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The Impact of Community-Based Waste Bank Programs on Environmental Awareness: Evidence from Bontang City

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Abstract: This study aims to examine the effect of the community-based Waste Bank Program on community environmental awareness in Bontang City, particularly in terms of changes in knowledge, attitudes, and environmentally responsible behavior. This study employed an associative quantitative design using a survey approach. Data were collected through a structured questionnaire administered to 100 respondents selected using stratified random sampling. The independent the implementation of the community-based Waste Bank Program, while the dependent variable was environmental awareness. Data were analyzed using descriptive statistics, Pearson correlation, and simple linear regression. The results indicated that the implementation of the Waste Bank Program was positively and significantly associated with community environmental awareness. The program contributed to improving public understanding of waste management, strengthening positive attitudes toward environmental protection, and encouraging environmentally responsible behavior, particularly in waste sorting and reduction practices. These findings suggest that community-based waste management can serve as an effective public policy instrument in promoting sustainable environmental behavior at the local level. The novelty of this study lies in its quantitative evaluation of Waste Bank implementation in a coastal industrial city, thereby providing empirical evidence to strengthen local environmental governance and community-based waste management policies.

INTRODUCTION

Waste management has become one of the most urgent and complex environmental issues in urban areas, particularly in cities experiencing rapid population growth and economic development. Processes such as urbanization, industrialization, and changing consumption patterns have significantly increased both the volume and complexity of waste generated from household and non-domestic sources (United Nations Environment Programme [UNEP], 2024). This condition requires a waste management system that not only focuses on collection and final disposal but also emphasizes sustainable waste reduction at the source through active community participation (Ministry of Environment and Forestry [KLHK], 2022).

In the context of urban development, environmental carrying capacity limitations represent a major challenge in waste management. The increasing volume of waste, which is not matched by adequate management capacity, may lead to various environmental problems, including soil, water, and air pollution, as well as increased public health risks (Aprilia, 2021). Therefore, waste management can no longer be viewed solely as a technical issue but must be understood as a multidimensional problem encompassing social, economic, and public policy aspects (Dunn, 2018). This condition highlights the need to move beyond conventional end-of-pipe approaches toward participatory and 3R-based waste management systems (Jain et al., 2021; UNEP, 2024).

Bontang City, as a coastal industrial city in East Kalimantan Province, faces significant pressure in managing waste. Industrial activities, the expansion of residential areas, and changes in lifestyle contribute substantially to the increasing volume of waste. Data from the Environmental Agency of Bontang City indicate a gap between the amount of waste generated and the amount that can be properly managed, resulting in an increased burden on the Bontang

Lestari landfill. In addition, the persistence of open dumping practices in several areas exacerbates environmental degradation through groundwater contamination and greenhouse gas emissions (Aprilia, 2021). These conditions highlight the urgency of implementing more innovative, efficient, and sustainable waste management strategies.

Along with the evolving paradigm of waste management, community-based approaches have gained attention as adaptive and locally relevant solutions. One prominent model is the Waste Bank Program, a mechanism that integrates environmental, economic, and educational aspects of community empowerment (KLHK, 2022). This program enables communities to sort and deposit recyclable waste with economic value, thereby reducing waste volume while providing financial incentives. Conceptually, the Waste Bank reflects the principles of a circular economy, where waste is treated as a valuable resource (Kirchherr et al., 2017).

Within the Indonesian public policy context, the Waste Bank Program has been institutionalized through various national and regional regulations (KLHK, 2022). In Bontang City, this program has been developed as part of a community-based waste management strategy and included among the local government's priority programs. Quantitatively, the number of Waste Bank units has increased significantly. However, this increase does not necessarily reflect the substantive effectiveness of program implementation. Empirical evidence shows that only a limited number of units operate consistently, while others experience stagnation due to various constraints, including low community participation, limited management capacity, and inadequate infrastructure support.

These conditions indicate a gap between policy objectives and implementation realities. From a public administration perspective, the success of a program is not only determined by its administrative existence but also by the quality of its implementation and its impact on behavioral change (Robbins & Coulter, 2020; Dunn, 2018). Previous studies suggest that community-based waste management programs have the potential to enhance public participation and pro-environmental behavior (Jain et al., 2021; Satya et al., 2025). However, most studies remain descriptive or qualitative, thus lacking strong empirical measurement of the relationship between program implementation effectiveness and environmental awareness (Uria-Olaizola et al., 2025). Moreover, previous studies have generally focused on participation, operational performance, or urban waste management practices, while limited attention has been given to the quantitative assessment of how Waste Bank implementation relates to environmental awareness in coastal industrial cities such as Bontang.

In this context, environmental awareness emerges as a key variable determining the success of the Waste Bank Program. Environmental awareness encompasses not only knowledge but also attitudes and behaviors related to responsible waste management (Kollmuss & Agyeman, 2002). Based on the Theory of Planned Behavior, environmental awareness plays a crucial role in shaping intentions and pro-environmental behavior (Ajzen, 1991). Therefore, enhancing community awareness becomes a strategic objective of the program.

Although theoretical relationships between Waste Bank Program implementation and environmental awareness have been established, empirical evidence based on quantitative approaches, particularly in Bontang City, remains limited. This indicates a research gap that necessitates systematic and measurable investigation of the relationship between variables. This study offers novelty by examining the effectiveness of Waste Bank Program implementation using an associative quantitative approach, thereby providing stronger empirical evidence in the context of community-based environmental policy (Iskandar et al., 2022; Voronkova et al., 2025). Unlike previous studies that primarily describe Waste Bank activities or community participation, this study quantitatively tests the relationship between program implementation and environmental awareness, including knowledge, attitudes, and behavior, in the specific context of a coastal industrial city.

The research problem addressed in this study is whether the implementation of the Waste Bank Program significantly affects community environmental awareness in Bontang City. Accordingly, this study aims to examine the impact of the Waste Bank Program on community environmental awareness. The findings are expected to contribute theoretically to the development of public administration and environmental policy studies, as well as practically by

providing policy recommendations for more effective and sustainable community-based waste management.

RESEARCH METHODS

This study employed an associative quantitative research design to examine the relationship and effect between variables statistically (Creswell, 2021). The independent variable in this study was the implementation of the community-based Waste Bank Program, while the dependent variable was community environmental awareness.

The research object was the community of Bontang City who were involved in or exposed to the Waste Bank Program, with the unit of analysis based on neighborhood associations (*Rukun Tetangga/RT*). The research location was selected purposively, considering Bontang City as a coastal industrial area facing complex waste management issues. The study was conducted from November to December 2025.

The population of this study consisted of 499 neighborhood units (RT) in Bontang City. The sampling technique used was stratified random sampling based on administrative regions (districts and sub-districts), ensuring proportional representation of each area. The sample size was determined using the Slovin formula with a margin of error of 10%, resulting in approximately 83 respondents, which was then adjusted to around 100 respondents to improve proportional representation, anticipate incomplete responses, and enhance the stability of statistical estimation. The 100 respondents were distributed proportionally across selected districts, sub-districts, and neighborhood units according to the number of RTs and the presence of Waste Bank activities in each stratum.

Data were collected using several techniques: (1) a structured questionnaire as the primary instrument, (2) direct observation of Waste Bank activities, and (3) documentation from relevant institutions such as the Environmental Agency of Bontang City. The questionnaire was developed based on operationalized research variables and employed a 5-point Likert scale to measure respondents' perceptions, attitudes, and behaviors. The Waste Bank Program variable was measured through indicators of program accessibility, waste collection activities, community participation, program consistency, and perceived economic benefits. Environmental awareness was measured through three dimensions, namely knowledge, attitudes, and environmentally responsible behavior. Prior to data collection, the instrument was tested for validity using the Pearson Product-Moment correlation and for reliability using Cronbach's Alpha (Sugiyono, 2021), ensuring accuracy and consistency in measuring the research constructs.

Data analysis was conducted in several stages. First, instrument testing was performed to ensure validity and reliability. The validity test showed that all questionnaire items had corrected item-total correlation values above the minimum acceptable threshold, indicating that the items were valid for measuring the intended constructs. The reliability test produced Cronbach's Alpha values above 0.70 for both variables, indicating acceptable internal consistency. Second, descriptive statistical analysis was used to describe respondent characteristics and variable distributions. Third, inferential statistical analysis was conducted, including Pearson correlation to determine the strength of relationships between variables and simple linear regression to examine the effect of the Waste Bank Program implementation on environmental awareness. Hypothesis testing was conducted at a 5% significance level ($\alpha = 0.05$) using SPSS version 25.0.

This methodological framework ensures that the processes of data collection, processing, and analysis are systematic, replicable, and scientifically verifiable, thereby producing valid and reliable empirical findings regarding the effect of the Waste Bank Program implementation on community environmental awareness in Bontang City.

RESULTS AND DISCUSSION

The results indicated that the implementation of the community-based Waste Bank Programis generally categorized as moderately effective to effective. This is reflected in respondents' assessments of program availability, accessibility, and service quality, which are considered relatively good. Most respondents reported that Waste Bank locations are easily

accessible and that program-related information has been adequately disseminated. However, the educational and socialization aspects received relatively lower scores compared to other indicators, suggesting that the program's educational dimension has not been fully implemented in a consistent and sustainable manner. In the context of Bontang City, this finding indicates that the Waste Bank Program has developed as a local environmental governance instrument, but its transformative capacity remains limited when educational activities are not implemented consistently across communities.

On the other hand, the level of community environmental awareness is categorized as high, particularly in the dimensions of knowledge and attitudes. Most respondents demonstrate a clear understanding of the importance of waste management and show concern for environmental cleanliness. However, in terms of behavior, environmentally friendly practices are not yet consistently applied by all respondents. This finding indicates the presence of an attitude–behavior gap, as described in the literature (Kollmuss & Agyeman, 2002). This gap may occur because knowledge and positive attitudes do not automatically eliminate practical barriers such as household habits, limited convenience, weak social pressure, irregular program activities, and unequal access to supporting facilities. Therefore, environmental awareness in Bontang City should be understood not only as an individual cognitive condition but also as a product of community norms and institutional support.

The results of the Pearson correlation test show a positive and significant relationship between the implementation of the Waste Bank Program and environmental awareness, with a correlation coefficient of $r = 0.678$ at a significance level of $p < 0.05$. This value indicates a strong relationship between the two variables, suggesting that better program implementation is associated with higher levels of environmental awareness. However, this relationship should be interpreted as a statistically significant association within the research model, rather than as definitive causal proof. This finding is consistent with previous research indicating that community-based waste management programs significantly influence pro-environmental behavior (Jain et al., 2021). For Bontang City, the result implies that strengthening program accessibility, continuity, and participation can support the local government's broader agenda of community-based environmental governance.

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Furthermore, the results of simple linear regression analysis reveal that the implementation of the Waste Bank Program has a significant effect on environmental awareness, as indicated by the regression equation $Y = 1.245 + 0.712X$. The regression coefficient ($\beta = 0.712$) suggests that an increase in program effectiveness is statistically associated with a corresponding increase in environmental awareness. The coefficient of determination ($R^2 = 0.460$) indicates that 46% of the variation in environmental awareness can be explained by the implementation of the program, while the remaining 54% is influenced by other factors outside the model. The significance test results ($p < 0.05$) confirm that the proposed hypothesis is accepted. These findings show that the Waste Bank Program is an important predictor within the model, although other factors such as education, social norms, household routines, environmental infrastructure, and local leadership may also shape community awareness.

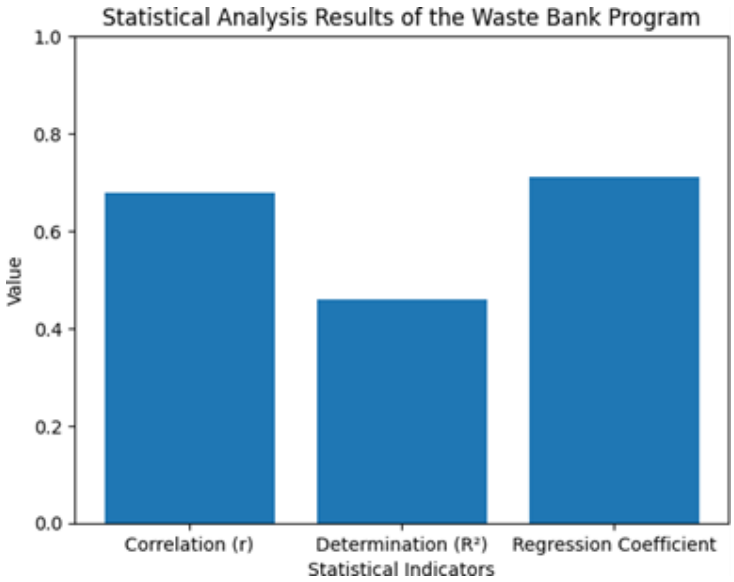

Figure 1. Statistical Analysis Results of the Effect of the Waste Bank Program on Environmental Awareness. Source: Processed primary survey data, 2025.

The bar chart in Figure 1 presents the correlation coefficient (r = 0.678), coefficient of determination (R^2 = 0.460), and regression coefficient (β = 0.712), summarizing the statistical association and model-based effect of the Waste Bank Program on environmental awareness.

From a theoretical perspective, these findings can be explained using the Theory of Planned Behavior, which states that individual behavior is influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). The Waste Bank Program functions as a policy intervention that not only provides waste management facilities but also creates social experiences that encourage changes in attitudes and behaviors. In this context, direct community involvement in waste collection, sorting, and exchange plays a crucial role in shaping environmental awareness. Such involvement strengthens perceived behavioral control because residents gain practical experience in sorting, depositing, and valuing recyclable waste.

On the other hand, program effectiveness is not solely determined by its existence but also by the quality of its implementation. The findings indicate that factors such as community participation, program consistency, management quality, and the intensity of educational activities play significant roles in determining program success. This is in line with the Community-Based Environmental Management (CBEM) approach, which emphasizes the active role of communities in environmental management (UN-Habitat, 2024). In terms of local governance, this means that the Waste Bank Program should not be treated merely as an administrative unit, but as a collaborative governance mechanism that requires continuous facilitation, monitoring, and community empowerment.

In addition, the economic benefits of the Waste Bank Program emerge as a key motivating factor for community participation. Respondents who perceive economic benefits tend to be more actively involved in the program. This finding supports the concept of the circular economy, which highlights that economic incentives can strengthen community motivation to adopt sustainable behaviors (Kirchherr et al., 2017). Nevertheless, economic incentives should be complemented by continuous environmental education so that participation does not remain purely transactional but develops into intrinsic environmental responsibility.

In the context of Bontang City as a coastal industrial area, these findings have important implications. The high environmental pressure resulting from industrial and household activities requires waste management approaches that are not only technical but also behavior-oriented. Therefore, the Waste Bank Program can be positioned as a strategic public policy instrument to collectively build environmental awareness. This is particularly relevant because coastal-

industrial cities require governance models that connect waste reduction, community participation, and behavioral transformation at the neighborhood level.

Overall, this study demonstrates that the implementation of the Waste Bank Program is significantly associated with and contributes to community environmental awareness. However, its effectiveness still needs to be improved, particularly in terms of educational activities and program consistency. Strengthening participatory and educational strategies is therefore essential to enhance the program's success in the future.

CONCLUSSION

This study aimed to examine the impact of the implementation of the Waste Bank Program on community environmental awareness in Bontang City. Based on the analysis results, it can be concluded that the research hypothesis is accepted, indicating that the implementation of the Waste Bank Program has a positive and significant association with environmental awareness. These findings confirm that participatory community-based programs can serve as effective policy instruments in shaping environmental awareness and behavior. Substantively, this study shows that program effectiveness is not merely determined by the existence of program structures, but rather by the quality of implementation, including community participation, program consistency, and perceived benefits. Environmental awareness is therefore formed through the interaction of direct program engagement, evolving social values, and incentives provided to the community. In the context of Bontang City, these findings indicate that community-based environmental management is relevant for strengthening local environmental governance in coastal-industrial areas. The Waste Bank Program not only functions as a technical waste management mechanism but also as a medium for social transformation in fostering a more sustainable environmental culture. However, this study is limited by its sample size, its geographic focus on Bontang City, and its reliance on self-reported survey data, which may not fully capture actual waste-sorting behavior. Future studies should examine additional contextual factors, such as local leadership, community social dynamics, and broader environmental policy integration, to develop more adaptive and sustainable community-based policy implementation models.

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