LESSON LEARNED FROM WASTE MANAGEMENT IN DONYAIHOM SUBDISTRICT MUNICIPALITY AND TALADJINDA SUBDISTRICT ADMINISTRATIVE ORGANIZATION, NAKHONPATHOM, THAILAND

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ABSTRACT

The present research work aims to study the qualitative descriptive lesson learned from waste management in Donyaihom subdistrict municipality and Taladjinda subdistrict administrative organization, Nakhonpathom, Thailand. This research uses purposive sampling with in-depth interview and research survey as tools for data collecting. To analyze the data obtained, note-based analysis, tape-based analysis, and memory-based analysis were adopted. The result shows that Donyaihom subdistrict municipality has one major problem which is a decline in recycle waste prices. The price of recycle waste is currently 0.17 US/kg as per recycle waste importing policy. Therefore, people in this area who collect recycle waste for selling find difficulty to sale due to reduce in its price. The government should control and reduce the amount of imported recycle waste. According to the result of Taladjinda subdistrict administrative organization, this area has facility problems which includes staff, waste trucks and garbage dumps that are not enough to support in this area. Because these regions are located closely, the best way to solve these problems with the lowest cost and quickest are equipment and experts sharing.

Keywords: waste, management, lesson learned

1. INTRODUCTION

Nakhon pathom province is located in western region of Thailand. It has 2,168.327 square meters. Nakhon pathom province has 37,989 tons of waste/year and has 2 waste disposal plants using open dump process [1]. In order to dispose of the waste using a sanitary landfill process, some subdistrict administrative organizations in Nakhonpathom province send 543 tons of waste to Nontaburi province, which is adjacent to Nakhon pathom province.

The amount of waste for the past 3 years is not stable. In 2018, Nakhonpathom province has 0.45 million tons of waste. In 2019, it decreased to 0.40 million tons. In 2020, it increases to 0.47 million tons as shown in the table.1 [2].

Table 1. The amount of waste in Nakhonpathom province for the past 3 years (2017 - 2019)

year	amount of waste (tons/ day)	Recycle waste (tons/ day)	Waste with sanitary disposal (tons/ day)	Waste with insanitary disposal (tons/ day)	Remaining waste (tons)
2019	1,093.03	343.00	548.27	201.76	94,748.00
2018	1,263.91	310.23	652.16	301.52	90,379.60
2017	1,165.00	234.00	516.00	415.00	114,374.00

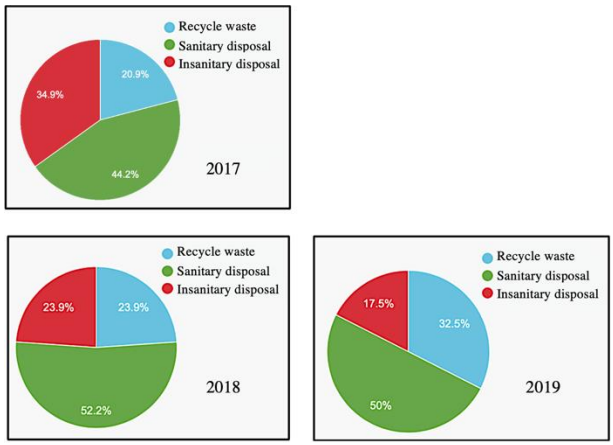

Figure 1. The waste management in Nakhonpathom province for the past 3 years (2017 - 2019)

Figure 1 shows that over the last three years, waste disposal has steadily decreased that can be disposed in a sanitized manner. Additionally, recycling waste sharply declined in 2020. As a result, there is a significant increase in unhygienic waste disposal.

There are some waste management researches in Thailand. A framework for indicator development in order to assess the capacity of local administrative organizations according household hazardous waste management is presented. Bangkok Metropolitan Administration is used as a case study. The indicator results show that the Bangkok Metropolitan Administration has clear plans in terms of household hazardous waste [3]. Thailand is a profligate user of one-time use plastics. Thais use 70 billion plastic bags a year [4]. Thailand has 33 of 500 or

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more bed hospitals and other hospitals and health centers with between 11 and 250 bed nationwide. It means that the quantity of medical waste is significant [5]. Thailand collected the industrial waste of 68,261 companies. They process 37.6 million tonnes toxic and industrial waste annually. The 2.8 million tonnes are toxic waste. The 15 regional waste management facilities are planned by Ministry of Industry's Department of Industrial Works (DIW) in 2015-2019 [6]

Donyaihom subdistrict municipality is one of the subdistricts municipal corporations in Nakhon pathom province. It won waste sorting award in 2016 for their community service to keep people hygienic. It has 0.02 square kilometers of garbage pit. This garbage pit used as open dump system in order to collect the waste from waste trucks every day and managed which is as shown in Figure 2.

Donyaihom subdistrict municipality always provide awareness and trains people about waste sorting every year. Three waste trucks are used to collect garbage in this area every day. Before leaving, every household and school sorts its trash. For industrial factories, it is necessary to obtain permission before disposing of waste at a municipal landfill or garbage pit.

Figure 2. Open dump garbage pit

Figure 3. People and student were trained to manage their waste every year

The amount of waste in 2018 – 2020 in Donyaihom subdistrict municipality area has 6.52 tons/day averagely. It can be divided to 4.598 tons/day of general waste, 1.871 tons/day of recycle waste, 0.050 tons/day of organic waste and 0.0014 tons/day of infected and dangerous waste. The most difficult type of waste to dispose of is dangerous waste. The Donyaihom subdistrict municipality is unable to dispose of hazardous and infected waste on its own. It must be kept in storage while waiting for the provincial administrative organization to collect it for yearly disposal. [7].

According to the data results obtained for waste management from two sub-districts of Donyaihom and Taladjinda are shown in Table.2 and Table.3 respectively. Based on the results obtained the data curation was carefully analyzed and discussed.

According to the Taladjinda subdistrict administrative organization, there are numerous waste sources in this area, including homes, schools, and 17 industrial factory plants. Around 7 to 8 tons of waste are produced each day. Using a waste truck, the Taladjinda subdistrict administrative organization is able to collect waste weekly twice from each village. Additionally, the Taladjinda subdistrict administrative organization is involved in numerous projects to promote environmental awareness (Figure 3.), including the creation of a conscience project (Figure 4.), resource and environment conservation projects, polluted water protection projects, waste sorting training projects, and large-scale cleanup events (Figure 5.).

Although, government sectors relating waste management try to encourage people in Taladjinda area shown in Figure 4 and Figure 5, There are no intense policies to control their behavior. Therefore, People still leave their waste without management.

Table 2. Waste operation result of Donyaihom Subdistrict Municipality (2017 - 2019)

Amount of waste divided by types	Result of waste management operation		
	2019	2018	2017
1. Amount of waste (tons/year)	1,719.15	2,314.10	1,460.00
2. Amount of recycle waste (tons/year)	-	211.70	365.00
3. Amount of waste dispose (tons/year)	1,646.15	2,102.40	1,095.00

Figure 4. Aware of creating conscience environment project

Figure 5. Big cleaning day project

Taladjinda subdistrict administrative organization manages to appoint private company in order to dispose their garbage wastes. For some organic wastes, each household applies to fish food, organic fertilizer, and ingredient for biogas. Moreover, the subdistrict administrative organization promotes a pot-rest management system to manage fallen leaves from plants and trees, as shown in Figure 6.

Figure 6. Pot-rest management system

The amount of waste obtained from Taladjinda subdistrict administrative organization area in 2017-2019 decreased continuously which is 17 tons/day in 2017, 14.64 tons/day in 2018, and 12.47 tons/day in 2019 respectively [8].

Table 3. Waste operation result of Taladjinda subdistrict administrative organization (2017-2019).

Amount of waste divided by types	Result of waste management operation		
	2019	2018	2017
1. Amount of waste (tons/year)	4,551.55	5,343.60	6,205.00
2. Amount of recycle waste (tons/year)	N/A	485.45	N/A
3. Amount of waste dispose (tons/year)	4,380.00	4,858.15	6,205.00

2. RESEARCH OBJECTIVE

The purpose of this study is to comprehend and learn from the Waste Management System implemented by Donyaihom Subdistrict Municipality and Taladjinda Subdistrict Administrative Organization in Nakhonpathom, Thailand.

3. METHOD

This qualitative descriptive study has 6 parts to reach the objective. The limitations of this research are 2 proposed areas located in Nakhon pathom province (western region of Thailand) and sample size. The sample size is 5% error calculated by number of people in the area using Yamane's formula [9].

3.1. People and samples

The research was successfully made possible by purposive sampling, which is used in this study, includes the mayor (head of administrator), officers, and people who work and living in the Donyaihom Subdistrict Municipality and Taladjinda Subdistrict Administrative Organization area. The majority of policy amended to control the waste management was provided by the Mayor. Key informants for this study are government officers who work in Donyaihom Subdistrict Municipality and Taladjinda Subdistrict Administrative Organization. This research uses determining the sample size of finite population by the Yamane's formula [9] to calculate sample size in each area shown as follows

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Finally, we have sampled 300 peoples per area (about 5% error) who provided the information and opinions about waste management in their locality or area.

3.2. Tools for data collecting

The in-depth interview and research survey are created through literature reviews and reviewed by experts to obtain appropriate questions related to the research objective. These questions can be divided into 3 parts as mentioned in sub-sections.

3.2.1 Part of waste management policies

The purposive interviews are used in this section. Mayor of the district and officers who work for Taladjinda Subdistrict Administrative Organization and Donyaihom Subdistrict Municipality make up the purposeful samplings for this section.

3.2.2 Part of operation and evaluation of waste management

This section focuses on conducting interviews with key informants or officers.

3.2.3 Part of results and opinions of waste management

This section focuses on surveying and interviewing residents and community leaders of the Donyaihom Subdistrict and Taladjinda Subdistrict area. The data obtained from survey then examined for further analysis.

3.3. Data collecting

The research team collects all the data through in-depth interviews with purposive samplings with key informants. Interviews are conducted to answer the research objectives questions. The interview process must be coordinated with sampling, explain the research objective, clarify the interview period, provide information about the day, time, and location of sampling. The survey responses are being compiled for content analysis.

3.4. Reliability of sampling

This study employs naturalistic inquiry [10] to investigate sampling reliability, which includes credibility, transferability, dependability, and conformability [11].

3.5. Sampling rights protection

The Silpakorn University Research, Innovation and Creativity Administration granted this study its ethical certification, confirming that it complies with the Declaration of Helsinki's principles. The ethic certification number is REC 65.0106-001-8901. Every sample was informed about the objective, the process, and specific criteria by the researcher(s). The data from each sample was kept private.

3.6. Data analysis

The note-based analysis, tape-based analysis and memory-based analysis are recorded and analyzed by researcher. The recorded data was sorted into related categories. Finally, content analysis, thematic analysis [12] and category data were used to interpret.

4. RESULTS

The results obtained from the sampling done for two sub-districts (Donyaihom and Taladjinda) as per their waste management systems can be in described in detail as follows

4.1. Donyaihom subdistrict municipality area

According to Donyaihom subdistrict municipality area, the result can be divided in to 3 parts which are conditions and successful factors of waste management, problems and unsuccessful factors of waste management and suggestions, guidelines, and strategies to solve problems and unsuccessful waste management.

4.1.1 Conditions and successful factors of waste management of Donyaihom subdistrict municipality

According to the result obtained from the survey, the successful factors of waste management of Donyaihom subdistrict municipality can be concluded by table 4.

Table 4. Conditions and successful factors of waste management of Donyaihom subdistrict municipality

Conditions and success factors	Successful description	Result
High waste price	In past (2017-2018), waste price was 0.65 US/kg. People were motivated to collect and sell waste to private companies. Donyaihom subdistrict municipality provided vehicle to collect waste from people.	A lot of people gather their trash or waste to sell.
Number of waste trucks	The 3 waste trucks can collect all wastes in the area (4.64 square kilometers).	No remain waste in the area.
Number of garbage collectors	There are 9 garbage collectors working in Donyaihom subdistrict municipality area.	No remain waste in the area.

4.1.2 Problems and unsuccessful factors of waste management of Donyaihom subdistrict municipality

According to the result obtained from the survey, the unsuccessful factors of waste management of Donyaihom subdistrict municipality can be concluded by table 5.

Table 5. Problems and unsuccessful factors of waste management of Donyaihom subdistrict municipality

Problems and unsuccessful factors	Unsuccessful description	Result
Low waste price	In 2019, waste had low price (0.17 US/kg.). Private companies bought waste from people in very low price.	As opposed to the previous year, fewer people collected trash or waste.

4.1.3 Suggestions, guidelines, and strategies to solve problems for unsuccessful waste management

According to information of Donyaihom subdistrict municipality, people was motivated to collect and sell their waste due to lucrative high waste price (0.65 US/kg.)

offered in 2017. Donyaihom subdistrict municipality needed to provide the vehicles to collect people waste from their house every day.

The cost of waste is currently 0.17 US/kg which is very less lucrative. To get the same amount of money as offered in 2017, people must collect more trash or waste. As a result, many people have stopped picking up trash. Additionally, the municipality of Donyaihom Subdistrict also stopped the waste truck vehicle that collects trash from residences.

Table 6. Suggestions, guidelines, and strategies to solve problems and unsuccessful waste management of Donyaihom subdistrict municipality area

Suggestions, guidelines and strategies	**Description**	**responsible person**
Government needs to control the recycle waste price.	- The importation of recyclable waste from other countries is a major cause of low waste prices. - To encourage people to sort their waste, the government should reduce imported recycle waste and buy it from local or Thai people.	Government or related department.

4.2. Taladjinda subdistrict administrative organization area

According to Taladjinda subdistrict administrative organization area, the result can be divided in to 3 parts which are conditions and successful factors of waste management, problems and unsuccessful factors of waste management and suggestions, guidelines, and strategies to solve problems and unsuccessful waste management.

4.2.1 Conditions and successful factors of waste management of Taladjinda subdistrict administrative organization

The conditions and successful factors of waste management of Taladjinda subdistrict administrative organization can be concluded by table 7.

Table 7. Conditions and successful factors of waste management of Taladjinda subdistrict administrative organization

Conditions and success factors	**Successful description**	**Result**
Cooperation of people	Community leaders, monks, Federal agents, and residents of this area create numerous projects to manage waste in their community, such as the biogas from organic waste project, the charcoal project, the water hyacinth fertilizer project, and the organic bin project. Furthermore, they collaborate with Maejo University to conduct research on waste fertilizer.	The amount of waste in canals and rivers is significantly reduced. Waste management involves many people. Organic waste can be reused extensively.

4.2.2 Problems and unsuccessful factors of waste management of Taladjinda subdistrict administrative organization

The problems and unsuccessful factors of waste management of Taladjinda subdistrict administrative organization can be concluded by table 8.

Table 8. Problems and unsuccessful factors of waste management of Taladjinda subdistrict administrative organization

Problems and unsuccessful factors	**Unsuccessful description**	**Result**
Number of garbage collectors	There are 3 garbage collectors working in Taladjinda subdistrict administrative organization area, but this area has 2,600 households.	It has 2 tons/day of waste remains in this area.
Number of waste trucks	There is only 1 waste truck in this area that supports 24.32 square kilometers with 2,600 households.	It has 2 tons/day of waste remains in this area.
Number of garbage dumps	Not enough garbage dumps around the area.	People litter their waste on public places.
Waste management policy	No waste management policy provided to people in this area.	People don't have conscience to manage their waste.
Government supporting	Every waste management project created by people is not supported by government.	Each project has low efficiency and lack of continuity.

4.2.3 Suggestions, guidelines, and strategies to solve problems and unsuccessful waste management

In Taladjinda subdistrict administrative organization area, the area size is similar to Donyaihom subdistrict municipality area, but they have only one waste trucks and three garbage collectors. Therefore, it has been observed that around 2 tons/day waste remains are filled in this area. In order to solve this problem, the suggestions, guidelines and strategies are concluded in the table 9.

Table 9. Suggestions, guidelines, and strategies to solve problems and unsuccessful waste management of Taladjinda subdistrict administrative organization area

Suggestions, guidelines and strategies	**Description**	**responsible person**
Providing waste management knowledge.	Providing awareness to the people about waste management, and the significance of the waste issues in their region.	Federal agents who work about waste management.
Waste sorting measure in the area.	Prepare waste sorting bins and garbage dumps around the area corresponding to number of households.	Government or related department.
Waste trucks and garbage collectors recruiting measure.	Recruit waste trucks and garbage collectors corresponding to area size and number of households.	Government or related department.

5. DISCUSSION

According to the results, the proposed areas have different successful factors and unsuccessful factors, although they are located closely. The findings of this research lead to problem solving that can manage immediately. To solve the waste management of proposed areas, the research finding founded that Donyaihom Subdistrict Municipality has 4.64 square kilometers, but it has 3 waste trucks and 9 garbage collectors. On the other hand, Taladjinda Subdistrict Administrative Organization has 24.32 square kilometers, but it has only 1 waste truck and 3 garbage collectors. Therefore, if these proposed areas can share equipment together, the problem of Taladjinda Subdistrict Administrative Organization will be solved.

Moreover, Taladjinda subdistrict administrative organization has many experts and cooperation of people who has experience and know-how about waste management that can share and work with Donyaihom Subdistrict Municipality. According to equipment and people sharing, some problems of each proposed area will be solved immediately with this management.

Some problems relating to policies and government cannot be solved shortly. Each area needs to report problems of waste to government in order to legislate policies to solve waste problems sustainably.

6. CONCLUSION

According to the information of waste management of Donyaihom Subdistrict Municipality and Taladjinda Subdistrict Administrative Organization, Nakhonpathom, Thailand, it can be concluded as follows:

The successful factor of waste management of Donyaihom Subdistrict Municipality is the price of recycle waste. If the price of recycle waste is 0.65 US/kg, many people in this area collect the recycle waste and sell them to private companies. Therefore, according to the data results obtained from waste management as observed in 2017-2018, the amount of total waste decreased significantly, and the amount of recycle waste increased greatly. In 2019, Thailand imported more recycle waste. Therefore, the price of recycle waste decreased greatly. The government should reduce the imported recycle waste and support local recycle waste management.

According to Taladjinda Subdistrict Administrative Organization, the waste management has successful factors which are the cooperation of community leaders, monks, Federal agents, and people who live in this area. They create many projects solving waste management problems in their area, but some important factors causing the waste management problems such as number of garbage collectors, number of waste trucks, number of garbage dumps, waste management policy and support from government agencies. These unsuccessful problems need to be solved by government.

Because these regions are located closely, the best way to solve these problems with the lowest cost and quickest are equipment and experts sharing. In the future, the suggested solving method will be applied to the proposed areas to confirm the discovered waste management method.

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