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Economic value evaluation of the Mekong river's flooding alert system using contingent valuation method

Phanuchai Pramuanl and Saksri Rakthai*

Department of Environmental Science and Technology, Faculty of Science and Technology, Pathumwan Institute of Technology, Wangmai, Pathumwan, Bangkok 10330, Thailand.

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Abstract

This research focus on the application of the contingent valuation method to the Mekong River's flooding warning system. The study area were 32 villages located in 8 provinces including Chiangrai, Nongkhai, Loei, Bungkan, Nakhonphanom, Mukdahan, Ubonratchathani and Amnartcharoen, Thailand, which have the Mekong River flow through the city. The objective of this research was analyzing willingness to pay for the Mekong River's flooding alert fee by elicitation 648 households in 8 provinces located alongside of the river. The study area were 32 villages located in such 8 provinces including Chiangrai, Nongkhai, Loei, Bungkan, Nakhonphanom, Mukdahan, Ubonratchathani and Amnartcharoen which have along the Mekong River flow through the city. The data was analyzed by using single bounded closed- ended CVM question, Non-parametric Model and Logistic Regression Model. The result showed that the willingness to pay by means of the Non-Parametric Model was 219.14 Bath per household per year (6.10 US$/hh/y) and its total value was 8,429,230.80 Bath per year (234,539.46 US$/y). This finding also revealed that the negative correlation of household's willingness to pay include the occupation (Beta = -0.884, sig = 0.001) and the distance between home to the Mekong River (Beta = -0.329, sig = 0.003).

Keywords: Economic value evaluation, Willingness to pay, the Mekong River, Flooding alert system, Contingent valuation method

1. Introduction

Flooding was the dramatic natural problem because it significant damaged local communities, infrastructure, properties, and agricultural areas [1]. In 2012 the central of Thailand encountered with the biggest flooding that caused damage cost for about 154,000 million baht (5,534,693 US$) and these harm would had been increasing if the government would not done anything [2]. However, we could use economic theory and tools reducing damage cost from flooding base on Benefit Pay Principle or BPP [3].

The Benefit Pay Principle was not only an important incentive policy to support conscious mind and social responsibility but also motivated positive behavior on environment of people [4]. The communities needed flooding prevention system or flooding warning system to help them to prepare themself and reduce their costs. They realized that they had to pay for special expenses for operation the system. However both systems were not market price, they did not have clearly price in market system and it was very difficult to set standard price.

Contingent Valuation Method (CVM) was the suitable economic tool to evaluate non market price to be market price [5] and was used to value specific changes form the status qua. Environmental economists often used it to value environmental policies and environmental damage [6]. CVM was a state- preference technique. Specially, in the CVM individuals were asked about the status qua versus some alternative state of the word, and the information was elicited about how the individual feels about the alternative relative to the status quo, and their WTP, if anything, to obtain the alternative [7].

The objective of this research was analyzing willingness to pay for the Mekong River's flooding alert fee by elicitation 800 households in 8 provinces located alongside of the river including Chiangrai, Nongkhai, Loei, Bungkan, Nakhonphanom, Mukdahan, Ubonratchathani and Amnartcharoen which have the Mekong River flow through the city. The data was analyzed by using single bounded closed- ended CVM question, Non- parametric Binary Logistic Model.

The results of this research could be used for decision making of the policy makers to invest the Mekong River's flooding alert system that could reduce flooding damage cost and maintain sustainability system.

2. Materials and methods

2.1 Study area

The Mekong River is the important trans- boundary river, it starts from China and run through Myanmar, Laos,

*Corresponding author.
Email address: nokrakthai@yahoo.com
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Thailand, Vietnam and Cambodia, respectively. In Thailand, the Mekong river flow through the city of 8 provinces including Chiangrai, Nongkhai, Loei, Bungkan, Nakhonphanom, Mukdahan, Ubonratchathani and Amnartcharoen which have the Mekong River flow through the city. This research focused on 32 villages located in such 8 provinces. Regarding the study area, such 8 provinces locate in Northeast of Thailand occupied with 5,031 km2 of land covering about 38,465 households. The area is a plateau with medium fertile land used for agricultural purpose. The major products of these communities were rice, tobacco, chili and lettuce that planted near the river. Because their major occupation was agriculture, water was very important factor for their life. They actually used water from the Mekong River to grow their agricultural products and cook their foods. Unfortunately, this area encounter with flood several times due to the fact that the hydropower dam located at the upstream of the Mekong River, outside Thailand, released a lot of water to generate electricity. Flooding destroyed agricultural products that they planted and increased their annual expenditure. However, they have realized that government or other relevant organizations could not prevent flood for them due to out of control, they needed flooding warning system to help them to plan for cultivation period and reduce damage cost.

2.2 Sampling and data collection

The researcher used Mitchell and Carson concept [8] to select 648 samples from the total population in 32 villages by purposive sampling. The data were collected in study areas between June and July, 2015. Adults aged between 18 to 65 years old were target groups and each questionnaire was collected on face-to-face basis by trained interviews, who described the meaning of each questionnaire and available choices to participants in order to avoid response bias.

2.3 Data collection

In order to assess Willing to Pay (WTP), demographics, socio-economic variables, participant's opinion on the Mekong River flow, environmental training experience and contingent valuation were assessed. Respondents were asked about the distance between their houses to the Mekong River and their home address at the beginning of the questionnaire in order to avoid repeat participation.

The first part of the questionnaire contained demographic questions including gender, age, marriage status, education, occupation, distance between home to the Mekong river, environmental training experience, environmental organization. The second part was socio-economic status such as monthly household income, monthly household expenditure and family size. The third part was the opinions on the Mekong River flow such as water level, water flow and soil erosion. The final part contained the contingent valuation survey including willingness to pay and the amount of the payment. The core questions were as follow: in order to prepare the Mekong River's flooding alert for your community to reduce flooding damage cost, the system need to be implemented, which incur cost per household. Considering respondent's household income and expenditure (1) are you willingness to pay……. Bath? and (2) How much maximum and minimum are your willingness to pay?

2.4 Statistical analysis

There were 2 parts of this analysis. First, initial descriptive analysis such as mean and standard deviation, the second, Non-parametric Model was used to calculate willingness to pay for the Mekong River's flooding alert and Logistic Regression Model was used to identify variables that affected the respondent's decision on WTP [9].

2.5 Theory

2.5.1 Non-parametric model

This model was used for calculating willingness to pay for the Mekong River's flooding alert as follow:

1) The percentage of respondent on start bid in each group.

$$S(Bj) = nj/Nj \quad (1)$$

Where

S(Bj) = The percentage of respondent on start bid in each group
nj = The number of respondent on bidding in each group
Nj = All of respondent in each group
J = respondent group (j=1,…,J)

2) The total willingness to pay of all respondents.

$$WTPtotal = \sum_{j=0}^{j}(S(Bj) - S(Bj+1) * N * Mj \quad (2)$$

Where

WTPtotal = The total willingness to pay of all respondents
N = The total samples (N = 648).
Mj = Mean of bidding in each group

3) The average willingness to pay.

$$meanWTP = WTPtotal /N \quad (3)$$

2.5.2 Logistic regression model

This model was used for identifying variables that affected the respondent's decision on WTP. The positive WTP was the dependent variable and independent variables were gender, age, marriage status, family size, occupation, education, the distance between home to the Mekong River, environmental training experience, environmental organization, monthly household income and monthly household expenditure.

3. Results

3.1 Demographic profile

In this study, 648 of questionnaires collected from the communities setting were retrieved during period, The independent variables including gender, age, marriage status, occupation, education, environmental training experience, environmental organization member and income as shown in Table 1.

3.2 The willingness to pay for the Mekong River's flooding alert

In the community sample, 645 (80.63%) of the 800 valid participants reported being willing to pay for the Mekong River's flooding alert. The percentages of the amount of WTP for 100,200,300, 400 and 500 Baht accounted for 68%, 45%, 29%, 8% and 19%, respectively (Table 2). A little less than a haft of the sample population (21%) expressed their unwillingness to pay because they did not enough money to pay for system. The willingness to pay by means of the Non-Parametric Model was 214.14 Bath per household per year (6.10 US$/hh/y) and its total value was 8,429,230.80 Bath per year (234,539.46 US$/y).

Table 1 Descriptions of independent variables

Metric variables	Percentage (%)
Male	92.3
Female	7.7
Marriage	84.6
Single	15.4
Farmer	64.3
Fisherman	28.6
Contractor	7.1
Primary school	78.6
Graduate school	12.4
Environmental training experience	66.6
environmental organization	20.4

3.3 Factors affecting willingness to pay for the Mekong River's flooding alert

The estimated Logistic Regression Model for WTP for the Mekong River's flooding alert was presented in Table 3. Only variables that had a significant impact on WTP at 0.05 levels were included base on systematic search procedure. The model was highly significance base on the Wald chi-square statistic (83.74). This finding also revealed that the negative correlation of household's willingness to pay include the occupation (Beta = -0.884, sig = 0.001) and the distance between home to the Mekong River (Beta = -0.329, sig = 0.003) as shown in Table 3.

4. Discussion

The economic value of the Mekong River's Flooding Alert System of this research was 219.14 Bath per household per year. This value was lower than the economic value of preventive flood system of Changkhlan sub-district, Mueang District, Chiang Mai province [1]. Estimated mean of WTP to prevent flooding was 410.54 baht per household per year. However both research used same technique and sample size, the economic value was pretty different due to community characteristic. Changkhlan sub-district Mueang District, Chiang Mai province was urban area and people who lived in this area had high income and education level. Urban community was higher willingness to pay than Mekong river communities who was agricultural occupation. Moreover, this research showed that the occupation and the distance between homes to the Mekong River were the important factors determining WTP because the major occupation of this research was farmer and fisher who very concerned about water level affecting their live.

5. Conclusions

Flooding was the dramatic natural problem because it significant damaged local communities, infrastructures, properties, and agricultural areas. Flooding alert system was the best way to protect damage cost of the local people. Contingent Valuation Method (CVM) was the suitable economic tool to evaluate non market price to be market price and environmental economists often used it to value environmental policies and environmental damage. The objective of this research was analyzing willingness to pay for the Mekong River's flooding alert fees by elicitation 648 household in 8 provinces. The result showed that the willingness to pay by means of the Non-Parametric Model

Table 2 Descriptions of dependent variables

Group (j)	Number (Nj)	Bidding (bid)	Yes (nj)	Percent in group (nj/Nj)	WTP in group (Baht/year/hh)
0	0	0	0	1	10,184.21
1	133	100	91	0.68	22,697.37
2	129	200	58	0.45	26,060.00
3	125	300	36	0.29	47,240.41
4	127	400	10	0.008	- 32,536.89
5	131	500	25	0.19	67,700.38
Total	645				141,345.48
				Mean	219.14
				Total	8,429,230.80 (Baht/year)

Table 3 Factors affecting willingness to pay($\alpha = 0.05$)

No	Indepentdent variables	Beta	SE	Exp	Sig
1.	Occupation	-0.884	0.258	0.413	0.001
2.	distance between home to the Mekong River	-0.329	0.109	0.720	0.003
	Constant		-11.135		
	Nagellkerke R^2		0.698		
	Correctly overall percentage		91.2		

Beta = Coefficients of the variables, SE = Standard Error
Exp = The expectation of event, Sig = The statistical significance at 0.05 level

was 219.14 Bath per household per year (6.10 US$/hh/y) and its total value was 8,429,230.80 Bath per year (234,539.46 US$/y). This study showed that the negative correlation of household's willingness to pay include the occupation (Beta = -0.884, sig = 0.001) and the distance between home to the Mekong River (Beta = -0.329, sig = 0.003). The finding also revealed that local people were very concern about environment impact effecting by hydropower dam and they have sustainable concept to reduce that impact by themselves. From the result, policy makers should use this idea to design mitigation plane which suitable for local people.

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