Willingness to pay and sustainable water resources management preference of the community in Parerejo, Lampung Province, Indonesia

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Abstract. Indonesia has abundant water resources in the rainy season but experiences water scarcity during the dry season. The need for sustainable management of water resources in overcoming hydrometeorological disasters such as floods and drought. The purpose of this study was to determine the value of willingness to pay, factors that influence willingness to pay, and the conservation policy chosen by the people of Parerejo Village in realizing sustainable water resource management. The policies offered in the management of sustainable water resources are greening, infiltration wells, and bio-pores. This study uses the Contingent Valuation Method (CVM) to see the influencing factors of willingness to pay and descriptive analysis to see preference policy accepted by society. The data used are primary data obtained from 156 respondents. The study showed that the willingness to pay for Parerejo village communities in the management of water resources is still low at ≤ IDR 50,000.00. Only variables of education and knowledge about water scarcity significantly influenced the willingness to pay for water resource management. Based on the descriptive analysis, the communities preferred the greening policies solution for sustainable water resources management.

1. Background
Indonesia is a tropical country that has two seasons that are rainy season and the dry season. Nowadays, the weather is challenging to predict, thus it leads to uncertain climate change. Climate change causes changes in the availability of water resources because the warmer the temperature lead to faster water evaporation [1]. When rainfall is high, it causes floods, and when rainfall is low, it causes drought.

Human needs are very dependent on water. Thus, there is a need for protection and care to be used sustainably [2]. The protection is in the form of the conservation of water resources. According to Law number 07 of 2004, water conservation is an effort made by the community and the government in maintaining the integrity and availability of water sources. Water conservation can be in the form of infiltration wells, bio-pores, or reforestation activities.

Most of areas in Indonesia are prone to drought, including Lampung Province. According to the Indonesian agency for meteorology, climatology, and geophysics, eight regencies in Lampung province experienced depletion of water resources. Pringsewu Regency is one of those experiencing water resource scarcity. The Pringsewu Regional Disaster Management Agency also mentioned that another problem regarding water resources is the flood disaster due to high rainfall [3]. There is a need to manage water resources to balance hydrometeorological disasters. In order to manage water resources properly, there needs to be a synchronization between community participation and government policies. Based
on these problems, the purpose of this study is to determine the amount of willingness to pay (WTP) of the community and the factors that affect WTP and to find out the policies desired by the community as an effort to manage water resources effectively and efficiently.

2. Literature review

2.1. Water resources conservation
Theoretically, water conservation is the efficient utilization of rainwater that falls to the land's surface with the right timing of the flow. Thus, there is no flood in the rainy season, and water is available in the dry season [4]. Conservation is a term that is often used to use water resources wisely. During this time, the water needs problem only prioritizes the improvement of the ability of water providers without seeing inefficiency. The problems lead to the importance of managing water resources [5].

Along with increasing community demand and higher water scarcity, it is necessary to manage water resources. Water resources management is an effort to plan, implement, monitor, and evaluate water resources conservation, utilization of water resources, and water damage control [6]. Integrated water resources management is a process that promotes the development and management of other related resources in a coordinated manner to maximize economic and social welfare somewhat without compromising the sustainability of the underlying ecosystem [7].

2.2. Willingness to pay
Willingness To Pay (WTP) is the amount a consumer is willing to pay to obtain an item or service. WTP calculation looks at how far the ability of individuals or communities in the aggregate to pay to improve environmental conditions to conform to desired standards, where WTP is the value of potential uses of natural resources and environmental services [8].

Research by Bogale & Urgessa [9] used the profit bivariate model. Household income, education, sex, time spent for collecting water, water treatment practices, water quality, and spending on the water have a positive and significant effect on WTP to increase the supply of water services. Meanwhile, the age of respondents has a negative and significant effect.

According to Boadu [10], household income is a significant factor affecting the willingness to pay for water. There is a statistically significant positive relationship between a history of water-related illnesses and their willingness to pay for water. The effects of most other socioeconomic factors in this study do not follow a consistent pattern and broad generalizations are not possible.

Halkos [11] found the relative importance of specific value components in determining the conservation preferences of water resources and individual WTPs to protect them. There is a high association between individual WTP towards river protection to respondent characteristics such as education, income, and origin.

3. Methodology

3.1. Research sites
This research was conducted in Parerejo Village, Gadingrejo District, Pringsewu Regency, Lampung Province, which experienced the scarcity of water resources and floods. Thus, there is a need to offer to the public regarding water resources conservation policies.

3.2. Population and sample
The population studied in this study is the population in Parerejo Village. The population of Parerejo Village is 4,308 people. The sampling method using the Slovin formula obtained 156 people, with an error rate of 8 percent.
3.3. Research type

This research is quantitative descriptive research. The data is generated from survey and interview methods using a structured research instrument questionnaire (questionnaire). The data mainly obtained from questionnaires. Thus, the questionnaire determines the final results of the study.

3.4. Methods and data analysis

3.4.1. Willingness to pay (WTP) analysis for the conservation of water resources. Contingent Valuation Method (CVM) is a survey method to ask the public about the value or price they provide for commodities without a market, such as environmental goods. The value of willingness to pay can be analyzed using the CVM approach. The steps in the application of CVM analysis, according to Fauzi [8] are:

1. Create an open market. It was built to explain why people should pay for the conservation of water resources in Parerejo Village.
2. Offer the value of WTP. Conducted by using questionnaires and the open-ended question approach to find out community concerns seen from the magnitude of the lowest to the highest value of WTP.
3. Estimate the average WTP value (equation 1). By using an average value, a higher value than the actual value will be obtained. Therefore it is better to use median value not to be influenced by an enormous enough range of offers.

$$ EWTP = \left( \frac{\sum_{i=1}^{n} W_{i}}{n} \right) \quad \ldots \ldots \quad (1) $$

Where:
- EWTP = average WTP
- W = the value of WTP $i$
- N = number of respondents
- I = respondents, $i$ are willing to pay

4. Adds the total value of WTP. The total value of WTP can be obtained using equation 2.

$$ TWTP = \sum_{i=1}^{n} WTP_{i} \left( \frac{n_{i}}{N} \right) P \quad \ldots \ldots \quad (2) $$

Where:
- TWTP = total WTP
- N = number of samples
- P = total population

3.4.2. Analysis of Factors affecting the willingness to conserve water resources.

Multinomial regression was employed to analyse the variables that affect the community's willingness to pay for water resources management in Parerejo Village. The multinomial regression model is presented in equation 3.

$$ WTP = \beta_0 + \beta_1 J K_i + \beta_2 Pd_{i} + \beta_3 Pd_{api} + \beta_4 J A_{Ki} + \beta_5 P KA_{iri} + \beta_6 SPA_{ai} + \beta_7 K K S_{Ri} + \beta_8 K KB_{i} + \beta_9 K KP_{i} + \epsilon_i \quad \ldots \ldots \quad (3) $$

Where:
- WTP = Willingness to pay (1 = willing; 0 = not willing)
- JK = Gender (1 = male; 0 = female)
Pdik  = Educational Level (0: Not Going to School; 1: Elementary School; 2: Middle School; 3: High School; 4: Diploma; 5: Bachelor; 6: Master )
Pdap  = income level
JAK  = number of family members
PKA  = knowledge of water scarcity (0: don't know; 1: know )
SPA  = water supply sources (1: Well; 2: PDAM; 3: both )
KKSR = infiltration well policy (1: willing; 0: not willing)
KKB  = biopore policy (1: willing; 0: not willing)
KKP  = reforestation policy (1: willing; 0: not willing)
β0 = intercept
β1, β2 ... 9 = coefficients
i = respond to i (i = 1,2,3 ... n)
ε = error

4. Results and discussion

4.1. Characteristics of respondents
The results of the socioeconomic characteristics of the community represented by the sampled respondents were obtained based on the results of the interview from 156 respondents in Parerejo Village and presented in Table 1. It is shown that male respondents were 52.6%, and the female respondent were 47.40%. It showed that most respondents were heads of households. The highest age range was aged 35-44 years or 25.6% in productive age.

There are 90.4% married respondents and 9.6% not married respondents. The most recent level of education; most of the respondents' education was elementary school graduates by 44.2%. There are 57 respondents or 36.5% of total respondents with an income of less than IDR 500,000. Meanwhile, only one respondent or 0.6% who has an income of more than 3 million.

There are 145 respondents, or 92.9% use water sources from wells. Meanwhile, only 5.1% or eight respondents use water sources from PDAM. There are three respondents, or 1.9 %, using both wells and PDAM. The reason the community does not use PDAM services is that they used water from other sources. The community uses wells as their daily needs, and some people use bottled water for drinking by 26.9%. The reason people do not use PDAMs is that the PDAM network does not reach people's homes. PDAM also has low water quality, and the installation costs are too expensive.

There are only 11.5% or 18 respondents know about water resources management problems. Even respondents do not know the terms used in the availability of water resources; the community has been making efforts to conserve water as a precaution in the problem of scarcity of water resources. 92% of respondents turn off the tap when the water in the tub completes and collects rainwater. The community also knows the purpose of saving water as much as 47.4% of respondents aim to maintain water resources. Besides, the respondent's response was also aware of the importance of protecting the environment.

4.2. Community WTP Value
The interview results generated from 156 respondents reveal that 111 respondents were willing to pay for water resources management. They are willing to pay 51.3% aware that clean water must be enjoyed in the future, and 35.3% answered because they are aware that there must be conservation for the availability of water resources.

Table 2 revealed that the value of the public WTP Village Parerejo is IDR 34,405. It can be interpreted that the WTP value less than or equal to IDR 50,000. 93 respondents out of 111 who choose WTP less than one or equal to IDR 50,000 agreed to conserve water resources. The value of the WTP is 83.78%. Meanwhile, 11 respondents, or 9.9% of total respondents, have the WTP value between IDR 51,000 - 80,000. The community is unwilling to pay for water resource conservation
because they think that water resource scarcity is a government responsibility. Figure 1 shows 71% people were willing to pay, while 29% were not willing to pay.

Table 1. Socioeconomic characteristics of respondents.

| Variable               | Description                        | Freq | Percentage |
|------------------------|------------------------------------|------|------------|
| Gender                 | Male                               | 82   | 52.60%     |
|                        | Female                             | 74   | 47.40%     |
| Age                    | ≤ 24 years                         | 9    | 5.8%       |
|                        | 25 - 34 years                      | 26   | 16.7%      |
|                        | 35 - 44 years                      | 40   | 25.6%      |
|                        | 45 - 54 years                      | 36   | 23.1%      |
|                        | 55 - 64 years                      | 31   | 19.9%      |
|                        | ≥ 65 years                         | 14   | 9.0%       |
| Marital status         | Married                            | 141  | 90.40%     |
|                        | Not Married                        | 15   | 9.60%      |
| Education              | Elementary school                  | 69   | 44.2%      |
|                        | Middle school                      | 44   | 28.2%      |
|                        | High school                        | 30   | 19.2%      |
|                        | Vocational School                  | 3    | 1.9%       |
|                        | Bachelor                           | 10   | 6.4%       |
|                        | Master                             | 0    | 0.0%       |
| Income (IDR)           | ≤ 500,000                          | 57   | 36.5%      |
|                        | 500,001 – 1,000,000                | 45   | 28.8%      |
|                        | 1,000,001 – 2,000,000              | 37   | 23.7%      |
|                        | 2,000,001 – 3,000,000              | 15   | 9.6%       |
|                        | ≥ 3,000,000                        | 1    | 0.6%       |
| Water sources          | Well water                         | 145  | 92.9%      |
|                        | Using PDAM (municipal waterworks)  | 8    | 5.1%       |
|                        | Both                               | 3    | 1.9%       |
| Water Resources Problems Knowledge | Know | 18 | 11.5% |
|                        | Do not know                        | 138  | 88.5%      |
| Willingness to accept infiltration wells policy | Willing to | 133  | 85.3% |
|                        | Not willing to                     | 23   | 14.7%      |
| Willingness to accept bio-pore policy | Willing to | 123  | 85.3% |
|                        | Not willing to                     | 33   | 14.7%      |
| Willingness to accept reforestation policy | Willing to | 142  | 78.8% |
|                        | Not willing to                     | 14   | 21.2%      |

Figure 1. Percentage of willingness to pay.
4.3. The determinants of WTP

There are nine independent variables to measure the factors that affect willingness to pay. They are gender, education, income, several family members, knowledge of the scarcity of water resources, water supply sources, willingness to accept infiltration, bio-pores, and robotization policies. Before conducting multinomial regression, it is necessary to carry out simultaneous tests. The simultaneous test is helpful to test whether the independent variables simultaneously affect the dependent variable.

Table 3. Omnibus tests of model coefficients.

| Step   | Chi-square | df  | Sig. |
|--------|------------|-----|------|
| Step   | 39.516     | 9   | 0.000|
| Block  | 39.516     | 9   | 0.000|
| Model  | 39.516     | 9   | 0.000|

Table 3 shows all the independent variables simultaneously affect the dependent variable at the 95% confidence level. The partial effect of each independent variable on the dependent variable is presented in table 5. The educational variable has a significant effect because the willingness to pay off the community is related to community knowledge about the importance of conservation that will be done.

The result of multinomial regression from Table 4 revealed that education and willingness to accept policy are the only significant variable. The p-value of the educational variable is 0.048, with a significance of 0.05. Every increase or decrease in 1 unit of education level results in an increase of 3.913 times the willingness to pay (WTP). In other words, if there is an increase in willingness to pay for environmental services from users or utilization of drinking water raw water by 3.913 times, the respondent's education level will also increase. The findings are in line with the research of Sutopo et al. [12], who examined that education had a significant effect on the willingness to pay for environmental services in the upstream Cisadane watershed. Willingness to accept policy variable absorption wells, bio pores, and reforestation significantly affect the willingness to pay. That is because people willing to accept the policy are undoubtedly willing to spend money to conserve water resources.

Table 4. Multinomial regression.

| Variable | Score | Sig.     | Result     |
|----------|-------|----------|------------|
| Gender   | 0.458 | 0.999    | Not significant |
| Education| 3.913 | 0.048    | Significant |
| Income   | 0.328 | 0.567    | Not significant |
| Number of family members | 264   | 607      | Not significant |
| Scarcity Knowledge     | 0.206 | 0.650    | Not significant |
| Water Supply Source    | 0.951 | 0.330    | Not significant |
| Willingness to Accept Infiltration Wells Policy | 43.621 | 0.000   | Significant |
| Willingness to Accept Biopore Policy | 13.867 | 0.000   | Significant |
| Willingness to Accept Reforestation Policy | 7.302 | 0.007   | Significant |
Five independent variables that are gender, income, the number of family members, the water resources scarcity knowledge, and the water supply sources, do not significantly affect the willingness to pay for water resources conservation. This research result is different from findings by Afifah [13], which revealed that income significantly affects people's willingness to pay for environmental services in the Kerandangan Nature Tourism Park, West Lombok. Most people who live in Parerejo work as farmers and rely on agriculture for their basic needs. Thus, their income is less stable. Although the scarcity of water resources is not significant, the people who live in Parerejo Village already know the importance of maintaining water availability awareness.

4.4. Conservation policy preferences

| Policy          | Frequency | Percentage |
|-----------------|-----------|------------|
| Infiltration wells | 133       | 85.26%     |
| Biopore         | 123       | 78.85%     |
| Reforestation   | 142       | 91.03%     |

The policy offered in this research survey is the making of wells, bio pores, and reforestation. Table 5 shows the community prefers reforestation as a conservation effort for sustainable water resources. It is because of the condition of Parerejo Village that still has much abandoned land. Thus, those land can be planted with the water-conserved plants. These plants include Kiara umbrella, Angsana, peacock flower, banyan, and red shoots. Most people are willing to accept conservation, but only 111 respondents are willing to pay the conservation fee.

5. Conclusion
The value of willingness to pay at Parerejo Village was IDR 34,405 because most people are willing to pay a sum of <IDR 50,000 for water resources conservation. Educational variables and the type of conservation of water resources have a significant effect on the willingness to pay for the conservation of water resources. The community preferred reforestation as a water resources policy, and most people are willing to grow crops that can hold water, such as Angsana and redbuds.

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