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Contingent Valuation Method Study For A Sanitary Landfill

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Abstract

The current waste disposal policy in Malaysia is no longer reasonably sound with resultant amplification of environmental problems arising from landfilling activities. The upshot of this requires a policy change towards a more sustainable disposal method, with demand for a sanitary landfill. Therefore, this study identifies the demand for sanitary landfills by using a survey-based method, the Contingent Valuation Method. Questionnaire surveys were undertaken in Kota Bharu and Bachok to determine the willingness of households to pay for the non-market values of a sanitary landfill, described by its environmental benefits. Along with the willingness to pay responses, the collected information concerning socio-cultural factors was analysed and processed into a logistic model. The households were willing to pay RM7.23 per month (USD1.74 per month) for the environmental benefits offered by a sanitary landfill. The willingness to pay was higher among those who pay for solid waste management, instead of among those who would directly benefit from the implementation of the sanitary landfill. This study examined the influence of socio-cultural factors with regard to willingness to pay to understand how the local setting affects the decisions of households. On a larger scale, the influence of the socio-cultural factors could display differences in the willingness to pay between places, regions or countries. The results show a positive prelude with respect to additional payment for the sanitary landfill and incorporation of non-market values into the project appraisal for project feasibility. The results also suggest the need for concerted efforts to raise awareness of sustainable waste disposal equally among households.

Keywords: Contingent valuation method, Non-market valuation, Solid waste disposal, Sanitary landfill

1. Introduction

The Progressive Solid Waste Management and Public Cleansing Act (Act 672) was introduced in 2011 to bring about changes in the proper sanitation of solid waste management (SWM) and public cleansing in Peninsular Malaysia and the Federal territories of Putrajaya and Labuan. Tremendous efforts have been made to improve SWM by transferring the SWM executive authority to the federal government from local authorities, and subsequently privatising the SWM services.

The enactment of Act 672 was an initiative for a sustainable SWM with main strategies for efficient solid waste (SW) services, SW minimisation and appropriate final disposal of SW. However, the implementation of the act as a full pledge in Peninsular Malaysia has encountered challenges of poor governance, lack of commitment among the stakeholders, insufficient facilities and funds, lack of a recycling market and a lack of awareness (Kamaruddin, et al., 2017; Choon, et al., 2016; Abas and Wee, 2014; Saeed, et al., 2009; Periathamby, et al., 2007; Manaf, et al., 2009; Yuan, et al., 2011). As a result, SWM in few states in Malaysia still not articulated under Act 672. This hinders the initiatives to meet the objectives of sustainable SWM equally in all the states of Peninsular Malaysia.

This study focuses on SW disposal in Kota Bharu, the capital city of the state of Kelantan, which is currently experiencing sluggish improvement in SW disposal which is contrary to the intention of Act 672. The transference of executive authority of SWM from the local authority to the federal government is already in motion, however, the aforesaid challenges tend to idle the process. Due to land scarcity, the generated SW from Kota Bharu is transported to a landfill site in the adjacent district, Bachok which is 30 kilometres away from the centre of Kota Bharu as shown in Figure 1. The landfill is under governance of the Kota Bharu Municipal Council receiving SW not only from Kota Bharu but also from Bachok. With 80 % of the landfill capacity used to accommodate SW from Kota Bharu, the disposal costs are being funded through an annual assessment payment by the households in Kota Bharu. Insanitary handling of SW disposal has caused significant environmental problems to arise such as river pollution, groundwater pollution and dispersion of vector borne diseases causing threats and nuisance within the environment and among the nearby households (Nazri et al., 2012; Moorthy and Shattar, 2015; Ali, et al., 2017).

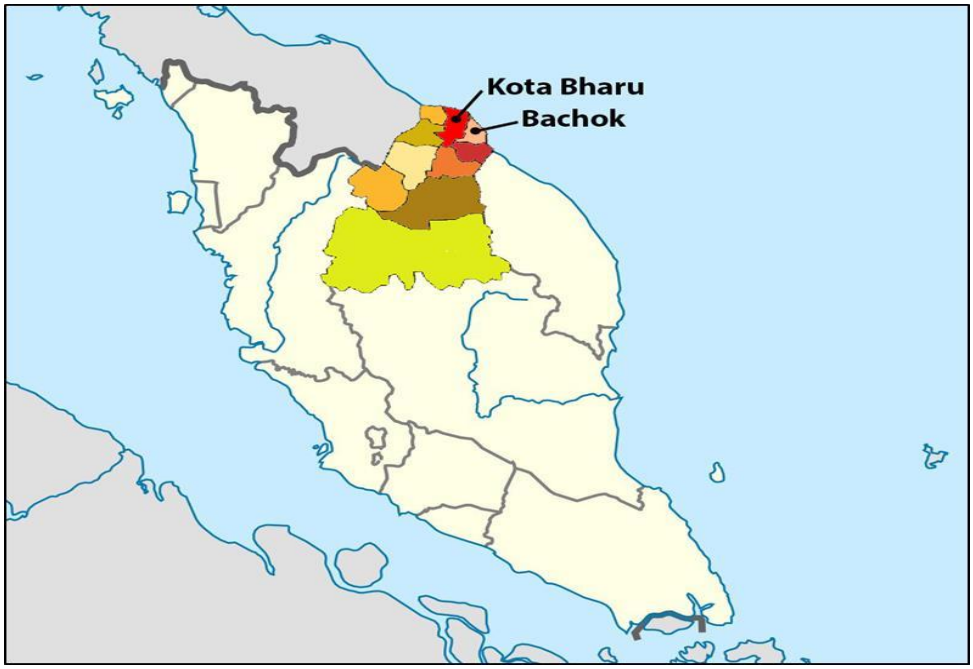

Figure 1. Location of Kota Bharu and Bachok in Peninsular Malaysia

With the given background, this study is motivated to support the initiatives regarding sustainable SW disposal in Kota Bharu. With the use of a non-market valuation method such as the Contingent Valuation Method (CVM), the households have been surveyed for their mean willingness to pay (WTP) for a sanitary landfill. A sanitary landfill is an integrated SW disposal facility equipped with provisions inclusive of cover soil, SW retaining structures, a drainage system, a leachate collection and treatment system, a gas collection system and a liner. These provisions have implications with respect to environmental protection by mitigating environmental impacts arising from landfill activities. The estimation of the mean WTP is based on four environmental attributes of a newly constructed sanitary landfill, inclusive of fully treated leachate discharge, no bad odour, controlled disease vectors and a pleasant view. The WTP is interpreted on a monthly basis of an additional SWM fee paid solely for the operation and maintenance of the sanitary landfill.

Corresponding to the intention of Act 672 to provide appropriate final SW disposal, this study has been carried out to yield the household demand information for SW disposal through elicitation of the WTP. The choice of Kota Bharu as the study area would be equivalent to the need for improving the SW disposal scheme in Kelantan to abate the harmful impacts from landfilling activities and to emulate the achievements of other states in providing sustainable SW disposal. This demand side information can be provided to the DNSWM and

SWCorp for future planning to provide a sustainable SW disposal service when the full transition of SWM executive power to the federal authority takes place. The WTP information is important for comprehensive budget analysis prior to project execution and to avoid mismatch between what the households want and the affordability from the supply side.

2.Literature Reviews

Upward trajectory of economic growth accelerating the rate of SW generation from increase in material production and consumption (World Bank, 2020). This creates excessive demand for SW disposal leading to the issues on negative externality. With landfilling as the most common method for disposal, many landfills stay unattended with severe pollution due to high management costs (Sahariah et al., 2015). The often associated landfilling impacts are landfill gas emission, leachate discharge, land use and disamenity effects degrading on the quality of the environment and human health from the excessive exposure (Edwards et al., 2018, Eshet et al., 2007, European Commission, 2000 and Martinez-Sanchez et al., 2017).

This requires a solution for a sustainable SW disposal method paralleled to the United Nation's pertinent targets for sustainable development that have a direct link to SWM (United Nation, 2016). Sustainable SW disposal would be those with minimum potential negative effects on society with them gaining maximum benefit from the SW disposal. Gradual implementation with realistic sustainable SW disposal goal is far more important than getting from a situation with no facilities at all to the state-of-the-art facilities in one 'leap' (Rodic and Wilson, 2017). For a developing country, a contemporary landfilling method by sanitary landfill is a sounder option rather than to implement a holistic SW disposal facility with SW reduction technologies by incinerating SW into ash prior to be landfilled. The gradual implementation is necessary to adapt with available resources, to match with local SW composition along with creating public awareness towards a change of pattern in their SW generation, SW composition and financial capability (Subhasish, et al., 2019).

A project on SW disposal facility is often challenged with public denial due to the "not in my backyard phenomenon" and the non-price of the SW disposal service (Willson, et al., 2013; Amirnejad, et al., 2018). Therefore, the onset of a sanitary landfill project should be able to address the challenges by taking the public point of view into account. This goes back to the goal of providing a sustainable SW disposal facility aiming at maximising the benefit to society. The benefit not only circulates around the disposal service itself but as also for the indirect values of the service, for instance, its environmental benefits. This requires the use of non-market valuation, in which, local insights of the people who directly benefit from the SW disposal service will be asked to determine their preferences. This study used CVM to assign economic value towards the sanitary landfill.

CVM is a questionnaire survey-based approach to elicit non-market values of proposed market conditions either offering potential improvement or to avoid potential damage. Based on the constructed hypothetical market condition, the CVM question was asked to elicit the maximum willingness to pay (WTP) or willingness to accept (WTA) of the customers, purposely to quantify the monetary values of the proposed market. CVM has received recognition as a methodology to estimate non-market values to support decision making, with emerging applications in valuing SWM across the globe with frequent evaluations on SW separation or recycling as articulated in Jamal, (2002), Aadland and Caplan, (2006), Yuan and Yabe, (2014) and Zen et al., (2014). There are not many CVM studies focusing on SW disposal except for Khee and Jamal, (2010) and Gaglias et al., (2016) who evaluated WTP for SW disposal. This is most probably driven by the fact that it is a back-end SWM service, hence it is not an easy task to elicit the WTP of an individual for a service that he/she is unfamiliar with.

It is a challenge to deliver CVM questions when the targeted respondents are not directly involved in the SW disposal service. This requires content validity of the survey instrument for successful conveyance of information to reduce protest bids (genuine zero WTP). Content validity are subjected to the realism of the survey instrument and at respondents' understanding and reactions to the questionnaire. Content validity can be tested in the questionnaire design, which may include focus groups, in-depth interviews and pre-testing (Bateman et al., 2002; OECD, 2021).

There are several WTP/WTA elicitation techniques for the CVM question such as open-ended, bidding game, payment card, single-bounded dichotomous choice (SB-DC) and double-bounded dichotomous choice (DB-DC) with each possessing different implications in yielding the WTP/WTA. This study used the DB-DC technique following extensive use of this particular technique in CVM literature, majorly due to its ability to avoid anchoring bias, to identify the location of the maximum WTP value and being statistically more efficient than the SB-DC technique (Hanemann, et al., 1991; Damigos, et al., 2016; Boyle, 2017). The DB-DC technique is an improvisation of the SB-DC technique by assigning one more bid to the initial bid where the direction of

the second bid depends on a YES or NO answer to the initial bid (Venkatachalam, 2004). The choices of the respondent to the first and second bids have implications towards the range of their WTP as indicated in Table I.

Table I. Willingness to Pay Implications from First Bid and Second Bid Responses

Response		Description	WTP implications
Yes/Yes	:	Respondent responses Yes for both first bid and upper second bid	WTP ≥ upper second bid
No/Yes	:	Respondent responses No on the first bid and Yes on lower second bid	Lower second bid ≤ WTP < first bid
Yes/No	:	Respondent responses Yes on the first bid and No on upper second bid	First bid ≤ WTP < upper second bid
No/No	:	Respondent responses No for both first bid and lower second bid	WTP < Lower second bid

3. Methodology

This study adheres to the key stages of the CVM application in the form of identification of bid values, construction of a policy scenario, questionnaire design, sampling plan and model estimation. The recommendations by the NOAA were followed closely to enhance the reliability of the findings such as conducting personal interviews, pretesting of the questionnaire, using the WTP elicitation format, minimising the non-response rate and using dichotomous choice questions (Yes or No) for WTP elicitation.

3.1 Identification of Bid Values

The double-bounded dichotomous choice (DB-DC) technique for WTP elicitation requires the presentation of bid values to the respondents. To provide priori information about the bid value ranges, an in-depth literature review, a focus group and a pre-test were held. The literature review scrutinised the range of WTP results from previous CVM studies in Malaysia. The studies that valued SWM resulted in a WTP ranging from RM5.82 to RM36.00 (Jamal, 2002; Begum, et al., 2007; Murad, 2007; Afroz and Masud, 2011, Rahimah, et al., 2012; Zen, et al., 2014). The WTP results of those related studies were discussed in a focus group session to examine whether the range of the values was relevant for this study. The participants for the focus group included six representatives from the responsible local authority in Kota Bharu and local households. The participants had different backgrounds to give unbiased and balanced insights on the bid values. They agreed on using bid values below RM10 which would be affordable and relevant to the policy change of improving SW disposal into a sanitary landfill.

Following the discussion from the focus group, a pre-test was then carried-out with 48 participants to elicit the actual range of bid values to be used for the actual survey as recommended by Hanemann and Kanninen (1999) and the NOAA. The open-ended technique was used since it had greater statistical power than single-bounded dichotomous choice (SB-DC) technique. Hence, it did not require as many observations for the pre-test. The question posed to the participants was as follows:

"Suppose Kota Bharu Municipal Council imposed an additional payment onto the *annual assessment payment, for* the *implementation of a sanitary landfill for a new solid waste disposal facility. What would be the maximum you would be willing to pay per month?"*

The participants directly stated the amount of their WTP which resulted in a range of WTP from RM1 to RM10. The results from the pre-test were consistent with the discussion in the focus group held earlier, agreeing on using any amount below RM10 as bid values. It was decided to use a narrowed range of first bid values for the actual survey (RM3, RM5 and RM7) since the actual DB-DC survey would include a lower bound and an upper bound of second bid values. The lowest bound would be RM1 and the highest bound would be RM9 as shown. The values chosen were affordable, relevant to the policy change of improving SW disposal into a sanitary landfill and most importantly, agreed by the prospective respondents. Hence, the non-response rate in the actual survey could be avoided.

3.2 The Policy Scenario

The questionnaire was designed to elicit the non-market value of a sanitary landfill. Hence, the questionnaire design must consist of an informative scenario of the changes from the status quo to achieve the improved policy since the respondents will be asked about their WTP based on the information given. The CVM literature shows that the policy scenario must be accompanied by a description of payment method to clearly define the

choice of benefit measures. These aspects were expected to have significant influence on the WTP of an individual.

In relation to this study, the scenario comprised a description of the changes from the improper SW disposal activities in the current operating landfill (status quo) to the newly constructed sanitary landfill (improved policy). The changes were defined by the environmental attributes of leachate discharge, bad odour, disease vectors and the view. The implementation of a sanitary landfill could alleviate the threats of the aforesaid environmental attributes with regard to the environment and human health in conjunction to the efforts of the government to meet the objective of sustainable SWM as enacted in Act 672.

The method of payment was well explained where the respondents from Kota Bharu had been paying for SWM twice a year through an annual assessment payment. Implementation of the sanitary landfill would require them to pay more, to avoid the environmental problems arising from the current SW disposal activities. Any decision on the sanitary landfill depended on their WTP. Based on the information given, the respondents were then asked for their WTP to indicate their agreement to the implementation of the sanitary landfill.

3.3 Questionnaire Design

Using a questionnaire as a survey tool requires a simple but innovative design to assist the understanding of the respondents (Jamal, 2005; Khee and Jamal, 2010). The main part of the questionnaire was to present the CVM question, but auxiliary questions were needed to stimulate the familiarity of the respondents with the topic being evaluated. General questions concerning the local SW disposal service were firstly included such as 'who provides the SW disposal service?', "how to pay for the SW disposal service?" and "where is the location of the current landfill?" The respondents were also asked to rank possible environmental problems encountered in the current landfill.

The CVM question consisted of the policy scenario and WTP elicitation questions. The construction of the scenario was as discussed earlier and presented through comparisons between the current landfill and a sanitary landfill described by environmental attributes such as leachate discharge, bad odour, disease vectors and the view. The improvement in these attributes with the implementation of a sanitary landfill represented mitigation of the environmental problems that were occurring in the current landfill. The CVM question using the DB-BC technique was posed in two-tiers as shown in Figure 2. In the question, the sanitary landfill was characterised by the improved environmental attributes, namely treated leachate discharge, no bad odour, controlled disease vectors and a pleasant view. In the first tier, respondents were offered the first bid value (e.g.: RM 5) representing an additional SWM fee for the sanitary landfill and they must vote either YES or NO to show their agreement/disagreement to pay the stated amount. In the second tier, they have to vote YES or NO in accordance to the first bid, if they say YES in the first tier, they will be posed with an upper second bid (e.g.: RM 7) and conversely if they said NO in the first tier, they will be posed with a lower second bid (e.g.: RM 3).

Many environmental problems are encountered in the Beris Lalang landfill due to landfilling activities. Suppose a new sanitary landfill could be built to avoid the environmental problems occurring. Please state your willingness to pay for such a sanitary landfill.

*Based on the questions below, if you choose **SANITARY LANDFILL**, it means you agree to pay an addition RM 5/month for the annual assessment payment which would mean the discharge of fully treated leachate, no odour, controlled disease vectors and a pleasant view.*

Characteristic	**SANITARY LANDFILL**			
Leachate	Fully treated discharge			
Bad Odour	No odour			
Disease Vectors	Controlled			
View	Pleasant			
Additional Fee	**RM 5/month**			
Are you willing to pay?	**YES**		**NO**	
	If **YES**, are you willing to pay an additional fee of RM 7/month?		If **NO**, are you willing to pay an additional fee of RM 3/month?	
	YES	**NO**	**YES**	**NO**

Figure 2. Double Bounded Dichotomous Choice Question

Following the CVM question, the socio-demographic background of the respondents was recorded by asking them questions concerning their residential area, gender, age, education, occupation, house-ownership, household size and income.

3.4 Sampling Plan

Three versions of the questionnaire using different first bid values (RM 3, RM 5, RM 7) were distributed to 624 respondents in two study areas, Kota Bharu and Bachok, which posed the mutual similarity of having SW disposed in the same landfill. This sample range was adequate following previous non-market valuation studies in Malaysia (Jamal, 2002; Afroz and Masud, 2011, Khee and Jamal, 2010; Rahimah, et al., 2012). For each questionnaire version, 208 respondents were approached. Following the ratio of the actual population in the study areas, questionnaire version one was distributed in Bachok and the remaining versions were distributed in Kota Bharu. Table II shows the bid values used in the three versions of the questionnaire.

Table II. Bid Values used in Different Questionnaire Versions

Questionnaire	First Bid	Lower Second Bid	Upper Second Bid
Version one	RM 3	RM 1	RM 5
Version two	RM 5	RM 3	RM 7
Version three	RM 7	RM 5	RM 9

The 624 household representatives aged 18 and above were randomly approached on weekdays and weekends in their homes by trained enumerators for the questionnaire survey. Face to face survey distribution was conducted since this method has the advantage of allowing the enumerators to explain and assist respondents to answer the questionnaire with accurate and complete responses. For that reason, the enumerators were firstly given role playing exercises of how to approach and assist respondents without initiating possible biases prior to the survey distribution.

3.5 Model Estimation

The theoretical background of CVM is composed from the structure of utility function and econometrics theory (Ferreira and Marques, 2015). This study employed CVM by using the double-bounded dichotomous choice technique. Hence the discussion of the estimation procedure of CVM will focus on its associated theoretical basis, namely the random utility theory (Hanemann, 1984). By estimating WTP through the random utility theory, an individual is aware of his utility function concerns concerning the non-market values of a good or a service. Given that these preferences are unobservable by researchers, they can be classified as random variables where the error term is directly included in the utility function. Following the DB-DC CVM technique, each respondent is presented with two bids where the level of the second bid is contingent on the response to the first bid. If the respondent responds with YES to the first bid (denoted by $\boldsymbol{B^i}$), then the second bid (denoted by $\boldsymbol{B_i^u}$) comprises an amount greater than the first bid ($\boldsymbol{B_i^u} > \boldsymbol{B^i}$). If the respondent replied with NO to the first bid, then the second bid ($\boldsymbol{B_i^d}$) is an amount smaller than the first bid ($\boldsymbol{B_i^d} < \boldsymbol{B^i}$). Therefore, there will be four possible outcomes under the assumption of utility maximisation of the respondent:

a) When both answers are YES (πyy), then we have Biu > Bi :

$$\pi^{yy}(B_i, B_i^u) = \Pr\{B_i \leq \max WTP \text{ and } B_i^u \leq \max WTP\} \quad (1)$$

$$= \Pr\{B_i \leq \max WTP | B_i^u \leq \max WTP\} \; Pr\{B_i^u \leq \max WTP\}$$

$$= \Pr\{B_i \leq \max WTP | B_i^u \leq \max WTP\} \; Pr\{B_i^u \leq \max WTP\}$$

$$= Pr\{B_i^u \leq \max WTP\} = 1 - G(B_i^u, \theta)$$

Since $B_i^u > B_i$,

$$\Pr\{B_i \leq \max WTP | B_i^u \leq \max WTP\} = 1$$

Similarly $B_i^d < B_i$,

$$\Pr\{B_i^d \leq \max\ WTP | B_i \leq \max\ WTP\} = 1$$

b) When both answers are NO (π^{nn}), then we have $B_i^d < B_i$:

$$\pi^{nn}(B_i, B_i^d) = \Pr\{B_i > \max WTP\ and\ B_i^d > \max\ WTP\} = G(, B_i^d, \theta) \quad (2)$$

c) When a YES is followed by a NO (πyn), then we have Biu > Bi :

$$\pi^{yn}(B_i, B_i^u) = \Pr\{B_i \leq \max WTP\ \leq B_i^u\} = G(B_i^u, \theta) - G(B_i, \theta) \quad (3)$$

d) Finally, when a NO is followed by a YES (πny), then we have Bid > Bi :

$$\pi^{ny}(B_i, B_i^d) = \Pr\{B_i \geq \max WTP \geq B_i^d\} = G(B_i, \theta) - G(B_i^d, \theta) \quad (4)$$

In Equation (3) and Equation (4), the second bid allows placement of the lower and upper bounds of the true WTP of the respondent. Meanwhile in Equation (1) and Equation (2), the second bid sharpens the single bound by raising the lower bound or lowering the upper bound. Given a sample of N respondents with B_i, B_i^u and B_i^d as the bids used for the ith respondent, the log-likelihood function takes the form as follows:

$$\ln L^D(\theta) = \sum_{i=1}^{N} \{d_i^{yy} ln\, \pi^{yy}(B_i, B_i^u) + d_i^{nn} \ln \pi^{nn}(B_i, B_i^d) + d_i^{yn} ln\pi^{yn}(B_i, B_i^u) + d_i^{ny} ln\pi^{ny}(B_i, B_i^d)\} \quad (5)$$

where d_i^{yy}, d_i^{nn}, d_i^{yn} and d_i^{nn} are binary-valued indicator variables. The maximum likelihood (ML) estimator for the double-bounded model, θ^D, is the solution to the equation $\partial lnL^D(\theta^D) / \partial\theta = 0$ subject to $\partial^2 lnL / \partial Q^2 < 0$. The double-bounded dichotomous choice model is estimated by using the logistic model due to its ability to deal with a dichotomous dependent variable.

CVM application enables welfare measurement through estimation of either mean or median WTP. The mean for the double-bounded technique is calculated from the area under the probability function of accepting the bid using an integration approach. The area signifies those who would enjoy the good or service at each price level, and their associated utility. It can be expressed as:

$$E(WTP) = \int_L^U (1 + e^{a+bwilling})^{-1}\, db \quad (6)$$

Where $(1+e^{a+bwilling})^{-1}$is the probability of saying YES and U and L are the upper and the lower limits of the integration consecutively. Meanwhile, the WTP median can be obtained through:

$$Median\ WTP = e^{\left(\frac{a}{b}\right)} \quad (7)$$

Since the analysis for this study includes independent variables, hence α is a linear function of the independent variables, of which $\alpha = X\beta$ where X is a vector of the independent variables and β is a vector of parameters

4.Results and Discussion

4.1 Socio-demographic and Knowledge Background of the Respondents

Relevant socio-demographic profiles of the respondents of whom the WTP were calculated for CVM analysis are shown in Table III. The average monthly household income was RM 2674.07. The mean age of the respondents was 41 years old given that the age range of the respondents was 18 years old to 80 years old. Some 74 % of the respondents resided in their own houses meanwhile the rest lived in rented houses or lived with parents. It would appear that 75 % of the respondents live 20 kilometres or more from the Beris Lalang landfill representing those who are from Kota Bharu. Meanwhile, 25 % of the respondents live within a 20 kilometres radius of the Beris Lalang landfill, representing those who are from Bachok. Some 69.7 % respondents were employed by the government sector, the private sector or were self-employed. Another 30.3 % were

unemployed, proclaiming they were either retirees, housewives or students. Some 61.9 % of the 624 respondents acknowledged the occurrence of environmental problems in the current operating landfill.

Variable	(%)	Mean
Age		41.53
Household income (RM)		2674.07
Distance from landfill		
Below 20 km	25.0	
20 km and above	75.0	
Employment		
Employed	69.7	
Unemployed	30.3	
House-ownership		
Self-owned	74.0	
Rented	25.0	
Parents' house	1.0	
Acknowledge the problems in current landfill	61.9	
Acknowledge the SW disposal fee	63.5	

Table III. Socio-demographic and Knowledge of the Respondents

Among the environmental problems, the respondents were asked to choose and rank only four environmental problems that occur in the landfill that reflects their own experience or general knowledge about SW disposal. Table IV shows the ranking of the environmental problems as perceived by the respondents. The results showed that bad odour, vector-borne diseases and groundwater pollution were the highest ranked impacts due to operation of the landfill. Other environmental problems including river pollution, air pollution, unpleasant view and soil erosion were the least ranked impacts. Apparently 63.5 % of the respondents acknowledged that fractions of the biannual payment for annual assessment (local tax imposed by the local authority) cover the expenses for SW disposal in Kota Bharu.

Table IV. Ranking of Environmental Problems in Current Operating Landfill

Environmental problems	Mean	Std. deviation	Ranking
Vector borne diseases	2.10	1.12	2
River pollution	2.59	1.03	4
Groundwater pollution	2.54	0.89	3
Bad odour	2.08	1.09	1
Soil erosion	3.06	0.85	7
Air pollution	2.96	0.97	5
Unpleasant view	3.03	1.10	6

4.2 Responses With Regard to Double Bounded Dichotomous Choice Questions

The analysed responses of the three versions of the DB-DC CVM questionnaires, differentiated by the value of the first bid (RM 3, RM 5, RM 7) are summarised as shown in Table V. Among the respondents presented with RM 3 as the first bid, 36.1 % of them had a maximum WTP higher than RM 5 per month by responding YES/YES to the first and the second bid. Aggregating the responses for NO/YES and YES/NO, 59.6 % had a WTP between RM 1 and below RM 5 per month. Only a minority of the respondents had a WTP lower than RM 1.

Table V. Responses with regard to Double Bounded Dichotomous Choice Questions

First bid	Upper second bid	Lower second bid	Yes/Yes	No/Yes	Yes/No	No/No	Total
RM 3	RM 5	RM 1	75 (36.1 %)	51 (24.5 %)	73 (35.1 %)	9 (4.3 %)	208 (100 %)
RM 5	RM 7	RM 3	95 (45.7 %)	30 (14.4 %)	51 (24.5 %)	32 (15.4 %)	208 (100 %)
RM 7	RM 9	RM 5	66 (31.7 %)	37 (17.8 %)	73 (35.1 %)	32 (15.4 %)	208 (100 %)

From the 208 respondents presented with RM 5 as the first bid, 45.7 % of them responded YES/YES denoting their willingness to pay higher than RM 7 per month. This percentage is higher even when compared to the aggregated percentage (38.9 %) of the respondents who replied with NO/YES and YES/NO which implies a WTP between RM 3 to below RM 7 per month.

The highest value for the first bid imposed was RM 7. Among the 208 respondents, the highest percentage at 35.1% indicated willingness to pay between RM 7 to RM 9 per month. The percentage of respondents who were willing to pay more than RM 9 per month was encouraging at 31.7 %. From these results, it shows positive feedback for the WTP elicitation. The use of an appropriate range of bid values to capture the WTP of the respondents encouraged positive responses.

4.3 Logistic Model

The DB-DC model was estimated by using logistic regression comprising of the WTP for the sanitary landfill as a dependent variable and socio-economic and socio-cultural factors as independent variables as described in Table VI. Information on the factors was obtained from the survey to elicit whether they have influence on the WTP. The specification of the model was as follows:

$$\mathrm{WTP} = \mathrm{C} + \beta_1 * LINC + \beta_2 * LAGE + \beta_3 * HOM + \beta_4 * EMP + \beta_5 * ALAND + \beta_6 * APAY + \beta_7 * DIS + \beta_8 * BID \quad (8)$$

It was expected that the WTP would have a positive relationship with LINC, the log of income and EMP. Meanwhile the WTP was predicted to have negative relationship with LAGE, the log of age. The relationship of WTP with APAY, ALAND, HOM and DIS was anticipated since these variables represent local socio-cultural factors that may direct to a positive or negative WTP. Finally, for BID, it was expected to have a negative relationship indicating the higher the bid amount, the smaller the probability of WTP. These expectations were deduced from the findings from many CVM studies concerning SWM, just to name a few Wang, et al., (2014), Khee and Jamal, (2010), Jamal, (2002) and Afroz and Masud, (2011) Rahji and Oloruntoba, (2009).

Table VI. Variables in the Logistic Model

Variable	Definitions	
Dependent variable		
WTP	Willingness to pay	1 = Agree to pay
		0 = Disagree to pay
Independent variables		
C	Constant	
INC	Household income (ratio data)	
AGE	Household age (ratio data)	
HOM	House ownership	1= Self-owned
		0= Others
EMP	Employment	1= Employed
		0= Unemployed
ALAND	Acknowledgement of problems in landfill	1= Acknowledged
		0= Unacknowledged
APAY	Acknowledgement of SWM fee	1= Acknowledged
		0= Unacknowledged
DIS	Distance from the current landfill	1= 20 km or above (Kota Bharu)
		0= Below 20 km (Bachok)
BID	Additional fee	Monthly fee

The results of the estimated model, as shown in Table VII show that LINC, the log of income had a significant positive sign at 1 % denoting respondents with higher income were most likely to agree to pay for the sanitary landfill. LAGE, the log of age had a significant negative relationship with WTP. It was assumed that the younger respondents were more lenient and less uptight when making decisions about policy changes. Hence this would lead to their positive responses with respect to their WTP. EMP on the other hand had a negative insignificant influence on the WTP, deviating from the norm results. This may be due to retirees who proclaimed they were unemployed but had a stable income that led to their WTP.

HOM and APAY had highly significant positive coefficients denoting the tendency of the WTP for sanitary landfill among the respondents who owned their housing property and for those who knew about the inclusion of the SWM fee into the annual assessment payment. DIS had highly significant positive coefficients representing higher WTP among the respondents who lived in Kota Bharu at 20 km or further distance from the current landfill. ALAND was found to insignificantly influence the positive WTP. Finally, BID had a significant negative relationship with WTP indicating the higher the bid amounts tended to lower the WTP of the respondents (the respondents were presented with RM 3, RM 5 and RM 7 for the first bid). This was an expected result since paying a higher amount would decrease the utility of a person parallel with the results of the SWM valuation in Amirnejad, et al., (2018), Afroz and Masud, (2011), Rahji and Oloruntoba, (2009) and Ferreira and Marques, (2015).

Table VII. Estimation Results from the Logistic Model

Variables	**Coefficients**
C	-1.632
	(1.495)
LINC	0.086 ***
	(0.113)
LAGE	-0.543 **
	(0.223)
HOM	0.3767 **
	(0.181)
EMP	-0.091
	(0.194)
ALAND	0.152
	(0.171)
APAY	0.496 ***
	(0.166)
DIS	1.346 ***
	(0.210)
BID	-2.996 ***
	(0.135)
Summary statistics	
Log-likelihood	786.894
AIC	-2.522
BIC	-2.522
χ^2	1573.788
Iterations completed	14
Observations	624

Note: Parentheses indicate the standard errors of the respective coefficients. *Significant at 10 % level ** Significant at 5 % level *** Significant at 1 % level.

4.4 Willingness to Pay Estimation

The application of CVM yielded a mean WTP value for an overall improvement in the sanitary landfill. The mean value for the double-bounded technique was calculated as the area under the probability function of accepting the bid using an integration approach as can be referred to in Equation (6).

Table VIII. Estimated Mean and Median Willingness to Pay

	RM/month
Median	5.98
Mean	7.23
CI 95 % Mean	5.07 to 7.07

From the regressed double-bounded model, the mean and median WTP for the sanitary landfill was estimated as stipulated in Table VIII. The mean WTP was slightly higher than the median WTP with the respondent's WTP of RM 7.23 per month and RM 5.98 per month respectively. These results are in the WTP range based on previous CVM studies concerning SWM in Malaysia ranging from RM 3.78 to RM 36.00 (Jamal, 2002; Murad, et al., 2007; Khee and Jamal, 2010; Afroz and Masud, 2011; Rahimah, et al., 2012; Zen, et al.., 2014). By focusing on the mean WTP, the aggregated WTP for an additional fee for the sanitary landfill would be RM 86.76 per year. This value is an additional payment into the annual assessment for a newly constructed sanitary landfill by using the specification of a Level 4 sanitary landfill with fully-treated leachate prior to discharge, no presence of bad odour, controlled disease vectors and a pleasant view.

5. Conclusion

Driven to assist with policy change towards sustainable SW disposal, this study undertook a non-market valuation by employing CVM to ask a sample of households about their preferences towards the first sanitary landfill constructed in Kelantan. Being a novel project, the acceptance of households regarding a sanitary landfill was still vague. This study may help to fill the gap by determining the WTP among the households in Kota Bharu and Bachok in respect of the benefits of a sanitary landfill.

Since SW disposal is an unfamiliar issue among households in Kota Bharu and Bachok, innovative approaches were taken to avoid protest bid probabilities towards the sanitary landfill. As suggested by Bateman et al., (2002) and OECD, (2021), questionnaire design included focus group and pre-testing to test content validity of the questionnaire. Since the WTP questions was based on the hypothetical context, questionnaire handling in this study prioritized on assisting with the respondents' understanding. Among initiatives taken were using visual aids to compare the differences in the current landfill and the sanitary landfill, interpreting DB-DC CVM questions into two-tiers to reduce the cognitive burden and the assistance of trained enumerators.

From the valid number of 624 respondents interviewed during the questionnaire distribution, the responses were analysed and manipulated into a logistic model to elicit their WTP and to address factors influencing their WTP. From the welfare estimation, a mean WTP of RM 7.23 per month was derived representing the price that the households were willing to pay giving two forms of consequential progress. First, an additional payment on top of the usual payment for SWM and second, the use of the non-market value of project appraisal.

Imposing an additional payment for sanitary landfill in Kota Bharu is quite complicated due to indirect SWM payment through an annual assessment payment. With different amounts being paid across the households depending on their property value, the additional payment for sanitary landfill must be a fixed rate. To illustrate, by using a non-market value of RM 7.23 per month, the annual additional payment proposed would be RM 86.76 per household. Considering the annual assessment is usually paid twice a year, allocating RM 43.38 per payment should not be burdensome for the households to pay.

The non-market value derived from the household perception can be provided to the DNSWM and SWCorp to provide a sanitary landfill for SW disposal when the full transition of SWM executive power to the federal authority takes place. A sanitary landfill requires high capital cost where a tight budget hinders the implementation. The inclusion of non-market value of the sanitary landfill into Cost-Benefit Analysis can improve project feasibility by internalising external benefits into the decision-making process. Besides, consideration of public agreement/disagreement as part of the project appraisal will avoid the opposition of the public which otherwise could halt project development or cause payment refusal in the future. In overall, the use of CVM for WTP elicitation with respect to the sanitary landfill provides a new insight regarding turning over a new leaf in the sanitary landfill project, albeit a financial dilemma amid SWM policy change.

This study anticipates discovering whether local socio-cultural factors have an influence on the WTP for a sanitary landfill. The respondents were informed that the sanitary landfill location was adjacent to the current landfill site in Bachok by assuming a higher WTP among the respondents in Bachok who will benefit from the mitigated environmental impact. Contrary outcome shows a higher WTP among the respondents from Kota Bharu coinciding with a higher WTP result among the house-owners. This proves the influence of the local setting with prudent behaviour among those who are responsible to pay for the current SWM services, instead of among those who will directly benefit from the implementation of the sanitary landfill. No obligation to pay for the current SW disposal causes the households from Bachok to be indifferent on the environmental protection issue. This brings to the importance to develop their awareness to not jeopardise payment consistency when the additional payment for SW disposal is imposed with innovative approaches through the local media, social networks or giving incentives.

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