The Wastewater Treatment for Achieving Green Economy

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Abstract. The study emphasizes the importance of putting in place a raw sewage pre-treatment system to filter out solid waste before dumping it into streams. Prior research indicates that trash management and Indonesian sociocultural habits are the main environmental issues in Indonesia. The quality of river water would change when frequent direct sewage disposal occurs. However, there is a risk of river pollution caused by negligent river users. To address this, new technologies are needed. This study seeks to use the creative economy to benefit society on an economic and social level. It is determined that community-based water tourism must be developed using human resources to take advantage of the natural potential of the river that flows along Kauman Babadan Banguntapan. The goal is to determine the differences between before-and-after the community service program for using a mechanical bar screen to purify wastewater in to promote a green economy. The study revealed that perceptions and attitudes of households regarding the river's water quality varied, but there was a strong belief that efforts should be taken to enhance it. The findings demonstrate the importance of addressing water quality issues, promoting environmental preservation, and encouraging community participation in sustainable activities.

1 Introduction

The ecology has been harmed by raw sewage in all its forms. Municipal raw sewage contains a certain amount of solid trash that can damage the environment. Pre-treatment of sewage can lessen the direct or indirect consequences of dumping raw sewage on surrounding municipal waterways. This study emphasizes the importance of putting in place a raw sewage pre-treatment system to filter out solid waste before dumping it into streams.

The trash problem in modern society is one of the most important environmental challenges. In Indonesia, improperly placed littering is still a concern. Prior studies suggest

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that the country's key issues are Indonesian sociocultural practices and garbage management. [1]. To prevent rubbish collection in communities, some people continue to throw trash into rivers in a number of Indonesian locations [2]. There are a number of devices utilized to solve the garbage-related river problems, including the Trash Wheel [3] utilized to clean up the river's rubbish. The United States' Baltimore River has used this method. However, compared to the Baltimore River, The state of the rivers in Indonesia varies greatly. Most Indonesia's rivers have been preserved in their natural state, meaning that there are still numerous villages along their banks. Water bodies can get contaminated by water logging, solid waste disposal, air and noise pollution, black smoke from traffic and industrial pollutants, and industrial discharge[4,5].

Theoretically, employing bar racks would be able to contain 60 to 70 percent of the solid trash from municipal wastewater. [6]. When it comes to direct sewage water disposal in this situation, bar screen treated wastewater should be somewhat superior to untreated wastewater because it has higher levels of dissolved oxygen (DO), reduced total dissolved solids (TDS), carbon dioxide (CO_2), and biological oxygen demand (BOD). The quality of river water would undoubtedly change when frequent direct sewage disposal occurs because the majority of solid trash may be reduced by utilizing bar screens [7]. The design and operation of treatment and disposal facilities, as well as the engineering management of environmental quality, depend on an understanding of the nature of wastewater.

Plumbon Hamlet, Banguntapan Village, is located in Bantul Regency's northern region and has a lowland topography. Plumbon Hamlet residents don't experience water shortages because there is always sufficient water availability, regardless of the season (wet or dry). Due to its exceptional position and close proximity to the City of Yogyakarta, Plumbon Hamlet has seen a substantial change from its previous land use of mostly residential. The fact that Kauman Babadan is home to numerous communities raises the possibility that the river pollution brought on by irresponsible river users may worsen, some of which are located along the river's course [8].

The issue of garbage in society is one of the major environmental problems. In Indonesia, the practice of people throwing trash in the wrong area is still an issue. According to prior study, the primary issues in Indonesia relate to waste management and the sociocultural practices of the Indonesian population [9]. To prevent waste accumulation in settlements, some people continue to throw trash down rivers in a number of Indonesian cities [2]. There are a number of devices utilized to solve the garbage-related river problems, including the Trash Wheel [3] to remove rubbish from rivers. The United States' Baltimore River has used this method. However, the state of rivers in Indonesia is very different from the Baltimore River. There are still many settlements along the banks of Indonesia's rivers since the vast majority have been left in their natural state[10].

According to our observations, the following are some of the issues the community is facing: (1) Although it has inherent potential, the river flow that runs along the Kauman Babadan part of Plumbon Banguntapan Hamlet has not been well utilized. This is due to the trash from the upstream region polluting the river. Therefore, to take advantage of this potential by routinely picking up waste, new technologies are needed, so that The river's water quality is suitable for fish farming and can be developed into a water tourism destination to boost the creative economy and, ultimately, raise people's incomes[11]; (2) Public ignorance about environmental cleanliness, particularly river cleanliness. (3) Absence of support for the Marbot group at the Nur Rohman Kauman Babadan and Ad-Darojat mosques, which might produce a good that exploits the potential of the hamlet and provides a secondary source of income for the locals. Kauman Babadan is a village in the Plumbon Hamlet, in the Bantul Regency. The drainage and waste disposal systems of Plumbom discharge solid waste, domestic sewage, and wastewater every day. Among the activities that

can endanger natural water supplies, dumping solid waste and wastewater is at the top of the list [12].

Development will occur if a location is supported by infrastructure, natural resources, and human resources. The potential of natural resources and human resources should be completely utilized to increase people's income [13]. Utilizing the rivers' natural potential as well as the available human resources, this study seeks to use the creative economy to benefit society on an economic and social level. It is possible to boost local economic activity and, as a result, indirectly raise the standard of living for Kauman Babadan, Banguntapan residents by clearing the river of trash pollution and utilizing it for water tourism. The potential of the surrounding natural resources and environment must be determined in order for the community to support government policies for managing natural resources and the environment and be sustainable [14]. Consequently, it is essential to give neighbourhood groups more influence [15]. It can offer creative ideas for new enterprises and job chances, and Finding opportunities for employment in the neighborhood and increasing people's income are crucial [15].

Based on the observations, The natural potential of a river that flows along Kauman Babadan Banguntapan was found to require the development of community-based water tourism using human resources. Community-based tourism refers to the process of creating tourist destinations that involves local communities in the development, management, and expression of ideas [16]. The study's precise goals is to determine the differences between before-and-after the community service program for using a mechanical bar screen to purify wastewater to promote a green economy.

2 Methods

2.1 Study site

This study was carried out at Banguntapan Village, Plumbon Hamlet, which offers community empowerment initiatives. There are groups made up of dasa wisma, PKK, and Karang Taruna women, as well as mosque marbot groups, for the programs in each RT region. Overall, Plumbon Hamlet's community empowerment initiatives have been carried out successfully. Better development and organization efforts are nonetheless required. In addition, a river flows through the Kauman Babadan region, offering locals a chance to boost their income. The Ad Darojat Marbot Group and the Nur Rohman Marbot in Kauman Babadan both still needed assistance with the management of local natural and environmental resources, including the river. The majority of the Marbot group members at the Ad Darojat and Nur Rohman mosques lacked the skills to supplement their income, so activities and training were needed by utilizing the natural potential represented by a river that flows through Kauman Babadan so they could provide for their daily needs and revive the group, so it has sustainability.

2.2 Survey design and administration

We conducted a survey of the homes in the study area A survey on the homes in the study area was conducted to learn how residents manage their plastic waste. In order to determine the sample size for households, Slovin's equation was utilized [17, 18]. In this investigation, an estimating error of 10% was used. Slovin's equation resulted in 45 households that were used for the survey. Using the stratified random sampling approach, the number of homes

from different economic strata was established, and they were then combined into one sample. [19].

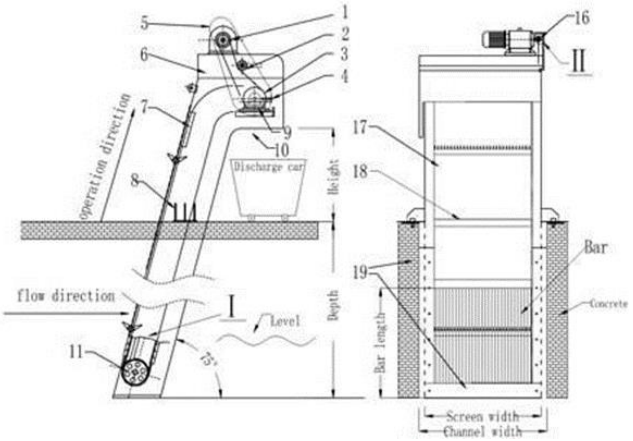

Fig. 1. Mechanical bar screen

There are four components in the final survey questionnaire (appendix). Section A maps out the sociodemographic characteristics (i.e., gender, marriage status, education level). Section B reveals the household's activities backgrounds (i.e. skills, involvement in business); Section C reveals the household activities related to river (i.e. the use of river water for daily needs, habit of throwing garbage into the river); Section D reveals the household's perception on water quality of the river (i.e. the water quality for fish breeding, actions taken to improve river water quality, river cleaning frequency per month, the quality of river water will have an impact on the health, flooding due to the wastewater, maintained and preserved for future generations, participate as volunteers); Section E reveals the technology of wastewater cleaning (i.e. knowledge in the mechanical bar screen, benefit of the mechanical bar screen);); Section F reveals the fish farming activities (i.e. knowledge of freshwater fish farming, willingness to participate in fish farming in the river).

Table 1. The predictor and the scale

Predictor	Scale
The water quality for fish breeding (X8)	
Yes	1
No	2
Actions taken to improve river water quality (X9)	
Don't throw garbage in the river	1
Clean up river trash regularly	2
Provide education to the community	3
Install river cleaners	4
Make the volunteer community	5
Other	6

Predictor	Scale
River cleaning frequency per month (X10)	
No need	1
1	2
2	3
3	4
4	5
>4	6
The quality of river water will have an impact on the health (X11)	
Yes	1
No	2
Flooding due to the wastewater (X12)	
Yes	1
No	2
Maintained and preserved for future generations (X13)	
Yes	1
No	2
Participate as volunteers (X14)	
Yes	1
No	2
Knowledge in the mechanical bar screen (X15)	
Not know	1
Just heard but	2
don’t know to use	
Already know but haven’t used it	3
Already know and have used it	4
Benefit of the technology (X16)	
Benefit	1
No benefit	2
Knowledge of freshwater fish farming	
Not know	1
Just heard but don’t know it is	2
Already know but don’t know how make it	3
Already know how it is	4
Willingness to participate in fish farming	
Yes	1
No	2

2.3 Data Analysis

The paired sample t-test, which is also known as the dependent sample t-test, is a statistical method used to find out if the difference between the means of two sets of data is zero. In a paired sample t-test, each subject or thing is tested twice, so there are two observations for each subject or thing. The paired sample t-test is often used in case-control studies or designs with repeated data. For instance, it is when it comes to determine the differences between before and after the community service program for using a mechanical bar screen to purify wastewater to promote a green economy. It is possible to measure the performance of a sample of residents before and after they finish the program and then use a paired sample t-test to figure out what changed.

There are two competing hypotheses in the paired sample t-test: the null hypothesis (H0) and the alternative hypothesis (H1). The null hypothesis assumes that the genuine difference in sample means between paired samples is zero. All observable differences are explained by random variation, according to this model. The alternative hypothesis, on the other hand, implies that the true mean difference between the paired samples is not equal to zero. In this study, the direction of the difference is irrelevant, hence a two-tailed hypothesis is employed. The formal definitions of the paired sample t-test hypotheses are given below.

1. The null hypothesis (H0) assumes that the true mean difference (μ_d) is equal to zero.
2. The two-tailed alternative hypothesis (H1) assumes that μ_d is not equal to zero.

As a parametric procedure, the paired sample t-test is predicated on several assumptions. Despite the robustness of t-tests, it is good practice to evaluate the degree of deviation from these assumptions to assess the quality of the results. The observations in a paired sample t-test are defined as the differences between two sets of values, and each assumption refers to these differences rather than the original data values. The paired sample t-test is predicated on four key assumptions:

a. The dependent variable must be continuous (interval/ratio).
b. The observations are independent of one another.
c. The dependent variable should be approximately normally distributed.
d. The dependent variable should not contain any outliers.

When interpreting the results of a paired sample t-test, there are two categories of significance to consider: statistical significance and practical significance. By examining the p-value, statistical significance can be determined. Under the null hypothesis, the p-value indicates the likelihood of observing the test results. The smaller the p-value, the lower the probability of observing the observed result if the null hypothesis is true. Consequently, a low p-value denotes less support for the null hypothesis. However, it is impossible to rule out the possibility that the null hypothesis is correct and that an extremely uncommon result is obtained. The researcher ultimately determines the threshold value for determining statistical significance, but typically a value of 0.05 or less is chosen. This corresponds to a probability of 5% or less of obtaining the observed result if the null hypothesis were true.

3 Result and discussion

3.1 Characteristics of respondents

There are 45 participants in the study, including numerous household heads who reside close to the river and members of the marbot of the Nur Rohman Mosque. A more detailed description will be presented in the characteristics of the members in the Community Partnership Program.

Table 2. Composition of participants based on gender

Gender	Total	Percentage
Male	38	85%
Female	7	15%

According to gender, 15% of participants were women and 85% of participants were men (see Table 2).

Table 3. Composition of participants based on marital status

Marital Status	Total	Percentage
Married	33	73%
Unmarried	12	27%

Of all participants, 73 percent were married, while the remaining 27% were either single or unmarried (see Table 3).

Table 4. Composition of participants based on education level

Education	Total	Percentage
Elementary School	2	4%
Junior High School	6	13%
Senior High School	36	72%
Vocational School	0	0%
Bachelor Degree	3	7%
Post graduate Degree	2	4%
Other		

Seventy-two percent of participants had at least a high school diploma, according to education level. 13 percent of participants had completed junior high school or something comparable. Only 7% of people have a bachelor's degree, while the remaining 4% have an equivalent of a primary or master's degree (see Table 4).

Table 5. Composition of participants based on certain skills

Skill	Total	Percentage
Have	20	44%
Not have	25	56%

Up to 56% of participants lacked particular skills. Table 5 shows that specific skills were possessed by 44% of individuals.

Table 6. Composition of participants based on involvement with the business

Involvement in business	Total	Percentage
Formal Business	4	9%
Informal Business	35	78%
Not involve	6	13%

To yet, none of the respondents have held a formal corporate position. 13 percent of participants did not work for any official or informal companies. 78 percent of participants

overall were engaged in informal companies. The remaining 9% are employed by formally registered enterprises (see Table 6).

Table 7. Composition of participants based on the use of river water for daily needs

Use of river water for daily needs (flushing, washing vehicles, etc.)	Total	Percentage
Yes	10	22%
No	35	78%

According to the use of river water for daily necessities (flushing, washing cars, etc.), 22% of all participants used river water for these purposes. 78% of individuals overall did not consume river water on a daily basis (see Table 7).

Table 8. Composition of participants based on their habit of throwing garbage into the river

Do you think that the residents around where you live sometimes still throw garbage in the river?	Total	Percentage
Yes	29	65%
No	16	35%

Sixty-five percent of respondents said that locals throw trash into the river as a habit. The remaining 35% of respondents, however, claimed that locals don't toss trash into the river (see Table 8).

Table 9. Result of Paired sample t-test

Predictor	Paired t-test	
	Mean	Sig.
Household's perception on water quality of the river		
The water quality for fish breeding	.111	.024
Actions taken to improve river water quality	.400	.000
River cleaning frequency per month	.644	.000
The quality of river water will have an impact on the health	.333	.000
Flooding due to the wastewater	.333	.000
Maintained and preserved for future generations		
Participate as volunteers	.155	.007
The technology of wastewater		
Knowledge in the mechanical bar screen	1.44	.000
Benefit of the technology	1.77	.004
Fish farming activities		
Knowledge of freshwater fish farming	1.422	.000

Willingness to participate in fish farming	1.422	.000

The results of the t-tests provide valuable insights into household perceptions regarding the water quality of the river and their engagement in related activities. The mean values represent the average perception of respondents, while the p-values indicate the significance levels.

The perception of water quality for fish breeding had a mean value of 0.111, indicating a slightly positive perception. However, this perception was not statistically significant ($p = 0.024$), suggesting that respondents' views on water quality for fish breeding varied.

On the other hand, respondents strongly believed that actions needed to be taken to improve river water quality, as indicated by the mean value of 0.400, which was statistically significant ($p = 0.000$). Similarly, the perception of the river cleaning frequency per month was high, with a mean value of 0.644, and statistically significant ($p = 0.000$). These findings highlight the importance placed by households on initiatives to enhance the quality of the river water.

The impact of river water quality on health was also considered significant by respondents, with a mean value of 0.333 and a statistically significant result ($p = 0.000$). Similarly, respondents expressed concerns about flooding caused by wastewater, with a mean value of 0.333, which was statistically significant ($p = 0.000$). These results indicate that households perceive potential health risks associated with poor river water quality and are aware of the negative consequences of wastewater-related flooding.

In terms of participation as volunteers, respondents had a mean value of 0.155, indicating a moderate inclination to engage in activities related to water quality improvement. This perception was statistically significant ($p = 0.007$), suggesting that some households are willing to actively contribute to environmental preservation efforts.

Regarding knowledge and technology, respondents exhibited a high level of understanding of the mechanical bar screen, with a mean value of 1.44, which was statistically significant ($p = 0.000$). Moreover, respondents recognized the benefits associated with wastewater technology, as reflected by a mean value of 1.77, which was statistically significant ($p = 0.004$). These findings underscore the importance of disseminating information and raising awareness about technological advancements and their positive impact on water quality.

Lastly, respondents displayed considerable knowledge of freshwater fish farming, as indicated by a mean value of 1.422, which was statistically significant ($p = 0.000$). Furthermore, their willingness to participate in fish farming activities was also high, with a mean value of 1.422, and statistically significant ($p = 0.000$). These results suggest a potential interest among households in engaging in sustainable practices like fish farming.

Overall, the t-test results emphasize the importance of addressing water quality concerns, promoting environmental preservation, and engaging communities in sustainable activities. These findings can inform policy and decision-making processes aimed at improving river water quality and fostering active participation from households.

4 Conclusion

The study revealed that household perceptions and attitudes towards the water quality of the river varied, but there was a strong belief that actions should be taken to improve it. Respondents also recognized the significant impact of river water quality on health and expressed concerns about flooding caused by wastewater. Their willingness to participate as volunteers in water quality improvement activities was moderate but statistically significant. Additionally, respondents demonstrated a high level of knowledge and understanding regarding the mechanical bar screen and the benefits associated with wastewater technology.

These findings highlight the need to address water quality concerns, promote environmental preservation, and encourage community engagement in sustainable activities.

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