Prepublished copy

Nature Environment & Pollution Technology

This is a peer-reviewed prepublished version of the paper

The Implementation of Contingent Valuation Method for Waste Management at Telaga Ngebel, Ponorogo, Indonesia: A Novel Approach to Ecotourism Waste Processing House

Evi Gravitiani[*]†, Ainina Ratnadewati[*], Nur Widiastuti[**]

[*]Faculty of Economics and Business, Universitas Sebelas Maret
Jalan Ir Sutami 36A Surakarta, Indonesia

[**]School of Economics Widya Wiwaha
Jl. Lowanu Sorosutan UH VI / 20, Sorosutan, Yogyakarta, Indonesia

†Corresponding author: Evi Gravitiani; evigravitiani_fe@staff.uns.ac.id

ABSTRACT

The increase in the number of visitors to the tourism sector has a positive impact on the economy of the surrounding merchants. However, it also creates negative externalities through increased waste generation. The generation of unresolved waste will disrupt the function of the environment. Ecotourism Waste Management is one way to handle waste from sellers and tourists by collecting, processing, and selling processed products. The "Waste Treatment House" manages sales proceeds from and for sellers with a profit-sharing system. This effort requires the willingness to pay (WTP) sellers for waste management. This study aims to determine the amount of waste retribution and the factors that influence it. The data used in this study were primary data of 104 sellers in Telaga Ngebel Area, Ponorogo, Indonesia, and were processed using ordinary least squares (OLS) regression and descriptive analysis. WTP value is influenced by age, monthly expenses, number of dependents, operating hours, and length of business. The products produced through the program are organic waste processed into compost and fish feed, while inorganic waste is processed into handicrafts. Finally, selling processed waste products and the proceeds from these sales are used to increase merchant empowerment through revenue sharing and savings and loan products. This study has limited secondary data, namely information about the sustainability of waste management that has been carried out and the exact number of sellers in the area around Telaga Ngebel.

Key Words	Waste Management, Economic Tourism, Circular Economy, Willingness to Pay, Contingent Valuation Method
DOI	https://doi.org/10.46488/NEPT.2025.v24i02.D1706 (DOI will be active only after the final publication of the paper)
Citation of the Paper	Evi Gravitiani, Ainina Ratnadewati, Nur Widiastuti, 2025. The Implementation of Contingent Valuation Method for Waste Management at Telaga Ngebel, Ponorogo, Indonesia: A Novel Approach to Ecotourism Waste Processing House. *Nature Environment and Pollution Technology*, 24(2), D1706. https://doi.org/10.46488/NEPT.2025.v24i02.D1706

INTRODUCTION

A total of 175 countries gathered in Nairobi, Kenya, in March 2022 to support a resolution by the United Nations Environment Programme (UNEP) to address waste generation, including plastic waste (Adamowicz, 2022). This resolution

is the first step towards a legally binding agreement. It is targeted to be reached in 2025, known as the International Legally Binding Instrument (ILBI) or Global Plastic Treaty (GPT), so various agreed formulations are needed (Bergmann et al., 2022; Cowan, Tiller et al., 2023; Maes et al., 2023). This led to the establishment of the Intergovernmental Negotiating Committee (INC), consisting of member states and relevant stakeholders. This committee meets regularly, from INC-1 to INC-5, as one of the supporters of the resolution in 2022. This effort is a further step taken to reduce waste pollution worldwide. Indonesia is one of the countries that actively strives to reduce pollution, as evidenced by its contribution to GPT.

Various global efforts have been made to ensure environmental cleanliness and safety. This can be seen from the emergence of sustainable waste management to overcome environmental pollution caused by waste generation (Masjhoer et al., 2022). The World Bank estimates that each individual produces 0.74 kg of waste worldwide and 2.01 billion tons annually, which is expected to increase to 3.40 billion tons by 2050 (Cai & Ou, 2023; Gasni & Mulyadi, 2022). The increase shows that appropriate waste management is needed to overcome the pollution problem. The condition is aggravated when no attention is paid to the issue. Therefore, it is essential to integrate sustainable waste management to address environmental pollution due to waste generation effectively (Mohamad Mulyadin et al., 2018).

One of the sectors that has the potential to contribute to the most significant waste generation is the tourism sector (Rahmattullah et al., 2023). Tourism is an economic sector that is very important in providing significant economic and social benefits. Despite this, there is still a lack of substantial empirical data on the negative impacts of the tourism sector, especially related to environmental pollution issues. This results in pollution from tourism activities, which can hamper efforts to control ecological pollution. More in-depth Research is needed to examine this issue and evaluate its implications for sustainable waste management (PLASTIC ATLAS ASIA, 2022).

Indonesia is the second largest producer of plastic waste in the world. One of the largest sources comes from the tourism sector, reaching 187.2 million tons, after China, which reached 262.9 million tons (Inayah & Istiqomah, 2021). According to the Ministry of Environment and Forestry, in 2019, the waste generated in tourism areas was 241 tons per day, consisting of waste from trash cans and waste scattered in several tourist locations (Hilman et al., 2023). This waste problem should not be ignored because it can gradually threaten the sustainability of living things and tourism. Therefore, a strategy that can be done to reduce the increase in waste is to encourage tourists and sellers to behave in a more environmentally friendly way.

Several other factors also support the high amount of waste from the tourism sector. Research conducted by Made et al. (2020) shows that the increasing amount of waste from the tourism sector in Indonesia is caused by population growth, lack of public awareness in protecting the environment, lack of socialization in various roles, weak implementation of waste handling regulations, and lack of landfills in the majority of tourism sectors in Indonesia.

The increase in the amount of waste in the tourism sector is still a classic problem that must be solved (Djuwendah et al., 2023). The waste generation that is not managed correctly disrupts the function of environmental balance, especially the environment around tourist attractions (I. M. Costa & Ferreira Dias, 2020). The waste produced is from visitors and sellers at the tourist spot (Achmad et al., 2023). One of the tourism sectors in Indonesia that has experienced an increase in the amount of waste is Telaga Ngebel, amounting to 6.5 tons of waste in 2021 and increasing to 8 tons in 2022 (Maria & Widayati, 2020).

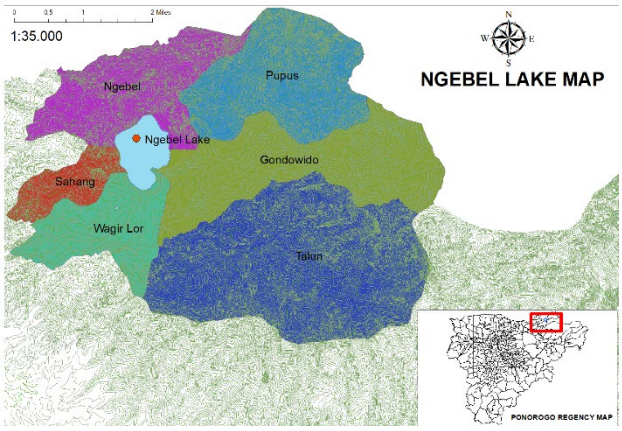

Figure 1. Telaga ngebel Map

Telaga Ngebel is a natural lake in Ponorogo Regency, East Java, flanked directly by four surrounding villages: Sahang Village, Ngebel Village, Wagir Lor Village, and Gondowido Village, as seen in Figure 1. The area of Telaga Ngebel is 150 hectares, with an altitude of 734 meters above sea level (Nisa et al., 2021). The height of the location causes the temperature around the telaga to be 20 degrees Celsius. Telaga Ngebel has a beautiful view: a row of hills flanking the Lake and the cool air. Tourists can also enjoy other tourist attractions such as speed boats, dancing fountains, horse rentals, and cultural performances on certain occasions. Tourist attractions owned by Telaga Ngebel have the potential to attract tourists to visit (Rahardjo et al., 2023). This makes Telaga Ngebel one of the potential tourists in East Java Province, as evidenced by the increasing number of Telaga Ngebel tourists from year to year, as shown in Figure 2.

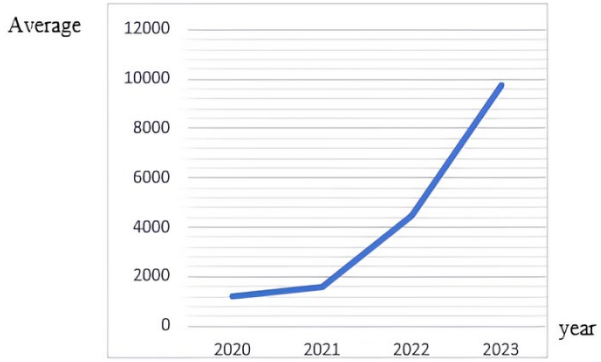

Figure 2. The Daily Averaga Number of Visitors to Telaga Ngebel

The average Number of Telaga Ngebel tourists per day in 2021 was 1607. This number increased from the previous year, only 1206 tourists, and grew in 2022, reaching 4465. One of the reasons for this increase is the absence of social restrictions due to the COVID-19 pandemic. The peak of the increase in the average number of tourists per day during 2020-2023 occurs in 2023, reaching 9275 tourists. The increasing number of tourists certainly has a positive impact, including for residents around Telaga Ngebel.

Residents use the increase in the Number of Telaga Ngebel tourists to improve the economy by trading food and souvenirs and renting rides. In addition to increasing the economic sector, the large number of tourists has side effects in the form of negative externalities. According to Anggarini, (2021), negative externalities are side effects of imbalances arising from a particular activity and outside the market system. A negative externality arising from the increase in tourists is the increasing amount of waste generation (Anggarini, 2021). Most waste comes from tourists and sellers who trade around Telaga Ngebel. The waste produced is, on average, single-use plastic waste from food, beverage, and souvenir packaging and fish bone waste from restaurants around Telaga Ngebel.

The waste is classified by type, namely organic, paper, plastic, cans, and other waste. Meanwhile, based on the source, waste is divided into three, namely: sellers, visitors, and residents who dispose of their waste at the Telaga Ngebel Landfill, as shown in figure 3.

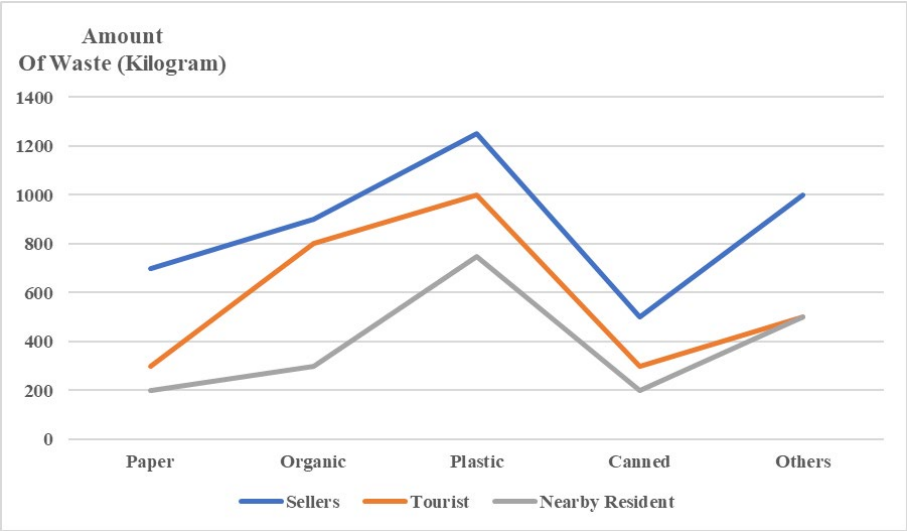

Figure 3. Amount of Waste by Type and Source in 2022

The most produced type of waste is plastic waste, which has a total waste of 3000 kilograms. The plastic waste is in the form of plastic bottles and food wrappers, the majority of which are sourced from sellers, with a total of 1250 kilograms. The second largest type of waste is organic waste, which has a total amount of waste of 2000 kilograms. The organic waste produced is food waste from restaurants (vegetables, fish bones, etc.), which sellers mostly produce with a total waste of 900 kilograms.

The sector that produces the least waste around Telaga Ngebel is the household sector because it does not dispose of its waste at the landfill in Telaga Ngebel, and The second sector that produces the most waste is the sector is the merchant sector. The total waste generated in 2022 is 8 tons of waste calculated from each week. There are two three-wheeled motorcycles with a capacity of 153 kilograms of waste that transport this waste to be collected at the Telaga Ngebel landfill.

This situation is exacerbated by waste management that is not as dense as the waste collection location far from tourist sites and the absence of waste management and other problems, as in Figure 4.

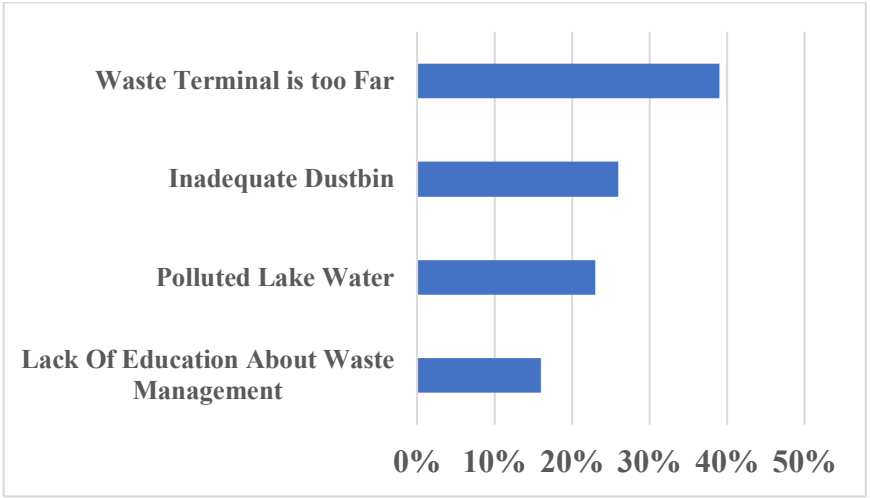

Figure 4. Waste Problems in Telaga Ngebel

The surge in the amount of waste due to the activities of sellers and visitors in Telaga Ngebel requires special attention to overcome it. One way that can be done is through the ecotourism waste management program (Hemali & Alwis, 2022). The program is one of the programs that initiate sellers to manage waste and make products that are of selling value. Sellers are considered actors who have a significant influence in increasing the amount of waste around the area because they stay for a long time, unlike visitors who only come occasionally to travel. Ecotourism Waste Management is an implication of

waste management programs carried out by and for sellers in the region through several stages, as in Figure 5 (Amirudin et al., 2023).

The application of waste management in ecotourism in Indonesia has begun to be encouraged. Research conducted by Sekarningrum, (2016) said that in the ecotourism location of Baluran National Park, Banyuwangi, waste management has been implemented by applying biodegradable waste composting. Almost the same thing is also seen in Research conducted by Thorley et al., (2019), namely waste management, which has been applied to Nagari Tuo Pariangan Tourism Village using three main sorting methods: composting, reprocessing, and residual waste. Slightly different from the previous two studies, the Research conducted by Wicaksono et al., (2023) focused more on making the Anthropocene Monument an ecotourism facility at the Piyungan Landfill, Bantul.

The Ecotourism Waste Management Program aimed at sellers in the Telaga Ngebel area is a program managed directly by sellers in a place called the waste processing house. There are four stages of the waste processing house process. As in Figure 4, the stage is waste management tailored for sellers (Thorley et al., 2019). The first stage is collecting, which is the process of collecting waste generated every day. The collection of such waste is carried out independently by sellers. Waste is collected and separated based on its type, namely organic and inorganic waste. Organic waste, according to Kumar et al., (2022) , is waste that comes from the rest of living things and has a relatively faster recycling period. In contrast, inorganic waste, according to Cowan, et al., (2023) and Cai and Ou, (2023), comes from processed products and has difficulty being recycled. The stage of waste separation by sellers is the second stage of the ecotourism waste management program.

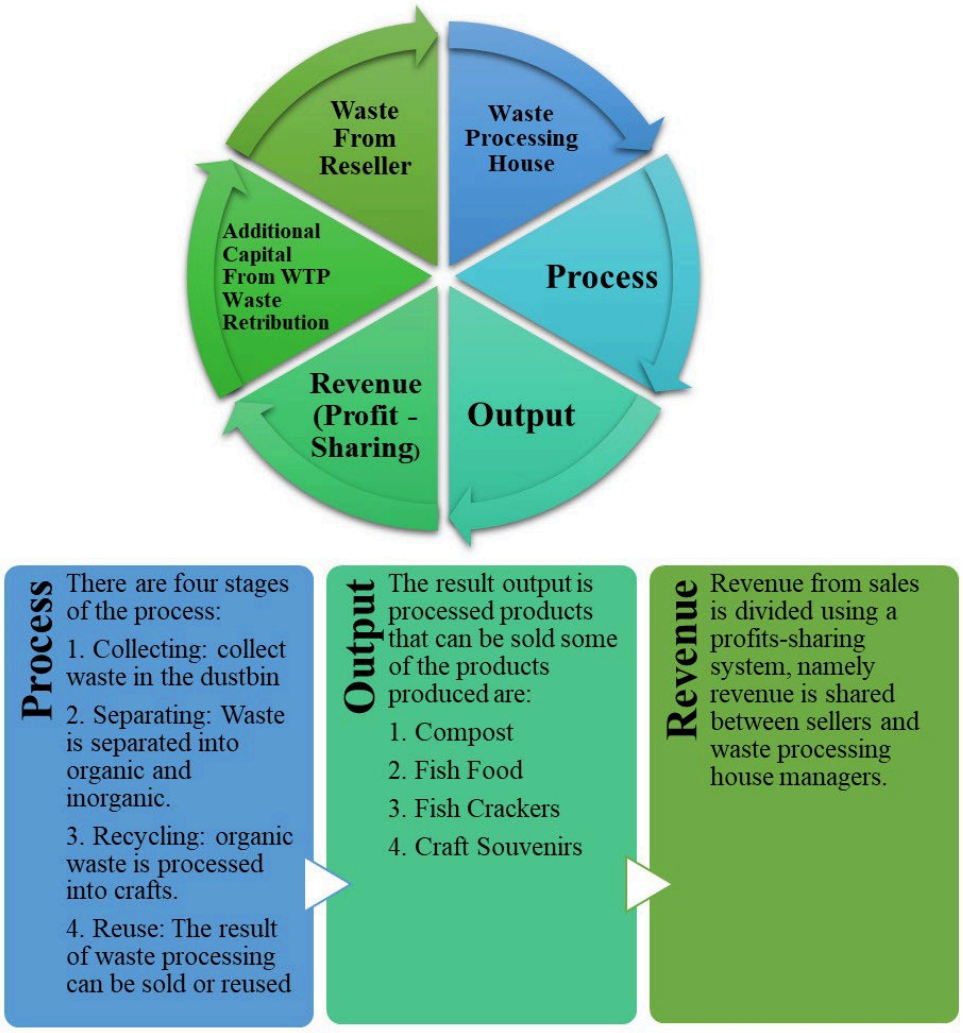

Figure 5. Integrating Waste Processing House for Effective Ecotourism Waste Management Implementation

According to Kumar et al., (2022), waste processing is the process of reprocessing the remaining consumables into materials that can be reused and even have selling value. Waste processing is done by regrouping waste into sub-groups to get different treatments (State et al., 2022). This study divides subgroups into types of organic waste, consisting of subgroups of fish bones, foliage waste, and wet food waste. The fish bones will be processed into processed products such as fish crackers, while foliage and wet food waste will be processed into compost and fish feed. The fish bones will be processed into processed products in the form of fish crackers, while foliage waste and wet food waste are processed into compost and fish feed. Making fish crackers made from fish bones requires several materials and stages as shown in figure 6. The processed product is currently still in the idea stage and will only be tested as well as compost and fish feed, so the business feasibility test has not been carried out.

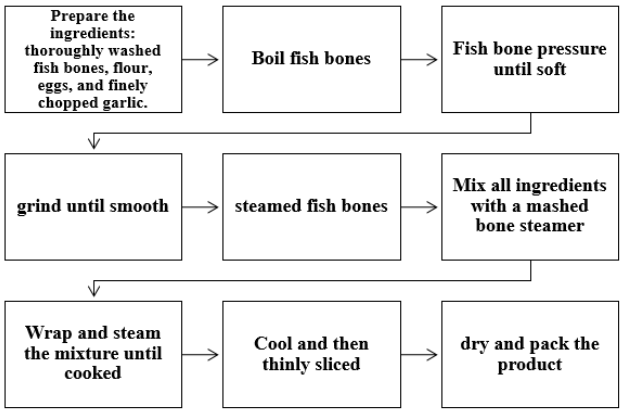

Figure 6. The Process of Making Fish Crackers Made from Fish Bones

Another thing with inorganic waste is that it is processed into handicrafts. The processed waste then becomes items of selling value, such as handicrafts from used bottles, lamp cap decorations, and shopping bags, which are then marketed into typical Telaga Ngebel products. In addition, waste in the form of plastic packaging is processed into eco-bricks, which is the last stage of the ecotourism waste management program (Ledheng et al., 2022).

Products processed by sellers waste in Telaga Ngebel will be managed and marketed by sellers, one of which is through galleries and workshops managed by the sellers' association and the local government, with the proceeds of the sale being given back to sellers. The ecotourism waste management program organized at the waste processing house certainly requires the involvement of various parties in its implementation, such as the government, tourism managers, and sellers around the area. The implementation began with training and counselling to sellers, in addition to synergy and commitment in the form of payment of merchant waste retribution as a form of environmental responsibility and used as waste processing capital. The waste retribution paid by sellers is a form of commitment and responsibility of sellers to the environment. The fixed waste retribution rate is one of the things that needs to be reviewed. One solution can be done through contingent valuation method analysis with the calculation of willingness to pay for merchant waste retribution in the Telaga Ngebel Area. Contingent Valuation Method (CVM) is a method for valuing environmental objects with no market value (Atinkut et al., 2020).

The CVM assessment in this study aims to calculate the value of hygienic environmental objects in the form of waste processing accountability in the Telaga Ngebel Area. The value of environmental objects is calculated through the willingness to pay for the merchant's waste retribution. One hundred four sellers in the region will be given a choice on the market hypothesis of the importance of waste processing and the impact of damage to the tourist environment. Providing options for this hypothesis is continued by asking about the value of willingness to pay waste retribution as an effort to preserve the environment through open questions. The amount of desire to pay the merchant is then added up to get the average WTP value of the Merchant's Waste Retribution (Nwofoke et al., 2017).

Several factors can influence the willingness to pay waste management retribution. Research conducted by Jamaludin et al., (2022)said that the WTP of waste management retribution is influenced by the high level of education and the amount of one's expenditure. Meanwhile, Saija et al., (2023)'s research found that age and number of dependents also affect WTP waste management. According to Jamaludin et al., (2022), the amount of WTP sellers on waste management is also influenced by the length of business, operating hours, and the contribution to waste management. The method used to determine the factors that affect the amount of WTP value is ordinary least square (OLS) with seven independent variables, namely: age, length of education, marital status, number of dependents, operating hours, willingness of sellers to process waste, and length of effort. Meanwhile, the dependent variable used is the amount of WTP Waste Retribution sellers.

Research on waste management in tourist attractions has been carried out previously by Wubalem et al., (2023), who said that ecotourism waste management can be analyzed and applied through the active role of visitors. Different results from Hung et al., (2023) show that ecotourism waste management in tourist attractions, especially natural tourism, is carried out through solid synergy between stakeholders and managers. Similar findings are shown in Suchek et al, indicating that the application of ecotourism waste management is still emphasized through the role of cleaners and the government in waste management. The three previous studies resulted in disagreement of results and differences in research points of view, most of which said that the role of sellers in tourism waste processing was underemphasized. The conflict is interesting, so this study will discuss waste management ecotourism at the waste processing house using CVM analysis calculated based on the

WTP of waste retribution and the factors affecting it.

MATERIALS AND METHODS

Research Design

This study uses a quantitative method in the form of Contingent Valuation Method (CVM) calculations, which aims to determine the value of environmental awareness measured using Willingness to Pay (WTP) waste retribution (Lake et al., 2023). In addition, researchers also use descriptive analysis to represent data and socioeconomic characteristics of sellers.

Sampling Techniques

To conduct this study, researchers used a simple random sampling method with a population of 140 sellers in the Telaga Ngebel area, which was then sampled using the Slovin method with an error of 5 per cent as follows:

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

Where:
n = sample size
N = population size
e = error estimate

Contingent Valuation Method

Data analysis in this study uses the contingent valuation method (CVM) with the aim of measuring the desire to pay individuals (WTP) for changes in the quantity or quality of environmental goods and services that do not have market value (Natsir et al., 2024). The existence of waste around Telaga Ngebel causes disruption of environmental functions in the form of pollution of water, air, and soil. Thus, it is necessary to evaluate how to overcome the waste problem, one of which is by looking at the waste-producing sector around Telaga Ngebel's responsibility to the environment by analyzing the value of environmental awareness through WTP payments.

There is a population of 140 sellers recorded in the group of sellers around Telaga Ngebel. The population is then calculated using the formula in equation (1) with an error rate of 5%, resulting in a sample of 104 sellers. Sellers are considered as one of the sources of waste producers around Telaga Ngebel, with a total of 4.35 waste generated from 8 tons of waste in 2022.

There are six stages in implementing CVM, namely: 1) Forming a hypothetical market, 2) Determining the bid/auction size, 3) Calculating the average WTP, 4) Predicting the supply curve, 5) Summing the results, and 6) Evaluating the CVM calculation [37]. The calculation of CVM in this study was carried out through several stages, namely:

Forming a Hypothetical Market

The market hypothesis is built by elaborating to sellers about the problem of waste and the disruption of ecological functions around the lake due to the high amount of waste. After describing the problem, then also described the benefits and

importance of protecting the environment around the telaga ngebel.

Determining The Bid/Auction Size

The amount in question is the Willingness To Pay (WTP) of the merchant's waste retribution. The assessment begins with a value of IDR 20,000 (USD 1,29), which is taken based on local government regulations regarding merchant levies. Furthermore, researchers will raise offers but are asked with the open question method.

Calculating The Average WTP

It can be assumed the average value of Willingness to Pay (WTP) by calculating the total number of WTP values divided by the number of respondents calculated through the average WTP value as follows:

$$EWTP = \frac{\sum_{t=1}^{n} W_i}{n} \qquad (2)$$

Where:
EWTP = WTP Estimation of Waste Retribution
Wi = Exit WTP to i
N = number of respondents
i = I-th respondent willing to pay

Summing Results

After estimating the average WTP value, the next step is to evaluate the total WTP value of the community using the formula that has been determined as follows:

$$TWTP = \sum_{t=1}^{n} WTP_i(\frac{n_i}{N})P \qquad (3)$$

Where:
TWTP = Total WTP of sellers
WTPi = WTP individual sample-i
ni = number of the i-0
N = Total sample
P = Total population
i = with respondent willing to pay

Ordinary Least Square Regression

The value of the seller's WTP against the Waste Management program Ecotourism through Waste Processing House is influenced by several factors. These factors were then analyzed using Ordinary Least Square (OLS) regression with the EVIEWS tool. The econometric equation used in OLS regression is as follows:

$$WTP = a + b_1U + b_2PT + b_3LNOutput + b_4JT + b_5JO + b_6Cont + b_7LU + e \quad (4)$$

Where the unit WTP used is thousand rupiahs, U is the age of the stall vendor in units of years, PT is the length of education taken by sellers in units of years, $Output$ is the number of expenses incurred by sellers for daily needs in a month in units of thousand rupiah, JT is the number of family members, JO is the operating hours of a business owned by a seller in a day, $Cont$ It is the seller's willingness to contribute to the program by using the Dummy Variable, dan LU is the length of business owned by the seller with units of years.

RESULT AND DISCUSSION

Socioeconomic Characteristics.

This study used cross-section primary data with the population of all sellers in the Telaga Ngebel area. Still, there was no definite data on the number of sellers, so the sample was taken from as many as 104 sellers based on respondents willing to be interviewed. The data was collected in 2023 using a random sampling technique through direct interviews. Data was obtained from as many as 104 sellers around the Telaga Ngebel area with the following socioeconomic characteristics:

Table 1. Socioeconomic Character of Respondents

Socioeconomic Characteristics	Frequency	%	Socioeconomic Characteristics	Frequency	%
Seller type			**Education**		
Food seller	80	76,92	Elementary	45	43,27
Non-food seller	24	23,08	Junior High School	18	17,31
Age			Senior High School	30	28,85
16 – 23	8	7,7	Bachelor	10	9,61
24 – 31	15	14,42	> Bachelor	1	0,96
32 – 39	16	15,4	**Outcome**		
40 – 47	26	25	170.000 - 206.500	13	55,5
48 – 55	23	22,11	206.501 – 243.000	13	17,2
>55	16	15,38	243.001 – 279.501	40	22,2
Contribution			279.502 –	27	0,8

to waste management			316.001		
Contributed	54	51,94	316.002 – 352.302	7	2,6
Not Contributed	50	48,06	>352.302	4	
Number of dependents			**Operational Hour**		
1	24	23.08	6 - 7,14	20	19,23
2	44	43,31	7,15 - 8,29	22	21,15
3	23	22,11	8,30 - 9,44	3	2,88
4	13	12,50	9.15 - 10,29	18	17,31
Years of Business			10,30 -11,44	4	3,85
10 - 13,9	30	28,85	11,15 -12,29	23	22,11
14 - 17,9	46	44,23	>12,29	14	13,46
18 - 21,9	15	14,42			
22 - 25,9	5	4,81			
26 - 29,9	3	2,88			
30 - 33,9	2	1,92			
>33,9	3	2,88			

Table 1 shows that most sellers around Telaga Ngebel sell food and have been trading for more than ten years. The average seller is in the productive age, dominated by the age range of 40-47 years. Many of the sellers around Telaga Ngebel have a reasonably good level of environmental awareness. As many as 54 out of 104 sellers are willing to contribute to the Ecotourism Waste Management program through the Waste Processing House.

3.2 Analysis Contingent Valuation Method

The level of awareness of the importance of waste management is also shown by sellers who are analyzed through the contingency valuation method, namely the willingness to pay for environmental services in the form of the WTP Ecotourism Waste Management program through the Waste Processing House, which is as follows:

Table 2. Sellers' Willingness to Pay for Sustainable Waste Management Retribution in Telaga Ngebel

WTP (IDR)	Frequency	WTP * Frequency (IDR)

20.000 (USD 1,29)	7	140.000 (USD 9,04)
22.000 (USD 1,42)	2	44.000 (USD 2,84)
23.000 (USD 1,49)	2	46.000 (USD 2,97)
24.000 (USD 1,55)	2	48.000 (USD 3,10)
25.000 (USD 1,61)	22	550.000 (USD 35,51)
27.000 (USD 1,74)	1	27.000 (USD 1,74)
28.000 (USD 1,81)	7	196.000 (USD 12,66)
30.000 (USD 1,94)	31	930.000 (USD 60,05)
32.000 (USD 2,07)	3	96.000 (USD 6,20)
35.000 (USD 2,26)	11	385.000 (USD 24,86)
40.000 (USD 2,58)	16	640.000 (USD 41,32)
Total		3.966.000 (USD 256,08)

The willingness to pay merchants in the Telaga Ngebel area for the Ecotourism Waste Management program through the Waste Processing House is relatively high. Table 2 illustrates the average WTP value of IDR 38,500 (USD 2,48) per month, and the amount of WTP value fluctuates and varies. Figure 6 shows that most sellers will pay a sustainable waste management retribution of IDR 30,000 (USD 1,94).

The WTP value of sellers exceeds the amount of retribution set by the government local IDR 10,000 (USD 0,64) for small and medium sellers. The number shows that sellers around Telaga Ngebel have a relatively high level of environmental awareness (Hanafi Ahmad, 2022).

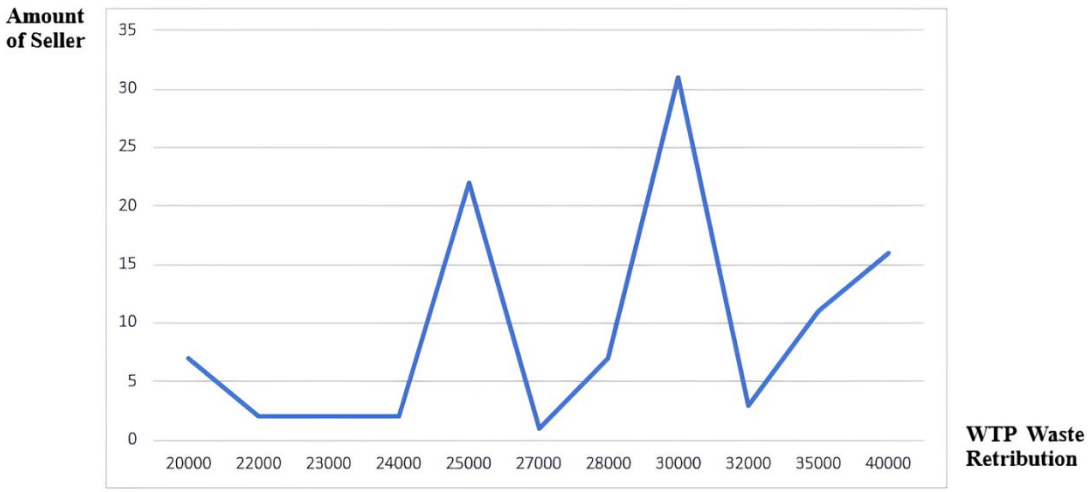

Figure 7. Seller's WTP for Waste Management Ecotourism program through Waste Processing House.

3.3 Regresi Ordinary Least Square

Several factors in this study affect the amount of WTP value, namely age, length of education, monthly expenses, number of dependents, operating hours, direct contribution, and business size. These factors are analyzed using multiple linear regression with the following equation:

$$WTP = 8,65 + 0,02U - 0,002PT + 0,08LNOutput \\ -0,04JT + 0,009JO + 0,005Cont - 0,002LU + e \quad (5)$$

The equation above indicates that several variables affect the size of the WTP value. The influence of variables can be predicted from the probability value. Suppose the probability value is less than 0.05. In that case, the variable affects the WTP value of sellers around Telaga Ngebel for the Ecotourism Waste Management program through the Waste Processing House (Mona et al., 2015). The probability values of each variable are shown in table 3, namely:

Table 3. Probability Value of Independent Variable

Variable	Coefficient	Std.Error	t-statistic	Probability	Result
U	0,02	0.000643	26.80342	0,00	Significant
PT	-0,002			0,24	Not
		0.001967	-1.175192		Significant
LNOutput	0,08	0.034501	2.234851	0,03	Significant
JT	-0,04	0.007329	-5.327994	0,00	Significant
JO	0,009	0.002668	3.239527	0,002	Significant
Cont	0,005			0,64	Not
		0.012121	0.455423		Significant
LU	-0,002	0.000997	-2.000442	0,05	Significant

The probability value of the independent variable seen in Table 3 shows that the variables of age, monthly expenses, number of dependents, operating hours, and length of business affect the WTP value of sellers around Telaga Ngebel against the Ecotourism Waste Management program through the Waste Processing House. These independent variables are factors that can affect the WTP value. The results of the equation above can be concluded that if the variables of age, length of education, expenses in a month, number of dependents, operating hours, contribution in managing waste, and size of business are zero, then the WTP value of sellers around Telaga Ngebel on sustainable waste management is 8.65%

The age variable is a variable that affects the WTP value. If the seller's age increases by one year, the WTP of sustainable waste management will increase by 0.02%. This follows Research conducted by Mona et al., (2015) , which says that a person's maturity level based on age affects awareness of the importance of protecting the environment, one of which is sustainable waste management. The majority of sellers around Telaga Ngebel are aged 40 – 47 years. With this age range, the amount of WTP proposed is greater than other ages, ranging from Rp.30,000 (USD 1,94) – to Rp.40,000 (USD 2,58). This amount is greater than the waste retribution fee for sellers regulated in local regulations, which is Rp.10,000 (USD 0,64), so it can be concluded that sellers in that age range have a high level of actualization and environmental awareness.

The following influential variable is the expenditure variable, which shows that if expenditure increases by 1%, then WTP for sustainable waste management increases by 0.08%. The result follows Research conducted by Maria & Widayati, (2020) and supported by Keynes's Consumption Theory that the higher the income, the higher the consumption or expenditure, including expenditure on environmental responsibility (Syukri et al., 2020). The majority of sellers have expenses of Rp.243,001 (USD 15,67) – Rp.279,501 (USD 18,02), but the more sellers spend, the more WTP value they are willing to pay. This is because these sellers produce more waste every day. This assumption is also supported by the high level of expenditure, which means that a person's income will also increase.

The variable that affects the amount of the third WTP is the number of dependents. The variable number of dependents has a probability value of less than 0.05. Still, it has a negative coefficient value, so the variable number of dependents

significantly negatively affects the WTP of sellers around Telaga Ngebel on sustainable waste management. It can be explained that the higher the number of dependents, the more the WTP value will decrease by 0.04%. Many of the sellers have a total of 2 dependents, and the highest number of dependents is four dependents of 13 sellers. Sellers with a large number of dependents tend to be willing to pay a low retribution of less than Rp.25000 (USD 1,61), even though the amount is still higher than local regulations related to waste retribution fees.

The number of dependents is considered an expense, so the more dependents there are, the more expenditures will increase this result follows Research conducted by Jamaludin et al., (2022) the operating hour variable shows significant results. Every additional 1 hour of seller operation will increase WTP by 0.009%. The increase is a form of merchant responsibility because the longer the operating hours, the more waste is produced. The result states that sellers are aware to pay more for the waste retribution. The last influential variable is the length of effort variable. The majority of sellers with high operating hours are sellers who have restaurants that are 11-12 hours a day. These sellers have more frequent waste disposal intensity with a larger amount than sellers with operating hours of less than 11 hours a day. The majority of waste produced is in the form of organic waste, such as vegetable residues and fish bones.

The last influential variable is the length of effort variable. An increase in one year of seller-owned business will reduce the WTP value by 0.002%. Sellers with the longest business of more than 34 years with a total of 3 sellers. These sellers have a low WTP tendency because the majority of sellers with long businesses are at an unproductive age, so that it affects income and has an effect on the amount of WTP value.

Multiple linear regression analysis in this study also indicates that two variables do not affect the amount of WTP value: Length of education and Contribution of Sellers to the Ecotourism Waste Management program through the Waste Processing House. The length of education of sellers cannot be used as a benchmark in determining the amount of waste retribution WTP because the average seller has low education, which is only up to elementary school.

In addition, the contribution of sellers to the Ecotourism Waste Management program through the Waste Processing House also cannot be used as a benchmark because the majority of sellers have contributed to the program so that the data obtained on these variables has an uneven distribution rate.

The Ecotourism Waste Management program through the Waste Processing House requires costs and contributions in the form of energy and time. The WTP value of sellers towards the Ecotourism Waste Management program through the Waste Processing House can be determined as waste retribution allocated for the operational costs of waste management, and the results of waste management can be sold or reused to minimize waste pollution around the Telaga Ngebel area.

Through the Environmental Office, the government has also provided waste management facilities through transportation personnel and waste processing machines, as shown in Figure 8, which can be used as a supporting tool for the Ecotourism Waste Management program through the Waste Processing House. Sellers in the region can also contribute to direct and sustainable management. Some sellers have also implemented sustainable waste management independently through several ways, namely: efficient use of resources, joint use of assets owned, reprocessing of leftover goods/materials into products that have usefulness and selling value, and reuse of goods/materials that are still suitable for use.

Figure 8. Waste Processing Housem, Telaga Ngebel

CONCLUSIONS

Research on ecotourism waste management on 104 sellers around the Telaga Ngebel area produced data that showed that the average willingness to pay merchants around the Telaga Ngebel area for sustainable waste management was IDR 38,500 (USD 2,49). The amount of WTP value is influenced by several factors, namely age, monthly expenses, number of dependents, operating hours, and length of business. This study has secondary data limitations, namely information about the sustainability of waste management that has been carried out and the exact number of sellers in the area around Telaga Ngebel.

The problem of waste produced by sellers around the Telaga Ngebel area can be overcome with several solutions. The determination of the monthly waste retribution fee of IDR 38,500 (USD 2,49) and the cost of retribution in the Telaga Ngebel area often change even though there are provisions from government regulations. Still, these provisions are only limited to the payment of merchant waste and do not cover tourist attractions, so the nominal retribution fee needs to be determined.

The second solution is to educate sellers about sustainable waste management. Education about it is related to the steps taken in the ecotourism waste management program through the waste processing house. Third, initiating sellers around the Telaga Ngebel area to separate organic and inorganic waste. Fourth, collaborate between sellers, tourism managers, and village communities to manage sustainable waste. This is shown by sellers' involvement with natural resources to manage waste. The fifth solution is to recycle waste generated through sustainable waste management programs. Namely, organic waste is processed into compost and fish feed, while inorganic waste is processed into handicrafts. Finally, selling processed waste products and the proceeds from these sales are used to increase merchant empowerment through revenue sharing and savings and loan products.

ACKNOWLEDGEMENT

The author expresses gratitude to Universitas Sebelas Maret for the research funding provided. The author also extends. Thanks to the sellers who acted as respondents in this study and to the tourism organizers in Telaga Ngebel for their assistance in completing this Research.

REFERENCES

Achmad, F., Prambudia, Y., & Rumanti, A. A. (2023). Improving Tourism Industry Performance through Support System Facilities and Stakeholders: The Role of Environmental Dynamism. *Sustainability (Switzerland)*, *15*(5). https://doi.org/10.3390/su15054103

Adamowicz, M. (2022). Green Deal, Green Growth and Green Economy as a Means of Support for Attaining the Sustainable Development Goals. *Sustainability (Switzerland)*, *14*(10). https://doi.org/10.3390/su14105901

Amirudin, A., Inoue, C., & Grause, G. (2023). *Rethinking Waste Management in Indonesia Using Public-Private Partnership Framework : A Case Study of PET Bottle Waste Management*.

Anggarini, D. T. (2021). Upaya Pemulihan Industri Pariwisata Dalam Situasi Pandemi Covid -19. *Jurnal Pariwisata*, *8*(1), 22–31. https://doi.org/10.31294/par.v8i1.9809

Atinkut, H. B., Yan, T., Zhang, F., Qin, S., Gai, H., & Liu, Q. (2020). Cognition of agriculture waste and payments for a circular agriculture model in Central China. *Scientific Reports*, *10*(1), 1–15. https://doi.org/10.1038/s41598-020-67358-y

Bergmann, M., Almroth, B. C., Brander, S. M., Dey, T., Green, D. S., Gundogdu, S., Krieger, A., Wagner, M., & Walker, T. R. (2022). A global plastic treaty must cap production. *Science*, *376*(6592), 469–470. https://doi.org/10.1126/science.abq0082

Cai, Y., & Ou, M. (2023). Experimental Study on Expansive Soil Improved by Lignin and Its Derivatives. *Sustainability (Switzerland)*, *15*(11). https://doi.org/10.3390/su15118764

Costa, F. T., Oliveira, T. P., Droval, A. A., Marques, L. L. M., Fuchs, R. H. B., & Cardoso, F. A. R. (2024). Evaluation of physicochemical properties of Nile tilapia skin collagen extracted in acid médium | Avaliação das propriedades físico-químicas do colágeno da pele de tilápia do Nilo extraído em meio ácido. *Brazilian Journal of Biology*, *84*, 1–10.

Costa, I. M., & Ferreira Dias, M. (2020). Evolution on the solid urban waste management in Brazil: A portrait of the Northeast Region. *Energy Reports*, *6*, 878–884. https://doi.org/10.1016/j.egyr.2019.11.033

Cowan, E., Setsaas, L., & Nørstebø, V. S. (2023). End of life at the top of the world—stakeholder perspectives for plastics and circular transitions in the Arctic. *Journal of Environmental Studies and Sciences*, *13*(4), 545–556. https://doi.org/10.1007/s13412-023-00845-6

Cowan, E., Tiller, R., Oftebro, T. L., Throne-Holst, M., & Normann, A. K. (2023). Orchestration within plastics governance – From global to Arctic. *Marine Pollution Bulletin*, *197*(October), 115635. https://doi.org/10.1016/j.marpolbul.2023.115635

Djuwendah, E., Karyani, T., Wulandari, E., & Pradono, P. (2023). Community-Based Agro-Ecotourism Sustainability in West Java, Indonesia. *Sustainability*, *15*(13), 10432. https://doi.org/10.3390/su151310432

Gasni, D., & Mulyadi, I. H. (2022). Effect of Extracting Method of Coconut Oils on Tribological Properties As Bio-Based Lubricant. *Journal of Applied Engineering Science*, *20*(3), 831–840. https://doi.org/10.5937/jaes0-32294

Hanafi Ahmad, A. (2022). Pengaruh Jumlah Kunjungan Wisatawan, Objek Wisata, Dan Retribusi Pariwisata Terhadap Pendapatan Asli Daerah. *Jurnal Sosial Ekonomi Bisnis*, *2*(1), 50–61. https://doi.org/10.55587/jseb.v2i1.34

Hemali, N. A., & Alwis, A. A. P. De. (2022). *Application of Material Flow Analysis to Municipal Solid Waste in Urban Areas in Developing Countries and Possible Solutions Under Circular Economic Framework*.

Hilman, Z., Awfa, D., Fitria, L., & Suryawan, I. W. K. (2023). *Problematika Sampah di Sektor Perjalanan dan Pariwisata : Kajian Literatur*. *11*(3), 896–903.

Hung, C. L., Yu, T. F., Lin, Y. H., Lin, Y. C., Chen, Y. H., & Lo, W. S. (2023). Reflective and Cooperative Learning for Understanding Sustainability through an Eco-Innovation Strategy in Rural Travel and Hospitality: A STEAM Case Study. *Sustainability (Switzerland)*, *15*(17). https://doi.org/10.3390/su151713152

Inayah, H., & Istiqomah, A. (2021). *Nilai Ekonomi Sampah di Kawasan Wisata Pantai Tanjung Bira , Sulawesi Selatan (Economic Value of Waste at Tanjung Bira Beach , South Sulawesi)*. *26*(1), 159–166. https://doi.org/10.18343/jipi.26.1.159

Jamaludin, H., Suliman, H., Elmaky, E., & Sulaiman, S. (2022). The future of food waste : Application of circular economy. *Energy Nexus*, *7*(June), 100098. https://doi.org/10.1016/j.nexus.2022.100098

Kumar, P., Malesios, C., Chowdhury, S., Saha, K., Budhwar, P., & De, D. (2022a). International Journal of Production Economics Adoption of circular economy practices in small and medium-sized enterprises : Evidence from Europe. *International Journal of Production Economics*, *248*(March), 108496. https://doi.org/10.1016/j.ijpe.2022.108496

Kumar, P., Malesios, C., Chowdhury, S., Saha, K., Budhwar, P., & De, D. (2022b). International Journal of Production Economics Adoption of circular economy practices in small and medium-sized enterprises : Evidence from Europe. *International Journal of Production Economics*, *248*(September 2020), 108496. https://doi.org/10.1016/j.ijpe.2022.108496

Lake, B., Sur, L. Del, Mamaco, A. W. A., Buncag, M. J. J., Magarin, R. A., Arreza, K. P., Rule, M. G. Q., & Calipusan, J. P. (2023). *Diversity Assessment and Contingent Valuation in*. *11*(6), 922–931. https://doi.org/10.13189/eer.2023.110603

Ledheng, L., Maria, E., Hano, Y., Fallo, Y. M., & Binsasi, R. (2022). *Inovasi Olahan Tulang Ikan Menjadi Kerupuk Di Kelompok Nelayan Wini Kecamatan Insana Utara Kabupaten Timor Tengah Utara Provinsi NTT*. *1*, 42–49.

Made, N., Kristina, R., Ketut, I. G., Pranata, I., & Ratnaningtyas, H. (2020). *Pengelolaan Timbulan Sampah Untuk Menjaga Citra Industri Pariwisata Pada Daya Tarik Wisata di Bali*. *25*(3).

Maes, T., Preston-Whyte, F., Lavelle, S., Gomiero, A., Booth, A. M., Belzunce-Segarra, M. J., Bellas, J., Brooks, S., Bakir, A., Devriese, L. I., Pham, C. K., & De Witte, B. (2023). A recipe for plastic: Expert insights on plastic additives in the marine environment. *Marine Pollution Bulletin*, *196*(June), 115633. https://doi.org/10.1016/j.marpolbul.2023.115633

Maria, N. S. B., & Widayati, T. (2020). Dampak Perkembangan Ekonomi Digital terhadap Perilaku Pengguna Media Sosial dalam Melakukan Transaksi Ekonomi. *Jurnal Konsep Bisnis Dan Manajemen*, *6*(2), 234–239. https://doi.org/10.31289/jkbm.v6i2.3801

Masjhoer, J. M., Syafrudin, S., & Maryono, M. (2022). Rural Waste Management System in Southern Zone of Gunungkidul Regency. *Environmental Research, Engineering and Management*, *78*(1), 70–82. https://doi.org/10.5755/j01.erem.78.1.29537

Mohamad Mulyadin, R., Ariawan, K., & Iqbal, M. (2018). Conflict of Waste Management in Dki Jakarta and Its Recomended Solutions. *Jurnal Analisis Kebijakan Kehutanan*, *15*(2), 179–191. https://doi.org/10.20886/jakk.2018.15.2.179-191

Mona, M., Kekenusa, J., & Prang, J. (2015). Penggunaan Regresi Linear Berganda untuk Menganalisis Pendapatan Petani Kelapa. Studi Kasus: Petani Kelapa Di Desa Beo, Kecamatan Beo Kabupaten Talaud. *D'CARTESIAN*, *4*(2), 196. https://doi.org/10.35799/dc.4.2.2015.9211

Natsir, M. F., Iqran, M., Muktadir, A., Ibrahim, E., Daud, A., Yusbud, M., Rahmadani, S., Anwar, A., Asfar, M., & Khaer,

A. (2024). *Analysis of Factors Influencing Community Behavior in Household Waste Management on Lakkang Island , Indonesia*. *12*(3), 19–26. https://doi.org/10.13189/eer.2024.120103

Nisa, I. K., Prabaningtyas, S., Lukiati, B., Saptawati, R. T., & Rodiansyah, A. (2021). The potential of amylase enzyme activity against bacteria isolated from several lakes in east Java, Indonesia. *Biodiversitas*, *22*(1), 42–49. https://doi.org/10.13057/biodiv/d220106

Nwofoke, C., Onyenekwe, S. C., & Agbo, F. U. (2017). Willingness to Pay (WTP) for an Improved Environmental Quality in Ebonyi State, Nigeria. *Journal of Environmental Protection*, *08*(02), 131–140. https://doi.org/10.4236/jep.2017.82011

PLASTIC ATLAS ASIA. (2022). *Challenges and Efforts in Japan Japan'S Plastic Waste Management – Challenges*.

Rahardjo, M., Gravitiani, E., Sasanti, I. A., Maret, U. S., & Information, A. (2023). *Toward Sustainable Tourism : Insights for Mactor Analysis in Ngebel Lake ,*. *12*(3), 396–407.

Rahmattullah, R., Nilasari, G., Kustiawan, M. R., Kuswandani, M. D., & Galuh, U. (2023). *ANALYSIS OF ENVIRONMENTAL POLLUTION POLICIES DUE TO ECONOMIC AND TECHNOLOGICAL*. *1*(4), 186–192.

Saija, M. E., Daniotti, S., Bosco, D., & Re, I. (2023). A Choice Experiment Model for Sustainable Consumer Goods: A Systematic Literature Review and Workflow Design. *Sustainability (Switzerland)*, *15*(17). https://doi.org/10.3390/su151713183

Sekarningrum, A. (2016). The Analysis of Ecotourism Principle on Methods of Waste Disposal to Minimize Negative Impacts in Baluran National Park. *Gadjah Mada Journal of Tourism Studies*, *3*(2). https://journal.ugm.ac.id/gamajts/article/view/72719%0Ahttps://journal.ugm.ac.id/gamajts/article/download/72719/33176

State, C. R., Eneyo, V. B., Attah, F. M., Antai, A. S., Adie, H. I., & Ochiche, C. A. (2022). *Tourism Viability Status of Kwa Falls Ecotourism Site of Aningeje Rural Community ,*. *10*(2), 125–132. https://doi.org/10.13189/eer.2022.100202

Syukri, A. U., Studi, P., Ekonomi, I., & Hasanuddin, U. (2020). *DETERMINAN POLA KONSUMSI MAHASISWA YANG BEKERJA*. *6*(1), 1–11.

Thorley, J., Garza-reyes, J. A., & Anosike, A. (2019). *THE CIRCULAR ECONOMY IMPACT ON*. *231*. https://doi.org/10.2495/WM180241

Wicaksono, A., Ihalauw, J. J. O. I., & Damiasih, D. (2023). *Anthropocene monument as an ecotourism destination in the Special Region of Yogyakarta , Indonesia*. *5*(1).

Wubalem, A., Woldeamanuel, T., & Nigussie, Z. (2023). *Economic Valuation of Lake Tana : A Recreational Use Value Estimation through the Travel Cost Method*. 1–20.