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The Effect of Innovation in Waste Management and Sustainable Packaging on Perceived Value and Consumer Satisfaction in the Snack Food Industry in East Java

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ABSTRACT

This study investigates the impact of waste management innovation and environmentally friendly packaging on perceived value and consumer satisfaction in the snack food industry in East Java. Utilizing a quantitative approach, data were collected from 170 respondents using a Likert scale (1-5). The analysis was conducted using Structural Equation Modeling-Partial Least Squares (SEM-PLS 3). The findings reveal that both waste management innovation and sustainable packaging positively affect perceived value and consumer satisfaction, with sustainable packaging having a stronger influence on satisfaction. Additionally, perceived value mediates the relationship between sustainability initiatives and consumer satisfaction. These results underscore the importance of adopting visible and impactful sustainability practices to enhance customer perceptions and loyalty. Snack food manufacturers are encouraged to prioritize eco-friendly packaging while communicating the broader benefits of waste management innovations to consumers.

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1. INTRODUCTION

The snack food sector is increasingly adopting sustainable practices to meet consumer demand for eco-friendly solutions, especially in waste management and packaging, with a focus on balancing economic performance and social responsibility [1]. The development of biodegradable materials from renewable biomass, such as corn and sugarcane starch, offers an alternative to petroleum-based plastics [2]. Advanced bioplastics with improved barrier properties are also in demand, ensuring food safety [2]. The transition to a circular economy is crucial in waste management, treating waste as a resource [3], and global strategies are being analysed to support sustainable development [3]. CSR initiatives play a role in reducing

food loss and waste (FLW), especially in companies that focus on environmental achievements [4], while young consumers' attitudes towards food waste are influenced by habits and emotions [5].

The shift in consumer preferences towards sustainability in the snack food industry in East Java is driven by increasing environmental awareness and demand for sustainable business practices. Companies in the region are seeking waste management solutions and eco-friendly packaging to align with these values, in line with the green marketing trend in Indonesia that is gaining popularity across industries [6]. Green marketing practices generally show a positive relationship with consumer outcomes, although the role of trust as a mediator remains complex [7]. Trust is critical in fostering responsible purchasing behaviour, especially for the snack food industry that seeks to meet the expectations of modern consumers [8]. In addition, there is a positive correlation between consumer purchase intention, environmental awareness and sustainable corporate image, which creates market opportunities for green products in East Java [9]. Circular economy principles such as local sourcing of raw materials can also be applied to promote sustainability and consumer satisfaction [10]. However, challenges remain in standardising sustainability practices and stakeholder education, as well as green supply chain integration and regulatory compliance to improve MSME competitiveness in the sector [6].

Innovations in waste management and green packaging significantly increase perceived value and consumer satisfaction in the snack food industry, in line with consumers' increasing awareness of the environment as a key driver of perceived value. Sustainable practices, such as green packaging, not only fulfill consumer expectations but also increase satisfaction and loyalty, as evidenced in the apparel and food sectors, where sustainable innovations mediate the relationship between green marketing and consumer satisfaction [11], [12]. Sustainable products provide functional and emotional value that influences consumer loyalty, especially for consumers with high green environmental awareness [13]. Nonetheless, barriers such as price sensitivity and lack of awareness may hinder the adoption of green products [14]. Sustainable product innovation acts as a mediator between green marketing and consumer satisfaction, while trust in green claims is essential to influencing consumer attitudes and behavior towards green products [15].

This study sought to examine the influence of waste management innovation and environmentally friendly packaging on perceived value and consumer satisfaction in the snack food industry in East Java. The findings of this study are expected to provide valuable insights for academics and practitioners, especially in understanding the evolving role of sustainability in consumer decision-making in the snack food industry. In addition, the results of this study will also help companies in East Java and beyond to refine their strategies by integrating sustainability practices that not only benefit the environment but also improve consumer perception and satisfaction.

The research questions guiding this study are as follows:

1. How does waste management innovation influence perceived value in the snack food industry?
2. How does environmentally friendly packaging affect consumer satisfaction?
3. What is the relationship between perceived value and consumer satisfaction in the context of sustainable snack food products?

2. LITERATURE REVIEW

2.1 Waste Management Innovation

Waste management innovation involves implementing new or improved systems, processes, or technologies to reduce, reuse, and recycle waste from the

production and consumption of goods. In the snack food industry, this includes efficient use of raw materials, energy-saving technologies, and minimizing environmental impact. Such innovations offer significant environmental benefits, like reduced pollution and resource conservation [16], [17]. Driven by regulatory pressures, consumer demand for sustainability, and cost-reduction strategies, companies adopting waste management innovations can enhance operational efficiency and reduce environmental risks, improving consumer perceptions [17], [18]. In the snack food sector, where packaging waste is a major concern, these innovations align with environmental goals and strengthen a company's CSR image, increasing consumer trust and perceived product value [17], [19]. This study explores how waste management innovations impact consumer perceptions and product value in the snack food industry.

2.2 *Environmentally Friendly Packaging*

Environmentally friendly packaging refers to the use of materials and designs that minimize environmental impact by being biodegradable, recyclable, reusable, or made from sustainable resources. As consumers become more aware of the environmental harm caused by excessive and non-biodegradable packaging, especially in the snack food industry, there is a growing shift toward eco-friendly alternatives [20], [21]. Packaging is a crucial touchpoint between the consumer and the product, and it significantly shapes consumer perceptions. Studies show that consumers favor products with sustainable packaging, as it aligns with their environmental values [22], [23]. Sustainable packaging not only reduces environmental impact but also enhances a brand's image as socially responsible, fostering consumer loyalty. Research across industries highlights that environmentally friendly packaging influences both the functional and emotional aspects of consumer satisfaction—fulfilling its protective and informative roles while also aligning with ethical values [22], [23]. In the snack food industry, such packaging can enhance consumer satisfaction by addressing both environmental concerns and product utility.

2.3 *Perceived Value*

Perceived value refers to a consumer's overall assessment of a product's utility based on their perception of the benefits received compared to the costs [24]. In the context of sustainable products, perceived value includes both functional value—such as quality and performance—and ethical value, which reflects environmental responsibility [25], [26]. When consumers believe that a product or company contributes to environmental sustainability, they tend to assign a higher value to that product [24], [26]. Research shows that perceived value is crucial in shaping purchase intentions and consumer loyalty, particularly for environmentally friendly products. Factors such as a company's waste management

practices, sustainable packaging, and the overall environmental impact of its products can significantly influence perceived value [22], [27]. Consequently, companies that adopt sustainable practices, including waste management innovations and eco-friendly packaging, are likely to see an increase in the perceived value of their products. This study examines the specific impact of these factors.

2.4 Consumer Satisfaction

Consumer satisfaction refers to a consumer's overall evaluation of their experience with a product or service, based on whether the product meets or exceeds their expectations [28], [29]. In the snack food industry, factors such as product quality, packaging, price, and brand reputation significantly influence consumer satisfaction. Studies have shown that environmentally responsible business practices, particularly those prioritizing sustainability, enhance consumer satisfaction [29]. This satisfaction is closely linked to perceived value, as consumers who perceive high value in a product are more likely to be satisfied with their purchase [28], [29]. Environmentally friendly packaging and waste management innovations further contribute to consumer satisfaction by aligning with expectations of corporate social responsibility and ethical practices [29], [30]. Satisfied consumers are more likely to exhibit brand loyalty, repurchase intentions, and positive word-of-mouth, which are crucial for success in competitive markets like the snack food industry. This study examines consumer satisfaction as an outcome of perceived value, with the expectation that waste management innovation and eco-friendly packaging positively impact both perceived value and consumer satisfaction in the snack food industry.

2.5 Conceptual Framework and Hypotheses

Based on the literature review, this study proposes the following conceptual framework, which links waste management innovation and environmentally friendly packaging to perceived value and consumer satisfaction:

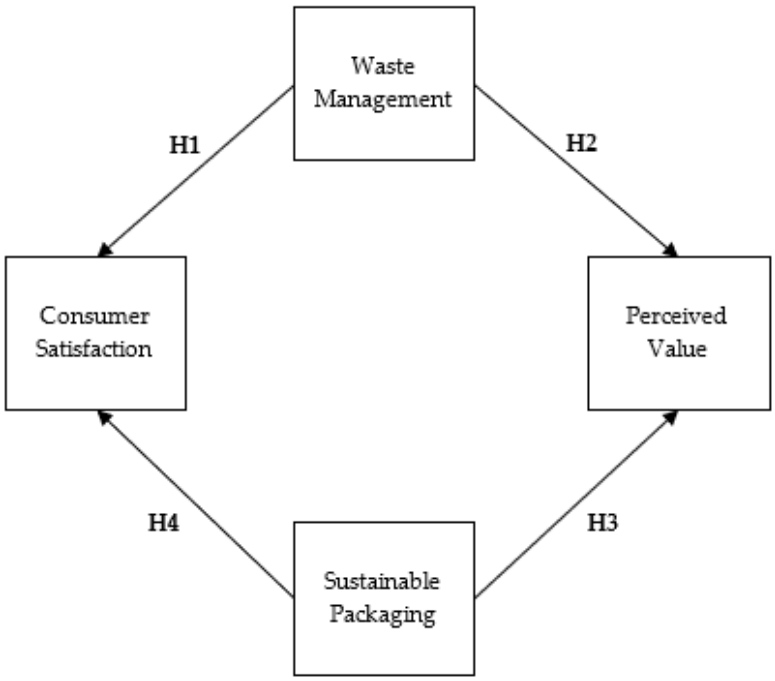

Figure 1. Conceptual Framework

3. METHODS

3.1 Research Design

This study employs a quantitative research design, utilizing a survey method to collect data from consumers in East Java who have purchased snack food products. The quantitative approach is appropriate for testing the relationships between the independent variables (waste management innovation and environmentally friendly packaging) and the dependent variables (perceived value and consumer satisfaction) as proposed in the conceptual framework. The research is explanatory in nature, seeking to explain how sustainability initiatives influence consumer perceptions and behaviors.

3.2 Population and Sampling

The population of this study consists of consumers who have purchased snack food products in East Java, a region selected for its large and diverse consumer base, as well as the presence of numerous snack food producers, making it an ideal context for examining consumer attitudes toward sustainability in the snack food industry. A non-probability sampling technique, purposive sampling, was employed to select respondents, with the inclusion criteria being: respondents must be at least 18 years old, have purchased a snack food product in the last three months, and be aware of or able to evaluate the packaging and waste management practices of the snack food products they consume. A total of 170 respondents were collected, a sample size considered sufficient for SEM-PLS analysis, where a minimum of 100-150 is generally recommended to achieve reliable results [31].

3.3 Data Collection

Data were collected through a self-administered questionnaire distributed both online and offline, designed to capture respondents' perceptions of waste management innovation, environmentally friendly packaging, perceived value, and consumer satisfaction related to snack food products. The survey instrument was divided into two sections to cover these topics comprehensively. To ensure clarity and relevance, the questionnaire was pre-tested with a small sample of respondents, and minor revisions were made based on their feedback.

3.4 Data Analysis

Data analysis was conducted using Structural Equation Modeling-Partial Least Squares (SEM-PLS 3), a statistical technique that allows for the analysis of relationships between latent variables while accounting for measurement errors. SEM-PLS was selected due to its ability to handle complex models, non-normal data distributions, and its suitability for exploratory research in fields like sustainability in the snack food industry. The analysis included several key steps: descriptive statistics were generated to summarize respondents' demographic characteristics and questionnaire responses; reliability and validity testing was performed using Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE), with discriminant validity assessed through the Fornell-Larcker criterion and cross-loadings; hypothesis testing was conducted by examining path coefficients between constructs, with significance determined through bootstrapping with 5,000 subsamples; and model fit was evaluated using R-squared (R^2) for endogenous variables and Q-squared (Q^2) for predictive relevance.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Descriptive statistics provide an overview of the demographic characteristics of the respondents and their responses to the questionnaire items. Out of the 170 respondents, the majority were aged between 25 and 45 years (67%), with an equal distribution of male (52%) and female (48%) respondents. Most respondents had completed at least a high school education (78%) and reported purchasing snack food products regularly, with 55% purchasing them at least once a week. These demographic characteristics indicate a diverse sample of consumers, allowing for a comprehensive analysis of perceptions toward sustainability in the snack food industry.

Respondents' perceptions of the key variables were generally positive: waste management innovation received a mean score of 4.02, indicating favorable views of companies' efforts in this area, while environmentally friendly packaging scored slightly higher at 4.15, reflecting strong consumer support for sustainable packaging initiatives. Perceived value was also rated positively, with a mean score of 4.08, suggesting that consumers recognize the added value of sustainability practices. Additionally, consumer satisfaction averaged 4.12, indicating a high level of satisfaction with snack food products that incorporate sustainability features.

4.2 Measurement Model Evaluation

The measurement model was assessed by examining the factor loadings, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) for each construct. These metrics were used to evaluate the reliability and validity of the constructs in the study, which included waste management, sustainable packaging, perceived value, and consumer satisfaction.

Table 1. Measurement Model Assessment

Variable	Code	Loading Factor	Cronbach's Alpha	Composite Reliability	Average Variant Extracted
Waste Management	WM.1	0.903	0.868	0.920	0.793
	WM.2	0.922			
	WM.3	0.844			
Sustainable Packaging	SP.1	0.888	0.886	0.922	0.747
	SP.2	0.898			
	SP.3	0.879			
	SP.4	0.786			
Perceived Value	PV.1	0.827	0.879	0.911	0.671
	PV.2	0.847			

	PV.3	0.860			
	PV.4	0.812			
	PV.5	0.745			
Consumer Satisfaction	CS.1	0.798	0.837	0.891	0.673
	CS.2	0.849			
	CS.3	0.829			
	CS.4	0.803			

Source: Data Processing Results (2024)

Factor loadings were used to assess the contribution of each indicator to its respective latent construct, with values above 0.7 deemed acceptable and those above 0.8 highly acceptable (Hair et al., 2017). In this study, all indicator loadings exceeded the threshold, indicating strong correlations with their latent constructs. Waste management indicators ranged from 0.844 to 0.922, sustainable packaging indicators from 0.786 to 0.898, perceived value indicators from 0.745 to 0.860, and consumer satisfaction indicators from 0.798 to 0.849. Cronbach's Alpha values, used to assess internal consistency, were above 0.7 for all constructs: 0.868 for waste management, 0.886 for sustainable packaging, 0.879 for perceived value, and 0.837 for consumer satisfaction, confirming strong reliability (Nunnally & Bernstein, 1994). Composite Reliability (CR) values, which provide a more accurate estimate of internal consistency, also exceeded the 0.8 threshold: 0.920 for waste management, 0.922 for sustainable packaging, 0.911 for perceived value, and 0.891 for consumer satisfaction, indicating excellent reliability. Average Variance Extracted (AVE) values, which measure the proportion of variance explained by each construct, were all above 0.5, demonstrating adequate convergent validity: 0.793 for waste management, 0.747 for sustainable packaging, 0.671 for perceived value, and 0.673 for consumer satisfaction.

Discriminant validity refers to how distinct a construct is from others, ensuring it measures a unique concept. In this study, discriminant validity was assessed using the Fornell-Larcker criterion, which requires that the square root of a construct's Average Variance Extracted (AVE) be greater than its correlations with other constructs [32]. The diagonal values in the table represent the square root of the AVE, while the off-diagonal values show the correlations between the constructs.

Table 2. Discriminant Validity

	Satisfaction	Perceived Value	Sustainable Packaging	Waste Management
Consumer Satisfaction	0.820			
Perceived Value	0.740	0.819		
Sustainable Packaging	0.698	0.666	0.864	
Waste Management	0.452	0.485	0.473	0.890

Source: Data Processing Results (2024)

The square root of the AVE for consumer satisfaction is 0.820, exceeding its correlations with perceived value (0.740), sustainable packaging (0.698), and waste management (0.452), indicating good discriminant validity. For perceived value, the AVE is 0.819, higher than its correlations with sustainable packaging (0.666), consumer satisfaction (0.740), and waste management (0.485), confirming distinctness. Sustainable packaging, with an AVE of 0.864, surpasses its correlations with other constructs, and waste management, with an AVE of 0.890, also demonstrates strong discriminant validity.

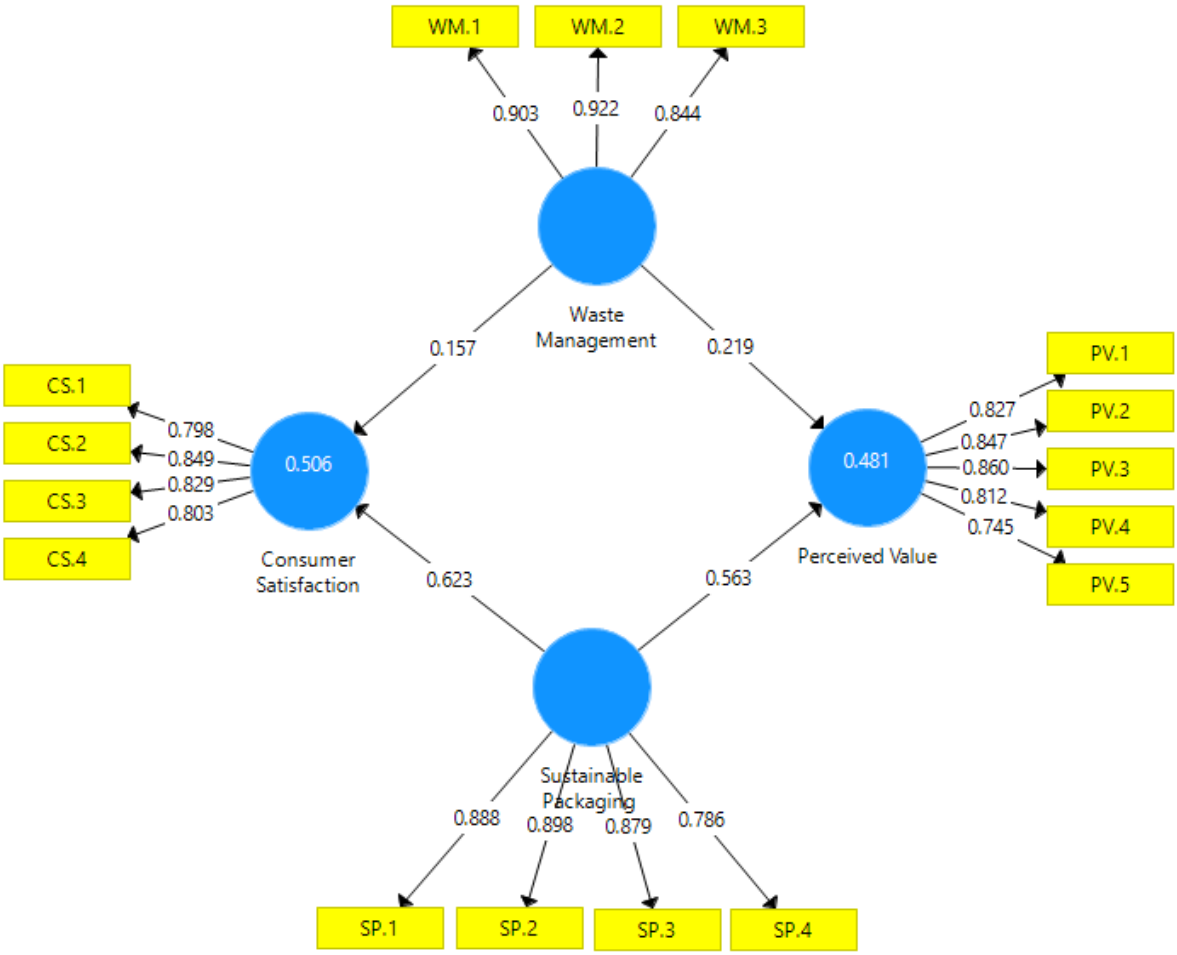

Figure 2. Model Results
Source: Data Processed by Researchers, 2024

4.3 Measurement Model Evaluation

Model fit refers to how well the proposed structural model aligns with the observed data. To evaluate the model fit in this study, various fit indices were used, including Standardized Root Mean Square Residual (SRMR), Squared Euclidean Distance (d_ULS), Geodesic Distance (d_G), Chi-Square, and Normed Fit Index (NFI). Both the saturated model (which assumes that all possible relationships are estimated) and the estimated model (which only estimates relationships defined in the model) were assessed.

Table 3. Model Fit Results Test

	Saturated Model	Estimated Model
SRMR	0.088	0.104
d_ULS	1.043	1.467
d_G	0.433	0.498
Chi-Square	281.450	303.136
NFI	0.794	0.778

Source: Process Data Analysis (2024)

The Standardized Root Mean Square Residual (SRMR) is used to assess model fit, with values below 0.08 considered good. In this study, the SRMR for the saturated model is 0.088, indicating a reasonable fit, while the estimated model's SRMR is 0.104, slightly above the 0.1 threshold, suggesting the need for refinement but still acceptable for complex models. Squared Euclidean Distance (d_ULS) and Geodesic Distance (d_G) further evaluate model fit, with lower values indicating better fit. The d_ULS for the saturated model is 1.043, and for the estimated model, it is 1.467, showing some misfit, while d_G values are 0.433 and 0.498, respectively, indicating a close fit. The Chi-Square statistic, sensitive to sample size, shows values of 281.450 for the saturated model and 303.136 for the estimated model, reflecting slight degradation in fit. Lastly, the Normed Fit Index (NFI) measures incremental fit, with values of 0.794 for the saturated model and 0.778 for the estimated model, both slightly below the 0.8 threshold, suggesting a marginally acceptable fit that could benefit from refinement.

Table 4. Coefficient Model

	R Square	Q2
Sustainable Packaging	0.506	0.497
Perceived Value	0.481	0.473

Source: Data Processing Results (2024)

The R-squared (R^2) value measures the proportion of variance in a dependent variable explained by the independent variables, with higher values indicating stronger explanatory power. For sustainable packaging, the R^2 value is 0.506, meaning that waste management innovation and other factors explain 50.6% of the variance, demonstrating moderate explanatory power. Similarly, the R^2 for perceived value is 0.481, indicating that 48.1% of the variance in perceived value is explained by the independent variables, suggesting a significant influence of sustainability efforts. Predictive relevance (Q^2), assessed using the blindfolding technique, also confirms the model's reliability. The Q^2 for sustainable packaging is 0.497, close to the R^2 value, indicating good predictive relevance, while the Q^2 for perceived value is 0.473, confirming that the model can accurately predict consumer perceptions based on sustainability efforts such as waste management innovation and eco-friendly packaging.

4.4 Structural Model and Hypothesis Testing

The structural model was evaluated using SEM-PLS to test the proposed hypotheses. The path coefficients, R-squared (R^2) values, and bootstrapping results are presented in Table 1 below.

Table 5. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values
Sustainable Packaging -> Consumer Satisfaction	0.623	0.626	0.068	9.184	0.000
Sustainable Packaging -> Perceived Value	0.563	0.564	0.072	7.819	0.000
Waste Management -> Consumer Satisfaction	0.257	0.256	0.075	2.605	0.003
Waste Management -> Perceived Value	0.419	0.224	0.085	4.586	0.000

Source: Process Data Analysis (2024)

The analysis reveals significant positive relationships between sustainable packaging and consumer satisfaction (β = 0.623, $p < 0.001$, T-statistics = 9.184), confirming that sustainable packaging strongly influences consumer satisfaction with snack food products. Similarly, sustainable packaging significantly enhances perceived value (β = 0.563, $p < 0.001$, T-statistics = 7.819). Waste management innovation also shows a significant positive impact on consumer satisfaction (β = 0.257, $p < 0.01$, T-statistics = 2.605), though the effect size is smaller compared to sustainable packaging. Additionally, waste management innovation significantly improves perceived value (β = 0.419, $p < 0.001$, T-statistics = 4.586), indicating that both sustainable practices contribute to higher consumer satisfaction and perceived value.

Discussion

The results indicate that sustainable packaging has a significant positive impact on both consumer satisfaction and perceived value, aligning with previous research that emphasizes the growing consumer preference for environmentally friendly products and packaging [28], [29]. In the snack food industry, consumers increasingly expect companies to adopt sustainable practices, particularly in packaging, which serves as a visible marker of environmental responsibility. Sustainable packaging not only meets functional needs but also enhances the emotional and ethical connection between consumers and brands. Snack food products with eco-friendly packaging are perceived as more valuable because they align with consumers' values and concerns for environmental sustainability, leading to higher satisfaction levels as consumers feel they are making a positive impact through their purchases [29]. For snack food companies in East Java, these findings suggest that investing in sustainable packaging materials, such as biodegradable or recyclable options, can enhance both consumer satisfaction and perceived value. Communicating their commitment to sustainability through packaging can strengthen brand image and appeal to environmentally conscious consumers, offering a competitive advantage in fostering loyalty and satisfaction.

The study found that waste management innovation has a positive and significant effect on both consumer satisfaction and perceived value, although its impact on consumer satisfaction is smaller compared to sustainable packaging, as waste management practices may not be as immediately visible to consumers [33], [34]. Innovations such as reducing production waste, recycling materials, and implementing circular economy principles contribute to the product's overall sustainability. While these efforts are less visible than packaging, they enhance a company's environmental credibility, which increases the perceived value of the product [19], [35]. For snack food companies, waste management should be an integral part of their sustainability strategy. Although its direct impact on consumer satisfaction may be lower than packaging, waste management innovations significantly shape perceived value and enhance brand reputation. By reducing waste and improving resource efficiency, companies can create a more sustainable production process, which in turn boosts perceived product value. Additionally, effectively communicating these innovations to consumers can strengthen brand loyalty through.

While both sustainable packaging and waste management innovation positively influence consumer satisfaction and perceived value, sustainable packaging has a stronger direct impact on consumer satisfaction. This suggests that consumers are more responsive to visible sustainability efforts, such as packaging, which they directly interact with, while waste management has a more indirect effect, contributing to perceived value rather than directly influencing satisfaction [21], [22]. This difference highlights the need to prioritize visible sustainability initiatives like packaging, while also investing in communicating the benefits of less tangible efforts, such as waste management. Snack food companies should focus on sustainable packaging as a key driver

of consumer satisfaction while improving the visibility of their waste management innovations through transparent reporting and marketing strategies that educate consumers about the broader environmental.

Strategic Recommendations

Based on the findings of this study, snack food companies in East Java should consider the following strategic actions:

1. Prioritize the development and adoption of environmentally friendly packaging materials to enhance consumer satisfaction and perceived value.
2. Implement waste management innovations to reduce environmental impact and increase perceived value, while ensuring these efforts are effectively communicated to consumers.
3. Increase perceived value through clear communication of the environmental benefits of sustainable practices. Highlight how these initiatives make the product more valuable and ethical in the eyes of the consumer.

While packaging should be prioritized for its direct impact on satisfaction, waste management innovations should not be neglected. Instead, these initiatives should be integrated into a broader sustainability narrative that the company communicates to its consumers.

5. CONCLUSION

The findings of this study highlight the significant role of sustainability practices—specifically waste management innovation and sustainable packaging—in shaping consumer satisfaction and perceived value in the snack food industry in East Java. Sustainable packaging has a stronger direct influence on consumer satisfaction, as consumers are more responsive to visible eco-friendly efforts, while waste management innovation, though less visible, positively impacts perceived value, which in turn enhances consumer satisfaction. This underscores the importance of effectively communicating less tangible sustainability efforts to consumers to maximize their impact. Snack food companies can boost customer satisfaction and loyalty by focusing on both sustainable packaging and waste management practices, ensuring these efforts are visible and understandable. The mediating role of perceived value suggests that consumers are more likely to be satisfied when products meet their needs and align with their environmental values. Companies should integrate these insights into their sustainability strategies, emphasizing transparency and communication to strengthen their competitive advantage.

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