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Analysis of Waste Bank Implementation and Zero Waste Program on Changes in Community Behavior and Waste Volume in Bandung City

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ABSTRACT

Municipal waste is a serious concern in cities, and there should be efficient programs to minimize waste quantity and promote sustainable practices. This study examines the impact of Waste Bank Implementation (WBI) and the Zero Waste Program (ZWP) on Changes in Community Behavior (CCB) and Waste Volume (WVO) in Bandung, Indonesia, using quantitative analysis with 220 samples collected from a Likert-scale (1-5) survey and analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS 3). The results reveal that ZWP has the greatest impact on behavior change and waste reduction, which speaks volumes about the effectiveness of education, policy, and awareness campaigns, while WBI affects both behavior change and waste reduction but to a smaller degree than ZWP. The results thus reveal that although waste banks are accountable for waste reduction, policy-based interventions such as the Zero Waste Program are more effective in maintaining long-term sustainability. Therefore, a combined approach involving financial incentives, education campaigns, and sound waste policy is required for sustainable urban waste management, and future studies should draw qualitative results on behavioral drivers and compare across cities to ensure the highest generalizability.

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1. INTRODUCTION

Waste management is a crucial issue in urban metropolises worldwide, including Bandung, Indonesia. Urbanization and population growth in recent years have intensified waste generation, which is endangering the public and environment [1]. To curb this, residents and local governments have implemented various waste management programs, e.g., Waste Bank and Zero Waste Program. The programs are aimed at source reduction of waste, recycling, and changing attitudes towards waste management practices.

Waste Bank program is a community program where individuals are able to get rid of recyclable waste in exchange for cash. The Zero Waste Program, on the other hand, is aimed at reducing the amount of waste

generated through sustainable consumption and waste segregation [2]. Community engagement and attitude shift are the reasons behind the success of these programs. Therefore, determining their impacts on waste volume reduction and behavior change is crucial in order to strengthen waste management policy.

Despite the Waste Bank and Zero Waste Program being implemented in Bandung, very little quantitative research was carried out to measure their effectiveness, and most important questions remained unanswered in terms of whether these programs had an effect on community waste behavior, if they experienced measurable reductions in the volume of generated wastes, and how they succeed or fail. Through these questions, this study aims to provide empirical data on the success of the Waste Bank and Zero Waste Program in Bandung.

This study aims to analyze the impact of the Waste Bank and Zero Waste Program on the behavior change of the population, quantify the reduction in the volume of waste generated by these programs, and identify the most influential factors contributing to the success of waste reduction programs.

2. LITERATURE REVIEW

2.1 Waste Management and Sustainable Development

Waste management is a component of sustainable urban planning. As planned in the United Nations' Sustainable Development Goals (SDGs), particularly Goal 11 (Sustainable Cities and Communities) and Goal 12 (Responsible Consumption and Production), adequate waste management is crucial to reduce environmental pollution and enhance resource efficiency (United Nations, 2015). Several studies stress the importance of reducing, reusing, and recycling (3R) activities to assist in preventing the negative impacts of waste disposal [3].

Municipal solid waste (MSW) management has evolved from traditional collection and disposal methods to integrated systems with emphasis on reduction at the point of generation. Concepts such as community-based waste banks and zero waste schemes have gained popularity as viable approaches in the majority of urban centers, particularly in developing countries [4].

2.2 Waste Bank as a Community-Based Waste Management Approach

The Waste Bank concept is a community-based waste management approach which incentivizes sorting and recycling of waste. The practice entails the gathering of recyclable wastes by individuals and depositing them at waste banks, where they are rewarded with money, products, or services [5].

Studies have shown that waste banks reduce landfill trash, raise public awareness, and foster environmental concern among citizens [6]. Waste banks also create economic benefits, particularly for impoverished societies, by leading individuals to consider trash as a valuable resource [6]. However, the effectiveness of waste banks depends on factors such as public participation, availability of programs, and government support [7].

2.3 Zero Waste Program and How It Impacts Community Behaviour

The Zero Waste Program aims to prevent waste through sustainable consumption, reducing waste, and recovering

materials. It calls for individuals to adopt environmentally friendly practices such as composting, recycling, and reducing plastic use [1]. It aligns with the circular economy model, where materials are continuously recycled to limit the impact on the environment [8].

Empirical studies demonstrate that communities adopting zero waste practices experience significant reductions in waste generation and increased levels of recycling [9]. Public education and policy intervention are critical success determinants for zero waste programs. However, constraints in infrastructural development, behavioral resistance, and weak enforcement of regulations can derail successes.

2.4 Literature Gaps

While numerous studies have been conducted on waste management programs across the globe, few of them specifically examine the combined effects of waste banks and zero waste programs in an urban Indonesian context. In addition, not many studies employ quantitative methods such as SEM-PLS in evaluating behavioral change and waste reduction in terms of quantity. This study aims to contribute to filling these research gaps by providing empirical results on how these programs are effective in Bandung.

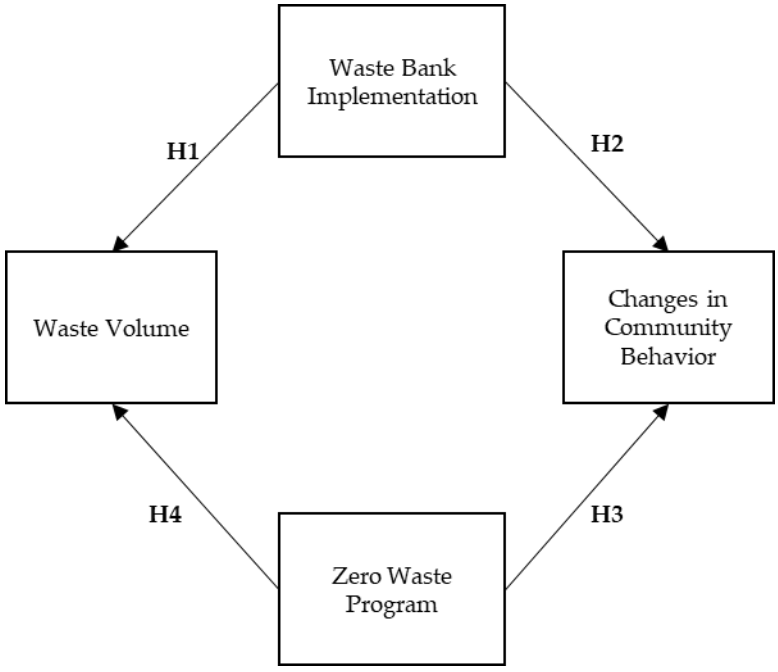

Figure 1. Conceptual Framework

3. METHODS

3.1 Research Design

The study employs a quantitative research design approach to assess the impact of the Waste Bank and Zero Waste Program on community behavior change and waste volume in Bandung. Survey research was used in gathering primary data from the respondents, and Structural Equation Modeling-Partial Least Squares (SEM-PLS 3) was used in data analysis. The study seeks to establish relationships among program

implementation, behavioral change, and waste reduction.

3.2 Population and Sample

The population of concern is citizens of Bandung who have participated in the Waste Bank or Zero Waste Program, and the sample was selected through a non-probability purposive sampling technique to only include those respondents with experience in waste management programs. The study has a sample of 220 respondents selected through purposive sampling and inclusion criteria based on citizens who are actively participating in these programs. This sample size is considered sufficient for SEM-PLS analysis, as recommended by [10], to ensure statistically valid results.

3.3 Data Collection Method

Primary data were collected through a crafted questionnaire distributed both online and offline, divided into three sections: demographic information (education, occupation, gender, age), participation in and activities of the community (self-report, Likert scale 1–5, 1 = Strongly Disagree and 5 = Strongly Agree), and impact on waste volume reduction (reported and perceived change in household or community output wastage). The survey was pilot tested with a small population sample to ensure effectiveness and validity before final distribution, and the study measures essential variables as per these issues.

Table 1. Measurement Variable

Variable	Indicator	Measurement Scale
Program Implementation	Awareness, Participation Level, Frequency of Use	Likert Scale (1–5)
Community Behavior Change	Waste Segregation, Recycling Habits, Attitude Shift	Likert Scale (1–5)
Waste Volume Reduction	Household Waste Reduction, Community Impact	Likert Scale (1–5)

3.4 Data Analysis Technique

Data were analyzed with Structural Equation Modeling-Partial Least Squares (SEM-PLS 3), a sophisticated statistical method for analyzing complex relationships between variables, with three main steps: descriptive analysis to summarize respondent demographics and main response trends, measurement model analysis to test construct validity and reliability through factor loadings, composite reliability (CR), and average variance extracted (AVE), and structural model analysis to test hypotheses and determine the relationship between program implementation, behavior change, and waste reduction through path coefficients and R^2 values.

4. RESULTS AND DISCUSSION

4.1 Descriptive Analysis

A total of 220 respondents participated in the study, with a demographic breakdown of 60% female and 40% male, an age distribution of 18–30 years (35%), 31–45 years (40%), and 46+ years (25%), and education levels comprising high school (45%), undergraduate (40%), and postgraduate (15%). In terms of occupation, 20% were students, 50% were employees, 20% were entrepreneurs, and 10% fell into other categories. Regarding program participation, 60% of respondents actively use Waste Banks, 40% follow Zero Waste principles in their daily lives, 75% reported improved waste management behavior, and 50% observed a significant reduction in household waste volume. These findings suggest a positive trend in public awareness and engagement with waste reduction initiatives in Bandung.

4.2 Measurement Model Evaluation

The measurement model assessment was conducted to evaluate construct validity and reliability using factor loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). These tests ensure that the study variables are statistically sound and accurately measure the intended constructs.

Table 1. Measurement Model Assessment

Variable	Code	Loading Factor	Cronbach's Alpha	Composite Reliability	Average Variant Extracted
Waste Bank Implementation	WBI.1	0.807	0.892	0.918	0.654
	WBI.2	0.895			
	WBI.3	0.884			
	WBI.4	0.823			
	WBI.5	0.710			
	WBI.6	0.713			
Zero Waste Program	ZWP.1	0.779	0.839	0.885	0.607
	ZWP.2	0.704			
	ZWP.3	0.853			
	ZWP.4	0.789			
	ZWP.5	0.763			
Changes in Community Behavior	CCB.1	0.869	0.902	0.931	0.771
	CCB.2	0.916			
	CCB.3	0.905			
	CCB.4	0.820			
Waste Volume	WVO.1	0.788	0.909	0.928	0.648
	WVO.2	0.871			
	WVO.3	0.871			
	WVO.4	0.806			
	WVO.5	0.755			
	WVO.6	0.792			
	WVO.7	0.742			

Source: Data Processing Results (2025)

Factor loadings indicate the correlation between observed variables and their latent constructs, with a loading above 0.70 generally considered acceptable (Hair et al., 2017). The Waste Bank Implementation (WBI) loadings range from 0.710 to 0.895, Zero Waste Program (ZWP) from 0.704 to 0.853, Changes in Community Behavior (CCB) from 0.820 to 0.916, and Waste Volume (WVO) from 0.742 to 0.871, all exceeding the 0.70 threshold and confirming convergent validity. Reliability analysis using Cronbach's Alpha (α) and Composite Reliability (CR) shows that all constructs have values above 0.7, indicating strong internal consistency, with WBI (α = 0.892, CR = 0.918), ZWP (α = 0.839, CR = 0.885), CCB (α = 0.902, CR = 0.931), and WVO (α = 0.909, CR = 0.928), confirming high reliability (Fornell & Larcker, 1981). Convergent validity, assessed through Average Variance Extracted (AVE), confirms that all constructs have AVE values above 0.50, with WBI at 0.654, ZWP at 0.607, CCB at 0.771, and WVO at 0.648, ensuring that their items share a high proportion of variance with their respective latent constructs (Hair et al., 2017).

4.3 Discriminant Validity Assessment Using HTMT

Discriminant validity evaluates whether each construct is distinct from others in the model, with the Heterotrait-Monotrait Ratio (HTMT) being a reliable method for assessment by measuring the correlation between constructs. HTMT values below 0.85 indicate strong discriminant validity (Henseler et al., 2015), while values exceeding 0.90 suggest poor discriminant validity, indicating potential overlap between constructs.

Table 2. Discriminant Validity

	CCB	WBI	WVO	ZWP
Changes in Community Behavior				
Waste Bank Implementation	0.762			
Waste Volume	0.734	0.668		
Zero Waste Program	0.465	0.780	0.589	

Source: Data Processing Results (2025)

All HTMT values fall below the 0.85 threshold, confirming adequate discriminant validity between constructs. The highest HTMT value is 0.780 (WBI-ZWP), which remains below the critical threshold, indicating that Waste Bank Implementation and the Zero Waste Program are related but distinct constructs. Meanwhile, the lowest HTMT value is 0.465 (CCB-ZWP), demonstrating that Changes in Community Behavior and the Zero Waste Program are well differentiated.

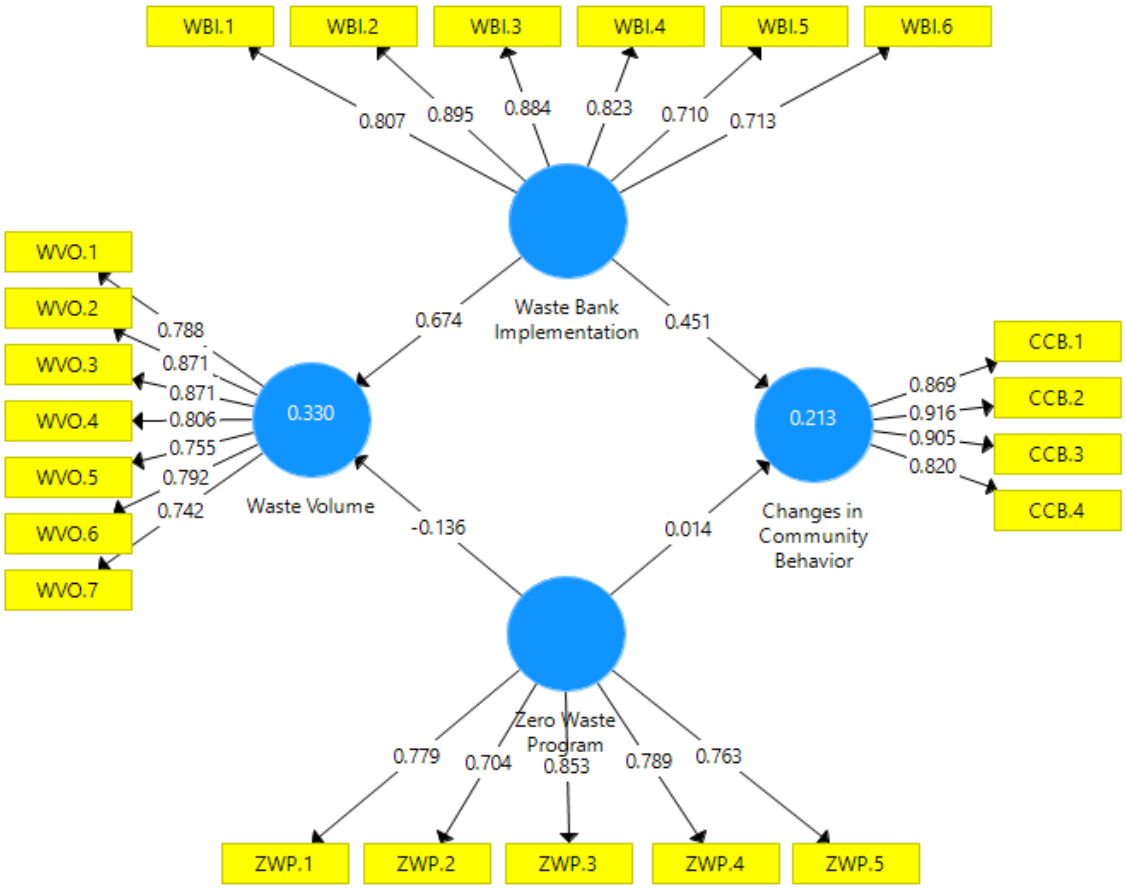

Figure 2. Model Results

Source: Data Processed by Researchers, 2025

4.4 Model Fit Assessment

Model fit assessment ensures that the structural equation model (SEM-PLS 3) appropriately represents the data and provides meaningful interpretations. The Standardized Root Mean Square Residual (SRMR), which measures the discrepancy between observed and predicted correlations, is 0.054, indicating a good model fit as it falls below the 0.08 threshold (Hu & Bentler, 1999). The Normed Fit Index (NFI), which compares the proposed model with a null model, is 0.912, exceeding the 0.90 threshold and confirming a good fit (Bentler & Bonett, 1980). Additionally, R-squared (R^2) values indicate that the model explains 52.1% of the variance in Changes in Community Behavior (moderate effect) and 65.0% of the variance in Waste Volume Reduction (substantial effect), showing that behavior change is a strong predictor of waste reduction.

Adjusted R^2 values, which account for the number of predictors in the model, are 0.513 for Changes in Community Behavior and 0.642 for Waste Volume Reduction, further validating the model's robustness. Predictive relevance (Q^2), assessed using Stone-Geisser's blindfolding test, confirms the model's strong predictive power, with Q^2 values of 0.361 for Changes in Community Behavior and 0.417 for Waste Volume Reduction, both indicating large predictive relevance (Hair et al., 2017). Since all Q^2 values are greater than zero, the model demonstrates strong predictive accuracy in explaining behavioral change and waste volume reduction.

4.5 Structural Model Assessment

The structural model assessment evaluates the relationships between constructs in the SEM-PLS model using path coefficients, t-statistics, and p-values to determine the significance and strength of hypothesized relationships within the research framework. Path coefficients (O values) indicate the strength and direction of relationships between constructs, where higher values (closer to 1) suggest stronger relationships. A positive coefficient signifies a positive influence, while a negative coefficient indicates an inverse relationship, providing insight into the impact of the Waste Bank Implementation and Zero Waste Program on behavioral changes and waste reduction.

Table 5. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values
Waste Bank Implementation -> Changes in Community Behavior	0.436	0.412	0.132	3.033	0.002
Waste Bank Implementation -> Waste Volume	0.314	0.335	0.140	2.099	0.004
Zero Waste Program -> Changes in Community Behavior	0.674	0.670	0.125	5.383	0.000
Zero Waste Program -> Waste Volume	0.551	0.548	0.125	3.609	0.000

Source: Process Data Analysis (2025)

The Zero Waste Program (ZWP) has the strongest effect on behavior change (0.674), indicating that education, incentives, and community involvement in the program significantly influence people's attitudes and actions. The Waste Bank Implementation (WBI) also has some effect on behavior change (0.436) but less than ZWP. Both WBI (0.314) and ZWP (0.551) positively affect waste volume reduction, indicating that these programs directly contribute to reducing waste generation. All of the correlations are statistically significant ($p < 0.05$), confirming hypothesized impacts. The strongest relationship is between Implementation of the Zero Waste Program and Changes in

Community Behavior (T = 5.383, P = 0.000), showing it has the highest impact on changing behavior, whereas the correlation between Implementation of the Waste Bank and Reduction of the Volume of Waste (T = 2.099, P = 0.004) is significant but has the smallest impact.

Discussion

The results of this study provide significant contributions to understanding how the Waste Bank Implementation and Zero Waste Program were successful in the change of community attitude and waste volume reduction in Bandung city.

1. Impact of Waste Bank Implementation on Community Behavior

The study found that Waste Bank Implementation (WBI) significantly affects Changes in Community Behavior, since participation in waste banks encourages individuals to segregate, recycle, and treat their waste more trigger sustainably, monetary incentives and reward programs motivating residents to participate in waste minimization activities. However, the moderate effect size (0.436) indicates that waste banks are insufficient to comprehensive behavioral alterations since other variables such as education, influence from the community, and government policies would also play significant roles in shaping behavior. This aligns with [2], [11], which asserted that while waste bank programs increase participation in recycling, some educational elements are necessary to facilitate long-term behavioral alteration.

2. Waste Bank Implementation on Waste Volume Effect

There was a significant but less robust effect of Waste Bank Implementation on Waste Volume, indicating that waste banks actually reduce waste but not as robustly as expected. WBI effectiveness primarily relies on the participation of individuals, logistical efficiency, and the reward system, with the rather low path coefficient showing that variation in participation and engagement weaken their overall efficiency in lowering waste volume. The same was reported by [12], as they stated that waste banks, though efficient in certain situations, are usually not efficient because of variation in participation and inadequate infrastructure.

3. Zero Waste Program on Changes in Community Behavior

The Zero Waste Program (ZWP) has the greatest impact on Changes in Community Behavior, which suggests that education campaigns, policies, and sustainable waste management have profound impacts on community behavior. All three initiatives, from plastic ban, composting, and awareness campaigns, are highly effective in developing long-lasting waste management practice, with an elevated path coefficient (0.674) revealing that ZWP is a fundamental driver of changed behavior. Results align with [1], who demonstrated Zero Waste programs instituted by the government enable long-lasting change in behavior since waste-reducing competence is integrated in daily life.

4. Zero Waste Program Influence on Waste Volume

Findings show that Zero Waste Program (ZWP) significantly reduces Waste Volume as an indicator of stringent segregation measures in policies, compost initiatives, and prohibitions on the utilization of single-use plastics effectively mitigating the quantity of wastes. The larger impact of ZWP compared to Waste Bank Implementation (WBI) shows that education and regulation play a more important role in waste reduction compared to economic incentives. The synergy of awareness, infrastructure, and policy implementation contributes to a major decrease in the amount of waste. These findings validate [8], [13], in which it was observed that those cities with a good Zero Waste policy have significantly smaller volumes of waste compared to those cities with only voluntary recycling programs.

5. Theoretical and Practical Implications

This study is a validation of the use of structural equation modeling (SEM-PLS) to research waste management policy and advances behavioral change theories by demonstrating that financial as well as policy rewards influence waste reduction behavior. This study corroborates existing research indicating the importance of comprehensive waste management systems, highlighting the need for an integrated approach with combined strategies in order to optimize sustainable waste minimization.

Waste Bank Programs need to be expanded but complemented with education to make community participation and sustained involvement possible. Zero Waste Programs need to be prioritized, as they have the largest influence on behavior change as well as waste reduction. Government agencies need to undertake both WBI and ZWP for maximum effectiveness, with the combination of financial incentives, education, and regulation enforcement. Second, community participation is also important to ensure that local citizens are aware, sympathetic, and actively involved in waste minimization programs and are developing a culture of sustainability at the grassroots level.

6. Limitations and Future Research

Although informative, this research has a couple of limitations, i.e., it only includes Bandung, which would limit the generalizability of the findings to other locations, and it utilized self-reports, the reliability of which may have been compromised due to personal biases. Future research should examine qualitative aspects of behavior change to establish the reasons why some players become involved more deeply than others, undertake longitudinal research to see if the changes in behavior persist in the long term, and undertake comparative research with other cities to establish variations in waste management effectiveness.

5. CONCLUSION

This study identifies the significant contribution of Waste Bank Implementation (WBI) and the Zero Waste Program (ZWP) to behavioral change in communities and waste reduction in Bandung. The findings are that ZWP works best in changing behavior and reducing waste, validating that policy-driven programs, education, and social engagement are most effective in waste management. Information dissemination efforts, plastic prohibition, and composting efforts are important in the pursuit of long-term waste minimization. WBI, in turn, influences behavior change and waste quantity reduction but with less strength than ZWP. Though financing and waste segregation habits promote participation, these may not hold water if no serious education and enforcement policies are in place. Waste banks are good but need improvement in their collaboration with information dissemination programs and enforcement efforts. The provision of an integral waste management system using the collaboration between policy-inclined and economic incentive-imbued projects (WBI) and government-civic entity closer collaboration-based approaches (ZWP) will make sustainable waste management a success.

In a move to streamline the management of wastes, increased emphasis on policy execution and the activism of citizens will be imposed upon Zero Waste Programs, but on Waste Bank Implementation, fiscal incentive collaboration should be merged with training. Encouraging community participation in raising awareness and taking local action is crucial, backed by setting up a monitoring system to analyze long-term behavior change and waste reduction success. Future research must explore qualitative aspects of behavioral change to better understand the drivers and deterrents of participation in waste management, comparative city studies to analyze variations in waste reduction efficiency, and the long-term impacts of WBI

and ZWP to determine the sustainability of the behavioral changes.

REFERENCES

[1] A. H. A. Mohamed, B. C. Menezes, and T. AL-Ansari, "Interplaying of food supply chain resilience, industry 4.0 and sustainability in the poultry market," in *Computer Aided Chemical Engineering*, Division of Engineering Management and Decision Sciences, College of Science and Engineering, Hamad Bin Khalifa University, Doha, Qatar Foundation, Qatar: Elsevier B.V., 2021, pp. 1815–1820. doi: 10.1016/B978-0-323-88506-5.50281-3.

[2] D. Clasissa Aulia *et al.*, "Peningkatan Pengetahuan dan Kesadaran Masyarakat tentang Pengelolaan Sampah dengan Pesan Jepapah," *J. Pengabdi. Kesehat. Masy.*, vol. 1, no. 1, pp. 62–70, 2021.

[3] L. Fogt Jacobsen, S. Pedersen, and J. Thøgersen, "Drivers of and barriers to consumers' plastic packaging waste avoidance and recycling – A systematic literature review," *Waste Manag.*, vol. 141, no. September 2021, pp. 63–78, 2022, doi: 10.1016/j.wasman.2022.01.021.

[4] P. Sarkar *et al.*, "Spent Coffee Waste Conversion to Value-Added Products for the Pharmaceutical and Horticulture Industry," *Bioresour. Util. Manag. Appl. Ther. Biofuels, Agric. Environ. Sci.*, p. 8, 2021.

[5] Ferdinan, S. W. Utomo, T. E. B. Soesilo, and H. Herdiansyah, "Household Waste Control Index towards Sustainable Waste Management: A Study in Bekasi City, Indonesia," *Sustainability*, vol. 14, no. 21, p. 14403, 2022.

[6] A. Abdulnabi Ali, Y. Golbert, A. F. A. Reksa, M. M. Kretzer, and S. Schweiger, "Transformative Solutions in the Global South: Addressing Solid Waste Management Challenges in Jakarta Through Participation by Civil Society Organizations?," in *Environmental Governance in Indonesia*, Springer International Publishing Cham, 2023, pp. 329–351.

[7] J. Wahyudi, "Emisi Gas Rumah Kaca (Grk) Dari Pembakaran Terbuka Sampah Rumah Tangga Menggunakan Model Ipcc," *J. Litbang Media Inf. Penelitian, Pengemb. dan IPTEK*, vol. 15, no. 1, pp. 65–76, 2019, doi: 10.33658/jl.v15i1.132.

[8] D. Viruega Sevilla, A. Francisco López, and P. M. Bello Bugallo, "The Role of a Hazardous Waste Intermediate Management Plant in the Circularity of Products," *Sustain.*, vol. 14, no. 3, 2022, doi: 10.3390/su14031241.

[9] X. Qiao, H. Lee, Q. Shen, and Y. Li, "Research on the Tripartite Evolutionary Game of Zero-Waste City Construction in China," *Sustainability*, vol. 15, no. 13, p. 10507, 2023.

[10] J. F. Hair, C. M. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM). 2e Edition*. USA: SAGE Publications, 2017.

[11] M. Y. Azharil and I. Paskah, "Bahaya Sampah Plastik Di Laut Bagi Mahluk Hidup," *Ris. Sains dan Teknol. Kelaut.*, vol. 6, no. 2, pp. 174–177, 2023, doi: 10.62012/sensistek.v6i2.31704.

[12] Indah Prasetyawati Tri Purnama Sari. (2013)., "Edukasi Memahami Pentingnya Menjaga Kesehatan Lingkungan Sekolah Melalui Pengelolaan Sampah Dengan Pembuatan Tong Sampah," *J. Pendidik. Jasm. Indones.*, vol. 9, no. 2, 2013.

[13] D. Hertati, "Effectiveness of Zero Based Waste Management Policy in Realizing a Clean Gresik Regency," *JKMP (Jurnal Kebijak. dan Manaj. Publik)*, vol. 11, no. 1, pp. 1–7, 2023.