

ANALYSIS OF COMMUNITY WILLINGNESS TO PAY FOR MANGROVE FOREST CONSERVATION IN PANTAI LANGO VILLAGE AND THE DETERMINANT FACTORS USING A PARAMETRIC APPROACH

Analisis Kesiediaan Membayar Masyarakat terhadap Pelestarian Hutan Mangrove di Kelurahan Pantai Lango dan Faktor-Faktor yang Mempengaruhinya dengan Pendekatan Parametrik

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ABSTRACT

Mangrove forest conservation is a crucial measure to prevent further ecological degradation in mangrove ecosystems. Such efforts require substantial financial resources for both conservation activities and management operations. Therefore, this study aims to estimate the community's Willingness to Pay (WTP) for mangrove forest conservation in Pantai Lango Village and to identify the factors influencing their WTP. The research employs purposive sampling for sample selection and utilizes a parametric analytical approach through a logistic regression model. The findings indicate that the average WTP derived from the logistic regression model is Rp 39,184.69 per person. Additionally, two variables are found to significantly influence the community's WTP in Pantai Lango Village, namely the bid amount and income.

Keywords: Mangrove Forest Conservation, Willingness to Pay (WTP), Influencing Factors

ABSTRAK

Pelestarian hutan mangrove merupakan salah satu upaya yang dapat dilakukan dalam mencegah kerusakan hutan mangrove. Upaya tersebut memerlukan biaya yang cukup besar untuk konservasi dan pengelolaan. Dengan itu, penelitian ini bertujuan untuk mengestimasi nilai kesiediaan membayar (*Willingness to Pay*) masyarakat terhadap pelestarian hutan mangrove di Kelurahan Pantai Lango dan mengidentifikasi faktor-faktor yang mempengaruhi WTP masyarakat. Penelitian ini menggunakan *purposive sampling* dalam pengambilan sampel dengan analisis data menggunakan pendekatan parametrik dengan model regresi logistik. Hasil penelitian menyatakan nilai rata-rata WTP dengan model regresi logistik sebesar Rp 39.184,69 per orang. Terdapat dua variabel yang berpengaruh terhadap *Willingness to Pay* (WTP) masyarakat di Kelurahan pantai Lango, yaitu penawaran (*bid*) dan pendapatan.

Kata Kunci: Pelestarian Hutan Mangrove, Willingness to Pay, Faktor yang Mempengaruhi

INTRODUCTION

North Penajam Paser Regency is one of the regencies in East Kalimantan Province, Indonesia. This region is the result of administrative expansion and was subsequently designated by the President of the Republic of Indonesia as the location of the new National Capital City (IKN). The population of North Penajam Paser Regency reached 193,550 inhabitants, with a growth rate of approximately 4.62% compared to 2021. Administratively, this regency covers an area of 3,333.06 km². North Penajam Paser Regency is divided into four districts, namely Babulu, Penajam, Sepaku, and Waru. Among these districts, Penajam District consists of 19 urban villages, one of which is Pantai Lango Urban Village. This urban village is located in the Balikpapan Bay area (BPS Kabupaten Penajam Paser Utara, 2024). According to data from Pantai Lango Urban Village in 2024, the population in this area amounted to 2,076 inhabitants. This urban village has an area of 44.24 km², including mangrove forest areas covering approximately 368.527 hectares.

Mangrove forest ecosystems are recognized as highly productive ecosystems, generating high organic matter that is essential for ecological food chains in surrounding waters (Rukmini & Hironimus, 2021). Mangroves have three vital functions, namely ecological, socio-economic, and socio-cultural functions. As coastal vegetation growing in river estuaries and influenced by tidal fluctuations (Kordi & Ghufra, 2012), mangroves also provide crucial ecosystem services in maintaining environmental balance along tropical coastlines (Donato *et al.*, 2012). Unfortunately, degradation of mangrove ecosystems in Balikpapan Bay has resulted in a significant decline in their functions for local communities.

Mangrove forest degradation in the Balikpapan Bay area is primarily caused by tree logging activities for housing development, aquaculture ponds, and industrial areas. Mangrove regeneration has also been hampered by the massive harvesting of seedlings for commercial purposes, thereby disrupting natural recovery processes. This condition indicates that mangrove forests in Balikpapan Bay have experienced substantial degradation (Warsidi & Endayani, 2017). In addition, an oil spill in Balikpapan Bay in 2018, resulting from damage to the crude oil pipeline connecting Lawe-lawe Terminal and the Balikpapan refinery, further exacerbated mangrove ecosystem degradation (Arwadi *et al.*, 2022). Jenebora Urban Village in North Penajam Paser Regency became the most severely affected area, with approximately 80% of the 22 hectares of mangrove ecosystems experiencing damage due to the oil spill. The crucial role of mangrove ecosystems in maintaining coastal environmental balance has therefore been severely compromised (Oktawati *et al.*, 2022).

One effort to prevent further degradation, particularly in Pantai Lango Urban Village, is through the analysis of community Willingness to Pay (Willingness to Pay/WTP) for mangrove forest maintenance and conservation. WTP represents the maximum amount that individuals are willing to pay to avoid environmental degradation. Therefore, this study aims to estimate the maximum WTP value of the community for mangrove forest conservation in Pantai Lango Urban Village using a parametric method, as well as to identify factors influencing community WTP in Pantai Lango Urban Village.

METHODS

This study was conducted from December 2024 to April 2025. The research location was Pantai Lango Urban Village, North Penajam Paser Regency, East Kalimantan. This study employed a quantitative research approach. Data collection was carried out through direct interviews with respondents using a previously prepared questionnaire as a guideline. The data used in this study consisted of two types, namely primary data obtained directly from respondents and secondary data derived from various supporting sources, such as previous research journals and the Central Bureau of Statistics. Primary data were obtained from field observations and respondent interviews using open-ended questionnaires. Meanwhile,

secondary data were obtained from various official sources and literature review studies (Apriani *et al.*, 2022).

The sampling method used in this study was purposive sampling with specific criteria assigned to respondents. Hartono *et al.* (2023) stated that purposive sampling is a sampling technique based on predetermined considerations applied to respondents. The total population of Pantai Lango Urban Village in 2024 was 2,076 inhabitants; therefore, the sample size in this study was calculated using the Slovin formula (Sari *et al.*, 2023).

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

$$n = \frac{2.076}{1 + (2.076 \times 10\%^2)}$$

$$n = \frac{2.076}{21,76}$$

$$n = 95,4 \text{ completed to be } 100$$

Where: N : Population size
n : Sample size
e : Error limits 10%.

The data analysis used in this study was a Willingness to Pay analysis using a parametric method to estimate the maximum WTP of the community and to determine the factors influencing it.

The calculation of the average WTP value was carried out using a parametric approach using a logit model to identify the independent variables influencing the community's WTP. In this study, the independent variables used were bid, age, education level, type of employment, and income. The WTP equation using the logit model is as follows (Osmaleli *et al.*, 2022):

$$P(Y \leq 1|x) = \beta_0 + \beta_1 \text{bid} + \beta_2 \text{Ur} + \beta_3 \text{TP} + \beta_4 \text{JP} + \beta_5 \text{Pdpt}$$

Information:

$P(Y \leq 1|x)$: Chances are people are willing to pay (1= Yes, 0 = No)

β_0 : Constant

$\beta_1 \dots \beta_n$: Regression coefficient

Bid : Bid value offered (rupiah/year)

Ur : Age (years)

TP : Level of education

JP : Type of work

Pdpt : Income (Rp/month)

After conducting a logistic regression analysis with the independent variable being the respondent's decision of "willing" or "not willing" regarding the bid value, a logit model was generated. The coefficients from this model were then used to estimate the WTP value using the following equation:

$$WTP = - \frac{\beta_0 + (\bar{X}_2 \times \beta_2) + (\bar{X}_3 \times \beta_3) + (\bar{X}_4 \times \beta_4) + (\bar{X}_5 \times \beta_5)}{\beta_1}$$

Information:

β_0	: Constant
β_1	: <i>Bid</i> (Offer)
β_2	: Age
β_3	: Education
β_4	: Work
β_5	: Income
$\bar{X}_2$	: Average Age
$\bar{X}_3$	: Average Education
$\bar{X}_4$	: Job Average
$\bar{X}_5$	: Average Income

RESULTS AND DISCUSSION

Respondent Characteristics

The respondents in this study were residents of Pantai Lango Village. The characteristics of the respondents in this study were used to identify the research object.

Table 1. Descriptive statistics of respondents

Variables	Information	Mean	Standard Deviation
Gender	Respondent's gender 1 = Male, 0 = Female	0,39	0,49
Age	Respondents' age is determined by the unit of years	43,6	11,02
Education	Respondents' formal education level is determined based on their educational level. 1 = Elementary School, 2 = Middle School, 3 = High School, 4 = Academy/Diploma, 5 = Bachelor's Degree	1,63	0,91
Occupation	Respondent's occupation 1 = Working, 0 = Not working	0,89	0,31
Income	Respondent's income in Rupiah 0 = No income, 1 = <Rp 1,000,000, 2 = Rp 1,000,000 – Rp 1,499,000, 3 = Rp 1,500,000 – Rp 2,499,000, 4 = Rp 2,500,000 – Rp 3,500,000, 5 = >Rp 3,500,000	3,03	1,28

Source: Processed research data, 2025

Table 1 shows that the majority of respondents in this study were female with an average of 0. In line with research conducted by (Malik *et al*, 2025) where female respondents (52%) were more numerous than male respondents (48%). The average age of respondents was 43 years with an age range of 22-71 years which means that this age is included in the productive age, this is in accordance with the Central Statistics Agency (2019). The average level of education of respondents was Elementary School (SD). In contrast to research (Wulandari *et al.*, 2025) which showed that the majority of respondents' education level was Senior High School (SMA). The average respondent had a job. This is different from research (Apriliawan *et al.*, 2020) which stated that the majority of respondents were unemployed (45.53%). The average income of respondents was Rp 1,500,000 – Rp 2,499,000, meaning that the income of the residents of Pantai Lango Village who were respondents was still below the

regional minimum wage (UMR) of Penajam Paser Utara Regency which was recorded at Rp 3,715,818 based on data from the Central Statistics Agency of East Kalimantan Province (2024). This is in line with research (Rahajeng *et al.*, 2019) which showed that the income of respondents in the Proboscis Monkey Mangrove Conservation Area in Tarakan City ranged from Rp 500,000 – Rp 1,000,000.

Calculation of WTP Using the Parametric Method

The WTP analysis was conducted to determine the community's willingness to participate in the conservation of mangrove forests in Pantai Lango Urban Village. The method used to estimate the WTP value was the Contingent Valuation Method (CVM). CVM is a survey-based method used to estimate the value of non-market goods and services. Out of 100 respondents, five bid categories were offered, namely IDR 10,000, IDR 20,000, IDR 30,000, IDR 40,000, and IDR 50,000. Each bid category consisted of 20 respondents. The respondents were local residents living in Pantai Lango Urban Village.

Based on respondents who were willing and unwilling to accept the bid values offered, the number of respondents willing to pay and unwilling to pay for the proposed bid values was identified. The analysis of community WTP for mangrove forest conservation in Pantai Lango Urban Village was conducted using CVM through the following stages:

1. Developing a hypothetical scenario

Respondents were provided with information regarding the condition of mangrove forests in Pantai Lango Urban Village and the importance of conservation, so that respondents could understand the hypothetical context presented and consider their willingness to contribute.

2. Obtaining the WTP value

The estimation of WTP values was obtained through direct interviews using questionnaires with a single-bounded dichotomous choice elicitation method. In the data collection process, five bid values were offered, namely IDR 10,000, IDR 20,000, IDR 30,000, IDR 40,000, and IDR 50,000, thus respondents were divided into five groups according to the bid values provided.

3. Estimating the mean WTP value

The estimation of the mean WTP value was also conducted using a parametric approach with a logistic regression method. This method utilizes the coefficients of the independent variables and the bid value variables to obtain the estimated mean WTP value (Ardilla & Nugroho, 2021).

Table 2. Results of the analysis of the average WTP using logistic regression

No.	Primary Data	Coefficient	Z	P > z
1	WTP	39.184,69	22,93	0,000

Source: Processed research data, 2025

Table 2 shows the results of the logistic regression analysis, where the WTP coefficient is Rp 39,184.69. Logistic regression analysis was used to identify the average community WTP for mangrove forest conservation in Pantai Lango Village. This analysis was conducted using Stata 17 software. The dependent variable in this study was the respondents' "yes" or "no" answers to the bid value offered. Meanwhile, the independent variables included the bid value, age, education level, type of employment, and income. The resulting formula is as follows:

$$WTP = - \frac{\beta_0 + (\bar{X}_2 \times \beta_2) + (\bar{X}_3 \times \beta_3) + (\bar{X}_4 \times \beta_4) + (\bar{X}_5 \times \beta_5)}{\beta_1}$$

$$= - \frac{3,605 + (43,6 \times 0,029) + (1,63 \times 0,062) + (0,89 \times 1,036) + (2.024.000 \times 0,0000000991)}{-0,0002}$$

$$= 39.184,69$$

These calculations indicate that residents of Pantai Lango Village are willing to contribute IDR 39,184.69 per person to mangrove forest conservation efforts. This contrasts with research by Osmaleli *et al.*, 2022, which found a WTP of IDR 12,266 per person using logistic regression.



Figure 1. Comparison of respondents who are willing to pay and who are not willing to pay

Figure 1 shows that the higher the bid value offered, the fewer respondents said they were willing to pay. Conversely, when the bid value gets lower, the number of respondents who say they are willing to pay more increases. This result is strengthened by research (Yusuf *et al.*, 2023) which states that the greater the price offered, the less willing the respondent is to pay, but when the price offered is smaller, the greater the respondent's desire to pay.

Factors Affecting Willingness to Pay (WTP)

The analysis of factors influencing community WTP (Uncertain Opinion) regarding forest conservation in Pantai Lango Village used a logistic regression model. This analysis requires dependent and independent variables. In this study, the dependent variable used is WTP, which utilizes the distribution of "yes" and "no" responses from respondents. Meanwhile, the independent variables are bid value, age, education level, type of employment, and income. The analysis can be seen in Table 3 below:

Table 3. Results of logistic regression analysis

No.	Variables	Coefficient	Z	P > z
1	Bid	-0,0002	-4,46	0,000
2	Age	0,029	0,77	0,443
3	Education	0,062	0,13	0,898
4	Occupation	1,036	0,68	0,497
5	Income	0,0000000991	2,31	0,021
	Constant	3,605	1,59	0,112

Source: Processed data, 2025

Table 3 shows the results of the analysis of factors influencing the willingness to pay of residents in Pantai Lango Village. The independent variables used in this study were bid value, age, education level, type of employment, and income. The resulting logistic regression model is as follows:

$$P(Y \leq 1|x) = 3,605 - 0,0002bid + 0,029Ur + 0,062TP + 1,036JP + 0,000000991Pdpt$$

Information:

$P(Y \leq 1|x)$: The probability that people are willing to pay or not willing to pay

β_0 : Constant

Bid : Bid value offered (rupiah/year)

Ur : Age (years)

TP : Level of education

JP : Type of work

Pdpt : Income (Rp/month)

There are two independent variables that have a significant influence on the community's willingness to pay in Pantai Lango Urban Village, namely:

1. Bid value (bid)

The bid value affects the community's willingness to pay in Pantai Lango Urban Village. This variable reflects the level of community willingness to contribute to mangrove forest conservation efforts. The results of the analysis conducted using logistic regression obtained a probability value ($P > |z|$) of 0.000, indicating a statistically significant effect at the 5% error level. The negative coefficient value indicates that the higher the bid offered, the lower the probability that the community is willing to pay the proposed bid. This result is supported by the study of (Osmaleli *et al.*, 2022), which shows that the bid variable is a factor influencing the level of individual concern in mangrove forest conservation efforts.

2. Income

Income affects the community's willingness to pay in Pantai Lango Urban Village. Based on the results of the logistic regression analysis, the probability value ($P > |z|$) was 0.021, indicating a statistically significant effect at the 5% error level. The coefficient value generated for this variable is close to zero, indicating that the magnitude of the coefficient is very small. However, this variable still exerts a statistically significant influence. The higher an individual's income, the greater the community's willingness to pay for the offered bid value. This finding is consistent with the study of (Rangkuti *et al.*, 2022), which states that income has a significant effect on WTP.

CONCLUSION

The estimated value of the community's Willingness to Pay (WTP) for mangrove forest conservation in Pantai Lango Urban Village using a logistic regression model shows an average WTP value of IDR 39,184.69 per person. There are two variables that have a real and significant influence on the community's Willingness to Pay (WTP) in Pantai Lango Urban Village, namely the bid value and income. This is indicated by the probability values of each variable being lower than the established level of significance.

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