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Environmental Knowledge and Participation in Waste Banks: Promoting Plastic Waste Reduction in Borobudur, Magelang, Central Java, Indonesia

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ABSTRACT

Background: Public awareness of environmental health in waste management is one of the causes of government problems in waste management, especially in tourist destination areas. The behavior of carrying shopping bags is one of the efforts to reduce the volume of non-organic waste. The success of this behavior has many influencing factors, so the purpose of this study is to determine the factors associated with the behavior of carrying shopping bags in Borobudur District, Magelang Regency, Central Java, Indonesia.
Subjects and Method: Cross-sectional analytic survey research in the Borobudur District area of 374 respondents. The time of this research was in November 2023, with a random sampling technique, and the research instrument was a questionnaire. This study analyzes six independent variables , and participants in the waste bank, on the dependent variable. We used the regression test. Logistics in the final stage.
Results: High knowledge of waste management (AOR= 2.43; 95% CI= 1.04 to 5.65; p= 0.040) and participate in a waste bank (AOR= 3.27, 95% CI 1.92 to 5.58; p= 0.001) increased plastic waste reduction behavior. This study showed that there was no relationship between education, gender, occupation, and participants in the Reduce, Reuse, Recycle (TPS3R) Waste Management Site program on the shopping bag carrying behavior.
Conclusion: High knowledge of waste management and participate in a waste bank increase plastic waste reduction behavior.

Keywords: Environmental health, participation, behavior, plactic waste reduction

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BACKGROUND

The Magelang regency specially in distric Borobudur, implementation of the ban on littering is still weak, the response to the level of waste sorting by residents is not consistent, it also gives a negative impression and is directly visible to tourists from all parts of the world. Waste generation rates are increasing globally. According to estimates, the world would produce 2.24 billion tonnes of solid garbage in 2020, or 0.79 kg of rubbish per person every day. Annual trash generation is anticipated to rise by 73% from 2020 levels to 3.88 billion tonnes in 2050 as a result of fast population expansion and urbanization. Direct and indirect effects of waste disposal on the environment include resource depletion, land occupation, methane and other green-house gas emissions that accelerate global warming, contaminated waters from land-filling, and acidification and toxic effects from air emissions from incineration (Wilson and Velis, 2015).

In Indonesia, the waste problem is a classic problem that society faces. Because it's every activity of our daily life produces garbage. Until now, waste production of each of these households has always been a social problem in society. Because, first, the number is constantly growing, secondly, the land available for accommodating increasingly heaps of garbage is limited, and thirdly, attempts to reduce volume waste by processing or recycling rephrasing into useful items require a lot of investment (Sasoko, 2022).

Rising communal living standards, rapid urbanization, expanding economies, and rising population levels have significantly increased the rate at which developing nations produce solid garbage (Hiremath, 2016). Indonesia's trash issue continues to be a problem. Population growth and technology inevitably results in an increase in the quantity and type of waste. The promptness of waste management solutions, however, has been forgotten. In Indonesia, 67,8 million tonnes of waste are produced annually. In Indonesia, the volume of organic garbage is the highest compared to other waste kinds. 60% of the waste is biological, and 14% is made of plastic (Hidayat et al., 2019).

Any material that is worthless, unusable, undesirable, or discarded and is in solid form is considered a solid waste. The production of solid waste puts people's health in peril. According to certain reports, people who live close to garbage disposal yards are experiencing an upsurge in health risks like bronchitis, dermatitis, asthma, cancer, and stomach issues (Kumar and Adnan, 2020). While resource depletion and other such effects are linked to indirect environmental impacts, direct impacts of waste account for a sizeable but relatively tiny portion of climate change (Vallero and Shulman, 2019). Solid waste not only has an impact on those who live close, but it also used to have an impact on others. Indeed, solid waste has an impact on the air and water beneath landfill sites due to the development of gases and leachate. The creation of methane and other gases at the landfill site causes the atmosphere to change abruptly, harming the ecosystem in the area (Priyadarshi et al., 2020).

Solid wastes, which are produced by practically all human activities, can easily be divided into groups based on where they came from. Household and consumer wastes, sewage sludge, agricultural wastes, wastes from energy production, wastes from extraction, and industrial wastes are the

main groups (Kumar and Adnan, 2020). Improper waste management has a substantial impact on the environment, health, and economy both globally and locally; in most circumstances, poor trash management results in more expensive charges down the road than what it would have cost to properly treat the rubbish from the start. Waste management is described as the various strategies and practices created and put into place to recognize, manage, and treat the various sorts of trash from generation through disposal. When analyzed from a life cycle perspective, taking into account direct effects like emissions and indirect effects like resource depletion, full implementation of waste management processes, including waste prevention and reuse, and recycling wherever possible, has and can further help avoid significant environmental impacts (Vallero and Shulman, 2019).

In Indonesia, a way of waste management has been developed through the Waste Bank. A waste bank is somewhere that used to collect garbage which has been sorted out. Results of collection of sorted waste will be deposited into the place of manufacture crafts from garbage or to the premises garbage collector. Waste banks are managed using a system like banking that conducted by volunteer officers (Sasoko, 2022). With respect in waste management, there are 2 factors related with household waste management is motivation and role of health workers (Ningsih and Sugiarto, 2020).

The use of shopping bags is not the only way to reduce the volume of plastic waste. The use of these bags can reduce waste if consumers use them continuously (Hinojosa, 2019). The use of plastic bags is expected to be biodegradable or compostable (Cheung, 2022). In Australia, the use of single-use plastic shopping has been banned, and the majority have used their own shopping bags. In Tasmania, 9 out of 10 shoppers use their own shopping bags since the regulation on the use of plastic bags was enacted. Only about 1 per cent of plastic bags used in Australia pollute the environment (Kilvert, 2018).

Few studies in Malaysia have explored people's knowledge and practice of sun exposure and sun protection usage. Studies found that Malaysian university students and road traffic officers frequently used sunscreen, protective clothing, sunglasses, and hats for skiLocal governments in American states, continue to increase their concern for shopping bags, 11 states have enacted laws to ban the use of single-use plastic bags (Wagner, 2017).

In China, the behavior of household waste sorting has an impact on the behavior of using shopping bags to maintain environmental awareness, this can be a reference for our knowledge about the effects of waste sorting behavior in developing countries (Wang et al., 2020). This study aimed to analyze to determine the factors that associated the shopping bag carrying behavior in Borobudur District, Magelang Regency, Central Java, Indonesia.

SUBJECTS AND METHOD

1. Study Design

This was a cross-sectional study carried out in Borobudur District on November 2023.

2. Population and Sample

The population in this study is the Borobudur community who are members of TPS3R, the sample is part of the population that meets the inclusion and exclusion requirements of the sample, the number of samples is 347 respondents the sampling technique is simple random sampling.

3. Study Variables

The independent variables is the education, employment, gender, knowledge about waste, participants in the "Reduce Reuse and Recycle Waste Disposal Site", waste

management program, and participants in the waste bank, while the dependent variable is the behavior of carrying shopping bags.

4. Operational Definition of Variables

Education: The highest level of formal education completed by the respondent.

Employment: The main type of work or employment status of the respondent, categorized as employed and unemployed.

Gender: is the difference in gender of research subjects which includes men and women.

Knowledge about Waste: The respondent's understanding of waste management concepts, measured using a questionnaire and categorized as good and no good.

Participation in the 3R Program: The respondent's involvement in activities that promote reducing, reusing, and recycling waste, categorized as participating or not participating.

Waste Management Program is defined as a programs organized by the community or government to manage household waste, where respondents' awareness or involvement is categorized as participating or not participating.

Participation in Waste Bank: The act of depositing recyclable waste in a waste bank by the respondent, categorized as participating or not participating.

Behavior of Bringing Shopping Bags: The respondent's habit of bringing reusable shopping bags when shopping, categorized as often, sometimes, or neverpressure.

5. Study Instrument

The research instrument used was a structured questionnaire that had been tested for validity and reliability, so as to be able to measure the research variables accurately and consistently. This questionnaire was used in the interviews and FGDs, with the items of questions arranged based on theoretical constructs and resulting in reliability values.

6. Data Analysis

Chi-Square test was conducted to examine the a variables on outcome independently. A multiple logistic regression was used to test the relationship among all independent variables on dependent variables simultaneously.

7. Research Ethics

This research was conducted in accordance with research principles and obtained approval from the research ethics commission with Number.2.03/KEPK/SSG/XII/-2022, and received approval from respondents in the form of signing an informed consent.

RESULTS

Table 1 presents the distribution of shopping bag carrying behavior among respondents based on education level, employment status, gender, knowledge of waste, and participation in waste-related programs. The analysis aims to identify whether these variables are significantly associated with environmentally responsible behavior, particularly the use of reusable shopping bags. Each variable was cross-tabulated with shopping bag carrying behavior (Yes/No), and statistical significance was tested using the chi-square test.

The analysis shows varying patterns of shopping bag carrying behavior based on several demographic and behavioral factors. Although differences in education level appeared, they were not statistically significant (p= 0.146). Respondents with secondary (55.6%) and higher education (51.6%) were more likely to carry shopping bags than those with no formal education (20.0%). Employment status and gender were also not significantly associated with shopping bag behavior (p = 0.906 and p = 0.748, respectively), with employed and

unemployed individuals, as well as men and women, showing similar proportions.

Table 1. Characteristics of respondents and relationship with the shopping bag carrying behavior

Variable	Shopping bag carrying behavior				p
	Yes (n=187)		No (n =187)		
	n	%	n	%	
Education					
No Formal	2	20.0	8	80.0	
Primary	41	48.1	55	51.9	0.146
Secondary	65	55.6	50	44.4	
Higher	79	51.6	24	48.4	
Employment					0.906
Employed	48	49.5	49	50.5	
Unemployed	139	50.2	138	49.8	
Gender					0.748
Man	21	47.7	23	52.3	
Woman	166	50.3	164	49.7	
Knowledge of waste					0.033
Good	20	69.0	9	31.0	
Not good	167	48.4	178	51.6	
Partisipant TPS3R Program					0.441
Yes	41	53.9	35	46.1	
No	146	49.0	152	51.0	
Partisipant waste bank					0.001
Yes	67	71.3	27	28.7	
No	120	42.9	160	57.1	

However, knowledge of waste management was significantly associated with shopping bag carrying behavior (p= 0.033). Among those with good knowledge, 69.0% carried shopping bags, compared to only 48.4% of those with less knowledge. Additionally, participation in waste bank programs showed a strong and significant association (p= 0.001), with 71.3% of participants carrying shopping bags, in contrast to only 42.9% among non-participants. Participation in the TPS3R program was not significantly associated with shopping bag use (p= 0.441), although slightly more participants (53.9%) reported carrying bags compared to non-participants (49.0%).

Table 2. Logistic regression results of several variables on the shopping bag carrying behavior

Independent variables	AOR	CI 95%		p
		Upper limit	Lower limit	
Education				
No Formal	0.31	0.06	1.60	0.163
Primary	0.22	0.04	1.12	0.069
Secondary	0.27	0.04	1.54	0.140
Higher (Ref)	-	-	-	-
Employed	1.05	0.58	1.89	0.877
Gender				
Sex (male)	1.13	0.52	2.42	0.753
Good knowledge	2.43	1.04	5.6 5	0.040

Independent variables	AOR	CI 95%		p
		Upper limit	Lower limit	
Participate in waste management Program	0.79	0.45	1.39	0.427
Participate in waste bank	3.43	2.02	5.83	0.001

The logistic regression analysis revealed that educational level was not significantly associated with shopping bag carrying behavior, although individuals with no formal, primary, or secondary education showed lower odds compared to those with higher education. Employment status and gender also showed no significant effect. However, having good knowledge about environmental issues significantly increased the likelihood of carrying shopping bags (AOR= 2.43; 95% CI= 1.04 to 5.65; p= 0.040), indicating the importance of awareness in shaping sustainable practices. Notably, participation in waste bank programs was strongly associated with shopping bag carrying behavior (AOR= 3.43; 95% CI= 2.02 to 5.83; p= 0.001), suggesting that involvement in community-based waste initiatives plays a key role in encouraging environmentally responsible actions. In contrast, participation in general waste management programs did not show a significant relationship.

DISCUSSION

In the Magelang Regency, particularly in the Borobudur District, the implementation of the littering ban remains weak. Public response to household waste sorting is inconsistent, which creates a negative impression—especially as it is directly observable by tourists from around the world. As a strategic tourism destination, Borobudur requires strong support through effective environmental management and structured waste handling, beginning at the family level (Li and Wang, 2021).

Table 1 shows that the behavior of people to use shopping bags is around 50%. Socialization to increase public awareness of plastic waste still needs to be improved. Research results in Malaysia show that around 76% of consumers are willing to use shopping bags (Zainudin et al., 2021). Public awareness is the main thing. People who care about the environment tend to reduce the use of plastic bags and switch to using shopping bags (Arı and Yılmaz, 2017).

Table 2 the results showed that education was not related to the behavior of carrying shopping bags. Higher education in the research location did not show a change in the Carrying Shopping Bag Behavior. This study shows that the education variable is inversely related to the level of solid waste management knowledge This shows that people's knowledge and concern for waste needs to be increased. The results of another study in Ecuador showed that household heads with higher education were more likely to use cloth bags or reusable materials compared to those with less education (Batooli Z et al., 2020). In this study there is no significant difference in the shopping bag carrying behavior. However, a study of consumers who shop at shops in Iran shows different things, working consumers have a deeper intention to use cloth bags (Batooli et al., 2022). This difference becomes our material for discussing waste socialization in offices and society at the age of millennials.

This study shows that gender is not related to the shopping bag carrying behavior. However, the results of research in Iran show that age and gender influence the behavior of using shopping bags (Batooli et

al., 2022). Other research has also found that households with female heads are more likely to use bags when shopping (Zambrano-Monserrate and Ruano, 2020). Regardless of gender, the behavior of using shopping bags is related to the impact of the natural ecological paradigm, awareness of the consequences, the importance of responsibility for the environment, attitudes and individual intentions to use environmentally friendly shopping bags and perceived behavioral control due to plastic pollution later. The revealed gender differences in the use of shopping bags in respect of the natural/new ecological paradigm, awareness of consequences, ascription of responsibility, attitude towards shopping bags, intention to use shopping bags and perceived behavioural control due to plastic pollution later.

Community knowledge about waste is related to the use of shopping bags In this case, people's knowledge of waste greatly influences the behavior of carrying shopping bags. This tendency is 2,425 times compared to low knowledge. Individual knowledge is very influential on attitudes and behavior towards a thing. Public knowledge is affected by age, research results in China show that consumer age is positively related to the use of shopping bags (Li and Wang, 2021). The results show that TPS3R participants are not related to the behavior of using bags when shopping. TPS3R participants are passive participants in waste management. The behavior of disposing of waste that they do is throwing it in a waste bag in front of the house provided by the TPS3R manager.

Waste bank is a government program as an effort to reduce the volume of waste which is increasing day by day. The current condition of the program is not all running well. The results of research in Depok, West Java found four factors that make the Waste Bank continue to play a role, namely the existence of a reliable leader (leadership), good management (management), incentives (incentive) and partner involvement (partnership). Meanwhile, community characteristics based on education level, income level also affect community participation in Waste Bank membership (Suparmini and Junadi, 2018). Table 2 in this study shows that participants in the Waste Bank are associated with the behavior of carrying shopping bags by 3,430 times compared to people who are not participants in the waste bank.

This research as literature by providing insight to apply planned behavior to increase awareness of carrying consumer shopping bags. The results provide guidelines for policy makers about carrying shopping bags (Chang and Chou, 2018).

This study shows that the factors related to the shopping bag carrying behavior are knowledge about waste and being a participant in a waste bank. Knowledge of good waste tends to behavior carrying shopping bags by 2,425 times compared to less knowledge. Being a participant in a waste bank tends to behavior carry shopping bags by 3,430 times compared to those who do not participate in a waste bank.

This study recommends improving public knowledge about waste management and encouraging participation in waste bank programs are key strategies to promote the habit of carrying reusable shopping bags. Strengthening education efforts and expanding community involvement through waste banks can significantly support sustainable waste reduction behaviors.

AUTHOR CONTRIBUTION

All authors contributed significantly to this research. Sutaryono conceptualized the study, coordinated the project, and led the manuscript writing. Hadi Ashar and Hastin

Dyah Kusumawardani developed the research instruments and assisted in the data analysis. Anas Rahmad Hidayat, Purwanti, Puji Lestari, Sukamsi, Teguh Setyaji, Dhanik Ernawati, and Maria Prasasti RPW conducted data collection and field supervision. Tuti Susilowati contributed to the interpretation of the data and critically revised the manuscript. Heru Subaris Kasjono provided methodological advice and reviewed the final draft. All authors have read and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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