Analysis of Consumer Behavior in Reverse Logistic Polyethylene Terephthalate in Indonesia Towards a Circular Economy

YUNIAR FARIDA [a,b,1], NURHADI SISWANTO [a] and IWAN VANANY [a]

[a] *Department of Industrial and Systems Engineering, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia*
[b] *Department of Mathematics, UIN Sunan Ampel, Surabaya, Indonesia*
ORCiD ID: Yuniar Farida http://orcid.org/0000-0001-8666-4980, Nurhadi Siswanto https://orcid.org/0000-0003-1148-9166, Iwan Vanany http://orcid.org/0000-0002-0774-514X

Abstract. PET (Polyethylene Terephthalate) waste is a crucial problem because of its high consumption as disposable packaging. Even used PET plastic is the most accessible type of plastic to recycle. So, recycling PET plastic waste is a solution to the problem of plastic waste that contributes to environmental safety while providing economic benefits towards a circular economy. In a circular economy, the consumer is the initial entity producing waste to be recycled. So that consumers can act as suppliers in reverse logistics, this study aims to analyze consumer behavior after PET consumption in terms of economic, social, environmental, and regulatory aspects. This study was conducted with a survey on household consumers with residence, education, and income variables. The survey results were presented using descriptive statistics, and the relationship between the variables was tested using the Chi-Square test. The survey results show an association between residence, education, and income variables with post-consumption consumer behavior. This research contributes to determining consumer behavior, leading to increased consumer engagement in the return of waste products in reverse logistics through implementing policies.

Keywords. consumer behavior, post-consumption, PET, Polyethylene Terephthalate, reverse logistics, circular economy

1. Introduction

Every year about 300 million tons of plastic are produced, producing more than five trillion plastic particles worldwide and causing severe environmental and health problems due to the plastic waste generated [1]. Most non-recycled plastic waste is sent to landfills or the ocean. Indonesia is the country with the second most significant level of plastic pollution in the oceans after China [2]. Plastic waste is not easily decomposed. If it is in the soil, it reduces the space for movement and air turnover in the ground, blocking water absorption into the dirt so that it not only causes flooding but also reduces soil fertility [3], [4]. Plastic waste that floods a lot in rivers hinders rivers' flow, so it becomes the cause of floods. Plastic waste in the ocean not only kills flora and fauna but

---

also endangers human health (threatens food safety) [3], [5]. In addition, the air is contaminated by toxic chemicals released when plastic is burned [4].

The problem of plastic waste that occurs a lot in the world is inseparable from the popularity of plastic as a raw material that can be produced into various superior plastic products [6]. Plastic is a durable, lightweight, and relatively cheap material compared to other materials [7]. One type of plastic waste widely found is PET (Polyethylene Terephthalate) plastic. Globally, the consumption of PET plastic for various packaging is estimated to reach 19.1 million tons (in 2017), of which 83% to 84% of the demand is dominated by bottled packaging for water, carbonated soft drinks, and other beverages [8]. As an instant consumer product, PET bottles are usually discarded after use. Every year about 0.3 – 1.2 million tons of PET bottles enter the oceans, polluting the marine environment and entering the human body through bioaccumulation in the food chain. The United Nations Environment Program (UNEP) reported that the losses caused by dumping plastic waste into the sea reached USD13 billion or around Rp180 trillion annually [9].

This used PET plastic is the most accessible type of plastic to recycle. So, recycling PET plastic waste is a solution to the problem of plastic waste that contributes to environmental safety while providing economic benefits towards a circular economy. Applying a circular economy through 5R (Reduce, Reuse, Recycle, recovery, and Repair) is difficult. Its success is primarily determined by Reverse Logistics, as the flow of products from consumers to producers in distribution channels. Reverse logistics involves collecting used products from end users/consumers, sorting products for return and processing at recycling plants, and redistributing those products to manufacturers [10], [11]. It is the consumer who acts as a supplier in reverse logistics. So the success of reverse logistics should be significantly influenced by consumer participation in this take-back program. However, in its implementation, the consumer perspective has not been paid much attention to, and the development of reverse logistics focuses more on the concept of recycling from the perspective of suppliers or producers [12]. Therefore, this study aims to analyze consumer behavior post-consumption of PET-packaged beverages and identify factors that motivate consumers to participate better in the return of post-consumption waste products towards a circular economy. This research contributes to designing better reverse logistics and enables governments and companies to develop strategies that motivate consumers to properly handle plastic waste to reduce environmental pollution.

2. Literature Review

Many studies use the Theory of Planned Behavior to understand human behavior [13], [14]. This theory proposes a model to understand human behavior better using variable attitudes, subjective norms, and perceived behavior (intentions). The first is a way of looking at behavior. This attitude is the degree to which a person evaluates or assesses his behavior, whether beneficial or unfavorable [13]. The second determinant is the subjective norm, the degree to which a person feels social pressure to perform or not perform an action [14]. The third element is the control of perceived behavior. This behavior refers to the presence or absence of factors that facilitate and hinder the individual from carrying out a behavior. This perceived behavioral control is widely used in recycling research [14]. The three Sustainable Development Goals (SDGs) concepts are commonly adopted in researching recycling behavior from the consumer side.

However, SDGs make it possible to change and develop as research develops. Additional variables can be included to better contribute to the study of behavior. The altruistic behavioral model proposes that behavior should be analyzed regarding personal and social norms. Norms and consequences of individual actions are used to understand consumer intentions in return for post-consumption waste. Subjective criteria refer to the feeling of moral obligation to do the right thing [13].

In the context of a circular economy, the investigation of consumer behavior can be reviewed from the aspects before and after consumption. In the pre-purchase review, how consumers' motivation to become more environmentally conscious is associated with their consumption behavior in buying environmentally friendly products to reduce waste that is wasted into the environment and benefit future generations [15]. Consumer perception also influences consumer behavior in purchasing products and is used as input for producers in designing more environmentally friendly products and economically acceptable to consumers [16]. On the other hand, how consumers behave after consumption is also crucial to study where the waste produced has a destructive impact on the environment. The success of a circular economy that reduces recycles, and reuses materials in the supply chain is influenced by consumers of one of the sources of reverse logistics suppliers. This study investigates consumer behavior after plastic consumption, especially PET waste.

Previous research on consumer behavior after plastic consumption and recycling, including Kianpour et al. [11], identifies potential factors to reduce consumer behavior in plastic consumption. Khan et al. [4] identify factors influencing consumer intent on the return/recycling of plastic waste. De Marchi et al. [17] explore consumer preferences and willingness to pay for plastic water bottles made from conventional plastic polymers and more sustainable plastic alternatives. Galati et al. [18] investigate consumer behavior and factors influencing purchasing behavior. Mauroner and Rita [19] investigate customer perceptions and behavior toward reusable water bottles in the German Market. Syafiqah et al. [20] investigate plastic consumption behavior and the effects of plastic use by customers. Heidbreder et al. [21] provide an overview of the existing socio-scientific literature on plastics, from risk awareness, consumer preferences, and predictors of usage behavior to political and psychological intervention strategies. From the various studies above, research on consumer behavior is associated with economic aspects (providing material benefits) and social and environmental aspects. As for the norm aspect, it can be related to a regulatory factor which should be the most crucial aspect that can force every stakeholder/entity, in this context, the community as a consumer. So that in this study, economic, social, environmental, and regulatory aspects will be investigated as motivations for consumer behavior after PET plastic consumption.

3. Methodology

This study aims to analyze consumer behavior post-consumption of PET-packaged beverages and identify factors that motivate consumers to participate better in returning post-consumption waste products to support reverse logistics towards a circular economy. Several stages are carried out, including a literature review, preliminary interviews to determine research factors, and making questionnaires aimed at consumers. Then, analyze the results of the questionnaire using statistical methods.

From the results of literature reviews and interviews, there are four aspects of consumer motivation studied that are the basis for preparing the questionnaire, including:

- The economic aspect, namely consumer behavior, takes advantage of the results of collecting used PET for resale. This aspect will be associated with residence, education, and income variables.
- The social aspect, namely the behavior of consumers who collect used PET to donate to waste pickers or unit waste banks. This aspect is associated with variables of residence, education, and income.
- The environmental aspect sees consumer behavior that participates in reverse logistics as a form of awareness that uncontrolled plastic waste will be very positive for the environment. This aspect is associated with variables of residence, education, income, and exposure to digital information.
- Regulatory aspects, veering consumer behavior associated with regulations that force consumers to re-collect PET post-consumption.

Furthermore, the data from the questionnaire results are categorized into nominal data, then tested for validity and reliability before data analysis. Data analysis was done by testing the relationship between predictor and response variables using the Chie Square test. *The Chi-square* test is a non-parametric comparative test performed on two variables, where the data scale of both variables is nominal [22]. The Chi-square test can be formulated as follows:

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \tag{1}$$

where, X^2 is a Chi-Square distribution, O_i is the i-th observation (observation) value, and E_i is the value of the i-th expectation. Hypotheses used:

H_0: No significant influence between the two variables
H_1: There is an essential influence between the two variables
Determining the degree of significance α and comparing values X^2 calculate with X^2 table:

    If X^2 calculate $\leq X^2$ table, then H_0 Accepted
    If X^2 calculate $> X^2$ table, then H_0 Rejected
    If *Sig.* $\geq 0,05$, then H_0 Accepted
    If *Sig.* $< 0,05$, then H_0 Rejected

In addition to the Chi-Squre test, data presentation with descriptive statistics was also carried out to provide a more detailed picture of the various aspects studied.

4. Result

4.1. Validity and Reliability Data

Validity and reliability tests are carried out on the questionnaire data distributed to consumers to obtain data worthy of analysis. The following are the validity test results:

Table 1. Validity and Reliability Data Test Results

					Correlations			
		Education	Residence	Income	Post-Consumption Consumer Behaviour	Total	**Reliability Statistics**	
Education	Sig. (2-tailed)	-	0.001	0.000	0.412	0.702	Cronbach's Alpha	N of Items
Residence	Sig. (2-tailed)	0.001	-	0.000	0.103	**0.000**		
Income	Sig. (2-tailed)	0.000	0.000	-	0.541	**0.000**		
Post Consumption Customer Behaviour	Sig. (2-tailed)	0.412	0.103	0.541	-	**0.000**	**0.702**	4
Total	Sig. (2-tailed)	**0.000**	**0.000**	**0.000**	**0.000**	-		
	N	293	293	293	293	293		
**. Correlation is significant at the 0.01 level (2-tailed).								

The table above shows that 293 respondents with each variable declared valid, indicated by the significant value in Total. Significance Value (Sig. (2-tailed)) < 0.05 means suitable. Meanwhile, the reliability test obtained the value of Cronbach's Alpha > 0.7, so the data was declared reliable.

4.2. Correlation between Factors

Based on the questionnaire distributed to the final consumer of drinks in PET packaging, data presentation with descriptive statistics is carried out as follows:

Table 2. Characteristics of Respondent (Predictor Variables) and Consumer Behavior (Response Variable)

Predictor Variables			Response Variables
Residence	**Education**	**Income**	**Post-Consumption Consumer Behavior**
Village (39.93%)	Under Senior High School (3.41%)	Income < IDR 500.000 (17.75%)	Throw in the garbage (63.14%)
	Senior High School / Diploma (23.89%)	IDR 500.000 < Income < IDR 3.000.000 (27.30%)	Collect and sell to informal collectors (21.50%)
City (60.07%)	Bachelor's degree and above (72.70%)	Income > IDR 3.000.000 (54.95%)	Collecting and selling to formal collectors such as waste banks (7.51%)
			Collect and donate to the unit waste banks (7.85%)

The descriptive data above shows that more respondents who fill out the questionnaire are from cities. This is understandable because the questionnaire is carried out online, while the village community has limitations in operating gadgets to fill in online. The aspect of education is also dominated by respondents with undergraduate teaching and above with an income of more than IDR 3,000,000, which shows the characteristics of urban people. Although urban communities dominate respondents, the reliability of respondents' answers has been statistically tested with validity and reliability tests so that the sample can represent the characteristics of the population studied. To find out how the influence of residence, education, and income on post-

consumption consumer behavior, a Chi-Square test was carried out with the following results:

Table 3. Chi-Square Test Result

Chi-Square Tests	Residence * Post Consumption Consumer Behaviour			Education * Post Consumption Consumer Behaviour			Income * Post Consumption Consumer Behaviour		
	Value	df	Asymptotic significance (2-sided)	Value	df	Asymptotic significance (2-sided)	Value	df	Asymptotic significance (2-sided)
Pearson Chi-Square	25.596[a]	3	0.000	13.744[a]	6	0.033	19.815[a]	6	0.003
Likelihood Ratio	25.341	3	0.000	12.559	6	0.051	20.831	6	0.002
Linear-by-Linear Association	2.665	1	0.103	0.677	1	0.411	0.375	1	0.540
N of Valid Cases	293								
	a. 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 8.78.			a. three cells (25.0%) have an expected count of less than 5. The minimum expected count is 0.75.			a. two cells (16.7%) have an expected count of less than 5. The minimum expected count is 3.90.		

From the table above, the influence of each factor on consumer behavior variables can be seen from the asymptotic significance (2-sided) value, whose value is below 0.05. This means that the element has a significant influence. Factors of residence, education, and income significantly influence consumer behavior after consuming PET-packaged beverages.

4.3. Motivation to Collect

How people's behavior after consumption is influenced by motivations derived from economic, social, environmental, and regulatory aspects. Several questionnaire questions are prepared that represent economic, social, environmental, and regulatory aspects.

Table 4. Motivation to Collect

Post-Consumption Consumer Behavior and Motivation for Collecting PET Waste	
Behavior if we find a bottle that was thrown on the road of our place	**Motivation to Collect Bottle Waste**
Throw in the trash (73.72%)	Economy (incentives from selling used plastic bottles) (22.53%)
Pick up and collect at home (9.90%)	The convenience of collection facilities or services (31.40%)
Just let it be (16.38%)	Save the environment from negative impacts and save resources (32.76%)
	Regulations from the Government (13.31%)
Consumer Perceptions of PET Waste on the Environment	
The danger of waste bottles to the environment	**Final disposal method for post-consumption bottles**
Difficult to decompose and pollute the soil (78.50%)	Landfill or burned by incinerators after mixing with domestic waste (11.60%)
Polluting sea water and causing river flow to be blocked (10.92%)	Recycling by the formal sector (33.79%)
Polluting the air when burned in an incinerator (7.51%)	Recycling by the informal sector or small industry (54.61%)
Don't understand (3.07%)	

Public Perceptions of Person in Charge of Recycling and Educational Media for PET Waste Recycling	
The entity responsible for the collection of post-consumption bottles	Publication Media
Beverage consumers (26.28%)	Television (11.26%)
Producer (33.79%)	Radio (0.68%)
Retailer (20.48%)	Local community (8.19%)
Government (19.45%)	The school (9.22%)
	Print mass media, newspapers, and leaflets (7.51%)
	Social media, internet (57.34%)
	Never (5.80%)

Table 4 above shows that, in general, the behavior of the Indonesian people after consuming drinks in PET packaging, many still choose to throw them in the trash. Incentives or income from selling used bottles, which are an economic aspect, are not attractive enough for the community. Only people with low-income levels make collecting used bottles an economic factor. So the collection of used bottles is mainly done by scavengers. It is scarce for urban people to collect PET bottles to sell to collectors or the central waste bank because the price is low, so it is less attractive, especially for those with a reasonably high income. Even if they collect PET waste, social and environmental actions are more motivated. People prefer donating the collected bottles to garbage collectors, scavengers, or unit waste banks rather than selling them because the selling price is low economically.

On the other hand, urban people tend to lack a place to store used bottles in their homes. So they prefer to throw the bottle in the trash. If a PET waste collection facility is easily accessible, the city's people are willing to collect.

Unlike the urban people, the intention of the villagers to collect used bottles is still relatively higher than that of the urban people. This is due to economic motives, where collecting used bottles is an additional income for rural communities with less income. The villagers are also not confused about storing used PET bottles because, on average, they still have land that can be used to store used bottles. In addition, informal collectors generally go to villagers who collect used bottles to buy so that the villagers do not need to make efforts to send their used bottles to collectors. When compared to other developing countries, in an Indian study, lower-income households reused the waste itself. In contrast, higher-income families gave it to be reused and recycled, suggesting that socioeconomic differences within a country may also play a role [23].

Meanwhile, in the regulatory aspect, it seems that it has not been a strong motivation for the Indonesian people to collect PET bottles again after consumption. It is evident from the behavior that throws away more than contains them. Regulations in Indonesia already regulate the obligation to reduce and manage waste through Presidential Regulation No. 97 of 2017 concerning national policies and strategies for collecting household and household-like waste. Presidential Regulation No. 83 of 2018 concerning strategies for handling marine debris. Ministerial Regulation of the Ministry of Environment and Forestry Number 75 of 2019 concerning the roadmap for waste reduction by producers. However, the regulation has not been fully implemented. There is no penalty for those who do not apply the law.

4.4. Discussion

In reverse logistics, one of the essential entities that must be considered is post-consumption consumer behavior because, after all, consumers are the source of materials

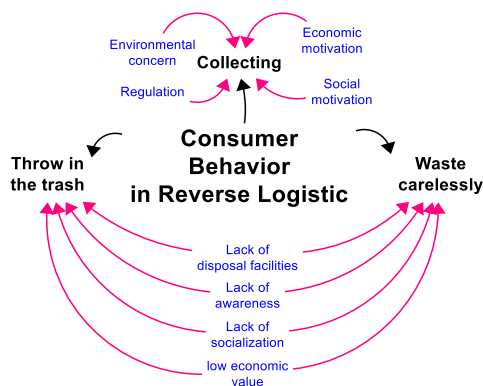to be recycled. If re-mapped, here are three consumer behaviors in Indonesia after PET consumption:

Figure 1. Consumer Behavior in Reverse Logistics PET Waste

From the picture above, the questionnaire results show that consumer behavior after consuming PET bottles still does not support the implementation of reverse logistics. More are throwing post-consumption PET bottles in the trash than collecting them. Consumers already know the dangers of PET waste that are wasted on the environment from various media such as social media or the internet, television, and print mass media. But just knowing is not enough. Many consumers still throw away used PET bottles instead of collecting them. So there needs to be aware that it is constantly socialized. Social media, which many consumers choose to get information, shows the characteristics of a tech-savvy, well-educated society. So education also plays a vital role in socializing the dangers of wasted plastic into the environment, re-collection actions, and knowledge related to the benefits of recycling PET waste to realize an environmentally friendly circular economy. Community social action also contributes to public awareness to care about the environment. This strategy of growing awareness through education and social activity is also widely used in countries with plastic waste problems, such as China [24] and the UK [25].

Paying attention to economic factors is also necessary to increase people's interest in collecting. Incentives or selling points of competitively used PET prices will improve people's interest in collecting. In addition, it is essential to campaign to use rPET material for various applications to increase the need for rPET [26]. Increasing the availability and ease of collection facilities will incur costs, but economic benefits will be obtained from increased PET waste. The availability of trash cans that sort PET waste with domestic waste in public spaces will make it easier for consumers to place used PET while making it easier for scavengers to pick up and collect it. In addition, a closer distance to the recycling facility will also increase interest in used PET collectors.

While recycling and reuse practices reduce plastic waste in the environment, they cannot minimize general resource use. Thus, reducing the use and production of plastics is essential. Existing regulations as a strategy to reduce plastic waste need to be translated into tactical steps supported by providing facilities and sanctioning entities, from producers to consumers. The use of alternative packaging materials that can be used repeatedly also needs to be applied to reduce their consumption from the source [27].

5. Conclusion

This study analyzes consumer behavior after PET consumption by reviewing economic, social, environmental, and regulatory aspects. The variables of residence, education, and income affect post-consumption consumer behavior. The research contributes to getting an overview that can be used as a strategy for optimizing reverse logistics in realizing a circular economy through the principle of reducing, reusing, and recycling. The survey results show that economic and regulatory factors have not motivated consumers much to participate in collecting PET waste again. Social and environmental aspects encourage consumers to be willing to collect.

Nevertheless, the fact is that there are still more people who choose to throw them away than collect them. So a strategy is needed to increase the role of consumers in collecting and recycling PET waste. The proposed method on the economic aspect is to increase the incentive or selling price of used PET and increase the use of rPET for various applications (Reuse). Strategies to reduce the use of PET from the source also need to be carried out by limiting the use of single-use plastic and reusable packaging. In the end, what can force consumers to reduce, recycle and reuse is regulation. So regulations must be translated tactically with punishment for those who violate them.

The study still focuses on the end consumer of households. Other groups can also act as consumers, such as supermarkets, retailers, public facilities such as recreational areas, and hotels that may have different behaviors that have not been studied. In addition, this research is also limited to post-consumption behavior, while consumer behavior in buying more environmentally friendly products has not been part of this study. The results of this research allow it to be developed towards an environmentally friendly product marketing mix strategy to get more success and benefits in realizing a circular economy.

References

[1] A. van Giezen and B. Wiegmans, "Spoilt - Ocean Cleanup: Alternative logistics chains to accommodate plastic waste recycling: An economic evaluation," *Transp. Res. Interdiscip. Perspect.*, vol. 5, p. 100115, 2020, doi: 10.1016/j.trip.2020.100115.

[2] W. Population, "Plastic Pollution By Country 2021," *Worl Population Review*, 2021. https://worldpopulationreview.com/country-rankings/plastic-pollution-by-country

[3] James Lawrence and Dr Suguna Lakshmi M, "A million bottles a minute: world's plastic binge," *Guard.*, pp. 1–5, 2017.

[4] F. Khan, W. Ahmed, and A. Najmi, "Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country," *Resour. Conserv. Recycl.*, vol. 142, no. November 2018, pp. 49–58, 2019, doi: 10.1016/j.resconrec.2018.11.020.

[5] T. Romeo, B. Pietro, C. Pedà, P. Consoli, F. Andaloro, and M. C. Fossi, "First evidence of presence of plastic debris in stomach of large pelagic fish in the Mediterranean Sea," *Mar. Pollut. Bull.*, vol. 95, no. 1, pp. 358–361, 2015, doi: 10.1016/j.marpolbul.2015.04.048.

[6] S. Huysman, J. De Schaepmeester, K. Ragaert, J. Dewulf, and S. De Meester, "Performance indicators for a circular economy: A case study on post-industrial plastic waste," *Resour. Conserv. Recycl.*, vol. 120, pp. 46–54, 2017, doi: 10.1016/j.resconrec.2017.01.013.

[7] O. Alam, M. Billah, and D. Yajie, "Characteristics of plastic bags and their potential environmental hazards," *Resour. Conserv. Recycl.*, vol. 132, no. January, pp. 121–129, 2018, doi: 10.1016/j.resconrec.2018.01.037.

[8] Y. Wang *et al.*, "Performance simulation and policy optimization of waste polyethylene terephthalate bottle recycling system in China," *Resour. Conserv. Recycl.*, vol. 162, pp. 1–13, Nov. 2020, doi: 10.1016/j.resconrec.2020.105014.

[9] A. L. Brooks, S. Wang, and J. R. Jambeck, "The Chinese import ban and its impact on global plastic

waste trade," *Sci. Adv.*, vol. 4, no. 6, pp. 1–8, 2018, doi: 10.1126/sciadv.aat0131.

[10] S. M. Budijati, Subagyo, M. A. Wibisono, and N. A. Masruroh, "The influence of environmental attitude on consumers' intentions to participate in a take back program," *Int. J. Logist. Syst. Manag.*, vol. 26, no. 4, pp. 421–452, 2017, doi: 10.1504/IJLSM.2017.082612.

[11] I. Kianpour, B. Hussain, and V. G. Tavares, "A complementary LC-tank based IR-UWB pulse generator for BPSK modulation," *Proc. 2017 IEEE East-West Des. Test Symp. EWDTS 2017*, 2017, doi: 10.1109/EWDTS.2017.8110138.

[12] J. Gaur and V. Mani, "Antecedents of closed-loop supply chain in emerging economies: A conceptual framework using stakeholder's perspective," *Resour. Conserv. Recycl.*, vol. 139, no. September, pp. 219–227, 2018, doi: 10.1016/j.resconrec.2018.08.023.

[13] J. Ma, K. W. Hipel, M. L. Hanson, X. Cai, and Y. Liu, "An analysis of influencing factors on municipal solid waste source-separated collection behavior in Guilin, China by Using the Theory of Planned Behavior," *Sustain. Cities Soc.*, vol. 37, no. November 2017, pp. 336–343, 2018, doi: 10.1016/j.scs.2017.11.037.

[14] F. Echegaray and F. V. Hansstein, "Assessing the intention-behavior gap in electronic waste recycling: the case of Brazil," *J. Clean. Prod.*, vol. 142, pp. 180–190, 2017, doi: 10.1016/j.jclepro.2016.05.064.

[15] N. H. Mai, "Investigating about Consumers' Attitudes to Green Children's Toys Products in Vietnam," *Int. J. Trade, Econ. Financ.*, vol. 12, no. 2, pp. 54–57, 2021, doi: 10.18178/ijtef.2021.12.2.693.

[16] C. Changchenkit and T. Plangklang, "Impact of Sustainability Marketing: An Empirical Study on Consumers' Perception and Attitudes towards Bio Plastic Coffee Cups in Thailand," *Int. J. Trade, Econ. Financ.*, vol. 11, no. 3, pp. 45–49, 2020, doi: 10.18178/ijtef.2020.11.3.664.

[17] E. De Marchi, S. Pigliafreddo, A. Banterle, M. Parolini, and A. Cavaliere, "Plastic packaging goes sustainable: An analysis of consumer preferences for plastic water bottles," *Environ. Sci. Policy*, vol. 114, no. March, pp. 305–311, 2020, doi: 10.1016/j.envsci.2020.08.014.

[18] A. Galati, L. Salvatore, T. Ciaccio, and D. Vrontis, "Resources , Conservation & Recycling Plastic or not plastic ? That' s the problem : analysing the Italian students purchasing behavior of mineral water bottles made with eco-friendly packaging," *Resour. Conserv. Recycl.*, vol. 179, no. July 2021, p. 106060, 2022, doi: 10.1016/j.resconrec.2021.106060.

[19] F. L. Mauroner and M. F. Rita, "An Analysis of the Customer Perception and Usage Preferences of Reusable Water Bottles in the German Market Dissertation written under the supervision of Dissertation submitted in partial fulfilment of requirements for the MSc in Management , at the Unive," no. February, 2019.

[20] N. Syafiqah, K. Jallaludin, N. S. Sukarno, S. Nur, and B. Nasir, "A Systematic Review On Consumer Behavior toward Plastic Consumption In Asian Countries," vol. 7, no. 1, pp. 150–158, 2021.

[21] L. M. Heidbreder, I. Bablok, S. Drews, and C. Menzel, "Tackling the plastic problem: A review on perceptions, behaviors, and interventions," *Sci. Total Environ.*, vol. 668, pp. 1077–1093, 2019, doi: 10.1016/j.scitotenv.2019.02.437.

[22] K. Gidlöf, E. S. Lahm, A. Wallin, and T. Otterbring, "Eco depletion: The impact of hunger on prosociality by means of environmentally friendly attitudes and behavior," *J. Retail. Consum. Serv.*, vol. 62, no. May, 2021, doi: 10.1016/j.jretconser.2021.102654.

[23] R. U. Pandey, A. Surjan, and M. Kapshe, "Exploring linkages between sustainable consumption and prevailing green practices in reuse and recycling of household waste: Case of Bhopal city in India," *J. Clean. Prod.*, vol. 173, pp. 49–59, 2018, doi: 10.1016/j.jclepro.2017.03.227.

[24] W. M. W. So, N. Y. I. Cheng, C. F. Chow, and Y. Zhan, "Learning about the types of plastic wastes: effectiveness of inquiry learning strategies," *Educ. 3-13*, vol. 44, no. 3, pp. 311–324, 2016, doi: 10.1080/03004279.2014.976239.

[25] B. L. Hartley, R. C. Thompson, and S. Pahl, "Marine litter education boosts children's understanding and self-reported actions," *Mar. Pollut. Bull.*, vol. 90, no. 1–2, pp. 209–217, 2015, doi: 10.1016/j.marpolbul.2014.10.049.

[26] M. Struk, "Distance and incentives matter: The separation of recyclable municipal waste," *Resour. Conserv. Recycl.*, vol. 122, pp. 155–162, 2017, doi: 10.1016/j.resconrec.2017.01.023.

[27] D. Xanthos and T. R. Walker, "International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review," *Mar. Pollut. Bull.*, vol. 118, no. 1–2, pp. 17–26, 2017, doi: 10.1016/j.marpolbul.2017.02.048.