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WILLINGNESS TO PARTICIPATE IN SOLID WASTE MANAGEMENT AMONGST RESIDENTS OF SEMBULAN TENGAH WATER VILLAGE IN SABAH, MALAYSIA

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ABSTRACT

Solid waste management presents significant challenges in many developing countries in Asia. In this paper we empirically investigate the willingness to participate (WTP) in solid waste management by residents of the Sembulan Tengah Water Village in Sabah, Malaysia by means of a survey study. Sembulan Tengah Water Village is a squatter community populated by poor people subsisting largely in the informal sector. The paper seeks to contribute to the existing empirical literature on the factors that significantly influence WTP generally, as well as WTP in terms of labour hours and pecuniary contributions. Using the binary logistic regression method, our results show that age, gender, educational level, length of stay, house ownership, and ethnicity significantly influence willingness to participate in solid waste cleaning activities. Age significantly influences WTP in terms of labour hours. Other factors, such as gender, education level, length of stay, income level, and house ownership, were significant in influencing WTP in terms of money. Our findings can be used for policy purposes to improve solid waste management in poor communities across developing countries in Asia and elsewhere.

Contribution/ Originality: This study is one of few studies that have investigated the willingness to participate generally, as well as willingness to participate in terms of labour hours and money in solid waste management, that specifically focus on a squatter community populated mostly by low-income residents.

1. INTRODUCTION

In an era of globalization characterised by swift technological change, rapid urbanization and population increases in developing countries, new problems have emerged. For instance, a sharp rise in solid waste has accompanied urbanisation which has presented public policy challenges (see, for example, [1, 2]). Efficient solid waste management is critical for the health and well-being of urban populations [2] Solid waste management consists in the control of the generation, collection, storage, transfer, processing and disposal of the solid waste [3]. The problems associated with efficacious solid waste management typically intensify in circumstances characterised

by illegal immigration and squatting. It is accordingly important to investigate how best to resolve these problems under these trying conditions. In this paper we thus examine empirically the willingness to participate (WTP) in solid waste management amongst the residents of Sembulan Tengah Water village on the outskirts of Kota Kinabalu in Sabah, Malaysia. Sembulan Tengah Water Village is located alongside of Sembulan River with total population around 3,830 residents. Most of the residents are in middle-income families in Sabah terms, largely as a consequence of around half are working in low income sectors. Accordingly, in order to test WTP, this study will specifically examine the WTP into in terms of both labour hours and money. By classifying the dependent variable in this manner, this can offer a clearer empirical view of the type of WTP and the factors that may affect WTP amongst the residents. In order to identify WTP in solid waste management in Sembulan Tengah Water Village, the logistic regression method was been used. Eight factors (i.e. age, gender, ethnicity, income level, occupation, education level, length of stay, and ownership) are included in this study that may influencing WTP amongst Sembulan Tengah Water Village residents. These factors may play an important role in affecting WTP, as suggested by the previous studies. Sembulan Tengah Water Village has been in existence for a substantial period and it now has 286 stilt houses with some 3,830 residents connected by simple plank bridges. Of the 286 homes, 159 houses are occupied by local people and the remaining 127 houses occupied by foreign residents, who are mostly undocumented with few *bona fide* citizens. Given that almost half of all residents are not Malaysian citizens (i.e. non-*bumiputera*), it is important to include ethnicity as one of the variables that may influence the WTP.

The paper divided into five main parts. The research problem is considered in section 2 whereas section 3 presents a synoptic account of previous empirical work on the WTP in solid waste programs. Section 4 outlines the empirical strategy employed in the present paper and section 5 presents the findings of the empirical analysis. Section 6 discusses the nature of the findings. The paper ends with a brief conclusion in section 7.

2. RESEARCH PROBLEM

Sembulan Tengah Water village, a squatter settlement on the periphery of the city of Kota Kinabalu in the Malaysian state of Sabah, faces acute solid waste problems. Kota Kinabalu City Hall has already taken several steps to tackle the problem, including the implementation of the 2016 Anti-litter Bylaw. However, despite these measures problems remain, as reported by Suzianah [4]. It seems clear that WTP represents a pivotal factor in any successful program. It is thus essential that Kota Kinabalu City Hall appreciate the nature of WTP amongst residents of Sembulan Tengah Water Village. Against this background, the present study empirically investigates the determinants of WTP in cleaning activities by local people in Sembulan Tengah Water Village.

3. EMPIRICAL ANALYSIS OF WILLINGNESS TO PARTICIPATE IN SOLID WASTE MANAGEMENT

Most empirical work on WTP in solid waste management indicates that age, gender, education level, occupation, home ownership, length of stay, income level, and ethnicity are important factors influencing WTP. For instance, Nkansah, et al. [5]; Sizya [6]; Addai and Danso-Abbeam [7] and Niringiye and Douglason [8] found that age had a significant impact on WTP in solid waste management. It has been argued that older people are unwilling to participate on grounds that they are accustomed to free government services. Awunyo-Vitor, et al. [9] and Abebaw and Ayenew [10] found that home ownership and length of stay are significantly positive influences on WTP in solid waste management. Lal and Takau [11]; Addai and Danso-Abbeam [7]; Awunyo-Vitor, et al. [9]; Anjum [12]; Amfo-Otu, et al. [13] and Trang, et al. [14] found that education levels and income levels significantly influence WTP. According to Murad and Siwar [15] women are more likely to participate in the solid waste management. Some researchers, like Amfo-Otu, et al. [13] found employment could positively influence WTP. In sum, socioeconomic factors significantly influence WTP.

4. EMPIRICAL STRATEGY

4.1. Data Collection

The study concentrated on the Sembulan Tengah Water Village only. The site was chosen because the Anti-litter By-law was strictly enforced and as a result many its residents was forced to participate in the cleaning activities. Data was collected using a survey questionnaire that was distributed among residents of Sembulan Tengah Water Village. The questionnaire consists of four sections: i) a demographic section, ii) the willingness to participate in the cleaning activity, iii) solid waste problems and iv) solid waste management. The questionnaire was distributed using a sample random sampling design. 170 respondents satisfactorily completed the questionnaire.

4.2. Model Specification

A logistic model was used to analyse the relationship between the multiple number of independent variables and the categorical dependent variable in estimating the probability outcomes [16]. The binary logistic model allows the researcher to estimate the probability that an event may or may occur through the prediction of binary dependent outcome from the set of independent variables [6]. The model is based on Gujarati [17] as shown below;

$$P\ (Y) = P - 1 = \beta 0 + \beta i Xi + \varepsilon i$$

P = P (Y=1) (person willing to participate).

P - 1 = (Y=0) (person not willing to participate).

Where;

P = Probability of occurrence.

Y = Dependent variable.

$\beta 0$ = Vector of Constant Coefficient.

$\beta i = \beta 1, \beta 2, \beta 3 \ldots . \beta 7$ = Coefficient of independent variable.

Xi = Vector of independent variable.

εi = Error term.

In this study, a binary logistic model was used to determine the WTP of individuals in terms of labour hour and money. It was hypothesised that WTP is related to demographic, social and economic factors which included;

$WTPi = (Age, Gender, Education, Occupation, Ownership, length\ of\ stay, Income, Ethnicity)$

The model above is then specified as follows as;

$$WTP = \beta 0 + \beta 1 AGE + \beta 2 GEN + \beta 3 EDU + \beta 4 OCC + \beta 5 OWN + \beta 6 LOS + \beta 7 INC + \beta 8 ETH + \varepsilon i$$

Where,

WTP = Willingness to participate (1=willing, 0=not willing).

$\beta 0$ = Vector of Constant Coefficient.

$\beta i = \beta 1, \beta 2, \beta 3 \ldots . \beta 7$ = Coefficient of independent variable.

AGE = Individual's age.

GEN = Individual's gender.

EDU = Individual's education level.

OCC = Individual's occupation.

OWN = Individual's home ownership.

LOS = Individual's length of stay.

INC = Individual's income level.

ETH = Ethnicity.

εi = Error term.

Table-1. Characteristics of Sembulan Tengah Water Village survey respondents.

Demographic features	Frequency	Percentage
Gender		
Male	63	46.0
Female	74	54.0
Total	137	100.0
Age of respondents		
18 - 29	66	48.2
30 - 39	30	21.9
40 - 49	21	15.3
50 - 59	13	9.5
60 above	7	5.1
Total	137	100.0
Ethnicity of respondents		
Melayu(bumiputera*)	16	11.7
Dusun/Kadazan(bumiputera)	19	13.9
Bajau(bumiputera)	68	49.6
Suluk (bumiputera)	8	5.8
Bugis/Banjar(bumiputera)	2	1.5
Rungus (bumiputera)	1	.7
Brunei (bumiputera)	11	8.0
Lain-lain (others)		
Butod (bumiputera)	1	.7
Butun (bumiputera)	2	1.5
Iban (bumiputera)	1	.7
Jawa	1	.7
Murut (bumiputera)	1	.7
Pakistan	2	1.5
Pemulan (bumiputera)	1	.7
Sungai (bumiputera)	2	1.5
Total	137	100.0
Level of Education		
Never attended school	24	17.5
UPSR/Primary school	20	14.6
PMR/SRP/PT3	15	10.9
SPM/SPMV	54	39.4
Skills Certificate	5	3.6
Diploma/Matriculations/Form 6	11	8.0
Bachelor's degree	8	5.8
Master	0	0
PhD	0	0
Total	137	100.0
Occupation		
Public sector	3	2.2
Private sector	50	36.5
Self employed	30	21.9
Unemployed	37	27.0
Student	17	12.4
Total	137	100.0
Home ownership		
Own	19	13.9
Parents/Family	39	28.5
Distant relatives	6	4.4
Rent	73	53.3
Total	137	100.0
Level of income		
Less than RM 1,000	69	50.4
RM 1,000 – RM 2,000	32	23.4
RM 2,001 – RM 3,000	6	4.4
More than RM 3,000	1	0.7

Total	108	78.8
Missing	29	21.2
Total	137	100.0
Length of stay		
Less than 5 years	20	14.6
5 – 10 years	12	8.8
11 – 15 years	9	6.6
16 – 20 years	16	11.7
More than 20 years	80	58.4
Total	137	100.0

Notes: *bumiputera is a broad linguistic-ethnographic categorization that includes Malaysian citizens in Sabah drawn from Bajau, Dusun/Kadazan, Melayu, Brunei, Suluk and Bugis/Banjar, etc. backgrounds, excluding Chinese, Indian and non-citizens, such as Pakistanis, etc.

5. CHARACTERISTICS OF RESPONDENTS AND RESPONSES

5.1. Respondent Profile

In this study, 54% of respondents are female and 46% are male. With respect to the age of respondents, 48.2% were in the range of 18-29 years old, followed by 30-39 (21.9%), 40-49 (15.3%), 50-59 (9.5%) and 60 years (5.1%) respectively. In terms of ethnicity, Bajau comprised the greatest number (49.6%) followed by Dusun/Kadazan, Melayu, Brunei, Other Ethnicity, Suluk and Bugis/Banjar. Data pertaining to the level of education shows that 39.4% possessed a qualification of SPM (Malaysia Education Certificate), followed by 'never attending school' (17.5%), UPSR or Primary School Test (14.6%), diploma (10.9%), degree (8%) and skill certificate (3.6%) respectively. Regarding occupation, 36.5% of respondents worked in the private sector while 2.2% worked as public servants with 21.9% self-employed and the rest either unemployed (27%) or studying (12.4%). In terms of home ownership, 53.3% are renting, 13.9% are homeowners, with the remaining 28.5% living in the houses owned by their parents/family and 4.4% living in houses owned by distant relatives respectively. Regarding monthly income, 21.2% had no earnings as they are unemployed or studying, 50.4% receive less than MYR1000 Malaysian (Ringgit), 23.4% receive between MYR 1000-2000, 4.4% receive between MYR2001-3000 and 0.7% receive more than MYR3000. Finally, data pertaining of length of stay shows that 58.4% lived in the Sembulan Tengah Water Village for more than 20 years, followed by the categories of less than 5 years (14.6%), 16-20 years (11.7%), 5-10 years (8.8%) and 11-15 years (6.6%) respectively. Respondent characteristics are summarised in Table 1.

5.2. Willingness to Participate

Respondents were asked if Kota Kinabalu City Hall did not impose the law on non-participation would they be willing (voluntarily) to participate in cleaning rubbish at their back and front yards. Of the respondents, 82.5% replied affirmatively that they were willing but 16.8% were not WTP in solid waste management. It is interesting to note that 86.9% of those who said yes had participated, while 13.1% of those who said no had never participated (thereby ignoring the court order).

The two WTP measures used in the study are in terms of labour hours (in-kind) and in money. Our results show that 26.3% of respondents were willing to use their labour hours, 20.4% willing to spend their money and 53.3% willing to use their labour hours and spend their own money. Of those WTP in terms of labour hours, 28.5% are willing use 1-2 hours, followed by more than 3 hours (27.7%), less than an hour (11.7%), and 2-3 hours (11.7%). Table 2 summarises the WTP responses:

5.3. Solid Waste Problems

The respondents were asked about the effects of indiscriminate or illegal dumping of household garbage at the Sembulan Water Village. Of the total respondents, 48.2% perceived solid waste caused pollution, 36.5% think it caused health problems, 23.4% think it is an eyesore not only to residents themselves, but also to outsiders,

particularly tourists, and 23.4% perceived it caused a stench. Perception of the respondents of the bad effects of solid waste is shown in a web plot in Figure 1.

Table-2. Willingness to participate in the cleaning activities.

Item	Categories	Frequency	Percentage
Respondent willingness to participate if KKCH does not implement Anti-litter By-law	Yes	113	82.5
	No	23	16.8
	Total	136	99.3
	Missing	1	.7
	Total	137	100.0
Participation of respondent in cleaning activities held by KKCH	Yes	119	86.9
	No	18	13.1
	Total	137	100.0
Participation frequency of respondents in cleaning activity	1 time	27	19.7
	2 times	32	23.4
	3 times	60	43.8
	Total	119	86.9
	Missing	18	13.1
	Total	137	100.0
Types of willingness to participate among respondents	Labour hours	36	26.3
	Money	28	20.4
	Both (labour hours and money)	73	53.3
	Total	137	100.0
In terms of labour hours	Less than 1 hour	16	11.7
	1 – 2 hours	39	28.5
	2 - 3 hours	16	11.7
	More than 3 hours	38	27.7
	Total	109	79.6
	Missing	28	20.4
	Total	137	100.0
In terms of money	Hiring people (RM13.26)		
	(RM4.42 minimum wages×3 hours)	30	21.9
	Cleaning necessities		
	(Estimation RM15)	71	51.8
	Total	101	73.7
	Missing	36	26.3
	Total	137	100.0
Willingness of respondents to reduce solid waste generation	Yes	127	92.7
	No	9	6.6.
	Total	136	99.3
	Missing	1	0.7
	Total	137	100.0
Willingness of respondents to continuously participate in the cleaning activities	Yes	128	93.4
	No	7	5.1
	Total	135	98.5
	Missing	2	0.5
	Total	137	100.0

Source: Field survey (2017).

Respondents were asked what type of solid waste (both organic and inorganic types) is visible, especially during low tide in their back and front yards. As shown in Figure 2, 73.3% reported food waste, 63.5% said plastics, 36.5% identified papers, 26.3% said it is aluminium and 17.5% said it is other materials, like wood, diapers, and bottles, 13.1% said glass and 10.2% identified discarded metal.

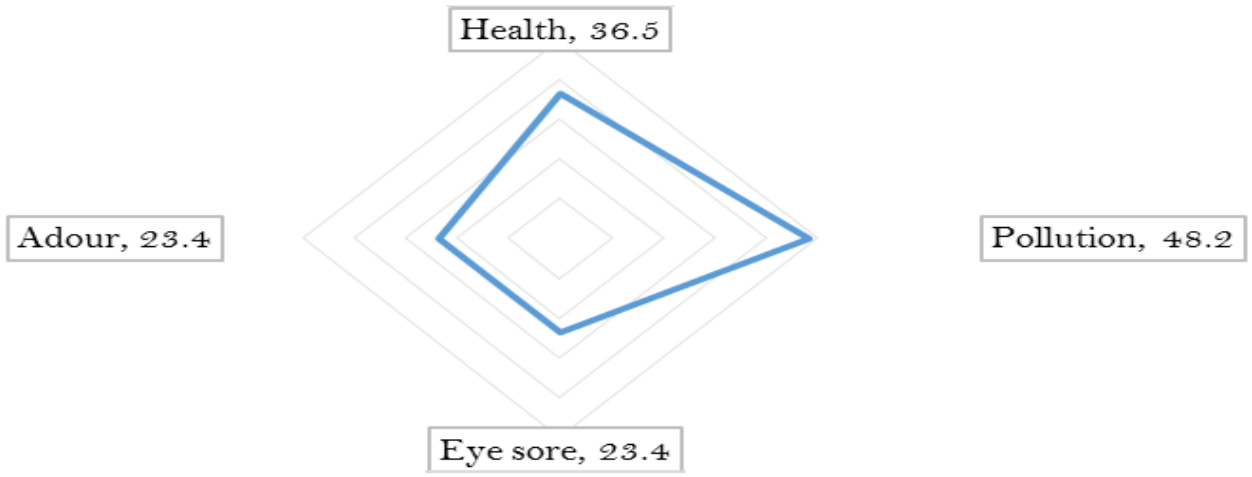

Figure-1: Effect of indiscriminate dumping of household solid waste.

Source: Field survey (2017).

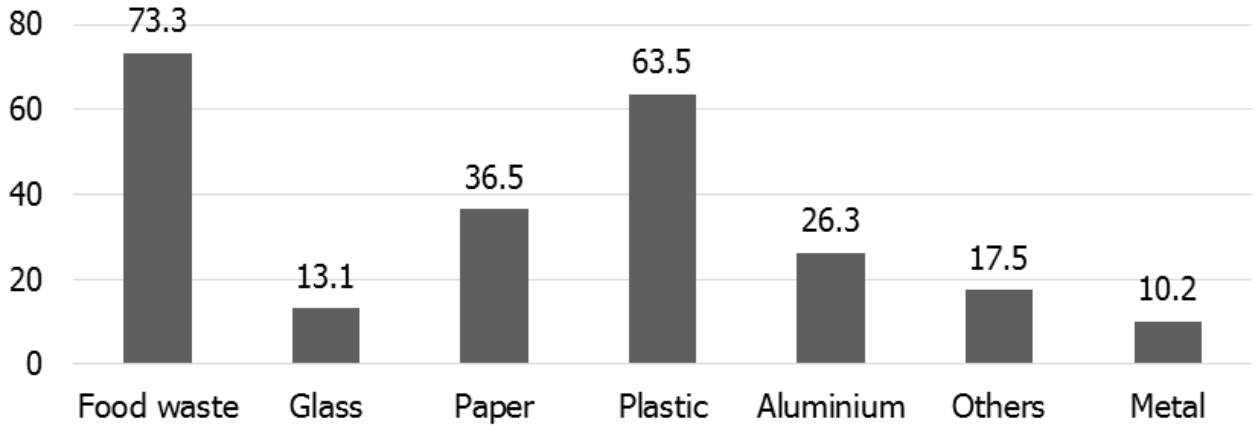

Figure-2. Type of solid waste as reported by respondents.

Source: Field survey (2017).

5.4. Solid Waste Management

The study site, together with the other water villages around it, is occupied largely by squatters. It is thus an illegal settlement. Very few stilt homes closer to the shore are connected legally to electricity, water and provided with individual garbage bins by Kota Kinabalu City Hall. Most of the stilt houses are located further away from land are illegally connected to electricity power but have no proper sanitation facilities (i.e. direct discharge of human waste into the sea below the stilt houses) or individual garbage bins. The illegal settlement does not pay quit rent. Quit rent for Kota Kinabalu City is based on general assessment (which includes sanitation charges) to Kota Kinabalu City Hall and thus are "non-rated areas" (i.e. provided with individual garbage bins and Kota Kinabalu City Hall collects the garbage as scheduled. However, in the recent years due to public health considerations, the Kota Kinabalu City Hall have provided these squatters areas with large garbage containers located at end of the jetty (on the road side). The users or residents of water villages are not charged for this service, which is funded by Kota Kinabalu City Hall from general revenue. The respondents were asked what they think about this service.

As shown in Table 3, 65% of respondents stated that the garbage bins provided by Kota Kinabalu City Hall were not big enough for the large amount of rubbish generated by the residents of Sembulan Tengah Water Village. The remaining 32.8% said that the bins were adequate for households in the area. 50.4% of respondents said Kota Kinabalu City Hall have been collecting solid waste daily, 33% said once or twice per week, 17.5% said 3 to 4 times per week, 2.9% said it was never collected and 2.2% said 5 to 6 times per week. The remaining 2.9% respondents did not answer the question.

Table-3. Garbage collection and disposal area.

Item	Categories	Frequency	Percent
Garbage bins provided is enough for the residential area	Yes	45	32.8
	No	89	65.0
	Total	134	97.2
	Missing	3	2.2
	Total	137	100.0
How often KKCH collects the garbage from the bins provided for the said area	Never	4	2.9
	1-2 times a week	33	24.1
	3-4 times a week	24	17.5
	5-6 times a week	3	2.2
	Every day	69	50.4
	Total	133	97.1
	Total Missing	4	2.9
	Total	137	100.0

Source: Field survey (2017).

A major problem for Kota Kinabalu City Hall in managing solid waste generated in the study site and surrounding much larger water villages resides in insufficient funding to provide large containers or garbage bins for the community to share. In addition, this was exacerbated by limited staff to collect garbage from those containers on schedule and to transport it to the nearest landfill (about 20 km away). The problem stemmed from indiscriminate dumping of household garbage. Public garbage containers located at the end of the jetty (at the roadside) which is about 5 minutes' walk from the last stilt house (towards the sea) seems to be too far. Residents simply throw garbage from windows and dump it into the sea. The efforts by some individuals, who dispose of their garbage properly, are overwhelmed by the amount of garbage illegal dumped by the majority.

The respondents were asked about the solid waste management in their area to find how each of them disposed of their garbage. The questions aimed to find out if they have participated in the organized gotong royong (i.e. collective action by the community working to together on *ad hoc* basis to clean their area). The results were as expected, as shown in Figure 3: 77.6% of the respondents participated in a gotong-royong which was co-organized by the Kota Kinabalu City Hall and the residents. Meanwhile, 15.7% (mostly houses near the road) admitted burning their thrash and 6.7% simply illegally dumped garbage.

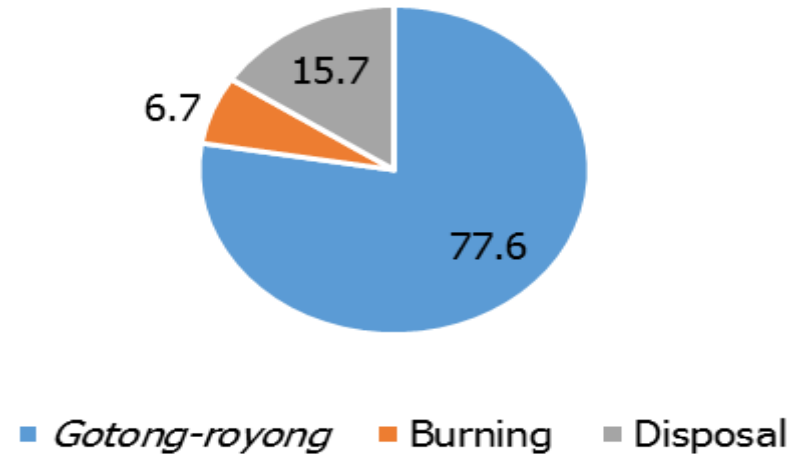

Figure-3. Type of solid waste management.

Source: Field survey (2017).

5.5. Descriptive Data

All variables are categorical variables since they fall into discrete categories as in Table 4. The total sample size included in this study was 137. Our model estimated the mean for WTP and WTP in terms of labour hours and money as 1.17 and 2.27 with a standard deviation of 0.376 and 0.853 respectively, which indicates that most

resident are willing to forego money in order to participate in the cleaning activities. Gender, age, house ownership, and income have means at 1.54, 2.01, 2.97 and 1.44 with standard deviations of 0.500 1.219, 1.175, and 0.645 respectively. Education level, occupation, length of stay and ethnicity have means above 3 (i.e. 3.45, 3.11, 3.91 and 4.01), with standard deviations of 1.693, 1.103, 1.524 and 2.949 respectively. In sum, resident WTP in the solid waste management was influenced by the variables included in our study.

Table-4. Description of variables for all samples.

Variables	N	Mean	Standard deviation
Willingness to participate	136	1.17	0.376
Willingness to participate (Labour hour and Money)	137	2.27	0.853
Gender	137	1.54	0.500
Age	137	2.01	1.219
Education	137	3.45	1.693
Occupational	137	3.11	1.103
House ownership	137	2.97	1.175
Income	108	1.44	0.645
Length of stay	137	3.91	1.524
Ethnicity	137	4.01	2.949

Source: Field survey (2017).

Table-5. Description of dummy variables.

Variables	Coding	Category description
Age	D1	30 – 39 years old
	D2	40 – 49 years old
	D3	50 – 59 years old
	D4	60 years and above
Gender	D5	Male
Level of education	D5	No formal education
	D6	UPSR/Primary school
	D7	PMR(primary school test)/SRP(Junior High School Test) /PT3
	D8	SPM(senior high school test) /SPMV(senior high school Vocational test)
	D9	Skills Certificate
	D10	Diploma/Matriculation/Form6
	D11	Degree
	D12	Master
Occupational	D13	Government servant
	D14	Private servant
	D15	Self-employed
	D16	Unemployed
House ownership	D17	Own
	D18	Parents or Family
	D19	Rent
Length of stay	D20	Less than 5 years
	D21	5 - 10 years
	D22	11 - 15 years
	D23	16 - 20 years
Level of income	D24	Less than RM1000
	D25	RM1,000 – RM,2000
	D26	RM,2001 – RM,3000
Ethnicity	D26	*Bumiputera*

Source: Field survey (2017).

5.6. Description of Dummy

We employed dummy variables to test against the dependent variable. Table 5 summarises our results for the dummy created for each categories of independent variable based on creating dummies in which $k - 1$. A binary logistic regression was undertaken, where all the independent variables were placed in a categorical variable in

order to test the influence of each of the categories on the dependent variable. Most of the independent variables has insignificant influence on the WTP. Thus, for the dummy variable, the categories of each of insignificant independent variable was dropped and marked as a reference. Following this procedure, one item for each of the independent variables (i.e. age, education level, occupational, length of stay, home ownership, and income level) was marked as a reference.

6. DISCUSSION OF RESULTS

The results obtained from the survey were most illuminating. We now consider our findings in terms of the various categories of responses.

6.1. Willingness to Participate

Table 6 summarises the results of the estimations undertaken using the WTP model:

Table-6. Willingness to participate by respondent characteristic.

Variable	βeta (SE)	Wald	Df	p-value	Exp(B)
Gender	1.656 (.863)	3.680	1	0.55**	5.240
30-39 years	-3.174 (1.253)	6.420	1	011**	.042
40-49 years	19.409 (6416.103)	.000	1	.998	2.687E8
50-59 years	-2.478 (1.916)	1.673	1	.196	.084
More than 60 years	-4.766 (2.541)	3.519	1	.061***	.009
No formal education	5.309 (2.727)	3.790	1	.052***	202.085
UPSR/Primary school	5.824 (3.009)	3.747	1	.053***	338.275
PMR/SRP/PT3	23.169 (7962.519)	.000	1	.998	1.154E10
SPM/SPMV	1.888 (1.848)	1.044	1	.307	6.605
Skills Certificate	23.539 (13642.225)	.000	1	.999	1.670E10
Diploma	1.943 (1.812)	1.149	1	.284	6.979
Public sector	-3.609 (2.612)	1.909	1	.167	.027
Private sector	-.504 (1.367)	.136	1	.712	.604
Self-employed	1.906 (1.616)	1.391	1	.238	6.724
Unemployed	-.111 (1.254)	.008	1	.93	.895
Own home	4.436 (2.346)	3.575	1	.059***	84.468
Parents/Family	1.321 (1.657)	.636	1	0.425	3.746
Rent	1.674 (1.602)	1.091	1	0.296	5.331
Less than 5 years	-1.012 (1.084)	.872	1	0.35	.363
5-10 years	-3.864 (1.584)	5.953	1	.015**	.021
11-15 years	-.735 (1.805)	.166	1	.684	.479
16-20 years	-4.608 (1.494)	9.507	1	.002*	.010
Less than RM1,000	-.551 (1.001)	.303	1	.582	.577
RM1000-RM2000	-2.069 (1.292)	2.565	1	.109	.126
RM2001-RM3000	19.336 (14283.244)	.000	1	.999	2.498E8
Ethnicity	2.510 (1.348)	3.464	1	.063***	12.300
Constant	-2.210 (2.215)	0.995	1	.318	.110
No. of observations	137	Goodness of fits			
-2 log likelihood	64.352				
Cox & Snell	0.353	Chi-square	8.846		
No. of observations	137				
-2 log likelihood	64.352				
Cox & Snell R^2	.353	Goodness of fits			
Nagelkerke R^2	.592				
Chi-square	59.268	Chi-square	8.846		
Prob>Chi^2	.000	Prob>Chi^2	.355		

Note: *significant level at 0.01 **significant level at 0.05 ***significant level at 0.1.

Table 6 indicates that based on Cox and Snell R^2 35.3% of the variation in WTP can be explained by the independent variables. In contrast, the Nagelkerke R^2 shows that a 59.2% variation of the WTP can be explained by the independent variables. The model thus fits the data. Moreover, there is a significant relationship between the dependent and independent variables, with a p-value<0.05. As shown in Table 6, six out of the eight variables are statistically significant in influencing the WTP. Occupational status and income however are not significant in influencing the WTP.

The impact of each of the independent variables is as follows:

Gender has positive value and significant at 1 percent level of confidence. This implies that males are more WTP in the solid waste management compared to women. From Table 6, we can see that the estimated coefficient for gender change per unit will increase the WTP by 1.656.

Age has a negative value and significant relationship with the WTP. The results show that respondents who fall into age categories of 30 to 39 years, 50-59 years and more than 60 years are unwilling to participate in solid waste management. These age categories act as free riders who enjoy the cleanliness provided by people age 40-49 years, without participating in cleaning activities themselves. The estimated coefficient of age of 30 to 39 years and more than 60 years imply that a unit increase will decrease the WTP by 3.174 and 4.766 respectively.

Education level has positive and significant relationship with the WTP. The estimation coefficient of level of education level for people with no formal education and UPSR/Primary school implies a unit increase will increase the WTP by 5.309 and 5.824 respectively. This result may flow from the fact that educated people are knowledgeable about the law and public policy.

Occupation is statistically insignificant in our model. This might due to the existence of factors which highly influence WTP.

Home ownership has a positive and significant influence on WTP. The estimation coefficient shows that home ownership will increase WTP by 4.436. This suggests the owners of the stilt houses prefer a cleaner environment. They have sense of belonging and they wanted their environment to be clean. In contrast, those who are renting are largely working in low paying jobs and hence have less time to clean.

Length of stay has a negative and significant influence on WTP. The estimation coefficient for people with durations of 5 to 10 years and 16 to 20 years will increase WTP by -3.864 and -4.608 respectively. This result was unexpected since it could be reasonably anticipated that a long tenure in an area would induce people to be more WTP.

Income was statistically insignificant. This is because probably because most of the respondents are low-middle income earners.

Ethnicity has a positive significant influence on WTP. In essence, *bumiputera* or legal residents are more WTP in solid waste management. The estimation coefficient shows that a unit increase in ethnicity will causing the WTP to increase by 2.510. It is possible non-*bumiputera* are considered as outsiders to the village, causing them not to participate. Alternatively, it could be that samples of non-*bumiputera* too small the distribution given in Table 1.

6.2. Willingness to Participate in Terms of Labour Hours

Table 7 summarises the results of the estimations undertaken using the WTP model:

Table 7 shows that the Cox and Snell R^2 explains the 26.2% variation in WTP in terms of the independent variables, whereas the Nagelkerke R^2 shows 38.2% variation of the WTP can be explained by the independent variables. Overall of the model fits the data and there are significant relationships between the dependent and independent variables since the p-value<0.05. In Table 7, only one out of eight variables are statistically significant with respect to WTP: gender, education level, occupation, home ownership, length of stay, ethnicity and income are

not significant in influencing WTP. We now consider in more detail the impact of each of the independent variables.

Table-7. Willingness to participate in terms of labour hours.

Variable	βeta (SE)	Wald	Df	p-value	Exp(B)
Gender	.608 (.532)	1.307	1	.253	1.837
30-39 years	.591 (.638)	.857	1	.355	1.805
40-49 years	.493 (.716)	.473	1	.492	1.637
50-59 years	-2.480 (1.295)	3.667	1	.055***	.084
More than 60 years	.358 (1.199)	.089	1	.765	1.431
No formal education	19.866 (13564.535)	.000	1	.999	4.244E8
UPSR/Primary school	20.797 (13564.535)	.000	1	.999	1.077E9
PMR/SRP/PT3	19.828 (13564.535)	.000	1	.999	4.083E8
SPM/SPMV	19.090 (13564.535)	.000	1	.999	1.953E8
Skills Certificate	20.104 (13564.535)	.000	1	.999	5.386E8
Diploma	18.766 (13564.535)	.000	1	.999	1.4128
Government servant	-19.561 (20094.294)	.000	1	.999	.000
Private servant	-.169 (1.421)	.014	1	.905	.844
Self-employed	-.108 (1.414)	.006	1	.939	.898
Unemployed	.230 (1.422)	.026	1	.871	1.259
Own	20.862 (15578.389)	.000	1	.999	1.148E9
Parents/Family	19.685 (15578.389)	.000	1	.999	3.541E8
Rent	20.557 (15578.389)	.000	1	.999	8.469E8
Less than 5 years	-.230 (.731)	.099	1	.753	.795
5-10years	-.843 (.891)	.896	1	.344	.430
11-15 years	-1.326 (1.244)	1.136	1	.287	.266
16-20 years	-.067 (.821)	.007	1	.935	.935
Less than RM1,000	.010 (.826)	.000	1	.990	1.010
RM1000-RM2000	.508 (1.001)	.258	1	.612	1.662
RM2001-RM3000	-19.512 (14745.741)	.000	1	.999	.000
Ethnicity	-.150 (.793)	.036	1	.850	.860
Constant	-41.083 (20656.282)	.000	1	.998	.000
No. of observations	137	Goodness of fits			
-2 log likelihood	116.269				
Cox & Snell R^2	.262	Chi-square	8.846		
Nagelkerke R^2	.382	Prob>Chi^2	.355		
Chi-square	41.538				
Prob>Chi^2	.027				

Note: *significant level at 0.01 **significant level at 0.05 ***significant level at 0.1.

Age for dummy categories of 50 to 59 years old is significant and negatively influences WTP in terms of labour hours in solid waste management. The estimation coefficient shows that a unit increase in age will decrease the WTP in terms of labour hours by 2.480. As shown, the model predicts that the dummy 50-59 years is 0.55 times less likely to let go of working hours in order to participate in the solid waste management compared to other categories. They are thus less likely to be willing to volunteer their time for the common good of the water villagers (through a cleaner environment). It is possible that their time has higher opportunity cost in terms of forgone wages earned. Previous cleaning activities co-organized by the residents of the study site and Kota Kinabalu City Hall were conducted during weekends. It is thus likely they are working extra hours during cleaning activities. If they were not working, then their time has higher opportunity cost in terms of forgone leisure.

Other variables are insignificant with respect to WTP, probably due to the existence of other variables which may influence WTP.

6.3. Willingness to Participate in Terms of Money

Table 8 summarises our results with respect to WTP in terms of money.

Table-8. Willingness to participate in terms of money.

Variable	βeta (SE)	Wald	Df	Sig.	Exp(B)
Gender	-1.822 (.708)	6.613	1	.010*	.162
30-39 years	.206 (.843)	.060	1	.807	1.229
40-49 years	.611 (.939)	.423	1	.515	1.842
50-59 years	.764 (1.179)	.419	1	.517	2.146
More than 60 years	1.778 (1.582)	1.263	1	.261	5.916
No formal education	-2.750 (1.524)	3.257	1	.071***	.064
UPSR/Primary school	-2.880 (1.635)	3.104	1	.078***	.056
PMR/SRP/PT3	-2.533 (1.487)	2.904	1	.088***	.079
SPM/SPMV	-2.092 (1.266)	2.729	1	.099***	.123
Skills Certificate	-22.935 (14958.752)	.000	1	.999	.000
Diploma	-2.923 (1.426)	4.201	1	.040**	.054
Government servant	-19.106 (20770.202)	.000	1	.999	.000
Private servant	.031 (1.207)	.001	1	.979	1.032
Self-employed	.044 (1.296)	.001	1	.973	1.045
Unemployed	-.371 (1.096)	.115	1	.735	.690
Own	-3.975 (1.759)	5.104	1	.024**	.019
Parents/Family	-4.545 (1.644)	7.643	1	.006*	.011
Rent	-4.277 (1.526)	7.855	1	.005*	.014
Less than 5 years	1.957 (.895)	4.783	1	.029**	7.075
5-10years	2.809 (1.177)	5.696	1	.017**	16.589
11-15 years	.569 (1.403)	.164	1	.685	1.766
16-20 years	1.086 (.945)	1.322	1	.250	2.964
Less than RM1,000	-1.013 (.839)	1.459	1	.227	.363
RM1000-RM2000	-2.144 (1.155)	3.447	1	.063***	.117
RM2001-RM3000	-19.999 (15137.021)	.000	1	.999	.000
Ethnicity	1.041 (1.072)	.942	1	.332	2.831
Constant	4.687 (1.884)	6.188	1	.013**	108.567
No. of observations	137	Goodness of fits			
-2 log likelihood	95.903				
Cox & Snell R^2	.269	Chi-square	15.842		
Nagelkerke R^2	.422	Prob>Chi^2	.045		
Chi-square	42.854				
Prob>Chi^2	.020				

Note: *significant level at 0.01 **significant level at 0.05 ***significant level at 0.1.

The Cox and Snell R^2 shows that 26.9% of the variation in WTP can be explained by the independent variables, while the Nagelkerke R^2 shows 42.2% of the variation in WTP can be explained by the independent variables. In general, the model does not fits the data. Moreover, there are significant relationships between the dependent and independent variables with a p-value<0.05. In Table 8, only five out of eight variables are statistically significant: age, occupation and ethnicity do not significantly influence WTP.

We now consider in more detail the impact of each of the independent variables:

Gender has a negative significant impact on WTP in terms of money, with an estimation coefficient of 1.822; which indicates that increase in the proportion of men will decrease the WTP in terms of money by 1.822. The model predicts that the odds of WTP in terms of money are 0.162, indicating that men are 0.162 times unwilling to participate in terms of money compared to women. Although all female samples are slightly larger than male samples Table 1 and most of them are not earning much the self-employed and unemployed categories in Table 1, they are less likely to contribute a small amount of money (to buy tools, refreshments, etc.) during cleaning activities.

Education level has a negative significant influence on WTP. The model predicts that a one percent increase in the education level (i.e. No formal education, UPSR/Primary School, PMR/SRP/PT3, SPM/SPMV, and Diploma)

would generate 0.064, 0.056, 0.079, 0.123 and 0.054 WTP respectively, with more likely to willing to forgo money to participate in solid waste management. This indicates that the higher the level of education, the more unwilling respondents tend to be in foregoing money to participate in cleaning activities. The estimation coefficients for no schooling, UPSR/primary school, PMR/SRP/PT3, SPM/SPMV, and diploma increase are 2.750, 2.880, 2.533, 2.092, and 2.923 respectively.

Home ownership has a significant and negative influence on WTP. The estimation coefficient shows that the increase in house ownership, parents/family, and rental caused the WTP to decrease by 3.976, 4.545, and 4.277 respectively. Put differently, regardless of the pattern of ownership, residents are mostly unwilling to pay for the solid waste management. Nevertheless, those owning a house are 0.24 times more likely to participate compared to those who did not owned a house.

Length of stay has a positive and significant influence on WTP in term of money. The estimation coefficient of length of stay for less than 5 years and 5 to 10 years will increase WTP by 1.957 and 2.809 respectively. In essence, groups with less than 5years and 5 to 10 years are 0.029 and 0.017 times more likely to forgo money compared to other categories. It is possible newer residents are more fearful of effective punishment for non-participation.

Income level has a significant and negative influence on WTP in terms of money. The estimation coefficient indicates that an increase of a unit of income level for the dummy RM1000-RM2000 will decrease the WTP by 2.144 units. The model predicts that the ratio of WTP in terms of money for the dummy RM1000-RM2000 is 0.117. This indicates that people in this level of income are 0.117 times less likely to participate in terms of money in solid waste management. It is plausible that most residents are low income earners since they live in squatter housing. Moreover, for a level of income RM1000 to RM2000, they simply cannot afford to pay more for solid waste management.

Other variables are statistically insignificant with respect to WTP.

6.4. The Effectiveness of Solid Waste Management

After the implementation solid waste management under the anti-litter by-law, the water village was significantly cleaner. This appears to be because residents were afraid of punishment. In aggregate, 81.5% of respondents agreed that the law based solid waste management was effective while the remaining 18.5% felt it had been ineffective. The effectiveness of the solid waste management can be proportionate with community participation. Mr. Jaraiman - the officer responsible for managing solid waste management - stated that residents are critical for effective solid waste management. In addition, officers responsible for prosecuting the residents at Sembulan Tengah Water Village agree that law enforcement based solid waste management is the most effective approach to the solid waste problem.

7. CONCLUSION

The indiscriminate dumping or illegal disposal of household garbage in the non-rated areas of squatter water villages in Sembulan has been the most pressing environmental and public health problem confronting Kota Kinabalu City Hall. Previous attempts by Kota Kinabalu City Hall to tackle the problem were not successful, mostly because they did not take into consideration the determinants of WTP amongst the target population. Previous programs, such as buying back garbage, moral suasion, cleaning campaigns, erecting fencing, etc., were based on commonly held beliefs. These included the presumption that residents were uneducated and that stilt houses were typically rented. As a result, residents were assumed to engage in the indiscriminate dumping of garbage.

Our survey results demonstrate that most of these commonly held beliefs are misplaced. This paper shows that although their houses are in a squalid condition, residents are proud, especially of their view of sea. They would much prefer an environment free of floating trash. Indeed, some residents purchased their own portable garbage

bins and properly disposed of their garbage into large containers provided by Kota Kinabalu City Hall. However, these efforts were overwhelmed by the bad habits of other residents.

This study investigated in what ways the 2016 Anti-litter Bylaw nudged residents to change their attitudes to the solid waste problem. Our results shed light on the level of WTP and the determinants of participation. In essence, the participation amongst local residents is a precondition but not sufficient in itself to make solid waste management successful. Understanding the WTP of residents in the solid waste management is thus crucial. Binary logistic regressions employed in this study showed that WTP in solid waste management is influenced by age, gender, education level, home ownership, length of stay, income level and ethnicity. In this sense, the empirical analysis undertaken in this paper contributes to the existing literature on the factors which significantly influence WTP. We have extended the WTP by analysing it in terms of labour hours (in-kind) and money.

From a policy perspective, the most important contribution of the paper is that it can act as a reference point for similar studies in other areas. In this sense, the present study represents a 'pilot study' on solid waste management in squatter areas which can be replicated in other places. It can also contribute positively to improve future solid waste management by encouraging policymakers to use law-based management to mitigate solid waste problems.

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REFERENCES

[1] A. Jethoo, V. Upadhyay, and M. Poonia, "Solid waste collection and segregation: A case study of MNIT Campus, Jaipur," *International Journal of Engineering and Innovative Technology*, vol. 1, pp. 1-6, 2012.

[2] A. R. Mishra, S. A. Mishra, and A. V. Tiwari, "Solid waste management case study," *International Journal of Research in Advent Technology*, vol. 2, pp. 396-399, 2014.

[3] M. A. Eusuf, M. Ibrahim, S. A. M. Din, and R. Islam, "Solid waste generation characteristics: The Malaysian local authorities outlook," *Journal of The Malaysian Institute of Planners*, vol. 9, pp. 51-76, 2011.Available at: https://doi.org/10.21837/pmjournal.v9.i2.85.

[4] J. Suzianah, "The village judge clean the initiative in a week. Berita Harian Malaysia." Retrieved from Https://Www.Bharian.Com.My/Node/179166, p. 1, 2016.

[5] E. Nkansah, N. Dafor, and F. G. Essel, "Willingness to pay for improved solid waste disposal in Tema metropolis," *UDS International Journal of Development*, vol. 2, pp. 7-10, 2015.

[6] R. R. Sizya, "Analysis of inter - household willingness to pay for solid waste management in Mwanza City, Tanzania," *Journal of Resources Development and Management*, vol. 4, pp. 1-11, 2015.

[7] K. N. Addai and G. Danso-Abbeam, "Determinants of willingness to pay for improved solid waste management in Dunkwa-on-Offin, Ghana," *Journal of Agriculture and Environmental Sciences*, vol. 3, pp. 01-09, 2014.

[8] A. Niringiye and O. G. Douglason, "Determinants of willingness to pay for solid waste management in Kampala City," *Current Research Journal of Economic Theory*, vol. 2, pp. 119-122, 2010.

[9] D. Awunyo-Vitor, S. Ishak, and G. S. Jasaw, "Urban households' willingness to pay for improved solid waste disposal services in Kumasi Metropolis, Ghana," *Urban Studies Research*, pp. 1-8, 2013.Available at: https://doi.org/10.1155/2013/659425.

[10] D. Abebaw and M. Ayenew, "Demand for improved solid waste services in Jimma town, Ethiopia: Evidence from household survey data," *Ethiopian Journal of Economics*, vol. 14, pp. 55-72, 2005.Available at: https://doi.org/10.4314/eje.v14i2.39815.

[11] P. Lal and L. Takau, "Economic costs of waste in Tonga," A Report for the IWP- Tonga, SPREP and the Pacific Islands Forum Seretariat2016.

[12] R. Anjum, "Willingness to pay for solid waste management services: A case study of Islamabad," *Pakistan: Pakistan Institute Of Development Economics, CEECC Working Paper No.3*, 2013.

[13] R. Amfo-Otu, W. Debrah, K. Adjei, and S. Akpah-Yeboah, "Willingness to pay for solid waste collection in semi-rural Ghana: A Logit estimation," *International Journal of Multidisciplinary Research*, vol. 2, pp. 40-49, 2012.

[14] P. Trang, D. Toan, and N. Hanh, "Estimating household willingness to pay for improved solid waste management: A case study of Thu Dau Mot City, Binh Duong," presented at the MATEC Web of Conferences 95, ICMME 2016, 2017.

[15] M. W. Murad and C. Siwar, "Knowledge, attitude and behaviour of the urban poor concerning solid waste management: A case study," *Journal of Applied Sciences*, vol. 7, pp. 3356-3367, 2007.Available at: https://doi.org/10.3923/jas.2007.3356.3367.

[16] H. Park, "An introduction to logistic regression: From basic concepts to interpretation with particular attention to nursing domain," *Journal of Korean Academy of Nursing*, vol. 43, pp. 154-164, 2013.Available at: https://doi.org/10.4040/jkan.2013.43.2.154.

[17] D. Gujarati, *The logit and probit models. In D. Gujarati, Econometrics by Example.* New York: Mcgraw Hill, 2012.