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Analysis Of Willingness To Pay (WTP) To Support The Sustainability Of Coral Reef Ecosystem In Wediombo Marine Protected, Gunungkidul

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The coral reef ecosystems are important ecosystem since it has several services to human and environment around. However, the area still faces environmental degradation issues due to lack of community awareness and suboptimal management. This study aimed to determine the amount of Willingness to Pay (WTP) that tourists and communities are willing to pay to protect the sustainability of coral reef ecosystem in in the Wediombo Marine Conservation Area. The data used in this study consist of secondary data and primary data obtained structured interviews with 67 tourists, and 48 community members. The sample sizes were determined using purposive random sampling for community members and accidental sampling for tourists. Processing and analysis were conducted using Contingent Valuation Method (CVM) and comparison the WTP value of tourists and community member. The results of this study are the WTP of the coral reef ecosystem in the Wediombo Marine Conservation Area are shows that the WTP value from tourists is higher from community members as much as Rp1.190.791.429 per year from community members and Rp2.325.840.000 per year from tourists.

KEYWORDS: Coral reefs; Total Economic Value; Monetary value; Wediombo Marine Protection Area; and Marine Engineering.

Introduction

Gunungkidul Regency is one of the regencies in the Special Region of Yogyakarta, renowned for its coastal and marine potential. One of the areas in Gunungkidul that is also a protected

area is the Wediombo Beach Area, located in Jepitu Village, Girisubo District [1]. This area has been designated as a Regional Marine Protected Area (MPA) of the Marine Nature Reserve type [2]. The Wediombo area, which is part of the Marine Protected Area (MPA), is intended to be a Coast Tourism Area based on Education, Conservation, and Adventure Tourism. The establishment of the area is based on the presence of coral reef areas, the development of fish landing bases, areas with geological uniqueness, as well as landing and turtle development areas [3]. There are some potential problems facing the Wediombo Area, namely environmental degradation due to lack of public and tourist awareness, unmaximum management and governance, and poor waste management [4]. Coral reef ecosystems are highly productive and dynamic, has several services to human and environment, part of the blue carbon ecosystem, and high economic value [5]. Therefore, further action is needed in the form of coral reef ecosystem preservation through the assessment of the willingness to pay to optimalize the management of the coral reef ecosystem, which is an important consideration for managing conservation areas.

The main problem of environmental degradation in the Wediombo area is due to massive tourism activities and fishing landings. The environmental damage that occurs will clearly have a negative impact and pressure on the ecosystems in the area, especially on the coral reef ecosystem. Unfortunately, the potential damage to the coral reef ecosystem is still not considered a serious enough matter for the public or visitors given the existence of which is considered a common property. Coral reef ecosystem damage is caused by waste and rubbish produced by the community, tourists and fishermen. The damage to the coral reef ecosystem in the Wediombo Beach Area clearly contradicts the paradigm of sustainable development. Evaluation of coral reef ecosystems is becoming so important as a basis for reviewing the management of aquatic conservation areas in the area [6]. Therefore, further studies are needed to analysis through the community awareness and optimalize the management by willingness to pay. This study aims to determine the amount of Willingness to Pay and comparing that value from the tourists and communities are willing to pay to protect the sustainability of coral reef ecosystem in the Wediombo Marine Conservation Area.

Methodology

2. 1 Research Location

This research was conducted in the Wediombo Beach Area in Jepitu Village District. Girisubo, Gunung Kidul Regency, Special Province of Yogyakarta (DIY), as shown in Figure 1 (a). Data collection occurred from December 2022 to January 2023 during Saturday and Sunday holidays. The method used is observation and field surveys.

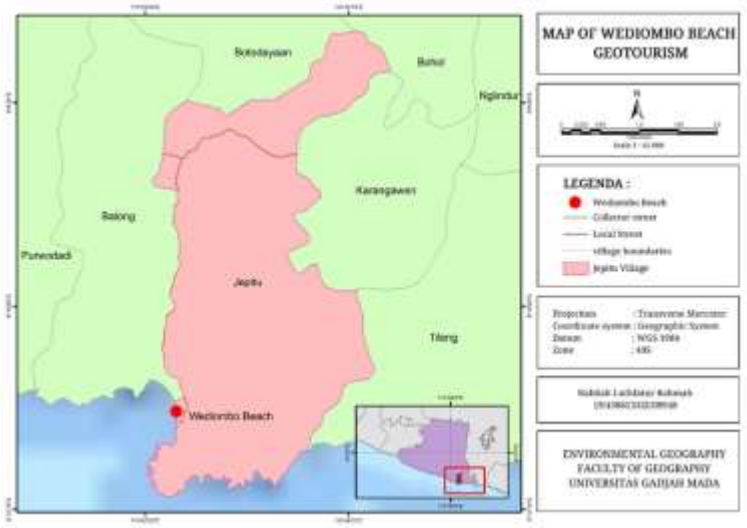

Figure 1 (a). Location Map of Wediombo Beach, Jepitu Village

2.2 Data and Sample

The data used in this study are primary and secondary data. This study's primary data is obtained from the results of structured interviews using questionnaires to tourists who visited Wediombo Beach and community members in Jepitu village. The secondary data is research supporting data and number of visitors to Wediombo beach in 2023 and number of community in Jepitu village 2023 obtained from the Gunungkidul Tourism Office in 2023. The sampling method used in this study is accidental sampling for tourists, namely a sampling technique based on respondents who happened to be or were available in a place according to the research context. While sampling method used for community members is purposionate sampling. Respondents were those aged 15-64 years with an income.

The sample size was determined based on calculations using the Krejcie and Morgan formula with a margin of error of 10%, as follows:

$$\mathbf{n} = \frac{\mathbf{X^2.N.P(1-P)}}{\mathbf{(N-1).d^2 + X^2.P(1-P)}}$$

Explanation:

n : Sample Size
N : Population Size
X^2 : Chi-Square Value
P : Population Proportion
d : Margin of Error

Based on the Krejcie and Morgan methods calculation results, the number of respondents is 115, including 67 tourists and 48 community members.

2.3 Data Analysis Method

Willingness to pay is analyzed using the Contingent Valuation Method and summing up the total value of willingness to pay. The bidding for the willingness to pay value in this research uses the Bidding Game Method and then calculating the average willingness to pay. CVM is

a survey-based approach to estimate the extent to which individuals or communities value commodities that do not have a market, such as environmental goods. The CVM method is carried out by asking people to directly state their willingness to pay for certain environmental services, such as the value of recreational services, based on a hypothetical scenario. This method has several dichotomies of questions, namely open-ended questions, bidding games, payment cards, and closed-ended referendum models. This study uses a bidding game approach, which offers payable values from the smallest to the largest [7].

There are several steps in using CVM, which consist of six steps, namely 1) Compiling a hypothetical market, 2) Determining the amount of bid or auction, 3) Calculating the average WTP or WTA, 4) Estimating the supply curve, 5) Summing up the total value of WTP, and 6) Evaluate CVM calculations [8]. The following are the stages of implementing CVM in this study [9].

a) Estimated Average of WTP

The WTP value can be estimated using the average value of the total WTP value divided by the number of respondents using the following formula:

$$EWTP = \frac{\sum_{i=1}^{n} W_i}{n}$$

Explanation :
EWTP : average of WTP value
Wi : WTP respondent-i
n : number of respondents
i : respondent-i who are willing to pay (i= 1,2,3, …n)

b) Summing up the Total Value of WTP

$$EWTP = \sum_{i=1}^{n} W_i \left(\frac{n_i}{N}\right) P$$

Explanation :
TWTP : total of WTP
Wi : WTP respondent-i
n : number of sample-i who is willing to pay
N : number of samples
i : respondent-i who are willing to pay (i= 1,2,3, …n)
P : number of population

Results

The characteristics of the respondents carried out further analysis on this research are the repondents of the community of Jepitu Village, Girisubo district as well as tourists of Wediombo Beach, Gunungkidul. The gender characteristics of the respondents in this study as shown in Table 1 are known to have a fairly comparable proportion between the sexes of both men and women, especially for the respondent community, which has a balanced percentage of 25 percent of the male and female. For the tourist respondents, the percentage was 52 percent higher than the female and 47 percent greater than the male.

Tabel 1. Characteristics of respondents based on gender

Gender	Community Member		Tourists	
	Total (people)	**Percentage (%)**	**Total (people)**	**Percentage (%)**
Male	24	50	32	47
Female	24	50	35	52
Total	**48**	**100**	**67**	**100**

The age characteristics of respondents and tourists are quite different, where the respondents have the characteristic of the age of the population in the majority age is 31-40 years, while for respondents tourists is in the age majority is 20-30 years of age is 47 percent as seen in Table 2.

Tabel 2. Characteristics of respondents based on age

Age	Community Member		Tourists	
	Total (people)	**Percentage (%)**	**Total (people)**	**Percentage (%)**
15-20	1	2	9	13
21-30	4	8	32	47
31-40	14	29	12	17
41-50	8	16	7	10
51-60	12	25	5	7
>60	9	18	2	2
Total	**48**	**100**	**67**	**100**

There is a discrepancy between the educational levels of the majority of people who have a formal education at the SD level, while tourists are dominated by a society whose final education is high school as seen in Figure 2.

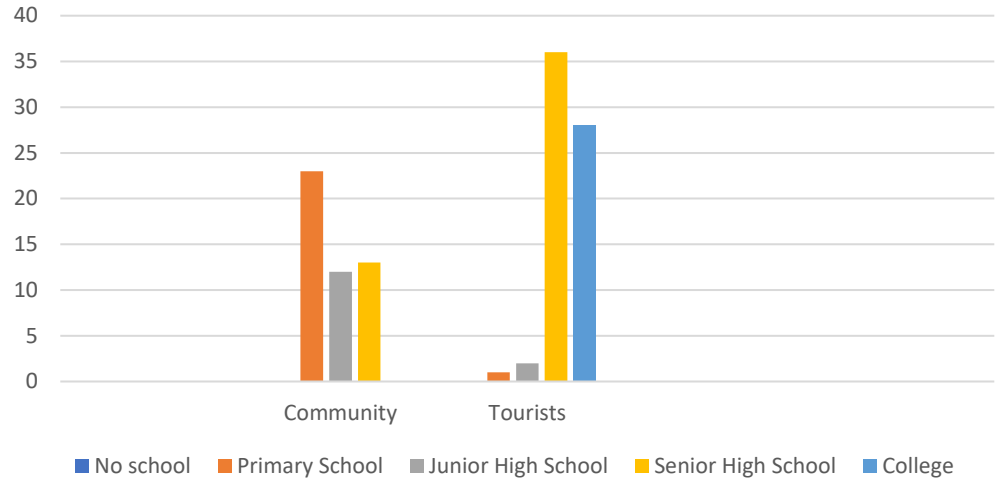

Figure 2 (a). Characteristics of respondents based on level of education

The majority of people in the Wediombo Area have jobs like fishermen and farmers wich 28 people, whereas the opposite of tourist jobs dominated by jobs like private employees at 32 people and other types is 11 people as seen in Figure 3.

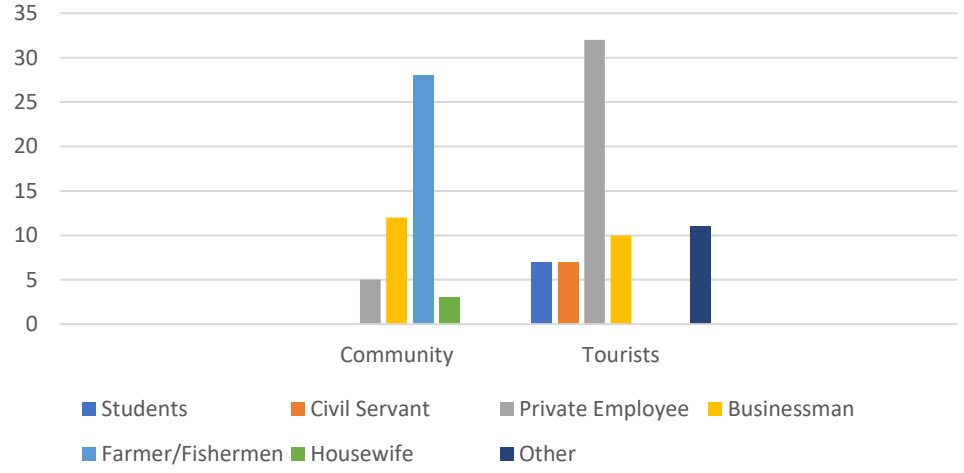

Figure 3. Characteristics of respondents based on type of work

This clearly proves that if the majority of the population of the village of Jepitu income is less than eligible, because having a total income a month is still less than the provisions of the Provincial Minimum Wage. This situation is reversed compared to tourists, where the majority of tourists have revenues of more than Rp4.000.000 as seen in Figure 4.

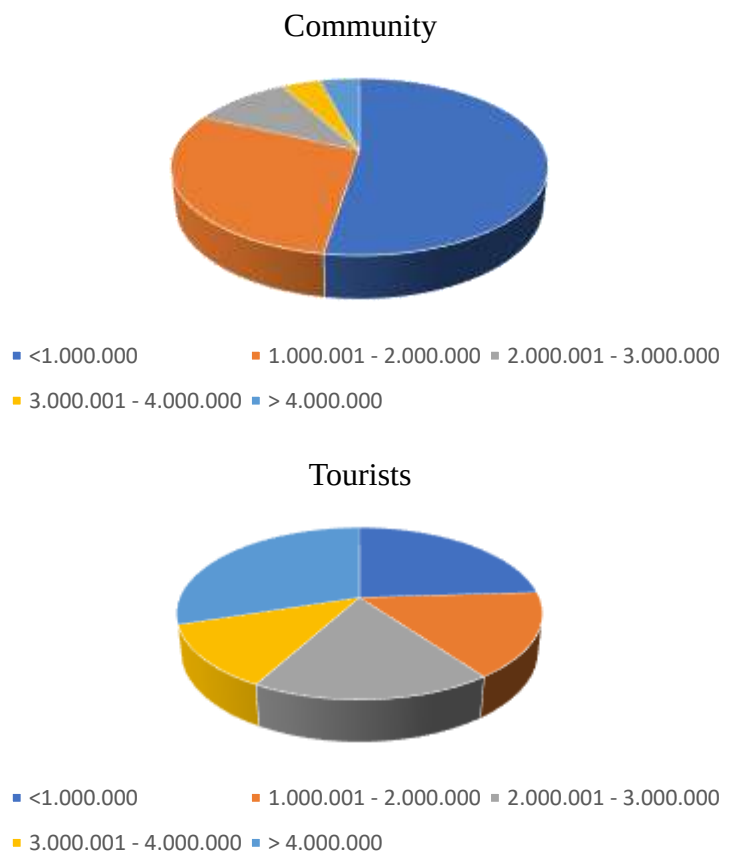

Figure 4 (a) Characteristics of respondents based on income

The percentage of WTP communities in paying the value of the inheritance is 87% or about 42 people out of 48 communities. Meanwhile, the other six are unwilling to pay. Out of a total of 42 societies willing to pay, the highest value given is Rp.200,000 and the lowest value is Rp.2,000 with each one person in total. The total value of the inheritance is Rp.967,000. With the total value of the following inheritance, the average value of WTP per year is Rp.276.286. Then, in connection with the result of the calculation of the total value of WTP per year obtained from the entire area of the coral reef is Rp.1,190.791.429. The following value obtains from the total value of the population of 4,310 people. Meanwhile, the value of WTP per year for each hectare is given Rp.87.046.157. The following values can be observed in Table 3.

Table 3. The amount willingness to pay of Communities

WTP value (Rp)	**Number of Community Member (people)**	**Number of WTP value (Rp)**
Rp2.000	1	Rp2.000

WTP value (Rp)	**Number of Community Member (people)**	**Number of WTP value (Rp)**
Rp5.000	9	Rp45.000
Rp10.000	15	Rp150.000
Rp15.000	1	Rp15.000
Rp20.000	9	Rp180.000
Rp25.000	1	Rp25.000
Rp50.000	3	Rp150.000
Rp100.000	2	Rp200.000
Rp200.000	1	Rp200.000
Total	42	Rp967.000
Average value of WTP (Rp/Month)		Rp23.024
Average value of WTP (Rp/Year)		Rp276.286
Number of Community Member (people)		4.310
Total WTP Value (Rp/Year)		**Rp1.190.791.429**
Area of Coral Reef Ecosystem (ha)		13,68
Total WTP Value (Rp/ha/year)		Rp87.046.157

The willingness to pay for tourists per year per hectare proves a larger total when compared to the willingness to pay for the community as seen in Table 4. The following value is Rp.170.017.544. The value of that amount is obtained from the total value of WTP per year of Rp.2,325.840,000 for the entire area of coral reefs. The total WTP value per year is calculated from the average value of WTP for the year, is Rp.240,000 with a total of tourists as much as 9.691 one in the year. As for the total tourists who are willing to pay from the survey results is as many as 49 people. The lowest value of inheritance according to tourists is Rp5,000 with two people in total and the highest value is Rp200,000 with one person in total. Total willingness to pay value from tourists is higher than willingness to pay value from community members as seen in Table 5.

Table 4. The amount willingness to pay of Tourists

WTP value (Rp)	**Number of Tourism (people)**	**Number of WTP value (Rp)**
Rp5.000	2	Rp10.000
Rp10.000	14	Rp140.000
Rp15.000	4	Rp60.000
Rp20.000	11	Rp220.000
Rp25.000	4	Rp100.000
Rp30.000	2	Rp60.000
Rp50.000	8	Rp400.000
Rp100.000	3	Rp300.000
Rp200.000	1	Rp200.000
Total	49	Rp980.000
Average value of WTP (Rp/Month)		Rp20.000

Average value of WTP (Rp/Year)	Rp240.000
Number of Tourists (people)	9.691
Total WTP Value (Rp/Year)	**Rp2.325.840.000**
Area of Coral Reef Ecosystem (ha)	13,68
Total WTP Value (Rp/ha/year)	**Rp170.017.544**

Table 5. Comparison Wiillingness To Pay of Tourists and Communities of Wediombo

Comparison Wiillingness To Pay of Tourists and Communities of Wediombo		
	Community Member	**Tourists**
Number of Respondents (people)	41	62
Total Population (people)	4.310	9.691
Average value of WTP (Rp/Month)	Rp23.024	Rp20.000
Average value of WTP (Rp/Year)	Rp276.286	Rp240.000
Median WTP (Rp/Month)	Rp150.000	Rp140.000
Standard Deviation (Rp/Month)	Rp83.950	Rp126.798
Total WTP Value (Rp/Year)	**Rp1.190.791.429**	**Rp2.325.840.000**
Total WTP Value (Rp/ha/year)	Rp87.046.157	Rp170.017.544

Discussion

Based on a live interview conducted with the residents of Jepitu Village, it is known that as many as seven residents who expressed their unwillingness to pay for the existence of the coral reef ecosystem in Wediombo are based on several factors. Residents feel that paying more to guarantee the existence of coral reef ecosystems is not a priority given that some residents still have difficulty in meeting their primary needs even their debts. The residents also still have no awareness of the importance of preserving the existence of coral reef ecosystems, they consider that coral reefs do not need to be maintained because they can grow naturally. In addition, the residents assess that there is still no effort to manage the coral reef ecosystem, so they are reluctant to pay for the unclear disadvantage.

According to an interview conducted with 67 tourists, there were six tourists who refused to pay for the WTP value of the coral reef ecosystem in the Wediombo capital. The reason that tourists refuse to make payments due to payments to the WTP value of the coral reef ecosystem will hurt tourists who will travel with the group. Tourists also feel that the facilities offered in Wediombo are still less so that it is not worth paying more to tour the coral reefs in Wetiombo. According to visitors, the government is supposed to subsidize tourist prices so tourists don't have to pay more to visit Wediombo. Besides, if payments are made more, feared visitors refuse to come on tour Wediombo, because according to visitors tourists still need to get a recreational area at an affordable price.

When investigated further it can be found that the willingness to pay value of visitors or tourists in Wediombo has a higher value for the WTP value it gives. The bequest value for tourists per hectare per year shows a considerable amount. The value is Rp170,017,544. This amount is derived from the total annual bequest value of Rp2,325,840,000 for the entire coral

reef area. The number of tourists willing to pay from the survey results is 49 people. The total annual bequest value is calculated from the average annual bequest value, which is Rp240,000, with a total of 9,691 tourists in one year.

Conclusion

This study shows that the total WTP value from tourists is higher than WTP value from community members by Rp2.325.840.000 compared to Rp1.190.791.429. This suggests that awareness of the importance of coral reef ecosystems in the future is still high for tourists compared to the communities that live around the KKP Wediombo. It indicates that there is a need for an effort to make the public aware of the significance of the coral reservoir ecosystem for future generations. So therefore, further research is required regarding to find out the factors that influence willingness to pay other than those explained in this research.

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