6 (1.5)	12 (3.0)	129 (31.9)
3. Garbage sieve						
3.1 Install a garbage sieve before draining the wastewater out of the household	106 (26.2)	81 (20.0)	116 (28.7)	9 (2.2)	7 (1.7)	85 (21.0)
3.2 Regularly scoop out the garbage that traps the filter sieve at least once a day	122 (30.2)	70 (17.3)	107 (26.5)	13 (3.2)	11 (2.7)	81 (20.0)
3.3 Do not push debris to flow through the sieve.	131 (32.4)	48 (11.9)	76 (18.8)	11 (2.7)	8 (2.0)	130 (32.2)
3.4 Must not remove the sieve either temporarily or permanently.	133 (32.9)	62 (15.3)	69 (17.1)	15 (3.7)	8 (2.0)	117 (29.0)
4. Grease trap						
4.1 Install a grease trap	72 (17.8)	36 (8.9)	57 (14.1)	11 (2.7)	7 (1.7)	221 (54.7)
4.2 Do not bring water from hand washing, bathing, washing, and rainwater to flow into the grease trap	61 (15.1)	40 (9.9)	55 (13.6)	9 (2.2)	8 (2.0)	231 (57.2)
4.3 Water from the kitchen is passed through a sieve to filter out food particles before dumping them into the grease trap	96 (23.6)	45 (11.1)	35 (8.7)	11 (2.7)	7 (1.7)	210 (52.0)
4.4 Must regularly scoop the grease out of the trap once a week.	66 (16.3)	41 (10.1)	65 (16.1)	11 (2.7)	7 (1.7)	214 (53.0)
4.5 Regularly inspect the drain from the grease trap. If there is a large amount of fat, lumps or stains must be scooped out more often than before	62 (15.3)	38 (9.4)	87 (21.5)	10 (2.5)	8 (2.0)	199 (49.3)
4.6 Remove the grease from the grease trap by scooping them into sealed containers and combining them with municipal waste to dispose	68 (16.8)	29 (7.2)	64 (15.8)	11 (2.7)	6 (1.5)	226 (55.9)

Table 6. Correlation analysis between independent and dependent variables.

(n=404 people)

	1	2	3	4	5
Education>>Age	-0.442**				
Marital status>>age>> education	0.334**	-0.247**			
Family members>>age>>education location>>Family members	-0.142**	0.127**			
Income>>age>> education>>marital status>>Location	-0.124**	0.2**	-0.083*	0.123**	
Cognition>>Gender>>Family's members	0.112*	0.1*			
Perception of Information >>Gender>>Marital status>> Location>>Income>>Knowledge	-0.121**	-0.087*	-0.149*	-0.099**	-0.368**
Opinion>>Location>>Income>>Knowledge	-0.13**	-0.115**	-0.179**		
WWM behavior>>marital status>>cognition>>knowledge>>Opinions	-0.146**	-0.155**	0.298**	-0.09*	

Table 6 shows the results of the correlation analysis between independent and dependent variables that all independent factors (socio-economic, cognition, perception of information, and opinions) of this study have a relationship with WWM behaviors.

Table 7. Regression analysis for WWM behavior.

(n=404 people)

Variables	B	Std. Error	Beta	t	Sig.
Constant		62.347	8.902	7.004	0.000
Genders	-1.061	1.84	-0.028	-0.577	0.564
Ages	0.048	0.068	0.039	0.718	0.473
Educations	-0.476	0.508	-0.051	-0.937	0.349
Marital status	-4.226	1.472	-0.147	-2.87**	0.004**
Family's member	0.203	0.487	0.020	0.418	0.676
Location	0.313	1.105	0.014	0.283	0.777
Income	7.31E-05	0.000	0.053	1.075	0.283
Knowledge	-0.460	0.336	-0.072	-1.37	0.171
Perception of Information	0.184	0.036	0.269	5.132**	0.000**
Opinion	-0.387	0.174	-0.109	-2.231	0.026

Notes: * $P < 0.05$; ** $P < 0.01$. $R = .355$; $R^2 = 0.126$; Adjusted $R^2 = 0.104$; $SEE = 17.911$; $F \text{ Change} = 5.683$; $df1 = 10$; $df2 = 393$; $\text{Sig. } F = 0.00$.

Table 7 presents the results of multiple regression analysis that the independent factors have influenced the WWM behavior as a dependent factor at a low level ($R = .355$), and all variables can describe the WWM behavior at a low level as well accounted for 12.6%. However, two independent factors influenced the WWM behavior statistically significantly at .01; the perception of information ($B=0.184$) and marital status ($B= -4.226$). When considering the adjusted regression coefficients, the perception of information was the first influential factor positively toward WWM behavior ($Beta = 0.269$). It means that the more people perceive the information, the more opportunities people have for

proper WWM behavior. Although there were some costs of wastewater installation and maintenance, if there was important information, the people in Kratum Ban municipality would purchase and use wastewater equipment effectively. Moreover, Facebook, Line, and TV media channels have become an important mechanism to reach people and encourage WWM behavior.

4. Discussion

Based on the problem statement, 1.8 million people die from natural water infections per day [4], the amount of wastewater released from households is approximately 80 percent of the amount of used water in Thailand [5]. All stakeholders must cooperate to manage water resources effectively and provide residents in urban areas with information about wastewater management. Both the community and the ecosystem will benefit from this strategy [7]. In this study, the perception of information became the highest influential factor to WWM behavior, which is consistent with the literature. Even though the WWM system has a great advantage, if it cannot persuade people to care about this issue, it will become a worthless system since no one would apply it. The more people perceive the information of WWM behavior, the more opportunities that WWM policy will be recognized and practiced.

Previous studies in Thailand's WWM were more distinct in diverse aspects. For instance, the technical, financial, and social factors for successful wastewater management [20], lifestyle and community settlement toward WWM behavior in Tha Jin river [21], factors affecting between community settlement and WWM behavior in Thailand [22], the public communication to solve pollution problems in Tha Chin River [23], and the length of living influence the environmentally responsible behavior in historical river areas [25], respectively. This research has combined all possible aspects to investigate the people in the urban area, Krathum Ban municipality, Samut Sakorn province. Furthermore, the findings of this research contribute academically that the marital status variable influenced the WWM behavior. The married status would have a greater knowledge of and opportunities to utilize water for a variety of purposes, such as watering the plants, washing clothes, and others. Couples will manage wastewater better than a single status based on those activities and experiences.

According to the literature, the majority of relevant wastewater management research focuses on technology, equipment development (such as septic tanks, grease ponds, and decomposing microorganisms), and lab experiments. This study helps to broaden the readership in the social sciences by analyzing the characteristics that influence household knowledge of existing equipment and using wastewater treatment technologies.

5. Conclusions

Whereas millions of people die every day from contaminated groundwater sources due to the insufficient wastewater collecting facilities to serve all communities, 80 percent of used water is still discharged into the river in Thailand. Examining the socio-economic, cognition, opinions, perception of information, and wastewater management behavior of people in urban areas is a significant aspect in comprehending wastewater management (WWM) behavior. The findings will be utilized to develop a guideline and recommendations for local authority governments to encourage water conservation of people.

The study discovered that the respondents had a diversity of socio-economic variables. For the

living duration, most respondents were born and did not migrate to other places. The house location of the respondents was mostly adjacent to the water sources such as rivers, canals, and swamps. The overall cognition on WWM behavior properly was at a moderate level. The overall opinions on WWM behavior of respondents was expressed positively in various issues. The perception of information about WWM Behavior of respondents were mostly through social media such as Facebook, Television, and Line application. Hence, most people in Krathum Baen municipality have proper WWM behaviors when sewerage is required. In terms of correlation test, socio-economic, cognition, opinion, and perception of information have a statistically significant relationship with the WWM behavior. In addition, two important factors influenced the WWM behavior: the perception of information and marital status.

Limitations, some respondents were afraid to participate in the questionnaire survey due to the local government inspecting the wastewater management system regularly. It affects the time operation for data collection. Thus, the recommendation for this limitation is that it should collect the research data together with the local government's activities during the WWM campaign. It contributes to obtaining respondents' acceptance as well as the requirement of WWM behavior. For future research, apart from the urban area, there were other types of areas in Thailand where the local government consistently promoted and publicized to create concrete wastewater management behavior for preventing the environmental impact such as the area surrounding the national park and the area which is full of the heritage and ancient construction. Finally, the next research ideas might include an R&D method that incorporates both scientific and social science perspectives on wastewater treatment systems for collaborative governance. As it can identify the factors that influence people's ability to engage in improved WWM behavior from this research, the outcome of that engagement must be studied in order to achieve long-term development. This method can assist policymakers in developing and subsidizing residential WWM in a sustainable manner, as well as applying it to other solid waste and wastewater management technologies comprehensively.

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Conflict of interest

The authors declare no conflict of interest.

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