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Tourist-Based Waste Management with Deposit Refund Implementation in Manggar Beach Area, Balikpapan Indonesia

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Abstract

The management of the Manggar Beach tourist area cannot be separated from obstacles related to the problem of waste generation. The problem of waste generation also results in the loss of aesthetic value and beauty of the beach, which decrease tourist interest in the tourism area. Therefore, efforts are needed to maintain the sustainability of the tourist environment by building tourist participation related to tourism waste management by applying the concept of the polluter pays principle so that tourist area more responsible for the waste they produce. Travel-based waste management can be done with a refund deposit mechanism. This study aims to (1) identify waste generation and the composition of the types of waste produced by tourists in the Manggar Beach tourist area; (2) analyze tourist perceptions regarding tourist-based waste management in the Manggar Beach tourist area; (3) measure the value of tourists' willingness to pay (WTP) on the amount of deposit refund in waste management in the Manggar beach tourist area. The result showed that plastic is the largest waste generation by tourist and 93% of tourists are willing to implement DRS for their waste. Thus, deposit refunds based on tourist' WTP can cover operational costs for waste management in the Manggar Beach Area, so that DRS can be implemented in the Manggar Beach Area.

Introduction

Manggar Beach is one of the tourist attractions located in Manggar Baru Village, Balikpapan City, East Kalimantan Province. This beach is the only beach tourism area whose management is still carried out by the Balikpapan City Government, namely under the Department of Youth, Sports and Tourism (DISPORAPAR) of Balikpapan City. It is stated in the Balikpapan City Spatial Plan 2012-2032, that Manggar Beach is directed as the center of the Beach Tourism Area in Balikpapan City, therefore the area needs to be developed in order to become a leading tourist area that is expected to sustain and drive the economy of the surrounding community and Regional Original Revenue (PAD). However, in its management, Manggar Beach Tourism Area (KWMP) is inseparable from the problem of waste generation. The lack of awareness, sense of responsibility and concern of tourists to dispose of garbage in its place is one of the factors for the problem of waste generation in the beach tourism area (Sari & Pratiwi, 2020). Marine debris monitoring data of Balikpapan City, especially on the coast of Manggar Beach issued by the Directorate General of Environmental Control and Damage of the Ministry of Environment and Forestry (2017), that most of the waste in KWPM is plastic waste of 1.6 pieces/m2.

The high level of plastic waste on the coast of Manggar Beach, if left unchecked, will result in the loss of part of the function of the coastal ecosystem related to its aesthetic value and beauty,

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which has economic benefits. The drift of waste into the sea (marine debris) will have an impact on the survival of various marine biota and ecosystems (Johan et al., 2020). For this reason, efforts are needed to prevent the problem of waste generation in coastal tourism areas, one of which is by applying economic instruments as an effort to preserve environmental functions. Polluter pays principle (PPP) is one of the principles of environmental improvement that requires polluters to pay for externalities arising from their activities (Suparmoko 1989). According to Muhdar (2009), environmental pollution is a problem that can be solved by calculating the price and paying for the losses caused by polluting activities. The application of PPP in waste management can be through the Deposit Refund System (DRS) mechanism, which is the payment of a sum of money as a guarantee against activities that have the potential to cause environmental pollution (Irawan & Chaerul, 2011; Yulia et al., 2022).

Tourist-based waste management is important to motivate and educate tourists to be more responsible in managing the waste they generate, according to Sustainable Development Goal (SDG) no 12 responsible production and consumption. Therefore, it is necessary to investigate the potential implementation of DRS in KWPM as a form of sustainable tourism management that can anticipate tourist waste generation, so that the function of the beach ecosystem is maintained while still being able to provide benefits from beach tourism activities.

Methods

Location and Time of Research

This research was conducted in Manggar Segara Sari Beach Tourism Area, Balikpapan City, East Kalimantan Province. Data were collecteing in October 2023 - November 2023.

Type and Data Collection

The data used in this study are primary data and secondary data. The following types and data collection are presented in Table 1.

Tabel 1. Data Type and Collection Matrix

Research Objectives	Data	Data Source	Analytical Tools
Identification of waste generation and composition of tourist waste types	Visitor number, volume and composition of waste	Key person from UPTD Manggar Beach	SNI: 19-3964-1994
Analysis of tourist perceptions related to tourist-based waste management in the Manggar beach tourism area	Tourist characteristics, tourist perception level	Tourist respondents	Indicators of tourist perception (Likert scale)
Calculating tourist's WTP for DRS	WTP value of tourists and number of tourists in the previous year	Traveler respondents	Open-Ended WTP (Fauzi, 2021)

Sampling Method

The research sampling method was carried out using a purposive sampling approach, with the consideration that the respondents understood and understood the waste problem in KWPM. Respondents in this study are tourists who are at least 18 years old, both local tourists (within the city) and tourists outside the region. Data collection on the sample was carried out through polls between researchers and respondents, as well as conducting documentation.

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The population is the total visitor to Manggar Beach in 2021 i.e. 78,025 (Disporapar Balikpapan, 2021). To determine the number of samples in this study using the slovin formula (Suharsaputra 2012).

$$n = \frac{N}{1 + N\,e^2}$$

Description:

n = Sample size/number of respondents

N = Population size

e = Tolerable standard error (10%)

Thus: $n = \frac{78.025}{1+(78.025\ x\ 0{,}1)}$ = 99,8

Based on the above calculations, the number of respondents was increased to 100 respondents.

Data Analysis

Tourist Waste Generation Analysis

Analysis of tourist waste generation includes the amount of waste generation, and the composition of waste types, where for data collection in the field for 8 consecutive days, namely on holiday weekends and during weekdays as referred to SNI: 19-3964-1994 which has been modified. Analysis of the composition of tourist waste using the formula, as follows:

$$\%\ Composition = \frac{B_i}{TBs}\ x\ 100$$

Description:

B_i = Weight of waste component i (kg/day)

TBs = Total waste weight (kg/day)

Analysis of waste generation by calculating the average value of waste generated by tourists per day. Analyze waste generation by using the formula, as follows:

$$RT_s = \frac{\sum B_s}{\sum U_s}$$

Description:

RT_s = Average tourist waste generation (kg/person)

B_s = Weight of waste generated by all tourists in one day (kg/day)

U_s = Number of tourists in 1 day (Person/day)

Perceptions Analysis of Tourist

Analysis of tourist perceptions using Likert scale techniques, with indicators of tourist perceptions divided into 2 categories, where indicators 1-4 regarding the impact of tourism activities on waste generation and indicators 5-7 regarding tourist-based waste management with the implementation of the DRS mechanism. Each indicator respondents will be given a score value of 1 = Strongly Disagree; 2 = Disagree; 3 = Uncertain; 4 = Agree; and 5 = Strongly Agree. Then the total weighted value of each indicator is calculated with the following

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perception index calculation (Danang Sunyoto & SE, 2012; Sugiyono, 2013; Harjianti & Navastara 2021).

$$Perception\ Index = \frac{Total\ score\ for\ each\ criterion}{Sum\ of\ the\ highest\ scores}\ x\ 100\%$$

After getting the perception index, it will then be entered into the interpretation criteria with interval analysis Strongly Disagree = 0 - 19.99%; Disagree = 20 - 39.99%; Uncertain = 40 - 59.99%; Agree = 60 - 79.99%; Strongly Agree = 80 - 100%. So that a scale index of tourist perceptions of tourism-based waste management and DRS implementation will be generated.

Analysis of Tourist's Willingness to pay toward Deposit Refund System

Analysis of tourist WTP using CVM with open ended, to measure how much the value of tourists' willingness to pay. There are several stages of using CVM in determining the WTP value of tourists, as follows:

Hipotetic Market

Hipotetic market built in this study is ilustrated as follows:

> "Tourism activities in Pántai Manggar provide benefits and impacts, namely benefits to improve the economy of the surrounding community and local original income (PAD), while the impact causes waste generation around the area. Tourist-based waste management is needed to overcome the waste problem in the Manggar Beach tourist area. For this reason, the participation of tourists is needed in the implementation of waste management in the Manggar Beach tourist area by paying a deposit refund for the waste generated. If tourists manage their waste according to the regulations, the deposit can be returned, but if not, the security deposit will not be returned, the security deposit that is not returned will be used to pay the waste management officer. If the deposit refund is implemented in waste management in the Manggar Beach tourist area, what is your willingness to make a payment as a refund deposit?"

Offering Value of WTP

The method used to obtain the WTP score of KWPM tourists is an open-ended question. This method is carried out by allowing respondents to be given the freedom to declare the value of the rupiah in determining the maximum amount of money they want to pay. So that they get answers and exact numbers that are in accordance with the respondents without any outside influence (Fauzi, 2021).

Average Value of WTP

After the WTP value of each respondent is obtained, then the average WTP value is calculated. WTP can be estimated by using the average value of the sum of the overall WTP value divided by the number of respondents. The estimated average WTP is calculated using the following formula (Fauzi, 2021):

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

Description:

EWTP = Estimated average of WTP

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Wi = The i WTP value

n = The number of respondents

i = the responden willing to pay

Results and Discussion

Amount of Generation and Composition of Manggar Beach Tourism Waste

Based on Figure 1, the composition of waste generated by tourists at KWPM are mostly inorganic waste (75%) and only 25% organic waste. Plastic is the largest amount of inorganic waste (36%), which is difficult to decompose, potential to cause environmental pollution, inline with the Directorate General of PPKL KEMENLHK (2018) statement. Further more they said that plastic waste is a type of waste that poses a serious threat to the environment because in the number tends to be larger, difficult to decompose by natural processes (non-biodegradable) and is one of the xenobiotic pollutants (unknown pollutants by biological systems in the environment resulting in pollutant compounds accumulating in nature).

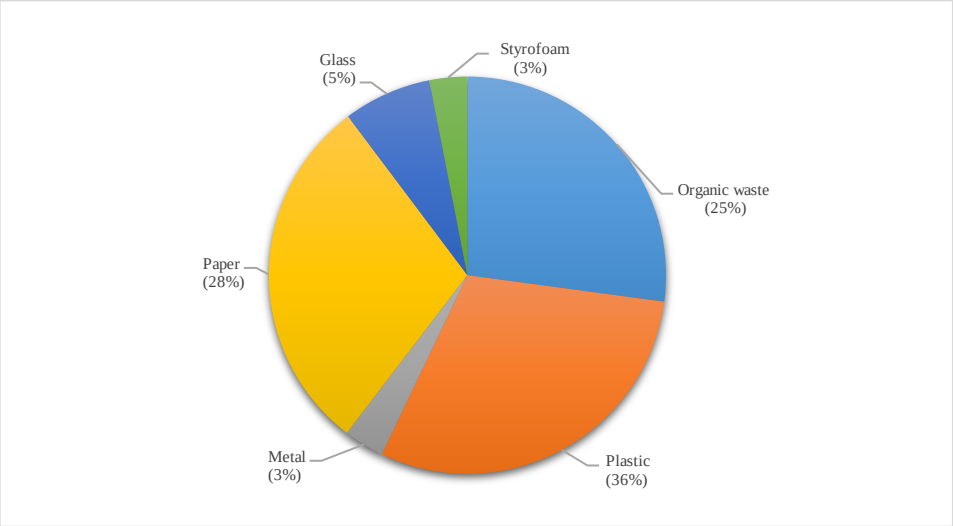

Figure 1. Amount and composition of waste generation types at KWPM per day

The average value of waste generation per day is used to estimate the amount of tourism waste generation at tourist sites as a whole by taking into account the number of tourists, so that the number of waste generation per year can be obtained (Table 2).

Table 2. Estimated amount of waste generated by tourists per year

Types of Waste	Average waste per day (kg/day)	Average waste per tourist (kg/tourist/day)	Total per year* (kg/year)
Plastic	9,53	0,024	1.867,69
Metal	1,04	0,002	122,22
Paper	9,34	0,018	1.411,85
Glass	2,28	0,002	170,01
Total	**22,20**	**0,05**	**3.571,77**

Note: *KWPM Visitor 2021 is 78.025 tourists (UPTD Manggar 2022)

Based on Figure 1 and Table 2, unmanaged plastic waste poses a serious threat to ecosystems, especially coastal ecosystem where it ecologically functions as a food supply for different types

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of biotopes. What is even more worrying is that if plastic waste is broken down into micro- and nano-plastics, the coastal ecosystem will be damaged because this kind of waste can end up in the bodies of marine biotopes. This can lead to a decrease in fishing productivity and ultimately to human health problems (Dirjen PRL 2022).

Besides threatening the functioning of the ecosystem, plastic waste on the beaches also has a negative impact on the economic and tourism sectors. Not properly managed waste will affect the hygiene and comfort of the tourist environment. Waste in the KWPM can distort the view and attractiveness of travellers. Unmanaged waste in the tourist area can also affect the interest of tourists in enjoying the tourist area. This can lead to a decrease in the number of visitor. This is because the visitor have a significant influence on the income of a region. (Pertiwi & Gede, 2014). To anticipate this happening, to improve the waste management tourists-based according to the PPP principle in order to reduce the burden of management and also to educate tourists to be responsible for waste produced when they carry out one of the tourist activities, one of which is by using the DRS method.

Tourist's Perception Toward waste Management in Natural Tourism Area

Based on Table 3, it can be grouped into 2 categories: (1) Indicators 1 - 4 regrading the impact of tourism on the waste generation, where tourists in KWPM agree that the waste around the tourist attraction is less well managed. Tourists acknowledge that waste in coastal areas is mostly solid waste, so waste from tourism can degrade the quality of the environment; (2) Indicators 5-7 on tourism-based waste management with the implementation of the DRS mechanism, tourists agree if tourist based waste management using DRS methods to solve the problem of solid waste, that tourists must pay deposits as a guarantee on the potential waste they produce.

Table 3. Results of the Likert Scale related to Public Perception of the Impact of Waste Generation from Tourism Activities and the Implementation of DRS

Indicators	Total Score	Perception Index	Interpretation
There is garbage generation in the Manggar Beach area	407	81%	Strongly Agree
Most of the garbage in the Manggar Beach area is solid waste (inorganic)	405	81%	Strongly Agree
Waste generation comes from tourist activities	475	95%	Strongly Agree
Garbage will reduce the aesthetic value of beach beauty	496	99%	Strongly Agree
What is your opinion (i) if the manager of the Manggar Beach tourist area plans to carry out tourist-based waste management with DRS	394	79%	Agree
The deposit refund mechanism by tourists in waste management can prevent/reduce waste generation in the Manggar Beach tourist area	404	81%	Strongly Agree
Are you willing to pay additional fees for tourist-based waste management with DRS	396	79%	Agree
Total	**2977**	**85%**	Strongly Agree

Description: Total indicators (7), Total respondents (100); Perception Index = Strongly Disagree = 0 – 19.99%; Disagree = 20 – 39.99%; Uncertain = 40 – 59.99% ; Agree = 60 – 79.99% ; Strongly Agree = 80 – 100%

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The results of the tourist perception attitude score based on Table 3 as a whole show positive tourist perception results, which means that tourists agree to support tourist-based waste management at KWPM.

WTP Tourists Related to the Implementation of Waste Management

The percentage of willingness to pay from 100 tourist respondents to the implementation of tourist-based waste management is presented in Table 4, which shows that the existence of DRS can spur tourists to take responsibility for the waste they produce directly. The enforcement of regulations from the authorities can also encourage tourists to manage the waste they produce (Dhokhikah et al., 2015).

Table 4. Willingness to pay for the implementation of tourist-based waste management

No	Willingness to Pay Tourists	Number (Person)	Percentage (100%)
1	Agree	93	93
2	Not Agree	7	7
Total		**100**	**100**

The WTP value for each unit of solid waste produced by tourists in the deposit refund system is presented in Table 5 With the nominal amount of money set to pay the security deposit, it is hoped that it can change the culture of tourists who do not care about the responsibility of managing the waste they produce. Based on the PPP principle where tourists who have thrown garbage out of place in tourist areas can cause environmental pollution. Therefore, the estimated number of DRS values is also calculated according to the average WTP of tourists at KWPM.

Table 5. Average WTP value of tourists with deposit refund system

Types of Waste	Average WTP (Rp)	WTP average rounding (Rp)
Plastic	6.355	6.000
Metal	6.527	6.500
Paper	3.441	3.000
Glass	1.441	1.000

The calculation of the estimated amount of deposit refund value according to the average WTP of tourists in the application of DRS is carried out to find out the refund deposit fund if 100% is not redeemed in a sorted place that has been provided at the exit gate. The estimated value of the total deposit refund from each unit of waste type is presented in Table 6.

Table 6. Estimation of implementation of DRS according to the average WTP of tourist

Types of Waste	WTP value (Rp/type/tourist)	Composition of each type of waste (%)	Average waste per tourist (kg/tourist/day)	Amount of waste for Deposit Refund* (kg/year)	Estimated deposit refund (Rp/year)
Plastic	6.000	36	0,024	62.694	376.166.592
Metal	6.500	3	0,002	435	2.829.957
Paper	3.000	29	0,018	37.878	113.633.658
Glass	1.000	5	0,002	726	725.630
Total					**Rp 493.355.837**

Note: * = 72.563 tourists (number of tourists willing to pay)

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Table 6 shows the estimated receipt of deposit refunds based on the average value of tourists' WTP if calculated from the willingness of tourists to pay deposits for tourists-based waste management plans. The estimated value obtained can later be allocated as funds for the implementation of waste management with deposit refunds. During the implementation of the deposit refund system, the collected funds can be used as environmental management costs and additional funds for incentives for cleaners (operational costs). The operational costs of cleaners at KWPM are presented in Table 7.

Table 7. Operational Costs of Cleaning Officers in the Manggar Beach Area

Cost Type	Sum (person)	Cost* (Rp/Month)	Operational costs (Rp/officer/month)	Operational costs (Rp/officer/year)	Waste per cleaner** (kg/year)
Cleaning officer fees	11	3.475.595	38.231.545	458.778.540	324,71

Note : * = Outsourcing fees according to the Minimum Wage of Blikpapan City

** = Total amount of waste in one year (3,571.77 kg/year) divided by the number of outsourced officers

Based on a study that has been conducted from 100% of respondents, only 93% are willing to participate in managing waste with the DRS mechanism, where 75% of respondents choose to take the deposit money by bringing their waste to a separate place and 18% of the other respondents choose not to take the deposit money by leaving their waste at the tourist location. From this data, the covering of operational costs presented in Table 8 is calculated.

Table 8. Scenario of covering DRS estimated costs to operational costs

Description	Respondent Participation (%)	Estimated deposit refund collected (Rp/year)	Estimated waste management costs (Rp/year)	Covering costs (%)	Explanation
SCENARIO 1: EXISTING					
Taking deposits and managing waste	75	-	-	-	Incentives from collected waste
Not refund and not managing waste	18	95.488.556	82.580.137	115	Incentives from collected waste and excess collected deposit funds
No garbage and no waste management	7	-	-	-	No incentives and visitor deal no visit
SCENARIO 2: NOT REFUNDTHE DEPOSIT MONEY					
Not refund and not managing waste	93	493.355.837	458.778.540	107	There are excess deposit fees but no education
No waste and no waste management	7	-	-	-	No incentives and visitor deal no visit
SCENARIO 3: REFUND THE DEPOSIT MONEY					
Refund money and not managing waste	93	-	-	-	All waste is managed but there is education
No waste and no waste management	7	-	-	-	No incentives and potential no-visits

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Based on table 8, the implementation of DRS is divided into 3 scenarios, namely: (1) Scenario 1 (existing) meaning that there will be incentives for cleaners from collected sorted waste and there will be excess deposit funds. However, in this scenario there will be a potential decrease in the number of visits; (2) Scenario 2 (no refund deposits), meaning that a certain amount of funds will be collected that can cover the operational costs of cleaners to manage waste and the environment. However, in this scenario there is no education for tourists to be responsible for the waste they generate; (3) Scenario 3 (refund deposit), meaning that there are no deposit funds left because all tourists want to participate in managing the waste generated from tourism activities so that waste can be managed properly, that way waste management does not need to spend wages to manage waste, in fact the waste that has been sorted and collected from the implementation of DRS can be used by cleaning staff (outsourcing) at KWPM to be sold to the waste bank as an incentive. In addition to carrying out tourism activities from this scenario, tourists are also educated about tourist-based waste management so that they can be responsible for the waste they produce.

If viewed from the financing component of scenario 3, it is more recommended to be selected and implemented so that it is hoped that in the future it can be educated even better so that the implementation of DRS in KWPM can reach 100%.

Conclusion

Based on the results and discussion of the research, the following conclusions can be drawn: (1) The largest amount of waste generated and the composition of the type of waste produced is plastic waste with a potential value of 0.05 kg/tourist generated per tourist in one day; (2) Tourist perceptions related to tourist-based waste management in the Manggar Beach area show a positive thing where 93% of tourists agree and are willing to manage waste with the implementation of DRS; (3) Receipt of deposit refunds based on the value of tourists' WTP can cover the operational costs of waste management in the Manggar Beach Area, so that tourist-based waste management with DRS can potentially be implemented in the Manggar Beach Area.

Based on the results and discussion of the research, the suggestions that can be given are as follows: (1) The implementation of DRS in KWPM needs to be implemented according to the average WTP of tourists and education so that all tourists take their deposits and manage their waste according to the provisions (Scenario 3); (2) There needs to be a ban and education for traders to use packaging that does not have a selling value such as styrofoam, in order to support the implementation of DRS in KWPM; (3) It is necessary to provide supporting facilities and infrastructure such as dropping boxes to separate organic and inorganic waste and create a counter system in several locations that are easy to reach so that there are no queues..

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