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Case Study

Consumer Insights for Optimization of Industrial Systems: The Case of Consumers' Greenwashing Perception in Adopting Single-Use Plastics Products in Padang City

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ABSTRACT

This study explicates the impact of consumer perceptions of greenwashing on the purchase intentions of single-use plastic products, specifically bottled still water and soft drinks, within the context of growing sustainability concerns. The objective is to understand how these perceptions influence consumer decisions and how the insights can inform the optimization of industrial practices related to packaging and marketing. Using a quantitative explanatory design, data was collected from no less than one hundred and sixty-eight respondents in Padang City through direct and online surveys. The sampling method is the Non-Probability Sampling method with a Purposive Sampling approach and it is directed to individuals who meet the following criteria: (1) minimum age of 17 years old; (2) domicile in Padang City; and (3) individuals or households who know bottled water and soft drinks brand. The data analysis, conducted via Structural Equation Modelling (SEM) using SmartPLS, reveals that negative perceptions of greenwashing significantly reduce purchase intentions. However, positive word-of-mouth can mitigate these effects, leading to a higher likelihood of purchase. The findings highlight the critical role of environmental awareness in shaping consumer behavior and suggest that companies should prioritize authentic sustainability practices which could be in terms of third-party certification to maintain consumer trust and optimize their product strategies. Companies are expected to be able to do business responsibly, by paying attention to the end-to-end production process that has minimal waste and minimal impact on the environment, through the development of more environmentally friendly products and optimization of waste management programs. Third-party certifications may be useful to support this effort.

Keywords: greenwashing, consumer behavior, environmental awareness, industrial optimization, single-use plastics, green marketing

INTRODUCTION

The motor vehicle tax or PKB 2021 to 2022, and 0% from 2023 until the end of the simulation period. Environmental sustainability has become a pivotal concern for industries worldwide, compelling a shift towards the optimization of industrial systems to achieve more responsible production and consumption. The United Nations' Sustainable Development Goals (SDGs), particularly Goal No. 12, which underscores the necessity for industries to innovate in ways that reduce environmental impact and promote sustainability across the value chain. In this context, the management of single-use plastics (SUPs) within industrial systems presents a significant challenge, particularly in optimizing production processes, supply chain logistics, and waste management practices.

Single-use plastics, especially in the beverage industry, contribute heavily to environmental degradation, with a substantial portion of plastic waste being mismanaged. This issue is exacerbated in regions like Indonesia, where plastic waste management infrastructure struggles to keep pace with the growing volume of waste. Based on research released by Plastic Overshoot Day, a non-profit division of Swiss-based research consultancy Earth Action (EA), Indonesia ranks fourth in the world in terms of mismanaged plastic waste production, after India, China and Brazil. In Indonesia, the amount of national waste continues to increase every year. Sistem Informasi Pengelolaan Sampah Nasional (SIPSN), which is part of the Ministry of Environment and Forestry of the Republic of Indonesia released data that the total national waste generation has increased by 35.31% year-on-year in 2022 compared to 2019. According to the National Plastic Action Partnership (NPAP) Indonesia, of the total waste generated in all regions in Indonesia, less than 10% (ten percent) of plastic waste is further processed through the recycling process. The Ministry of Environment and Forestry has regulated the way to reduce waste from upstream through Ministerial Regulation (Permen) No. P.75/MENLHK/SETJENKUM.1/10/2019 concerning Roadmap for Waste Reduction by producers. However, its implementation may not be optimal. However, despite initiatives by manufacturers to adopt recycled materials and improve waste management, consumer scepticism persist, particularly regarding the authenticity of these efforts—often perceived as 'greenwashing.'

Greenwashing occurs when a company claims to be environmentally friendly but does not match its words with its actions, then it can be assumed that the company is practicing a false form of green marketing. Greenwashing, where companies are seen as overstating their environmental efforts, has critical implications for both consumer trust and industrial optimization. According to [1], greenwashing refers to a deceptive practice where companies misrepresent their environmental effects to create a false impression of ecological responsibility. This is driven by various factors, i.e. competitive advantage, consumer demand for sustainability, and regulatory gaps. When consumers perceive that a company's sustainability claims are misleading, it not only undermines the company's reputation but also complicates the optimization of industrial processes aimed at achieving genuine sustainability. For example, consumers' perceptions regarding the misleading plastic recycling processes undertaken by companies will then influence the companies' ability to maximize their industrial efforts and to sell their products. This disconnect highlights a crucial gap in the integration of consumer feedback into the optimization strategies of industrial systems. A clear example can be drawn from this situation when companies are forced to follow issues in environmental concerns and involve it in their production system.

This study seeks to address this gap by examining the intersection of consumer perceptions of greenwashing and industrial processes, particularly in the context of single-use plastic products in the beverage industry. As [2] greenwashing practices influence consumers' behavior and attitude, such as distrust, and suspicion toward companies' green advertisement campaigns which can lower consumers' intention to buy products. Consumers' perception of the environment in their daily life would be a significant predictor that determines individual sustainable consumption [3]. Directly and indirectly, this consumer perception will influence the operation of industrial processes. Therefore, the objectives of this study are two-fold: (1) to analyze how perceptions of greenwashing influence consumer purchase intentions and (2) to propose strategies for optimizing industrial processes that align with both consumer expectations and sustainability goals. Objective number one is analyzed by considering green concern and green electronic word-of-mouth (e-WOM) as the major variables in predicting consumer purchase intention. Meanwhile, objective number two will be built based on the findings and analysis regarding variables that would change consumers' perceptions. By integrating consumer insights into industrial decision-making, this research aims to enhance the efficiency and effectiveness of sustainability initiatives across production and supply chains.

The study builds on existing literature that emphasizes the importance of aligning consumer behavior with industrial practices. However, it advances the discourse by offering a framework that guides industries in minimizing the risks

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associated with greenwashing while optimizing their operations for sustainability. By using the quantitative approach, this study tries to examine how consumers' perceptions regarding greenwashing practices, green e-WOM, and consumers' green concerns will contribute to the creation of green purchase intention among consumers. This approach not only contributes to the theoretical understanding of green consumerism but also provides practical solutions for industrial engineers and managers seeking to enhance their systems' performance sustainably. Therefore, this study brings value and offers originality in linking consumers' environmental behavior and perception in buying industrial products, and particularly it is contextually a pioneering study in the topic and research in Indonesia.

Given the increasing pressure on industries to reduce their environmental footprint, this research is timely and significant. It underscores the need for a holistic approach that integrates consumer perceptions with the optimization of industrial systems, ensuring that sustainability efforts are both credible and operationally feasible. By focusing on the interplay between green marketing and industrial optimization, this study offers valuable insights for industries aiming to navigate the complexities of sustainability in a globalized economy.

METHODS

This study is quantitative, and aims at examining the impact of greenwashing perceptions and word-of-mouth, with green concern as a moderating variable, on green purchase intention. As mentioned by [4] market forces are one of the external drivers for companies to undertake greenwashing practices. For instance, pressures from consumers and investors regarding environmental performance will encourage brown companies to create false eco-images. As previously argued by [5] on organization myth and ceremony, companies, for the purpose in attaining legitimacy within their environments, tend to prone to construct stories about their actions [6] that correspond to stakeholder expectations but are decoupled from actual business operation. It can be concluded from those arguments and findings that market forces matter in greenwashing practices. Therefore, it is reasonable to use the construct of consumers' behavior in terms of their perceptions and concerns as the major considerations in examining their intention to purchase green products.

The insights gained from this analysis are intended to escalate optimizations of industrial practices, particularly in aligning product development and marketing strategies along with consumer expectations for sustainability. The population in this study consists of individuals and households familiar with the eco-friendly claims of bottled still water and soft drink brands. This group was selected because their perceptions are critical for understanding the broader consumer response to green marketing strategies, which in turn can inform the optimization of production and supply chain processes in the beverage industry. The sample was selected using a non-probability sampling method with a purposive sampling approach, resulting in 165 respondents from Padang City, Indonesia. Sampling criteria is directed to individuals who meet the following characteristics: (1) minimum age of 17 years old; (2) domicile in Padang City; and (3) individuals or households who know bottled water and soft drinks brands. Sampling size follows Lemeshow's sampling size measurement as a simplified approach to calculating sample size when the population size is unknown. Usually, the minimum number sampling size in using Lemeshow's sampling size is 100 samples, and therefore it is reasonable to use this sampling size technique.

Data was collected through online and direct surveys by using the questionnaire as the major instrument, ensuring a comprehensive consumer perception. Initially, the direct survey through the questionnaire was distributed to no less than 200 potential respondents, with a response rate of 60,5% (121 respondents). Despite the sampling size filled Lemeshow's minimum sampling size measurement, this study decided to extend its sampling size number by spreading an online survey. The number of 78 respondents took part in filling this online questionnaire, and after a careful analysis, there were only 44 valid responses. The survey instrument was designed using a five-point Likert

scale to measure the strength of agreement or disagreement with various statements related to greenwashing perceptions, word-of-mouth, green concern, and purchase intention. The survey instrument is adopted from [7] which is designed to measure perceptions from respondents regarding topics of the study.

Data analysis was conducted in the form of correlational analysis, which connects the exogenous and endogenous variables of the study. This method was chosen to capture detailed consumer attitudes that can be directly applied to optimize product and marketing strategies within the industrial context. The data was analyzed using Structural Equation Modelling (SEM) with SmartPLS version 4 as a tool to support data analysis, enabling precise assessment of the relationships between variables. According to [8] SEM is an appropriate statistical method when researchers are dealing with complex models, non-normal data, small sample sizes, or formative constructs. This analysis is intended to provide actionable insights that can be applied to optimize industrial practices, particularly in reducing the negative impact of greenwashing on consumer trust and purchase intention. Processed data analysis through SmartPLS, was undertaken by measuring the outer model and inner model and has followed statistical procedures mentioned by SmartPLS.

The outer model measurement included tests for validity and reliability to ensure the constructs used were both valid and reliable, enhancing the applicability of the findings to industrial settings. The validity of the constructs was tested using convergent validity (measured by outer loadings and AVE values) and discriminant validity (measured by the Heterotrait-Monotrait ratio). Following the rule of thumb as stated by [6], convergent validity is valid if the value of Average Variance Extracted (AVE) > 0,50. Meanwhile, in the discriminant validity, the threshold HTMT value is suggested 0,90. The reliability was assessed using Cronbach's Alpha and Composite Reliability. A construct is considered reliable if the threshold value of Cronbach's alpha and composite reliability ≥ 0,70. Furthermore, the inner model measurement is carried out which consists of R Square, PLS Predict, and path coefficient assessments. Hypothesis testing is measured by bootstrapping. The output can explain whether the hypothesis is accepted or rejected by looking at the original sample value, t-statistics and p-values. Original sample to see the direction of influence between variables, positive or negative. Variables can be concluded to be significant if the T statistics value is greater than 1.64 (one-tailed) with a significance level < 0.05 (95% confidence level). These measures ensure that the data collected is robust and can be reliably used to inform industrial optimization strategies.

Meanwhile, in inner model measurement and hypothesis testing, this study employs R Square, PLS Predict, and path coefficient assessments. Further, hypothesis testing was conducted using bootstrapping to determine the significance of relationships between variables. The result of bootstrapping is the coefficient of determination (R square) value. PLSpredict is used because it is considered to have a good level of prediction compared to R-square. PLSpredict not only has the predictive power of the model in the sample, but can predict the power outside the sample.

The outcomes of these tests are critical for developing strategies that optimize industrial practices, particularly in the areas of product design, marketing, and supply chain management, ensuring that they align with consumer expectations for sustainability. Bootstrapping is used for structural model measurement. Detailing the thinking pattern in conducting and operating the study, it uses the following study framework as the basis for its analysis and to make use of SmartPLS program in a more effective way.

Referring to the Figure 1, this study further arranges its hypotheses.

H1. There is an influence of greenwashing perception among consumers to their green purchase intention of single-use plastic products.

H2. There is an influence of greenwashing perception among consumers to green word of mouth spread among consumers of single-use plastic products.

H3. There is an influence of green word of mouth spread among consumer of single-use plastic products to their intention to purchase single-use plastic products.

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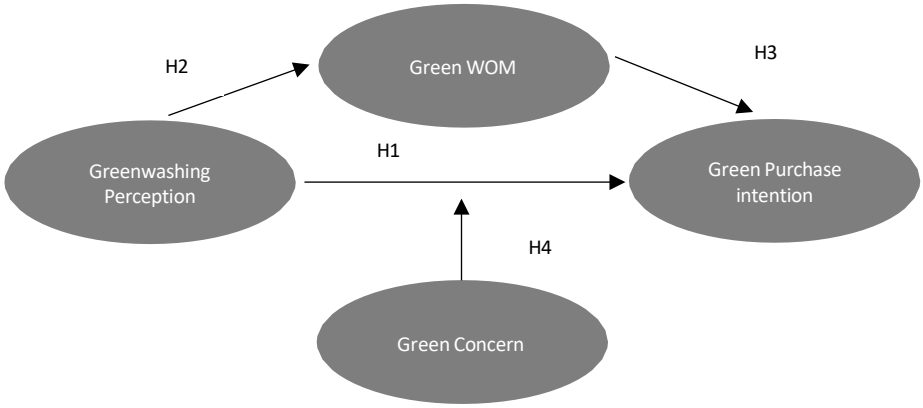

Figure 1. Research Framework
(Source: conception of the authors, adopted from various literatures)

H4. Green concern possessed by consumers will moderate the influence of greenwashing perception among consumers to their green purchase intention of single-use plastic products.

Hypotheses formulation was arranged by using the conception of variables as stated in the following Table 1. Using those hypotheses and literature review related to the topic of this study as the major cornerstone, it further develops tasks and duties during the research.

Table 1. Operational Definition of Variables

Variable	Definition	Indicators
Greenwashing Perception	Consumers' attitude when companies' green marketing practices are claimed to be more beneficial for natural environment compare with the realities [7] [9]	Misleading by using words (GP1) Misleading by using visual and graphics (GP2) Uncleared and not-proven environmentally friendly claims (GP3) Exaggerated or overstated claims regarding environmentally friendly functions (GP4) Misleading important information that would lead to false claiming (GP5)
Green Purchase Intention	Consumers' possibility to buy certain products which is produced from their environmental concerns and represent consumers' possibility to buy goods and services from reputable environmentally friendly companies [7] [9] [10]	Companies environmentally image (GPI1) Companies environmentally friendly practices (GPI2) Companies environmentally friendly performance (GPI3)
Green Word of Mouth	Verbal communication among consumers by informing their friends, families and colleagues about positive environmental messages from products of a company [7] [9]	Recommend products by considering: Environmental images (GWM1) Environmental function (GWM2) Environmentally friendly practice (GWM3) Environmentally friendly performance (GWM4)
Green Concern	Individual awareness toward natural environment and ability to solve environmental problems [7] [9]	Level of concerns regarding environmental degradation (GC1) Level of awareness toward environmental issues (GC2) Level of interest with environmental problems and the issue of environmental protection (GC3) Level of initiative to improve the quality of environment (GC4)

Table 2. Respondent Demographics

Respondents Data	N	%	Respondents Data	N	%
Gender			**Occupation**		
Male	127	77,0%	Student	60	36,4%
Female	38	23,0%	Civil servant	38	23,0%
Age			Private employee	13	7,9%
17-20 years	23	13,9%	Self-employed (entrepreneur)	15	9,1%
21-30 years	73	44,2%	Housewives	9	5,5%
31-40 years	36	21,8%	Teacher (PPPK/Honorary)	17	10,3%
41-50 years	9	5,5%	Others	13	7,9%
Over 50 years	24	14,5%	**Income (IDR)**		
Education			< 2,000,000	66	40,0%
Elementary school	0	0,0%	2,000,000 – 5,000,000	68	41,2%
Junior high school	3	1,8%	5,000,000 – 10,000,000	27	16,4%
Senior high school	53	32,1%	> 10,000,000	4	2,4%
Diploma	3	1,8%	**Family background: concern for environment**		
Undergraduate	92	55,8%	Very concerned	59	35,8%
Postgraduate or above	14	8,5%	Concerned	98	59,4%
			Less concerned	8	4,8%
			No concerned	0	0,0%

RESULTS AND DISCUSSION

The first task was to identify the demographic profile of the respondents in this study (Table 2). Following this task, the study finds that the demographic profile of the respondents was dominated by young, educated individuals (77% female, 44.2% aged 21-30 years, and 55.8% with undergraduate degrees), which indicates a market segment highly sensitive to environmental issues and greenwashing. The demographic profiles found in this study are viewed and argued to have strong linkages to respondents' awareness of their perceptions regarding greenwashing practices and intention to buy single-use plastic products. Higher educational background, together with the age range of respondents are the major factors that could improve respondents' awareness to purchase more environmentally friendly products. This demographic's strong environmental concern (with 59.4% from environmentally concerned families) suggests that industries need to tailor their product designs and marketing strategies to meet the expectations of these consumers. Understanding these characteristics is critical for optimizing market strategies and ensuring that products align with consumer values, thereby enhancing product acceptance and market penetration.

Based on gender, the respondents were dominated by females at 77% and the remaining 23% were males. Based on age, almost half of the respondents are aged 21-30 years (44.2%). So then, respondents in this study can be concluded to be dominated by the millennial generation or gen Y. If based on the latest education, most respondents have higher education, which are around 55.8% are undergraduate, 8.5% are postgraduate, while 32.1% are high school graduates. The high school education background is also entirely influenced by the respondents' occupation status as students (36.4%). Looking at details of the respondents, the study has found the following demographic profiles of its respondents.

Outer Model Measurement

The first step to measure the reflective measurement model was undertaken by evaluating indicator loading. The value of recommended indicator loading is ≥ 0,708, because it indicates that every construct can explain more than 50% of variance of indicators. The robust indicator loadings, all exceeding the recommended value of 0.708, and

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Table 3. Indicator Loadings

Indicators	Green Concern	Green Purchase Intention	Green WOM	Greenwashing Perception	Green Concern >< Greenwashing Perception
GC1	0.725				
GC2	0.980				
GC3	0.774				
GC4	0.869				
GPI1		0.921			
GPI2		0.724			
GPI3		0.902			
WOM1			0.915		
WOM2			0.952		
WOM3			0.953		
WOM4			0.920		
GP1				0.743	
GP2				0.850	
GP3				0.845	
GP4				0.875	
GP5				0.830	
Green Concern >< Greenwashing Perception					1.000

high-reliability scores (Cronbach's Alpha and Composite Reliability > 0.70) confirm that the constructs used in this study are reliable.

This robustness ensures that the insights derived from these constructs can be confidently applied in industrial contexts, particularly for optimizing green marketing strategies and aligning them with consumer expectations to avoid the risks associated with greenwashing. The study also confirmed convergent validity (AVE values > 0.5) and discriminant validity (HTMT ratio < 0.90), indicating that the constructs measured are both accurate and distinct. This validity is crucial for ensuring that the findings are reliable and can be effectively used to inform industrial decision-making. In particular, these validated constructs provide a strong basis for refining green marketing practices and enhancing product designs to better meet consumer expectations and optimize industrial processes. Based on the Table 3, all items are proven to have indicator loading values greater than 0.708, which means the indicators are valid.

In measuring the reliability of the construct, this study employs composite reliability analysis, which can be seen from the recommended composite reliability and Cronbach's Alpha values of 0.70 - 0.90. Based on the results in Table 4 and following the rule of thumb in measuring composite reliability, it can be concluded that all study variables are reliable.

Table 4. Reliability Test

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Green Concern	0.906	1.513	0.906
Green Purchase Intention	0.814	0.870	0.888
Green WOM	0.952	0.953	0.965
Greenwashing Perception	0.894	0.961	0.917

Table 5. Convergent Validity Test

	Average variance extracted (AVE)
Green Concern	0.710
Green Purchase Intention	0.728
Green WOM	0.874
Greenwashing Perception	0.688

Table 6. Discriminant Validity Test

	Heterotrait-monotrait ratio (HTMT)
Green Purchase Intention >< Green Concern	0.179
Green WOM >< Green Concern	0.126
Green WOM >< Green Purchase Intention	0.710
Greenwashing Perception >< Green Concern	0.421
Greenwashing Perception >< Green Purchase Intention	0.191
Greenwashing Perception >< Green WOM	0.236

The next step in assessing the outer model measurement is to test the convergent validity of each construct. Measurement of convergent validity can be seen from the Average Variance Extracted (AVE) value. Table 5 shows that all variables meet the prerequisites of convergent validity, reflected by the AVE value > 0.50.

Hair et al. (2019) recommends the Heterotrait-Monotrait ratio (HTMT) in measuring discriminant validity because it is considered more accurate. The recommended HTMT ratio is lower than 0.90 or 0.85. Thus, looking at the measurement results in Table 6, the discriminant validity requirement is met.

Inner Model Measurement

The PLS Predict analysis, showing moderate predictive power, suggests that the model is effective in anticipating consumer responses to green marketing strategies. This predictive capability is essential for optimizing industrial operations, including production planning, inventory management, and supply chain logistics, ensuring that these processes are aligned with consumer demand and expectations for sustainability.

The R Square value indicates how much the combination of independent variables together affects the value of the dependent variable. The more the r square value approaches 1, the better the model will be because it shows greater explanatory power. As the rule of thumb, R Square value of 0.75 can be considered substantial, 0.50 is considered moderate and 0.25 can be considered weak. The study finds the R square value for Green Purchase Intention is 0.468, close to the value of 0.50, meaning that the combination of Greenwashing Perception, Green Word-of-Mouth, and Green Concern variables can explain the Green Purchase Intention variable by 46.8% (Table 7). Thus, the model can be considered moderate. While the remaining 53.2% is the influence of other independent variables outside the model used in this study.

PLS Predict

According to Hair et al. (2019), R-Square only shows the explanatory power of the model in the sample, not the predictive power outside the sample. Thus, PLS Predict is carried out to assess whether the research model has a good

Table 7. R Square

	R-square	R-square adjusted
Green Purchase Intention	0.468	0.455
Green WOM	0.065	0.059

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Table 8. PLS Predict

	Q^2predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
GPI1	0.043	0.968	0.778	1.010	0.832
GPI2	-0.004	1.018	0.821	1.033	0.832
GPI3	0.087	0.994	0.815	1.028	0.849
WOM1	0.036	0.983	0.812	0.984	0.810
WOM2	0.034	1.046	0.849	1.023	0.834
WOM3	0.056	1.021	0.826	1.003	0.810
WOM4	0.027	1.020	0.829	1.030	0.841

prediction level. To measure the PLS Predict results, it needs to be compared with the linear regression model (LM). The PLS model has good predictive power if the RMSE (Root Mean Squared Error) value and MAE (Mean Absolute Error) value in SEM PLS are lower than the linear regression model (LM). Based on Table 8, the proposed PLS model has medium predictive power.

Hypotheses Testing

The hypothesis testing results offer key insights for optimizing industrial practices. The significant positive relationship between Green WOM and Green Purchase Intention underscores the importance of fostering positive word-of-mouth through authentic sustainability practices. This finding suggests that industries should prioritize transparent and credible green marketing strategies to enhance consumer trust and optimize product adoption rates. On the other hand, the non-significant effect of Greenwashing Perception on Green Purchase Intention indicates that while greenwashing negatively impacts purchase intention, its effect can be mitigated by strong word-of-mouth. This guides industries to focus on engaging communities and customers as part of their sustainability efforts, ensuring that marketing practices are not only perceived as authentic but also contribute to long-term brand loyalty and operational success. Table 9. shows the results of the path coefficient through bootstrapping measurement.

Hypothesis 1 which measures the effect of Greenwashing Perception on Green Purchase Intention has a negative correlation coefficient (-0.007), with a T statistics value of 0.091 (< 1.64) and P Values of 0.494 (> 0.05). This means that Greenwashing perception is negatively but not significantly related to Green Purchase Intention, so there is no significant effect between greenwashing perception and purchase intention. This might be a prove that Hypothesis 1 of the study is not supported. The results of statistical data processing show that there is a positive correlation between

Table 9. Hypotheses Testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Green Concern -> Green Purchase Intention	0.073	0.072	0.068	1.080	0.140
Green WOM -> Green Purchase Intention	0.612	0.622	0.068	8.999	0.000
Greenwashing Perception -> Green Purchase Intention	-0.007	-0.014	0.079	0.091	0.464
Greenwashing Perception -> Green WOM	0.254	0.266	0.101	2.520	0.006
Green Concern x Greenwashing Perception -> Green Purchase Intention	0.126	0.095	0.093	1.350	0.089

Greenwashing Perception and Green WOM (+ 0.254). The T statistics value is 2.520 (> 1.64) and P-Values are 0.006 (< 0.05) which means that there is significance in the relationship between variables. Thus, Hypothesis 2 which states that greenwashing perception is negatively related to green WOM is rejected. Hypothesis 3 which measures the relationship between Green WOM and Green Purchase Intention on products with Single-Use Plastic (SUPs) packaging has a positive correlation value (+0.612), with a T statistics value of 8.999 (> 1.64) and P Values of 0.000 (<0.05). This means that Green WOM has a positive and significant influence on Green Purchase Intention, so that Hypothesis 3 is accepted. In Hypothesis 4, the statistical measurement results show a positive correlation on the moderating role of Green Concern that connects Greenwashing Perception and Green Purchase Intention (+0.126). The value of T statistics is 0.089 (< 1.64) and P Values 0.093 (> 0.05) which means there is no significance in the relationship between variables. Therefore, it can be concluded that Green Concern moderates the relationship between perceived greenwashing and purchase intention in SUPs but is not significant, so Hypothesis 4 is accepted.

Discussion

The negative relationship between greenwashing perception and green purchase intention in purchasing single-use plastic products underscores the critical need for industries to prioritize authenticity in their sustainability initiatives. When consumers perceive that a company's green claims are exaggerated or misleading, it undermines their trust and reduces their intention to purchase, particularly in the context of single-use plastic products. An excessive claim from the industries campaigning their product as an environmentally friendly product, but failing to prove the practice toward the environment will consequently raise consumers' negative perception about the product and companies themselves. It is understood that every industry has its contextual differences, and therefore it should tailor their marketing strategies to address specific consumer concerns, including environmental concerns. To optimize industrial processes and enhance product acceptance, companies should focus on developing transparent communication strategies that align with consumer expectations for environmental responsibility. This approach not only mitigates the risks associated with greenwashing but also strengthens the credibility of the brand, contributing to long-term sustainability, business continuity, and further, market success.

When a company claims to be environmentally friendly but do not match its actions, it can be assumed that the company is practicing a false green marketing form which is well known as 'greenwashing' [11]. Consumers determine their behavior and decision to purchase products once they believe that companies have addressed sustainability issues in their production process and end-products [12]. Related to this possible practice in various industries, the study found insignificant negative relationships between greenwashing perception and green purchase Intention. This means that the higher the level of consumer greenwashing perceptions of a product or company, the lower the possibility for them to have bigger purchase intention towards products with single-use plastics products. This finding is consistent with the previous studies. For example, according to [7] once consumers perceive that a company exaggerates its green performance, then it can reduce the credibility of corporate actions and will form a negative evaluation of the company. This study found that consumers' perception toward greenwashing, will directly and/or indirectly through green electronic word of mouth influence their decision to purchase products. As [13], once consumers realized that they were being deceived about a product of great importance to them, they reacted strongly negative toward the companies. Contrary, [14] found that greenwashing perceptions will only affect brand image of a product, but does not influence consumers' purchase intention. This can be found in the soft drink industry, which still has great consumers' purchase intention although greenwashing has lowered their brand image.

However, this result is also reinforced by the family background of respondents who come from families who care about the environment, so that, the perception of greenwash affects their purchase intention for products with disposable packaging. Respondents' profiles and characteristics are understood to directly relate to this finding, which

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further expands understanding regarding greenwashing perception and consumers' behavior. The occurrence of individual background in environmental concerns as a moderating variable will be the major contribution that could be further explored and examined in this topic. Contrary to [15] who argued that exposure to greenwashing can damage brand reputation, so companies need to consider the risks to their brand development and performance when deciding to greenwash, the study believes and argues that the context matters, which means that this finding cannot be generalized to all types of industry.

Contrary to some previous studies, such as [7], [16], and [17], this research found that greenwashing perception will positively and significantly affect green word of mouth among consumers. The finding of this study suggests that when consumers discuss products perceived as greenwashed, it will often lead to a broader dissemination of these perceptions, which can significantly influence public opinion. From an industrial perspective, this finding highlights the importance of managing consumer perceptions and controlling the narrative around sustainability claims. Companies should strategically engage with consumers to address and correct any misconceptions, thereby optimizing their marketing and communication efforts to maintain a positive brand image and foster consumer trust.

However, it can also be concluded if companies apply greenwash practices to mislead their customers, it will cause customers to be reluctant to convey positive word of mouth about green signals in the market [17]. In addition, consumers will not recommend and will not encourage others to buy products that are indicated to greenwashing, and they are tending to spread negative word of mouth and messages to others. The perception of greenwashing supposed to lead to negative word of mouth behaviour about the environmental message of a particular product [18] which may endanger companies' reputation in the future.

The significant positive effect of green word of mouth on green purchase intention indicates that word-of-mouth is a powerful driver of consumer behavior in the context of green products. When consumers receive positive word of mouth related to green products from others, it tends to increase their purchase interest in green products. The fact that word of mouth is not only disseminated through direct word of mouth in today's world, also concludes the importance of the message regarding greenwashing practice. Consumers may use electronic word out mouth through the maximum use of social media platforms as the medium of expression, which could be negative or positive expressions. The findings of this study are also consistent with several previous research studies. Products and brands with positive green word of mouth will win consumer trust and could directly influence customer purchasing decisions [19] and [7]. In reverse, the practice of greenwashing may escalate negative word of mouth about one product or a company, and the negative message will be speed up using social media platforms by the consumers. For industrial systems, this finding emphasizes the importance of cultivating positive word of mouth through authentic and effective green marketing strategies. Organizations can optimize their marketing and operational strategies by building strong relationships with environmentally conscious consumers, ensuring that their sustainability claims are credible and resonate with the target audience. This approach not only enhances consumer trust but also increases the likelihood of product adoption, contributing to the overall success of the company's sustainability efforts.

The role of green concern as a moderator between greenwashing perception and purchase intention further illustrates the complexity of consumer behavior in the context of environmental sustainability. Consumers with higher environmental concerns are more likely to be influenced by greenwashing perceptions, which in turn affects their purchasing decisions. Despite this finding, exploration and examination into a broader consumer group would be suggested – as different contextual consumer groups may lead to different results. This study was undertaken with a group of consumers which has environmental concerns and a specific industry, and the result might be different if the contexts are also different. As [20], cultural and demographic characteristics of consumers are viewed as the major determinants that can influence their perception regarding greenwashing practices.

Public opinion will affect the thoughts and feelings of consumers, and of course, it will also have an impact on their behavior, such as product or service purchasing behavior. According to [21], environmental concern is considered a key environmental factor for analyzing the personal characteristics of green marketing. Consumer attention to environmental issues will affect purchasing decisions, especially for products that claim to be environmentally friendly.

Consistent with the findings in previous research conducted by [7], green concern plays a positive role as a moderator between greenwash perceptions and purchase intention. The findings in this study indicate that green concern can strengthen consumer perceptions which in turn shape a reduction in consumer purchase intention for products with disposable packaging. This finding suggests that industries need to be particularly mindful of their target audience's environmental values when developing and marketing green products. By aligning product offerings with the environmental concerns of their consumers, companies can optimize their product design, marketing strategies, and supply chain operations to better meet consumer demands and enhance sustainability.

CONCLUSION

This study shows that consumers' perception of greenwashing has a significant impact on their purchasing behaviour, especially for single-use plastic products. These perceptions shape positive or negative public opinion, and positive publicity cushions the negative effects of greenwashing. Industry must therefore adopt authentic sustainability practices to build consumer confidence and to align product development and marketing strategies with the growing expectations of environmental responsibility. In theory, this research advances our understanding of how perceptions of greenwashing influence purchasing behaviour and contributes to a wider discourse on green consumerism and its impact on industrial practices. It also provides a conceptual insight into consumer decision-making in relation to environmentally friendly products. In practice, the findings provide practical guidance for engineers and managers to optimise production and marketing processes to meet the growing demand for sustainable goods. In order to achieve these objectives, the sector should give priority to transparency and authenticity in its sustainability initiatives by substantiating green claims in its marketing with concrete measures. The strategies include the integration of consumer feedback in product development and optimisation of supply chains to minimise environmental impact. Further measures - such as third-party certification, public sustainability reporting and greater involvement of stakeholders - can further reduce greenwashing and increase transparency. These practices not only enhance the competitiveness of the market but also advance wider sustainability goals. Although the study provides valuable insights, its scope is limited to a specific region and product category and the sample size is relatively small, which may limit its generalisation. Cultural and contextual differences between regions could also affect consumers' perception of greenwashing. Future research should explore these perceptions in different industrial and cultural contexts in order to create a more comprehensive framework for industrial practices. In addition, it would be useful to explore the role of technological innovation in strengthening green marketing strategies. In conclusion, the study highlights the critical impact of consumer perception on the success of sustainability initiatives and the need for companies to incorporate this knowledge into their industrial systems in order to meet consumer expectations and contribute to long-term environmental objectives.

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DECLARATION OF AI TOOL USAGE

During the preparation of this manuscript, the author utilised AI tool to generate text from selected paragraphs, enhancing the academic tone and clarity. All output generated by AI tool was critically reviewed and thoroughly edited by the author to ensure clarity of expression and adherence to academic standards. The author takes full responsibility for the integrity and content of this manuscript.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest regarding the authorship or publication of this research.

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