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Factors influencing willingness to pay for a municipal waste collection fee in Songkhla, Thailand

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Abstract

The municipal solid waste management has been a radical problem especially in Songkhla, Thailand. The municipality has attempted to reduce by putting a huge effort on waste collection and disposal over the last few years. Even though the amount of waste was decreased, it did not reflect a sustainable waste management due to an unchanging behavior of waste generation of Songkhla residents. To solve this, the study aimed to find factors influencing Songkhla residents to pay for a municipal waste collection fee in order to implement the policy in the future. 400 questionnaires were obtained from households located in the Songkhla municipal area. The data were analyzed with a binomial logistic regression technic because of the ability of analyzing binary variable. The findings indicated that the residents who got married and live in a detached or semi-detached house with young adult members would accept to pay some amount of fee. Meanwhile, the residents who live in a city center where they are running a store or live in townhouse close to major places like a hospital, a police station, an education institution, and a superstore did not want to pay for the fee due to high opportunity of increasing waste disposal cost. As a result, to implement the policy in Songkhla, the policymakers should divide their plan into two stages. Firstly, the policy should be imposed in an outside area where people live in a detached or semi-detached house and has to be delivered with a good quality. Secondly, the policy could then be implemented in the city center which most residents live in store buildings and townhouses. In this way, any opposition from the residents could be minimized as they have seen a good quality of the service in the first stage before. Thus, a sustainable municipal waste management could occur in Songkhla, Thailand.

Keywords: municipal waste, economics instrument, waste collection fee, willingness to pay, pay-as-you-throw

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1. Introduction

The waste management in Thailand has been found as a serious problem during the last decade. For example, in 2013 the amount of solid waste was 26.77 million tons and just 7.2 million tons of these were managed with an appropriate way [1]. This could reflect an inefficient waste management in Thailand. As a result, there were many cases of waste dump burning in Thailand; for instance, in Bangpu industrial area, Prakkasa, Samutprakarn on March 16, 2014, in Hatyai, Songkhla on March 30, 2014 and in Khoka, Lampang on March 30, 2014. These problems induced not only property damage but also an environmental pollution. Due to a lack of good waste management in Thailand, some waste dumping areas would have various kinds of waste such as combustible waste, incombustible waste, recycle waste, and hazardous waste especially from industries. In fact, the hazardous waste in Thailand in 2014 had been accounted for 2.69 million tons and 77% of these came from industrial sector [2].

The waste management crisis issues mentioned above have put a pressure on the Thai government and then waste management was proposed as a nation agenda. Both government office and individual needed to take that in to account and find out the way of reducing waste in the country. Songkhla as a major province in the south of Thailand had been ranked as a top province producing waste in 2013. It used to account for 2.5 million tons of waste and people living in Songkhla could generate waste for 1.8 kilograms per person [2]. That is why Songkhla had to tackle this problem as a main priority. Songkhla waste disposal policies were then issued under the province's strategies. The first policy was to dispose the waste which was waiting for being managed with an appropriate way. The second one was to educate the official how to account with hazardous waste. The third policy was to make an instruction and policy for hazardous waste. The last policy was to build Songkhla residents' discipline for waste disposal. The policies were conducted so that the municipal solid waste in Songkhla decreased dramatically. Consequently, Songkhla had been taken from the top 10 list of the highest making waste provinces in 2014. It can be seen that Songkhla could achieve its goal of reducing waste but is this a sustainable way for reducing waste? As each Songkhla policy needs to be forced in practice, the cost of control would be high as well as the budget for doing that needs to be prepared for a long period of time. This would reflect unsustainability

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on the process as the individual didn't change their behavior of waste generation.

From this point of view, there were many economists claimed that command and control policy could not achieve an economic efficiency and cost-effectiveness due to a high operation cost. For this reason, using of command and control policy only may not meet a sustainable way [3]. An economic instrument has been proposed for this case, namely a waste collection fee. It could lead to an efficiency level of waste. In other words, the marginal benefit from reducing waste would equal to the marginal cost of environmental protection [4]. The concept of a waste collection fee here was defined as pay-as-you-throw (PAYT) [5, 6]. It means that a household must pay for getting a service of waste collection provided by a municipality. The fee can be charged with 2 basis of thinking: a unit charging system and a flat fee system. The former would charge households depending on their amount of waste generated. The latter would charge at a curtain point of waste generated. For example, a household is charged 40 baht if it produces waste not over 20 litres per day like the statement in the law of Ministry of Public Health, Thailand. However, there was a study of Nakamoto [7]. He found that a flat fee system would take a higher cost of administrative and have less effect on households' behavior of waste generation than a unit charging method. This was supported by the study of Beukering *et al.* [8]. They showed that a unit charging system could reduce the amount of waste generated by households in main cities of Netherland. It is obvious that the economic instrument like a waste collection fee could lead to an efficiency of waste management in Songkhla municipality as it could decrease the cost of collecting municipal waste and change behavior of people to think before producing waste. Thus, the city could achieve a sustainable waste management in the long term.

For this reason, the implementation of Songkhla municipal waste collection fee seems important and needs to tackle carefully. Thus, this paper paid attention to the point of finding factors which influence Songkhla municipal residents' willingness to pay for a waste collection fee because Karagiannidis *et al.* [9] claimed that demographic characteristics could impact on the implementation of waste charging policy as well. To know what factors leading people to paying for the fee is the key point as it is the first step of imposing the policy. If factors are uncovered, policy implementers could then make a deal with the residents who never paid for a waste collection fee before. As a result, Songkhla municipal residents would not refuse for a waste collection fee policy when it is imposed in the city.

2. Methods

2.1 Population and sample

The population used in this research was households located in Songkhla municipal area. There were about 26,788 households in the area [10]. The number of samples was then calculated with the level of confidence at 95% and came up with 400 samples, approximately. These samples were taken by a random sampling technic.

2.2 Data

Data were collected by using questionnaire as a main tool. The questionnaire was divided into 3 parts. First part was designed for collecting personal detail of Sonkhla municipal residents. The second consisted of waste generating behavior questions and the last part was about willingness to pay for a waste collection fee by using CVM with an open-end question method [11]. This technic has been used widely in the area of environmental evaluation such as in the paper of Fu *et al.* [12], and Lu *et al.* [13]. In fact, before collecting data of both demographic and behavior data including CVM, the questionnaire was tested for proving its validity and reliability by measuring an item objective conguence index: IOC and Cronbach's alpha, respectively. The results represented an above acceptable level so the questionnaire could then be used.

2.3 Methodology and analysis

Regarding the environmental economics theory [14], the society would meet the social maximized benefit from a reduction waste policy when the marginal benefits of reducing waste equals to the marginal cost of reducing waste [15, 16]. To meet that point, Coase [17] introduced the theory of bargaining under a less transaction cost condition but in this case, there is a huge of transaction cost due to many stakeholders in the circumstance. Thus, the bargaining theory would not be applicable. For this reason, the policy maker should implement the market mechanism policy like a waste collection fee which in turn increases the cost of throwing waste of the residents [18]. However, as the residents in Songkhla have not been experienced of paying for a waste collection service before, there is a need to study factors influencing the residents' willingness to pay as well. To examine this, the descriptive statistic was chosen in order to explain personal detail and waste generating behavior of Songkhla municipal residents by using frequency, percentage, mean, and standard deviation. In addition, the analysis part of factors influencing willingness to pay of the residents for a waste collection fee used binomial logistic regression technic due to its ability of analyzing dependent variable which forms like a binary data. The technic could turn out an opportunity proportion of an event that Songkhla residents would like to pay for a collection fee: Prob(y = 1) compared with an event that Songkhla residents would not like to pay for a collection fee: Prob(y = 0). This could be stated as follows:

$$\frac{\Pr(y=1)}{\Pr(y=0)} = \frac{\frac{1}{1+e^{-x\prime\beta}}}{\frac{e^{-x\prime\beta}}{1+e^{-x\prime\beta}}} = \frac{1}{e^{-x\prime\beta}} = e^{x\prime\beta} \quad (1)$$

We shall take natural logarithm into the equation 1. Then we got.

$$\ln\left(\frac{\Pr(y=1)}{\Pr(y=0)}\right) = x'\beta = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k \quad (2)$$

From the equation 2, it can be seen a liner form of the equation so the β parameters could be estimated with an ordinary least squares method: OLS. Thus, each factor could be tested in order to know there relationship between focusing factors and an opportunity proportion of willingness and non-willingness to pay for a waste collection fee. In addition, the factors tested in this research were divided into two groups. First one was a group of demographic factors such as sex (SEX), age (AGE), education level (EDU), marital status (STU) which 0 represents single and 1 represents marriage and divorce, religion (REG), career (CAR), a number of over 13-year-old members (MEM13UP) and less than 13-year-old members (MEM13DOWN), household revenue (REV), house type which was classified into detached or semi-detached house (HOME1) and shop or townhouse (HOME2), and house expected price (HOMP). The second group indicated a behavior of waste generation; for example, an amount of waste generated per day (WASTQ), a percentage of consumption waste (WASTC), a frequency of putting waste bag on collecting points (WASTF), an index of house characteristic (HOMEC), an index of house neighborhood (HOMEN), an index of transportation around house (HOMEV), an index of environment around house (HOMEE), an index of waste management around house (HOMEW).

Moreover, each kind of indices was calculated from scores of answers that the respondents gave. For example, to compute a house characteristic index, the respondents were asked about their house characteristic such as a number of bed rooms, and house size. A house neighborhood index would represent their neighborhood atmosphere such as the relationship with neighbours, main places closing to their house like park and market. A transportation index could illustrate the communication and transportation around their area; for instance, public transport accessibility, and street and road quality. An environmental index shows a quality of environment around their house such as air quality, green area, and congestion. The last one was a waste management index. This one would present a quality of waste management serviced by the municipality such as a number of waste collecting points, reliability of the service. In addition, the dependent variable is a natural logarithm of an opportunity proportion of having willingness to pay for a waste collection fee and having not willingness to pay for it (Y^*). The explicit equation representing this could be written as follows:

$$\begin{aligned}\ln\left(\frac{P(y=1)}{P(y=0)}\right) = Y^* = {} & c + \beta_1 SEX + \beta_2 AGE + \beta_3 EDU \\ & + \beta_4 STU + \beta_5 REG + \beta_6 CAR \\ & + \beta_7 MEM13UP + \beta_8 MEM13DOWN \\ & + \beta_9 REV + \beta_{10} HOME1 \\ & + \beta_{11} HOME2 + \beta_{12} HOMP \\ & + \beta_{13} WASTQ + \beta_{14} WASTC \\ & + \beta_{15} WASTF + \beta_{16} HOMEC \\ & + \beta_{17} HOMEN + \beta_{18} HOMEV \\ & + \beta_{19} HOMEE + \beta_{20} HOMEW \quad (3)\end{aligned}$$

3. Results and discussion

The data collected from households located in the Songkhla municipal area were analyzed with both descriptive and inferential statistics as described above. The first part of this section was devoted to an explanation of data and then the second part would show factors influencing willingness to pay (WTP) of Songkhla residents for a service of waste collection.

The descriptive statistics indicated that an average age of 400 respondents is 47.5 years old. The household revenue is about 22,825 baht per month. They also generate waste for 3.5 kilograms per day and 50% of these are from their consumption. An average of member in a household is about 4 and a house price is about 2,200,000 baht averagely.

The information of 400 samples used in this study was shown in the Table 1, it can be seen that most of respondents is female accounting for 61.75%. They got a bachelor degree at most followed by primary and secondary school. The majority of them got married already and they hold Buddhism as a main religion. The career of main respondents is a business owner. 56% of them live in a detached and a semi-detached house type while the rest lives in a shop, a townhouse type and other. Most of them leave their waste at municipal collecting points for about 83% whereas the rest leaves there waste at other point. They also prefer to take their waste bag to collecting points every day followed by every two day. This is relevant with the answer that they need a service of waste collection from the municipality every day (90%). The questionnaire also asked them that have you ever been charged for a waste collection service. The answers is no for about 70%. It means that 30% of them have an experience of waste collection charging already.

The information about household member is quite important as it could represent an amount of waste generated in their household as well. Thus, the Table 2 was created to show a number of members in a household. This number was divided into a number of members who have over and less than 13 years old.

The Table 2 indicated that most households have 4 members followed by 3 members and there are 1 household has 12 members in the house. This is the highest number of members in a household. The study then investigated a number of over 13-year-old

Table 1 Descriptive statistic of respondent characteristics

	Item	Freq.	Percent	Cum.
SEX	Male	153	38.25	38.25
	Female	247	61.75	100.00
EDUCATION	Not educated	34	8.50	8.50
	Primary school	94	23.50	32.00
	Secondary school	91	22.75	54.75
	Diploma	71	17.75	72.5
	Bachelor	102	25.50	98.00
	Higher than bachelor	8	2.00	100.00
STATUS	Single	71	17.75	17.75
	Marriage	300	75.00	92.75
	Divorce	29	7.25	100.00
RELIGION	Buddhist	338	84.50	84.50
	Islam	55	13.75	98.25
	Christian	7	1.75	100.00
CAREER	Business owner	269	67.25	67.25
	Government Official	41	10.25	77.50
	Company Official	31	7.75	85.25
	Other	59	14.75	100.00
HOME_TYPE	Detached & Semi-detached house	224	56.00	56.00
	Shop & Townhouse	151	37.75	93.75
	Other	25	6.25	100.00
WASTE_PLACE	Municipal waste collecting point	333	83.25	83.25
	Other point	67	16.75	100.00
WASTE_FREQUENCY	everyday	310	77.50	77.50
	every two day	49	12.25	89.75
	every three day	18	4.50	94.25
	every four day	12	3.00	97.25
	every five day	4	1.00	98.25
	every six day	1	0.25	98.50
	every seven day	6	1.50	100.00
WASTE_NEED_COLLECT	every day	360	90.00	90.00
	every two day	26	6.50	96.50
	every three day	12	3.00	99.50
	every four day	1	0.25	99.75
	every six day	1	0.25	100.00
WASTE_FEE_STATUS	Need to pay	121	30.25	30.25
	No need to pay	279	69.75	100.00

members and found that the majority of households have 2-3 members who are over 13-year-old. Meanwhile, there are 56% of households which don't have members who are less than 13-year-old. These numbers could indicate that Songkhla households are quite a large size family, basically as their members still live together in one house. Thus, there would be a potential to generate a large portion of waste per household in the city.

A binomial logistic regression analysis was then obtained to indicate factors influencing Songkhla residents' willingness to pay for a municipal waste collection fee and the results were shown in the Table 3. At a 0.05 significant level, some factors could influent Songkhla residents' willingness to pay. These factors are a marital status (STU), a career (CAR), a number of over 13-year-old members (MEM13UP), household revenue (REV), house type 1: detached and

Table 2 Household members separated by age over and less than 13 years old

Numbers	Household members all		Household members age over 13		Household members age less than 13	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
0	0	0.00	12	3.00	225	56.25
1	16	4.00	25	6.25	106	26.50
2	56	14.00	111	27.75	52	13.00
3	95	23.75	106	26.50	9	2.25
4	106	26.50	73	18.25	5	1.25
5	74	18.50	47	11.75	3	0.75
6	25	6.25	15	3.75	0	0.00
7	17	4.25	8	2.00	0	0.00
8	4	1.00	1	0.25	0	0.00
9	5	1.25	0	0.00	0	0.00
10	1	0.25	1	0.25	0	0.00
11	0	0.00	1	0.25	0	0.00
12	1	0.25	0	0.00	0	0.00
Total	400	100	400	100	400	100

Table 3 Results of binomial logistic regression analysis

Variables	Coef.	Std. Err.	z	P>|z|
SEX	0.177999	0.300315	0.59	0.553
AGE	-0.0162	0.013808	-1.17	0.241
EDU	0.108027	0.120755	0.89	0.371
STU	-0.9598	0.375896	-2.55	0.011*
REG	-0.09539	0.399643	-0.24	0.811
CAR	0.38725	0.142204	2.72	0.006*
MEM13UP	0.24728	0.0993	2.49	0.013*
MEM13DOWN	-0.1146	0.168951	-0.68	0.498
REV	-0.0000117	0.00000578	-2.02	0.043*
HOME1	1.177095	0.321978	3.66	0.000*
HOME2	-1.173943	0.3213832	-3.65	0.000*
HOMP	-0.00000022	0.000000083	-2.66	0.008*
WASTQ	-0.01339	0.04582	-0.29	0.770
WASTC	-0.00052	0.005276	-0.1	0.922
WASTF	-0.06198	0.146327	-0.42	0.672
HOMEC	0.64059	0.316274	2.03	0.043*
HOMEN	-2.0875	0.314256	-6.64	0.000*
HOMEV	0.980293	0.367441	2.67	0.008*
HOMEE	-0.00872	0.217019	-0.04	0.968
HOMEW	0.503329	0.204903	2.46	0.014*
_cons	-10.4041	4.430739	-2.35	0.019*

Remark: * is significant level at 0.05

semi-detached house (HOME1), house type 2: shop and townhouse (HOME2), house expected price (HOMP), an index of house characteristic (HOMEC), an index of house neighborhood (HOMEN), an index of transportation around house (HOMEV), an index of waste management around house (HOMEW). As a result, the explicit equation form of the relation between a natural logarithm of a opportunity proportion of having WTP and having not WTP ($\ln\left(\frac{P(y=1)}{P(y=0)}\right) = Y^*$), and influencing factors could be built as follows:

$$
\begin{aligned}
Y^{*} = {} & -10.4041 - 0.9598\ STU + 0.38725\ CAR \\
& \quad (0.375896) \quad (0.142204) \\
& + 0.24728\ MEM13UP - 0.0000117\ REV \\
& \quad (0.0993) \quad (0.00000578) \\
& + 1.177095\ HOME1 - 1.173943\ HOME2 \\
& \quad (0.321978) \quad (0.3213832) \\
& - 0.00000022\ HOMP + 0.64059\ HOMEC \\
& \quad (0.000000083) \quad (0.316274) \\
& - 2.0875\ HOMEN + 0.980293\ HOMEV \\
& \quad (0.314256) \quad (0.367441) \\
& + 0.503329\ HOMEW \\
& \quad (0.204903) \qquad (4)
\end{aligned}
$$

The results showed in the table 3 illustrated that there is a negative correlation between a marital status factor and a natural logarithm of WTP opportunity proportion (Y*). This can be interpreted that if Songkhla residents change from having a single status to a married status, they would tend to decrease their opportunity to pay for the fee as their cost of waste disposal might increase due to their members and activities which could rise from being family household. Career is also one of the influencing factors. In fact, the paper further examined this factor and found that the residents who work as a business owner may not want to pay for the fee while the other like government and company officers would be willing to pay for the fee. This is caused by an opportunity of generating waste which is driven by a different type of work. A number of over 13-year-old members also shows a significant positive correlation with Y*. It means that if a household has more over 13-year-old members, the household would increase their chance of paying for their waste disposal. A household revenue factor has also a relation with the dependent variable. The relation illustrates that the residents would not want to pay if their household revenue increase. This was quite skeptical so the paper then examined this point. The result could be expressed that high household revenue could indicate high opportunity to generate more waste due to an increase in activities. Hence, the household would not want to handle with an extra cost of throwing waste when the fee is implemented.

The important thing to note is that a house type factor plays a main role for the analysis. It indicates that Songkhla residents who live in a detached or semi-detached house would be willing to pay for a waste correcting fee while the residents who live in a shop and townhouse would not want to pay. This could imply that normally, people living in a shop and townhouse might use their house as a shop, a restaurant, or a store so they may generate more waste than the people living in a detached or semi-detached house. That is why they don't want to pay as they know the cost of waste disposal might increase due to their nature of living. A house expected price factor also shows a negative correlation as a high price house generally produces waste much more than a low price house due to the size of house.

Most house characteristic indices could influent Songkhla residents' WTP, significantly. In fact, a house characteristic index, a transportation index and a waste management index have a positive correlation to the WTP of Songkhla residents while a neighborhood index has a negative one. These may be interpreted that people living in a large scale house, having good transportation accessibility, and having a good service of waste management would tend to pay for the waste collection fee. However, if their house is close to the main places of the city like a school, a police station, a hospital, a market, and a supermarket, these could then reduce the people's WTP. The reason for this is that living close to the main area could lead the residents to having a burden from other waste disposal.

4. Conclusions

The findings of the study illustrated both Songkhla residents' behavior of waste generation and factors influencing Songkhla residents' willingness to pay for a waste collection fee. To sum up the behavior of waste generation, it can be seen that most Songkhla residents leave their waste at municipal collecting points and they prefer to take their waste bag to a collecting point every day. That is why they need a service of waste collection from the municipality every day as well. They also generate waste for 3.5 kilograms per day and 50% of these are from their consumption. The study of factors influencing Songkhla residents' willingness to pay for a waste collection fee also showed a various kinds of significant factors. In conclusion, the residents who got married and live in a detached or semi-detached house with over 13-year-old members would tend to have willingness to pay for the fee. By contrast, the residents who live in a shop or townhouse closing to main places like a hospital, a police station, an education institution, and a superstore would not want to pay for the fee due to a high opportunity of increasing waste disposal cost.

For this reason, to implement a municipal waste collection fee policy in Songkhla municipal area, Policy implementers should design a plan carefully. Regarding the results, the implementation plan should begin with imposing on the residents who live in a detached or semi-detached house located outside the city due to their high opportunity to accept the policy. The second stage is that the policy should be imposed in the city center where a majority of Songkhla residents live after proving a good service of waste management in the first step already. The key point of implementing is that municipal collecting staffs have to deliver a service with quality. Thus, the amount of waste generated would decease like the case in Dhaka city, Bangladesh [19] and in Shingu city, Japan [20]. The both case represented a successful story of a waste collection fee implementation which were driven by a service quality. However, the period of

implementation may take time as most residents may not been imposed a waste collection fee before. They may refuse the policy at first but this would be reduced if the provided service has quality enough. However, there would be free riders when the policy is imposed. These may be reduced by distributing waste bin to household individually like the case in USA.

Last but not least, the study can be improved in a further research by investigating an optimal rate of waste collection fee. The rate should be based on Songkhla residents' willingness to pay and reflecting fairness. In addition, the administrative cost of operation has to be taken into consideration as well so that the waste management in Songkhla city could illustrate sustainability and become a waste management city model of Thailand.

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