Journal of Sustainability Science and Management
Volume 8 *Number* 2, December 2013: 197-206
ISSN: 1823-8556

IMPROVEMENTS IN DOMESTIC WATER SERVICES IN KELANTAN: ARE PEOPLE WILLING TO PAY?

MAHIRAH KAMALUDIN[1*], KHALID ABDUL RAHIM[2], ALIAS RADAM[3] AND MOHD RUSLI YACOB[4]

[1]Agricultural and Food Policy Studies Institute, [2]Agricultural and Food Policy Studies Institute, [3]Faculty of Economics and Management, [4]Faculty of Environmental Studies, University Putra Malaysia, 43400 UPM Serdang, Selangor.

**Corresponding author: mahirahkamaludin@gmail.com*

Abstract: This study evaluated the willingness to pay by the people in Kelantan for improved domestic water services. Unsatisfactory services by the Kelantan water company are a long-standing issue in the state. Excessive water consumption, frequent interruptions, rapid social and economic growths are putting higher demands for quality of services and the water company is unable to cope with the growing number of populations. This study employed Choice Experiment (CE) method to examine other possible preferences in domestic water services. This method highlighted four attributes such as water quality (QUAL), water interruption (INT), non revenue water (NRW) and water prices (WP) in its services. Respondents were required to trade off their income for positive changes in the services. Basic and interactions in Conditional Logit (CL) models were estimated to account for heterogeneity in the selected choices of the consumers from options provided in water service attributes. A survey has been carried out with 552 respondents based in every district (stratum) in the state. It is interesting to note that of the four attributes considered in this study, reducing the frequency of water interruption becomes a priority in the services for the population.

KEYWORDS: Choice experiment, willingness to pay, water services, conditional logit, marginal value.

Introduction

The importance of water to life cannot be denied as water is the most precious substance among all of our natural resources. High growth rates in population, increasing water consumption, and water pollution are among the factors which are putting pressure on water resources. Hence, any new development of water resources and improvement in water services should be found immediately to meet the increasing water demand. Interruptions in services and other failures in water industry are a controversial issue in Kelantan. The 9th Malaysia Plan states that Kelantan is ranked 13th in Malaysia based on development composite index by state and a large share of the population lives in rural areas. A few states which are less developed in Malaysia struggle to improve water coverage mostly in rural areas including Kelantan (Lee, 2011). There are many problems in Kelantan's water industry which show low water supply coverage, the highest Non Revenue Water (NRW) rate in the country, low production capacity and a low quantity of water supply (National Economic Planning Unit, 2006). Kelantan may not have adequate financial resources to enhance water supply coverage.

The sole water provider in Kelantan is Air Kelantan Sdn. Bhd. (AKSB). The water sector was privatized in October 1995 and before this it was under the Water Supply Division, Public Works Department. A research by the Association of Water and Energy Research Malaysia (2011) highlighted some cases in Kelantan with low coverage performance, dirty and smelly water supply and frequent unscheduled interruption. Presently, water tariffs are low and unable to generate enough revenue to cover the full cost of capital investment, operation and maintenance. Water tariff in 2009 only covered 78% of operating expenses (National Economic Planning Unit, 2010). Kelantan ranked 3rd in

2011 which demonstrates lowest water prices for domestic water services (RM0.55 applied for first 35m^3). If the price is too low, the water company will not be able to maintain and sustain its operations and if the price of water is too cheap it leads to wastage. Inexpensive water and its ample supply makes consumers take water for granted. Low pricing of water can cause serious wastage of water. Thus, poor condition of water supplied, low water prices, lack of financial resources and facilities are worsening the industry in the state. An important question remains to be answered; are consumers willing to pay for higher service standards with the intention to improve the domestic water services? The opinion and preferences from consumers will help the industry with upgrading projects and improvement in facilities, so that they gain benefit from higher standard of services in the future.

The main objective of this study is to valuate water service attributes in Kelantan. People have been presented with a set of preference then they select the best preference for improvement. This study estimates the monetary trade off between all attribute levels and price attribute. Marginal willingness to pay is calculated by the differences in coefficients between the two attribute levels. People preferences and tastes will be able to determine willingness to pay and demonstrate the ability to pay.

Consumers are willing to pay a higher price if they obtain a high social value from the water service. Many previous researchers such as Vasquez *et al.,* (2009), Farolfi, Mabugu and Ntshingila (2007) and Larson, Lew and Onozaka (2001) have used willingness to pay (WTP) approach for improving water supply services in their studies. WTP reveals that if something is worth having, then it is worth paying for. Adamowicz (1994) was the pioneer in CE method in non market valuation of environmental resources. Hensher *et al.,* (2005) conducts a study to know how much consumers are willing to pay for specific service levels and finds that people are willing to pay in order to reduce the frequency of water interruptions and wastewater overflows. The strength of CE method is that it will seek people's preferences based on characteristics/attributes of the goods and services and it is able to tell the social preferences based on the different management scenarios of environmental assets (Perni *et al.,* 2012).Besides, it provides a richer data set that includes benefit transfer potential, context flexibility, strategic bias reduction and framing effect control (Do and Bennet, 2007). However, the CE involves greater demands on concentration and patience of respondents in order to choose the best preference in a choice set. The respondents are faced with the cognitive burden due to complex tasks (Bennet and Blamey, 2001). This application takes time as it needs the respondents to study and understand the attributes and their levels.

Methodology

This study used Choice Experiment (CE) to determine consumer's willingness to pay by eliciting consumer preferences since an improvement in water services can be explained by the attributes and consumer's valuation relies on attribute levels. The respondents were provided with a 'choice set' which includes three choices including *status quo* or current water services. The choices are explained in terms of a common set of attributes and the choices are differentiated from one another. The attributes and attribute levels indicate the values on the program for improved domestic water services. The selected attributes are water quality, water interruption, non-revenue water, and water prices. Too many attributes may put high burden on respondents, however if the attributes are too few, it reduces the accuracy of the results since some information may be absent (Mohd *et al.,* 2008). Conditional Logit (CL) model is used to estimate the CE method. The utility function includes U_i^c as dependent random variable, attributes of the investigated program and their attribute levels is V_i^c and random unobservable component ε_i^c. The model shows that the utility which a consumer *c* correlates with alternative *i* is stated as:

$$U_i^c = V_i^c + \varepsilon_i^c \qquad \text{(Equation 1)}$$

Equation 1 offers consumers, c with c = 1, 2, 3,... and a set of alternative choices which is i = 1, 2, 3,... Probability of consumer c choosing alternative i can be denoted in parametric function of general form represented as follows:

$$Prob_i^c = f(x_i^c, x_j^c; \text{i} \neq \text{j}, \beta) \quad \text{(Equation 2)}$$

Where;

$Prob_i^c$ = Probability of consumer c in choosing alternative i

x_i^c = Parameter of observable characteristics of alternative i for consumer c

x_j^c = Parameter of observable characteristics of alternative j for consumer c.

McFadden (1974) as cited by Hanley *et al.,* (1998) states that the analysis of CL model assumes that the random error terms are independently and identically distributed (IID) based on Gumbel distribution (Type 1). The probability that consumer c chooses alternative i over alternative j with the presence of the random term can be written as below:

$$Prob_i^c = Prob\ \{(U_i^c > U_j^c)\}\ ;\ \text{i} \neq \text{j} \quad \text{(Equation 3)}$$

$$= Prob\{(V_i^c + \varepsilon_i^c) > (V_j^c + \varepsilon_j^c)\}\ ;\ \text{i} \neq \text{j} \quad \text{(Equation 4)}$$

$$= Prob\{(V_i^c - V_j^c > (\varepsilon_i^c - \varepsilon_j^c)\}\ ;\ \text{i} \neq \text{j} \quad \text{(Equation 5)}$$

Probability of consumer c choosing alternative i over alternatives j in the choice set C can be shown as below:

$$Prob_i^c = \frac{exp\ (\mu V_i^c)}{\sum_j^J exp(\mu V_j^c)} \quad \text{(Equation 6)}$$

Assuming that the demonstrates a linear parametergeneralized specification of utility function can be written as below:

$$V_i^c = \beta_1 x_i^c + \beta_2 x_{1i}^c + \beta_3 x_{2i}^c + \ldots\ldots\ldots + \beta_s x_{si}^c \quad \text{(Equation 7)}$$

Where β is vector of parameters to be estimated and x signifies for all explanatory variables in the model.

$$Prob_i^c = \frac{exp\ (\beta' V_i^c)}{\sum_j^J exp(\beta' V_j^c)} \quad \text{(Equation 8)}$$

According to Equation 7, the β coefficients can be used to estimate the marginal rate of substitution (MRS) or at which consumers are willing to trade-off between the attributes. The substitution rate can be estimated by dividing the β coefficient with another β coefficient (monetary attribute) and multiply it by -1. So, the equation is as follows:

$$\rho_k^c = \frac{\frac{\partial V}{\partial x_{c,s}}}{\frac{\partial v}{\partial P_{c,s}}} = \frac{-1\beta_{c,s}}{\beta_{c,s=p}} = -\frac{\beta_{attribute}}{\beta_{monetary}} \quad \text{(Equation 9)}$$

If consumers induced changes in water industry, this study presents a set of attributes and the choices can be made by respondents so that they can reveal their preferences. The attributes consist of qualitative (e.g., water quality) and quantitative (price) items and are constructed based on discussions with supervisors, expertise, officers in AKSB and information from previous studies. Table 1 shows the chosen set of attributes and attribute levels to provide options in making decisions for a change in their domestic water services. The first attribute is water quality (QUAL). There are three levels chosen for this attribute such as satisfactory, good and very good. The attribute levels illustrate whether the indicators meet WHO standard or not. This study follows the WHO guideline which is specified through the contents such as *Acidity(pH),* level of *Nitrate(NO_3),Nitrite (NO_2)* and *Ammonia (NH_3), Turbidity (NTU)* and *Hardness* or *Calcium (Ca2+)*in the water supplied. The level should not exceed level for consumption because it may pose risks to human health.

The second attribute is water interruption (INT). The levels assigned for this attribute are frequently, sometimes and never. The attribute levels describe the frequency of water supply interruption happening in their homes. Frequent water supply interruptions can affect various daily activities and complicate consumers in many ways. The third attribute is Non Revenue Water (NRW). High rates of NRW can be viewed as poor performance of delivery services to consumers. Three levels are selected such as high, moderate and low. The targeted and expected percentages of NRW are selected as the attribute levels and they can be considered as a benchmark of their performance.

Table 1: List of attributes and their Levels Selected for the Study.

Attributes	Attribute Levels	Description
Water Quality	*Satisfactory*	*Meets the level of indicators set by WHO but still need to be improved.*
	Good	Meets the level of indicators set by WHO.
	Very Good	Meets the level of indicators set by WHO and improves the quality of water supply constantly.
Water Interruption	*Frequently*	*Water supply interruption has always been a few times a year.*
	Sometimes	Water supply interruption has been once a year.
	Never	Never been interrupted.
Non Revenue Water	*High*	*Maintain the current NRW percentage (52%).*
	Moderate	Achieve the targeted NRW percentage (35%).
	Low	Achieve the national average NRW percentage (30%).
Water prices	*No Change:*	*Maintain the current water prices (RM0.55).*
	Increase 18%:	Increases by 18% from current water prices (RM0.65)
	Increase 45%:	Increases by 45% from current water prices (RM0.80)
	Increase 78%:	Increases by 78% from current water prices (RM0.98)

Note: *Italics* demonstrates the status quo attribute levels.

Table 2: Example of CE Question in Questionnaire.

	Service Option 1	**Service Option 2**	**Current Service Option**
Water Quality	Good	Good	Satisfactory
Water Supply Interruption	Sometimes	Frequently	Frequently
Non Revenue Water (NRW)	Low	High	High
Water Price	Increase 78%	Increase 18%	No Change
Option	x		

Table 3: Total of Respondents According to the Districts.

District	No. of Respondents	Percentage (%)
Kota Bharu	168	30
Pasir Mas	70	12.7
Tumpat	55	10
Bachok	46	8.3
PasirPuteh	44	8
Tanah Merah	45	9
Kuala Krai	38	7
GuaMusang	34	6
Machang	35	6
Jeli	17	3
Total	552	100

Monetary attribute in this study is water price (WP). Inclusion of price attribute is important in CE studies as it permits the estimation of marginal willingness to pay for other attribute. The adjustment in the prices brings a major impact on consumer's budget decisions. For the attribute levels, this study chooses the national average water price which is RM 0.65 on the first 35 cubic meters and maximum water price in the country which is domestic average water price in Johor (RM0.98 on the first 35 cubic meters). The selection of attribute levels is based on current water price of the state, national average price and maximum water price in Malaysia. Therefore, consumers decided to select the best price in order to have higher level of services.

During the survey, the respondents have been told that changes in water price will affect their budget allocation for other expenditures. Respondents can choose *status quo* or current service option if they do not intend to have any changes in the services and they are very comfortable with the current situation. They need to choose the best option for changes in water services based on their best preference. Table 2 portrays an example of CE question in the questionnaire.

Suppose Service Option 1 and 2 below are the only possible alternatives to the Current Service Option for domestic consumers, which option do you prefer? (Please choose ONE and tick in the box).

The sample consists of 552 respondents in every district in Kelantan who are registered domestic users of Air Kelantan Sdn. Bhd. The sample size is valid as it represents the population of Kelantan which is 1.6 million in 2011 (Department of Statistic, 2012). They have been told that the study will help the water industry and the water company to understand consumers' expectations regarding water service improvement. The data collection was conducted in four months starting in September 2011 until December 2011. Table 3 shows the total number of respondents who were selected based on the districts in the final survey.

This study used random sampling in all districts since the survey sample is from a broad population and it is problematic to identify every member in the population. In household surveys, the distribution of households is bigger in urban areas (Kota Bharu) than in rural areas (Jeli). Besides, the distribution of the respondents was not equal in each district because of the districts do not have the same total number of population. The respondents were randomly selected in districts but we were restricted to take 3 percent from the number of sample in each district in order to come out to 552 respondents from the all districts in the survey.

Results

Table 4 presents the average age of respondents is 38 years old and most of them are female (50.2%). Average household size is 5 people with average household income at RM 4077.90 per month.

Estimation procedures for CM have been completed by using econometric software which is LIMDEP, NLogit Version 9. The findings are the results of the basic and interaction conditional logit (CL) models. Table 5 shows the results of the estimated CL model for each attribute levels in the Choice Experiment.

In general, attribute signs are as expected except for a few attributes such as *never* in water interruption attribute, *moderate* and *low* in non revenue water attribute. The variables that are insignificant may be caused by the close link to the base level which makes people prefer the base level. The sign of water quality attributes are both positive at level two (good) and three (very good) significant at 1% level. The situation shows that people choose to have an improvement in water quality since they realize it is an important resource in daily life. Poor water quality may threaten their family health conditions.

The attribute level of water interruption (*sometimes*) shows a positive in its relation, implying that people prefer disruption in water services about once a year compared

Table 4: Socio Demographic Characteristics of Respondents.

Characteristics	Frequency	Percent (%)	Mean	SD
Gender				
Male	275	49.8		
Female	277	50.2		
Age(years)				
20 – 30	153	27.7		
31 – 40	170	30.8		
41 – 50	162	29.3	38.34	10.99
51 – 60	53	9.6		
61 – 70	10	1.8		
>71	4	0.8		
Household				
Size(people)	271	49.1		
1 – 5	266	48.2	5.10	2.59
6 – 10	15	2.7		
>10				
Education Level				
PhD/Master	22	4		
Bachelor	139	25.2		
Diploma/Certificate	200	36.2		
Secondary level	134	24.3		
Primary level	50	9.1		
No Education	7	1.3		
Household Income				
(monthly)				
Less than RM2,000	162	29.3		
RM2,001–RM4,000	154	27.9		
RM4,001–RM6,000	127	23	4077.90	2720.711
RM6,001–RM8,000	51	9.2		
RM8,001–R10,000	22	4		
>RM10,001	36	6.5		

Table 5: Results of Conditional Logit Model (Model 1).

Variables	Coefficient (β)	t-value
Water Quality		
Good	0.7191	5.343***
Very Good	1.3897	9.318***
Water Interruption		
Sometimes	1.0669	11.915***
Never	-0.1890	-1.68*
Non Revenue Water		
Moderate	-0.1304	-1.507
Low	-1.0806	-5.581***
PRICE	-2.4281	-3.816***
Marginal values of the attributes		
Good	0.2961	7.279***
Very Good	0.5723	4.767***
Sometimes	0.4394	4.473***
Never	-0.0778	-1.256
Moderate	-0.0537	-1.360
Low	-0.4450	-2.442**
Number of observations		2760
Log Likelihood		-2823.539
Pseudo R^2		0.0688
Adjusted Pseudo R^2		0.0676

Note: (*) 10% level, (**) 5% level, (***) 1% level.

to 'frequent' water supply interruption (current condition). However, when the respondents were offered with the new level 3 of water services (*never* been interrupted), they have rejected it because they believed it is impossible to be implemented. The NRW attribute demonstrates negative signs in the model. The people believed that the water company should be accountable in reducing non revenue water and should bear the cost of improving infrastructures.

The basic CL model can be more precise by improving the model fit itself. This study chooses to include socio-economic attributes in the model in order to improve the model fit. The insertions of socio-economic variables also provide heterogeneity in choices (Nam, 2004). The insertion of new attributes slightly improved the model fit compared to the base model. The socio-economic

Table 6: CL Model with Interaction.

Variable	Model 2	
	Coefficient	t-value
QUAL2	0.469	3.283***
QUAL3	0.489	2.547***
INT2	0.598	4.586***
INT3	-0.845	-3.384***
NRW2	-0.439	-2.909***
NRW3	0.2044	0.605
PRICE	-2.2635	-3.489***
NRW3_AGE	-0.0238	-3.510***
DIST3_EDU	0.0479	2.916***
NRW2_EDU	0.0106	2.232**
QUAL3_INC	0.2981	6.358***
INT2_INC	0.2078	5.027***
NRW3_INC	-0.1979	-3.033***
QUAL2_GEN	0.5163	4.980***
QUAL3_GEN	0.4203	3.647***
Marginal values of the attributes: $-\frac{\beta_{attribute}}{\beta_{monetary}}$		
QUAL2	0.2072	
QUAL3	0.2160	
INT2	0.2641	
INT3	-0.3733	
NRW2	-0.1939	
NRW3	0.0903	
NRW3_Age	-0.0105	
INT3_Education	0.0211	
NRW2_Education	0.0046	
QUAL3_Income	0.1316	
INT2_Income	0.0918	
NRW3_Income	-0.0874	
QUAL2_Gender	0.2280	
QUAL3_Gender	0.1856	
Summary Statistics		
No. of Observations	2760	
Log likelihood	-2757.027	
Pseudo R^2	0.0907	
Adjusted Pseudo R^2	0.0883	

Note: (*) 10% level, (**) 5% level, (***) 1% level.

variables interact with the main attributes that help to evade the difficulties in Hessian Singularities. Hence, the new interactions offer a rich data set based on precise consumer preferences at every levels. The result of CL interactions model is shown in Table 6 below:

By adding the socio-economic variables with the new interactions, the model fit progress has improved. The log likelihood gets better compared to Model 1 (Table 5), as shown by increases in value from -2823.53 to -2757.027. The Pseudo R^2 also increases compared to Model 1 (0.0688 to 0.0907), and adjusted R^2 also increases considerably from 0.0676 to 0.0883. Thus, it indicates that the model has improved until it has a high explanatory power. It implies that a precise model specification has been accomplished.

The sign of QUAL is both positive at level two and three and significant at 1% level. The situation shows that people choose to have an improvementin water quality since they realize the effects of bad water quality especially on their health. The main attribute of INT2 (level 2) demonstrates positive relationship, implying that people prefer 'sometimes' rather than 'frequent' water supply services interruption (current condition). However, when the respondents were proposed with the new level 3 water services (INT3), they rejected it. It proves that respondents still choose the current situation of water services. The coefficient of NRW2 is

positive in its relation implying that consumers prefer an improvement in reduction of NRW problems in the state, as they decide to move away from current level of NRW (*status quo*).

The interactions with socio-economic factors produce a negative sign to the variable of NRW3_Ageand significant at 1% level, which indicates that young people tend to support reduction of NRW in water services compared to older people in the state. It implies that the younger generation is aware that NRW can create losses to the country and it may have a bad effect on the industry. Education is significant and illustrates a positive relationship in these variables such as INT3_Education and NRW2_ Education. Respondents with higher level of education are concerned with water interruption and non-revenue water problems as shown by significant level both at 1%. This group of respondents certainly believed that interruption in water services and NRW problems may affect their consumption and they place these as priority elements in water consumption. Respondents with higher household income really take water quality and disturbance in water services very seriously as indicated by the positive signs for the variables QUAL3_Income and INT2_Income, with each variable significant being at 1% level. Thus, it is consistent with the economic theory which says that WTP increases with level of income. Conversely, the variable NRW3_Income shows a negative sign at 1% significant level. It implies that some people with higher income are not concerned withNRW issue as they believe that the water company as water provider should solve the problems. Gender variables, QUAL2_Gender and QUAL3_Gender are positive in their relationships and significant at 1%. The relations showed that male has a tendency to be more concerned about water quality compared to female since probably male are accountable as head of household.

Results on Marginal Values of Willingness to Pay

Estimated coefficients for all variables are used to measure the outcome of changes in attributes based on the price that consumers are willing to pay for changes in water services. Marginal WTP are calculated based on Equation 9. Table 7 demonstrates the results of CL basic and interaction models, for estimated marginal values of the differences in attribute levels.

Table 7: Marginal Values for Difference in Attribute Levels.

Attribute Levels	Conditional Logit Model	
	Basic (Model 1)	Interactions (Model 2)
	RM	
Water Quality (QUAL)		
QUAL1 → QUAL2 *Satisfactory to Good*	0.29	0.21
QUAL2 → QUAL3 *Good to Very Good*	0.28	0.01
Water Supply Interruption (INT)	0.44	0.26
INT1 → INT2 *Frequently to Sometimes*		
INT2 → INT3 *Sometimes to Never*	-0.48	-0.1
Non Revenue Water (NRW)	-0.05	-0.19
NRW1 → NRW2 *High to Moderate*		
NRW2 → NRW3 *Moderate to Low*	-0.39	0.28

The result of MRS at level '*satisfactory to good'* is at RM0.29 in Model 1. An improvement of services from level of '*good to very good'* is at RM0.28. These values illustrate how much respondents are willing to pay for any improvement in water services for each level. Model 2 shows that the value of MRS is higher at '*satisfactory to good'* which is RM0.21 compared to '*good to very good'* at RM0.01. There is a large difference in both values in this model. The marginal values for differences in water supply interruption attribute for improvement in level '*frequently to sometimes*' is at RM0.44 in Model 1 and RM0.26 in Model 2. Meanwhile, the differences in MRS values at *'sometimes to never'* is at negative values RM0.48 in Model 1 and RM0.1 in Model 2. The values of differences in MRS at 'Non revenue water' attribute demonstrate relatively low values compared to other attributes and most levels incurred negative values.

Conclusion

This study applies CE method to measure consumer preferences for improvement in domestic water services. The CE offers benefit transfer potential through its water service attributes and their levels. The respondents decided their preferred option whether to move on from current condition to improved condition. This study revealed that consumers are willing to pay new proposed water prices as long as they are guaranteed of a high standard in water services. The CE offers options for trade-off such as water quality (QUAL), water supply interruption (INT), Non revenue water (NRW) and water price (WP). The study calculated marginal values and it showed the monetary value that people are willing to place for each change in attributes. The findings demonstrated that people are willing to contribute more on "*water supply interruption*" attribute since it produces highest marginal value from *base* level to *moderate* level. People prefered that the disruptions are reduced to at least once a year. Presently, the water interruption is too frequent and it is worsening the situation in their homes and disturbing many activities.

The findings of the study can convince the government to allocate more resources and financial aids, such as soft loans to the water company. This action will benefit those involved in the industry such as policy makers, water companies and consumers. The government should regulate the market by controlling water prices so as to be in balance that protect both sides; producers and consumers. When the government sets the ceiling prices and the water company is unable to cover the high cost of production, then the government should play its role to help the industry by giving subsidies. Since water is considered as a 'public good', it should be provided to the consumers in the best condition. From water provider's view, the higher tariff can be used for improving infrastructure to provide higher level of services. It can be used for further maintenance works such as the replacement of old and rusty pipes, upgrading water treatment plants and reducing Non Revenue Water in the state. Revising prices can help the water companies to reduce cost somewhat but they still have to operate until the optimum production is achieved. By increasing the prices the public will be aware of the importance to conserve water and avoid water wastage. It will lead to economic effectiveness of water utilization among consumers. Consumers need to be educated about the specific value and benefits that they would get if the services are improved. What they would gain and what they would lose if the program of imposing higher water prices is implemented will affect their utilisation of water.

References

Adamowicz, W., Louviere, J., & Williams, M. (1994). Combining Revealed and Stated Preference Methods. *Journal of Environmental Economics and Management*, 26: 271-292.

Association of Water and Energy Research Malaysia. (2011). *National Water Services Industry Restructuring–Kelantan State Case Study*. Retrieved from: http://www.awer.org.my/publication/report/national_water_services_industry_restructuring-kelantan_case_study_eng.pdf

Bennett, J., & Blamey, R. (2001). *The Choice Modelling Approach to Environmental Valuation.* Massachusetts: Edward Elgar Publishing Limited.

Department of Statistic. (2012). *Kelantan at a Glance: Population in 2011*. Retrieved from: http://www.statistics.gov.my/portal/index.php?option=com_content&id=526&lang=en&negeri=Kelantan

Do, T. N., & Bennet, J. (2007). *Estimating Wetland Biodiversity Values: A Choice Modeling Application in Vietnam's Mekong River Delta* (Working Paper EEN0704). Program at Australian National University Economics and Environment Network.

Economic Planning Unit. (2009). Incidence of Poverty, by Ethnicity, Strata and State, Malaysia 1970-2009. *Household Income*

and Poverty. Retrieved from: http://www.epu.gov.my/c/document_library/get_file?uuid=5bf3a7ca-37a7-4ebb-96c6-634ce17141dc&groupId=34492

Farolfi, S., Mabugu, R. E., & Ntshingila, S. N. (2007). Domestic Water Use and Values in Swaziland: A Contingent Valuation Analysis. *Agrekon,* 46 (2): 157-169.

Hanley, N., Wright, R. E., & Adamowicz, W. (1998). Using Choice Experiments to Value the Environment: Design Issues, Current Experience and Future Prospects. *Environmental and Resource Economics,* 11(3-4): 413-428.

Hensher, D. A., Shore, N., & Train, K. (2005). Households' willingness to Pay for Water Service Attributes. *Environmental & Resource Economics,* 32: 509-531.

Larson, D. M., Lew, D. K., & Onozaka, Y. (2001). The Public's Willingness to Pay for Improving California's Water Quality, *Annual Meeting of Western Regional project W-133*. Miami: Florida.

Lee, C. H. K. (2011). Privatization, Water Access and Affordability: Evidence from Malaysian Household Expenditure Data. *Economic Modelling,* 28: 2121-2128.

Malaysian Water Association. (2011). *Malaysia Water Industry Guide*. Kuala Lumpur: MWA.

McFadden, D. (1974). Conditional Logit Analysis of Qualitative Choice Behaviour. In: Zarembka, P. *Frontiers in Econometrics*. New York: Academic Press.

Mohd, R. Y., Alias, R., & Khairil, W. (2008). *Economic Valuation of Marine Parks Ecotourism Malaysia: The Case of Redang Island Marine Park*. Serdang, Malaysia: Universiti Putra Malaysia Press.

Mohd, R. Y., Alias, R., & Zaiton, S. (2011). Willingness to Pay for Domestic Water Service Improvement in Selangor, Malaysia: A Choice Modelling Approach. *International Business and Management,* 2(2): 30-39.

Nam, P., & Son, T. (2004). Household Demand for Improved Water Services in Ho Chi Minh City: A Comparison of Contingent Valuation and Choice Modelling Estimates. In Research Report 2005-RR, Economy and Environment Program of South East Asia. Retrieved from: http://www.eepsea.org

National Economic Planning Unit. (2006). *9th Malaysia Plan*. Kuala Lumpur: NEPU, Malaysia.

National Economic Planning Unit. (2006). *10th Malaysia Plan*. Kuala Lumpur: NEPU, Malaysia.

Perni, A., Jose, M. P., & Federico, M. C. (2012). Social Preferences and Economic Valuation for Water Quality and River Restoration: the Segura River, Spain. *Water and Environment Journal*, 26: 274-284.

Vasquez, W. F., Mozumder, P., Hernandez-Arce, J., & Berrens, R. P. (2009). Willingness to Pay for Safe Drinking Water: Evidence from Parral, Mexico. *Journal of Environment Management,* 90: 3391-3400.