

Contingent Valuation on Urban Trees in City of Kota Kinabalu, Sabah

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ABSTRACT: This paper explores the function of urban trees in the City of Kota Kinabalu by finding the perception of public in the City about the trees and using Contingent Valuation Method (CVM) to find the valuation of urban tree in the city. Willingness to Pay (WTP) was chosen to use in the research to find the economic valuation of urban trees in city of Kota Kinabalu. The payment vehicle in the questionnaire is respondent WTP on donation and the elicitation method is open-ended question. A total of 121 questionnaires were selected for analysis from 154 questionnaires that distributed throughout the research. The majority of respondent are happy with the trees number and the function of trees in the city. Meanwhile, majority of respondent are willing to pay (donation) for increasing the number of trees in the city based on RM 5.00 that elicited. From the maximum WTP that stated, only 64 of questionnaires were selected for estimation of WTP after calculated the weakness of CVM. The mean and median of the WTP is calculated using basic mathematical and the value for mean is RM 7.84, while for the median is RM 5.00. Then, maximum aggregate WTP is calculated based on OLS regression model, maximum aggregate WTP= $-2.717+8.481 (NT)- 3.423(BG) + 4.296 (PG)+0.926 (PD)$ is find out where initial WTP stated, races, transportation and education have relationship with the WTP respondents stated. Based on the model, the maximum value of WTP is RM 2.54. Then, the total economic value of urban trees in the area based on the valuation, is calculated, for mean is RM 3,629,629.92, median is RM 2,314,815.00 and maximum aggregate value is RM 1,175,926.02. Using 2% of market interest rate, the present value of the urban trees is RM 1,086,373.87.

Keywords: Contingent Valuation, Willingness to Pay, Urban trees, Economic benefits, City of Kota Kinabalu.

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INTRODUCTION

The function of urban trees always related with landscape architecture or aesthetic appeal to the urban users but there are many benefits of urban trees to the public. Urban tree also give the same services as any other infrastructure that available in the city (Yaoqi et al., 2007). The impacts of urban trees are equivalent to any other infrastructures to the city, even though it is hard to see with the naked eye. The impacts have shown in less of water bill, gaining of tourists, expertise and businesses to the city (Yaoqi et al., 2007). The benefits of urban trees in Malaysia is still relative new as the country is rarely seen the trees as a symbol of prosperity. The increasing of urban users in developing country such as Malaysia has contributed to increasing of building of infrastructure in the urban area. Hence, the urban trees usually will make way in the urban planning. Besides that, urban trees provided variety of services such as provisioning services, cultural services and regulating services to the urban areas. Thus, this research is to find the opinion of public in city of Kota Kinabalu regarding the services of the urban trees.

Ciriacy - Wantrup in 1947 has proposed the first developed survey to measuring all benefits of soil conservation programs that use hypothetical market for public goods, which do not have market value by creating hypothetical scenario, which is called contingent valuation method (CVM) [Smith, 1993]. The use of Contingent valuation Method (CVM) is to measure the use value or non-use value of public goods. The CVM is a survey that use stated monetary method to elicited the amount of an individual willing to pay or receive for change in environment. In contingent valuation, there are two ways how to elicit the amount of money of an individual that is called willingness to pay (WTP) and willingness to accept (WTA). The use of CVM is famous for valuation of recreation sites as there are many economic valuations of park especially Public Park has been done in previous study. In

Malaysia, CVM has been around in Malaysia since late 1980s and mostly used to determine the forest products, wildlife, soil protection, carbon sequestration, biodiversity conservation and recreational opportunities (Mohd Rusli et al., 2008). Nowadays, the development of environmental valuation in Malaysia has been rapid and it is increasingly used, not only focusing on non-timber forest products but also on various sectors includes ecotourism. In most applications, CVM has been most commonly used approach, directly asking respondents' whether they would be willing to pay a certain amount of money for realizing the level of the non –market good described [Bateman and Willis, 1999]. Hence, this study is also to find out the total economic valuation of urban trees in the city using the CVM.

METHODOLOGY

Research site

Kota Kinabalu is one of the largest cities in Malaysia. It is located in east Malaysia and the capital of Sabah state. Kota Kinabalu is located at west coast of Sabah and total area of the city 351 km² (SEDIA, 2012). The city coordinates is 5°58'17"N 116°05'43'E. Kota Kinabalu has total number of population 629,943 in 2010 and the density of the population is estimated around 1,319 people/km² and also known as Rainforest City (SEDIA, 2012). The city have 9 zones and mostly the green spaces is in zone 1 and 4. There are few green spaces in the city such Padang Merdeka, City Park and Malaysia Monument. The areas have high number of public user as the zones have high number of trees shade. The site is used to find the public opinion about tree as the site have high percentage of tree in the area, hence this help the public to understand better the functions of urban trees in the city.

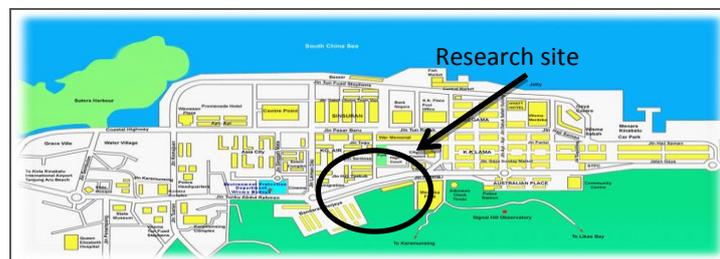


Figure 1. Location of CVM study site at Kota Kinabalu City

Contingent Valuation Method (CVM)

Contingent valuation method in the questionnaire is asked to respondents in attempts to measure the gains benefits from public perspective (non-use values). The contingent valuation method (CV) is used to derive willingness to pay (WTP) of public on the non-use values of urban trees in city of Kota Kinabalu. Hence, monetary values from the improvement number of trees in city of Kota Kinabalu with suggested amount of WTP (RM5) is asked to the respondent whether they are willing to pay for the amount that been asked. Then, follow up questionnaire is open-ended where the maximum value of WTP is asked to the respondents. The payment vehicle in the questionnaire is respondent WTP on donation and the elicitation method is open-ended question

Ordinal Least Square (OLS) regression technique using the linear regression is used to estimate the amount of WTP (Yeo, 2012). Using this approach, all parameter of opinion and socio-demographic in the questionnaire is tested to find out the relationship of parameter that affected the respondents willingness to pay. Furthermore, the suggested amount of money is also tested in the regression to know whether the amount of money suggested is affected the public maximum

valuation of willingness to pay. The model using is Ordinal Least Square (OLS) based on linear regression.

$$WTP = \alpha + \beta_i X_i + \varepsilon_i \quad (1)$$

Where, X_i is a vector for the parameter tested, ε_i is the standard error, β_i is the parameter p-value and α is the p-value of constant.

For mean and median WTP in open-ended CVM elicitation is calculated using simple arithmetic mathematical because it do not require fitted model (Ndebele, 2009).

Questionnaire design

The questionnaire is based on application of Contingent Valuation Method (CVM) where there are three parts of questionnaire. The first part of questionnaire is the function or role of urban trees in Bandaraya Kota Kinabalu based on public opinion about the trees. Then, second part of the questionnaire is about the contingent valuation method (CVM) which in this questionnaire WTP (Willingness to Pay) is used in the questionnaire to ask the respondents valuation. Then, the final part of the questionnaire is about the socio-demographics of the respondents. CVM is used in this researched to elicit the preferences of public goods such as urban trees by creating hypothetical scenario to find the amount of money that public willingness to pay for the hypothetical scenario. Most of the researched using WTP rather than WTA has higher rate of bias upwards, therefore most of CVM studies are designed to elicited WTP estimates (SEDIA, 2012).

Sampling method

This research is using convenience sampling method, as the method is quick and do not required specific group for sampling, furthermore convenience sampling is used in the researched, as the number of population of city of Kota Kinabalu based on 2010 census is available for research. Based on the convenience sampling by Yamane (1967):

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

Where n is the sample size, N is a population size and e is the probability predicted. Based on the formula, with the population size of Kota Kinabalu on 2010 of 629,943 populations (SEDIA, 2012) and probability of 90% confidence interval, the minimum sample size that required for the research is 100 respondents.

RESULT AND DISCUSSION

Descriptive statistic: The socio-demographic characteristics of respondents for public in urban green are shown in Table 1. Majority of the respondents were male (62.81%), their age around 18 to 29, mostly are university undergraduates and currently study. However, majority of respondents' monthly income were no income (38.84%) due to high number of students participates and the second highest monthly income around 1001-2000 (28.93%). This indicates the public in city of Kota Kinabalu were mostly have low income. Majority of the public user are Kadazandusun and this is shown where majority of public were grew up in rural area as most of Kadazandusun from higher latitude area such as Ranau (See table 1 for further analysis).

Table 1. Socio-Economic of Respondents Statistics

Parameter	Frequency	Percent
Gender (Total)	121	
• Male	76	62.81
• Female	45	37.19
Age (Total)	121	
• <18	2	1.65%
• 18-29	75	61.98%
• 30-39	20	16.53%
• 40-49	13	10.74%
• 50-59	9	7.44%
• 59>	2	1.65%
Nationality (Total)	121	
• Malaysian	121	100%
• Non-Malaysian	0	0.00%
Race (Total)	121	
• KadazanDusun	42	34.71%
• Bugis	11	9.09%
• Bajau	21	17.36%
• Malay	16	13.22%
• Cina	7	5.79%
• India	1	0.83%
• Others	23	19.01%
Education level (Total)	121	
• Primary school	7	5.79%
• Secondary school	46	38.02%
• Diploma	31	25.62%
• Bachelor degree	35	28.93%
• Master degree	0	0.00%
• Others	2	1.65%
Monthly income (Total)	121	
• No Income	47	38.84%
• <1000	22	18.18%
• 1001-2000	35	28.93%
• 2001-3000	7	5.79%
• 3000>	10	8.26%
Profession (Total)	121	
• Unemployed	15	12.40%
• Student	30	24.79%
• Government servant	26	21.49%
• Private worker	31	25.62%
• Self-employed	15	12.40%
• Retired	2	1.65%
• Others	2	1.65%
Transportation (Total)	121	
• Car	51	42.15%
• Public Transport	45	37.19%

• Motorcycle	13	10.74%
• Walking	12	9.92%
• Bicycle	0	0.00%
Area grew up (Total)		
• Urban	31	25.62%
• Suburban	8	6.61%
• Small Town	27	22.31%
• Rural	54	44.63%
• Don't Know	1	0.83%
Household size (Total)		
• 1-3	17	14.05%
• 4-6	56	46.28%
• 7-9	34	28.01%
• 9>	14	11.57%

Contingent Valuation Method (CVM) Estimates

Total of 121 questionnaires is taken to analysis but only 64 set of questionnaire is analysis to estimate the amount of WTP after taken factors of CVM weakness such as outlier and protest response. Table 2 shows only stated amount WTP, Race (Bajau), Transportation (Walking) and education level is significant at probability 0.1 tested based on the 100 sample size. The highest parameter is the stated suggested amount WTP had significant impact on respondents hypothetical WTP of trees number in City of Kota Kinabalu. Other parameter tested such as gender, income, household size, area grew up, profession, opinion on tree number, and satisfaction on tree condition and age are not significant in the OLS regression models.

Table 2 . Parameter Estimates for Open-Ended OLS Regression Model

OLS Regression Model	t	Sig.
• Constant	-.924	.360
• Gender	.755	.454
• Bangsa (Bajau)	-2.292	.026**
• Income	.947	.348
• Household size	.777	.441
• Transportation (Walking)	2.039	.047**
• Profession (Unemployed)	.706	.484
• Area grew up (Rural)	-.386	.701
• Opinion on tree numbers (Less)	-.616	.541
• Satisfaction on tree condition (unsatisfied)	.593	.556
• Education level	1.927	.060*
• Age	-.268	.790
• WTP on stated RM 5	5.658	7.0124E-7***

*** - sig. 0.01

** - sig. 0.05

* - sig 0.10

Based on the OLS Regression Model, the model is constructed where:

$$WTP = -2.717 + 8.481 (NT) - 3.423(BG) + 4.296 (PG) + 0.926 (PD)$$

NT – Stated suggested amount of RM 5 (p-value = 7.0124E-7)
(References variable) 1 = Yes willing to pay 0 = Not Willing to pay

BG – Race (Bajau) (p-value = 0.026)
(References variable) 1 = Bajau 0 = Otherwise

PG – Transportation (Walking) (p-value = 0.047)
(References variable) 1 = Walking to the city 0 = Otherwise

PD – Respondents education level (p-value = 0.060)

Table 3 . Analysis of Variance (ANOVA) of OLS regression model

Model		Sum of Square	df	Mean Square	F	Sig.
1	Regression	808.291	12	67.358	4.386	.000
	Residual	783.236	51	15.358		
	Total	1591.527	63			

The estimation of mean and median WTP of the elicit WTP is using simple arithmetic formula and from the formula the value of WTP is RM 7.84 for mean and RM 5.00 for the median. Based on the OLS model, we find out the maximum value WTP of public.

Then, using the data from census of (SEDIA, 2012) in 2010 indicates there are 629,943 populations that live in greater Kota Kinabalu near the city of Kota Kinabalu. Thus, total economic valuation of urban trees in city of Kota Kinabalu based on 2010 census (SEDIA, 2012) the total economic valuation of urban trees in city of Kota Kinabalu by mean of maximum WTP is RM 3,629,629.92 and median of maximum WTP is RM 2,314,815.00. Then, using OLS regression model the maximum aggregate of WTP is RM 2.54 and the total economic valuation of urban trees is RM 1,175,926.02.

Thus, using a present value to aggregate the benefit of urban tree, using 2% as urban trees is public goods, which lower than Malaysia current market interest rate at 3%. The economic valuation of urban trees at present value is RM 3,223,007.50, RM 2,055,489.48 and RM 1,086,373.87 using the maximum aggregate WTP of OLS regression.

Table 4. Estimation of WTP value and Total Value of Urban Trees in City of Kota Kinabalu

	WTP value	PV of urban trees
• Mean WTP	RM 7.84	RM 3,223,007.50
• Median WTP	RM 5.00	RM 2,055,489.48
• OLS Regression Model	RM 2.54	RM 1,086,373.87

CONCLUSION

The study shows many respondents are willing to pay for improvements of tree numbers in City of Kota Kinabalu. Majority of respondents are willing to pay the amount of money that stated as respondents are likely to pay higher than the suggested amount as the mean of WTP at RM 7.84, but the median of WTP is RM 5.00 due many respondents are not willing to pay higher or lower than the suggested amount. This shows that the stated suggested amount of RM 5.00 in the questionnaire do affect the WTP of respondents in WTP even after checking the warm-glowing effect in respondents WTP. Most of the public stated that they are willing to pay for improvement of tree numbers in Kota Kinabalu due to the benefit of urban tree provided to the environment. The aim of the study is to estimate the valuation of urban trees in City of Kota Kinabalu. This is due to increasing number of population in Kota Kinabalu in recent years that resulting higher rate of development in the area which resulting many tree is cutting down to make way for building development. Thus, this research is hope to prevent the authority from neglect the necessity of public in the city. In addition, this study will help the authority to create better policy and asking for one-off donation to the public in helping to funding for any improvement in trees number in the city. The results indicates that the total benefit of urban tree in the city is RM 1,086,373.87 using 2% of market interest rate based on the OLS model maximum aggregate value of RM 2.54. Furthermore, the study also shows that the authority might considering to one time charge the public with minimum RM 2.00 if they are planning to improve the tree numbers in Kota Kinabalu as the majority of the public are agree to pay to increase the tree numbers in the city. In addition, majority of the respondents want improvements in term of tree selection as some of the public find the tree are less appeal to them.

The study has few limitation such as small sample size, the use donation as payment vehicle, open-ended WTP elicitation question which will cause bias as the sample size is only 64 WTP valuation which is success rates is only 51% from total of 121 questionnaire that used for analysis is taken for WTP analysis. Donation still might have warm glowing effect although treatment have been done by thoroughly checked the socio-economic of respondents. The outlier in the WTP has been checked using OLS regression residual plot and the data that are heavily impact the data is discarded after checked the respondents socio-economic and statements of their WTP. For future study, we suggested to find the contingent valuation of urban trees in city of Kota Kinabalu using different types of payment vehicle such as taxes and using payment card as elicitation question with open-ended follow up to the shop owner in the city as target respondent. This could create better valuation of the urban tree as the shop owner could understand better the value of tree because they are part of community to the city.

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REFERENCES

- [1] Bateman, I. J. & K. G. Willis, (1999). *Contingent Valuation of Environmental Preferences: Assessing Theory and Practice in the USA, Europe and Developing Countries*. Oxford: University Press.

- [2] Mohd Rusli, Y., Ahmad, S. & Alias, R. (2008). How Much Does Ecotourism Development Contribute to Local Communities? An Empirical Study in a Small Island. *The ICFAI Journal of Environmental Economics*, 5(2), 54-67.
- [3] Ndebele, T. (2009). *Economic Non-Market Valuation Techniques: Theory and Application to Ecosystems and Ecosystems Services. A Case Study of the Restoration and Perservation of Pekapeka Swamp: An Application of the Contingent Valuation Method in Measuring the Economic Value of Restoring and Preserving Ecosystem Services in an Impaired Wetland*. Palmerston North. New Zealand: Massey University.
- [4] Sabah Economic Development and Investment Authority (SEDIA). (2012). *Greater Kota Kinabalu Healthcare Overview*. Kota Kinabalu: SEDIA.
- [5] Smith, V. K. (1993). Non-market valuation of environmental resources; an interpretive appraisal. *Land Economics*, 69, 1-26.
- [6] Yamane, Taro. (1967). *Statistics, An Introductory Analysis*, 2nd Ed., New York: Harper and Row.
- [7] Zhang, Y., Hussain, A., Deng, J. & Letson, L. (2007). Public Attitudes Toward Urban Trees and Supporting Urban Tree Programs. *Environment and Behaviour*, 39(6), 797-814.
- [8] Yeo, S. C. (2012). *Estimating the economic benefits of urban trees using Contingent Valuation Method*. Masters thesis, Universiti Putra Malaysia.