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Author Introduction
Sustainable Packaging

Evaluating Consumer Views on Eco-Friendly Packaging: A Statistical Perspective

Bhattacharyya S[1*]

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[1*] Sandip Bhattacharyya, Assistant Professor, Department of Commerce, THK Jain College, Kolkata, West Bengal, India.

Packaging plays a crucial role in marketing and production by ensuring products rich consumers safely. Various types of packaging materials and designs are used, some of which are environmentally friendly, while others may not be environment friendly. Sustainable packaging has gained importance as consumers become more aware of environmental issues. This study explores how consumers perceive sustainable packaging and how it influences their buying behaviour. The research focuses on key attributes of packaging, including material type, colour, wrapping strategy, attractiveness and cost to examine how these factors relate to consumer decisions. To analyse this, data was collected through a structured questionnaire from target consumers and the responses were analysed using statistical tools mainly correlation and descriptive statistics. The findings suggest that some packaging attributes have a stronger influence on consumer preference and their willingness to pay extra for eco-friendly packaging. The study highlights the importance of combining factors like packaging material and attractiveness to enhance consumer acceptance of sustainable packaging. These insights can help businesses design packaging strategies that not only protect the product but also appeal to environmentally conscious consumers. By understanding the relationship between packing features and consumer behaviour, companies can develop marketing approaches that encourage sustainable consumption. The study emphasizes that integrating sustainability in packaging is not just beneficial for the environment but positively impacts brand perception and sales. This research contributes to the growing field of green marketing by providing practical recommendations for businesses to align their packaging strategy with consumer expectations on sustainability.

Keywords: sustainable packaging, consumer perception, packaging attributes, eco-friendly materials, green marketing

Corresponding Author

Sandip Bhattacharyya, Assistant Professor, Department of Commerce, THK Jain College, Kolkata, West Bengal, India.
Email: sandip2074@gmail.com

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1. Introduction

Environmental pollution has become a critical issue worldwide, with various components of the environment increasingly affected by human activities especially consumption patterns. Among these, packaging waste significantly contributes to environmental degradation. In response, the concept of green or sustainable packaging has gained prominence as a strategy to minimize waste and promote sustainable development. Modern consumer products typically involve multiple layers of packaging including primary, secondary and tertiary level using materials such as wood, paper, glass, plastic and composites. Plastic is the most widely used packing material due to its durability, lightweight nature and cost effectiveness. However, plastic packing possesses significant environmental challenges once discarded, leading to pollution and ecological damage. To address these concerns, manufacturers are encouraged to adopt sustainable packaging strategies that emphasize the use of biodegradable and eco-friendly materials. Sustainable packaging aims to balance product safety and effectiveness with environmental responsibility aligned with broader green business practices.

A key question remains: How do consumers perceive sustainable packaging and what impact does it have on their purchasing decisions?

It is unlikely that any single packaging attribute alone drives consumer behaviour. Instead, a combination of factors such as material type, colour, attractiveness and cost may collectively influence buying patterns. This study examines the impact of various packaging attributes on consumer purchasing behaviour using correlation analysis to identify significant relationships. Understanding these factors are essential for businesses aiming to promote green packaging and encourage environmentally conscious consumption.

2. Scope of the Study

The study focuses on understanding consumer perceptions related to sustainable packaging strategies. It explores how various packaging attributes such as material, colour, product wrapping, attractiveness and cost influence consumers buying decisions. The Research emphasizes eco-friendly packaging alternatives and their acceptance among consumers aiming to highlight the factors that drive purchasing behaviour in favour of green packaging. This study is limited to analysing consumer's insights within a specific demographic or geographic area. It does not cover manufacturing processes or the supply chain implications of sustainable packaging. Additionally, the research concentrates on the perception and behavioural aspects rather than environmental impact assessment or life cycle analysis of packing materials. This focused approach helps businesses and policymakers understand key consumer priorities and barriers to adopting sustainable packaging, thereby supporting more effective strategies for promoting eco-friendly products in the market.

3. Literature Review

(Gupta & Singh, 2025) **f**ound that environmental and health consciousness significantly influence consumer attitudes towards eco-friendly packaging, which in turn shapes purchase intentions and also subject norms and perceived ease of adoption play mediating roles. This study also found that in the three tier cities environmental consciousness and health awareness strongly influence attitudes towards eco-friendly packaging.

(George, Susainathan, & Parayitam, 2023) showed that awareness of green packaging and packaging initiatives positively relate to green packaging behavior and environmental concern and availability of alternatives moderate these effects.

(Sharma & Babel, 2001) found many consumers consider packaging in purchase decisions, awareness about eco-friendly packaging is lower, income and education are major correlates most are unwilling to pay extra for green packaging.

(Nair, Mazgaonkar, & Shetye, 2025) evaluated key factors that are design colour and material affecting buying intention for convenience goods using green packaging and found that visual appeal and material play strong roles in influencing consumer response.

(James & Kurian, 2021) assessed that Indian e-commerce consumers are generally favourable towards sustainable packaging. Their attitudes are positive. The challenges are in converting their attitude into actual purchase behavior. Indian consumers in the e-commerce context are generally favourable towards sustainable packaging.

Consumers especially show willingness to pay for eco-packaging. Ease of use and convenience are strong influences.

(Sethi & Malviya, 2025) examined how consumer perception of green packaging is linked to purchase intention and loyalty. It suggested that positive perception enhanced both intention to purchase and loyalty towards brands that adopt green packaging.

4. Research Gap

Despite the growing body of research on sustainable packaging in India, several research gaps remain there. Many studies examine single attributes of packaging such as material transparency, colour and bio-degradability rather than the combined effect of multiple attributes. Second, while consumer awareness of eco-friendly packaging is often high, fewer studies thoroughly explored how knowledge, trust in levels and clarity of information shape purchasing decisions. Third, cost and price premium continue to be recurring barriers, but there is limited empirical research quantifying how much more consumers are willing to pay under varying socio-economic, regional and demographic conditions. Fourth, many literatures focused on urban or educated populations leaving rural and lower-income groups underrepresented. Finally, infrastructure constraints such as availability of recycling, proper disposal channels or green packaging options are often discussed in theory but not well studied in empirical consumer-based research. Collectively these gaps suggest a need for studies that explore attribute combinations, quantify cost thresholds, and broaden demographic representation to integrate the role of infrastructure and information clarity in sustainable packaging adoption.

5. Objective of the Study

1. To explore the impact of various sustainable packaging attributes such as packing material, colour, wrapping strategy and attractiveness on consumer buying behaviour.
2. To assess how consumers perceive the extra cost associated with eco-friendly packaging and its influence on their willingness to pay more.
3. To identify which combinations of these packaging factors most strongly affect consumers purchasing decisions towards sustainable products.

6. Research Methodology

Research Design: The study follows a quantitative research design aimed at analysing the impact of sustainable packaging attributes on consumer buying behavior. The design is descriptive correlational, focusing on understanding consumer perceptions and the strength of relationship between packing variables and their willingness to pay extra for eco-friendly packaging. The study does not include exploratory techniques such as factor analysis but strictly uses descriptive statistics and correlation analysis for hypothesis testing.

Sample and Sampling Technique: The data was collected from a total of Fifty-One respondents. The sample consists of consumers from urban areas specifically from Kolkata and Howrah allied areas, who have experience in purchasing packaged goods. A convenient sampling technique was used to select respondents due to ease of access and limited resources. Although not probabilistic, this method allowed gathering preliminary insights into consumer perceptions of sustainable packaging in a specific demographic.

Data Collection: Data was collected through a structured questionnaire developed specifically for this research. The questionnaire was designed on a five-point Likert scale format to measure the degree of agreement, likelihood or frequency related to sustainable packaging attributes and consumer buying behavior. The scale ranges from Strongly agree to strongly disagree for consumer's attitude questions and similarly structured options for likelihood and frequency.

The question was divided into sections:

- Demographic information
- Consumer perception of packaging material and Colour
- Views on product wrapping strategies related to hygiene and innovation
- Opinions on packaging attractiveness
- Perceptions of cost and willingness to pay extra for eco-friendly packaging

The dependent variable in this study is Willingness to pay extra for eco-friendly packaging, while the independent variables are grouped into four categories reflecting packaging attributes,

packing material and colour, product wrapping strategy attractiveness and product cost perception.

Grouping of Variables: In the SPSS software, the questionnaire items were implied into variables Full stops were assigned to each Likert scale response to enable quantitative analysis the independent variables were grouped as follows:

Product Material and Colour: This group measures consumer awareness of environmental impact related to packing materials and their influence on purchase decisions.

Product Wrapping Strategy: This assesses consumers' perception of packing innovation and hygiene benefits.

Attractiveness: this group captures emotional and visual appeals factors of packaging that may impact on consumer buying behavior.

Cost Perception: This reflects consumer views on price implications of sustainable packaging and their willingness to pay extra cost. For ease of analysis, average scores were computed for each independent variable group by calculating the mean of respective survey questions within each group.

7. Data Analysis and Techniques

(a) Descriptive Statistics: Descriptive statistics were used to summarize and present the basic features of data collected from the fifty-one respondents.

Measures such as mean scores, frequency counts and percentages were calculated for each attribute to understand overall consumer perceptions and behavior.

(b) Correlation Analysis: The analysis lies in examining the relationship between the independent variables and the dependent variable. Pearson correlation coefficient and Spearman correlation coefficient were applied to assess the direction and strength of the association between each independent variable and the willingness to pay extra sustainable packaging. Also, the association between various combinations of independent variables with the dependent variable to understand synergic effects.

The combinations established include:

- Product packing material and colour combined with product wrapping strategy.
- Product attractiveness combined with cost perception.
- Product wrapping strategy combined with product attractiveness.

This approach enabled the identification of which packaging attributes or their combinations have the most significant influence on consumers buying decisions.

Data Analysis

(a) Descriptive Statistics

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
IV1_Mean	51	1.00	2.67	1.7647	0.37294	.275	0.333	-0.593	.656
IV2_Mean	51	1.00	2.33	1.7124	0.34654	-0.063	0.333	-0.819	.656
IV3_Mean	51	1.00	4.00	2.5752	0.58908	-0.492	0.333	0.931	.656
IV4_Mean	51	1.00	3.50	1.8824	0.71825	0.179	0.333	-1.157	.656
Valid N (listwise)	51								

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Do you think plastic packaging causes environmental pollution?	3.8431	0.855	0.104	0.006
If bio-degradable materials can replace plastic?	3.9216	0.914	0.107	0.015
Does packing colour inspire you to purchase?	2.8235	0.628	0.008	0.310

Data Source: Author’s Calculation and Compilations

Interpretation: The descriptive statistics provide valuable insights into consumer perceptions regarding various attributes of sustainable packaging. The first independent variable group packaging material and colour shows a mean score approximately 1.76 on a scale where lower value represents stronger agreement indicating that respondents generally perceive plastic packaging as damaging to the environment and they are optimistic about potential of biodegradable materials as viable alternatives. This suggests that consumers are environmentally conscious and value packaging materials that contribute to sustainability. Similarly, the wrapping strategy with a mean score of 1.71, indicates positive consumer attitudes towards hygiene and innovative wrapping approaches. This aligns with the understanding that consumers appreciate packaging that not only protects the product but also ensures cleanliness and innovation, which are crucial in today's health-conscious market environment. The third variable product attractiveness with a comparatively higher mean of 2.57, reflects a more neutral attitude. This suggests that while the visual appeal and emotional connection of packaging do influence consumer behavior. These factors may not be as strongly weighted as environmental concerns or wrapping strategies, when it comes to sustainable packaging. It highlights that consumers prioritize substance in this context, placing more emphasis on ecological benefits than on aesthetics alone. The extra cost perception variable shows a mean value of 1.88, a general willingness among consumers to bear additional cost for eco-friendly packaging, though this acceptance is less strong than the environmental and wrapping factors. This reveals some moderate sensitivity to price increases related to sustainability efforts, which companies should consider when pricing their green products. The Skewness and Kurtosis values for these variables suggest that the data distribution is reasonably normal, supporting the reliability of these findings. These descriptive outcomes collectively justify focusing on eco-friendly materials and innovative wrapping methods as the key factors driving consumer willingness to pay extra for sustainable packaging. They indicate that a combination of these packaging attributes significantly influences buying behavior, emphasizing the need for businesses to integrate environmental considerations with functional and cost-effective packaging strategies to meet consumer expectations.

(b) Correlation Analysis

Table 2: Pearson Correlation Analysis

		IV1_ Mean	IV2_ Mean	IV3_ Mean	IV4_ Mean	Willing to pay extra for an eco-pack?
IV1_Mean	Pearson Correlation	1	0.154	0.244	0.081	0.110
	Sig. (2-tailed)		0.281	0.084	0.571	0.443
	N	51	51	51	51	51
IV2_Mean	Pearson Correlation	0.154	1	0.315	-0.045	0.059
	Sig. (2-tailed)	0.281		0.024	0.754	0.683
	N	51	51	51	51	51
IV3_Mean	Pearson Correlation	0.244	0.315	1	-0.081	0.113
	Sig. (2-tailed)	0.084	0.024		0.572	0.430
	N	51	51	51	51	51
IV4_Mean	Pearson Correlation	0.081	-0.045	-0.081	1	-0.195
	Sig. (2-tailed)	0.571	0.754	0.572		0.170
	N	51	51	51	51	51
Willing to pay extra for an eco-pack?	Pearson Correlation	0.110	0.059	0.113	-0.195	1
	Sig. (2-tailed)	0.443	0.683	0.430	0.170	
	N	51	51	51	51	51

Data Source: Author's Calculation and Compilations

Interpretation: The correlation analysis was conducted to examine the relationship between four key independent variables related to sustainable packaging attributes that is packing material and colour (IV 1), wrapping strategy (IV 2), attractiveness (IV 3), and extra cost perception (IV 4) and the dependent variable that is consumer's willingness to pay extra cost for eco-friendly packaging. The results show weak positive correlation between the independent variables and the willingness to pay extra for eco-friendly packaging. Packaging material and colour demonstrated a marginal positive correlation that is ($r = 0.110$, and $P > 0.05$), indicating a minimal but positive relationship with consumers' readiness to pay a premium price for green packaging.

Wrapping strategy had an even smaller positive correlation that is (r = 0.059 P > 0.05), suggesting Wrapping strategy had an even smaller positive correlation that is (r = 0.059 P > 0.05), suggesting that factors like hygiene and innovation in packaging have limited influence on the willingness to pay extra in this sample. Attractiveness also showed a positive but weak correlation that is (r = 0.113, P > 0.05) with the dependent variable, implying that while the emotional and visual appeal of sustainable packaging matters somewhat to consumers, it is not a strong stand-alone driver in deciding to pay extra cost. Extra cost perception had a negative correlation that is (r = 0.195 P > 0.05) with willingness to pay extra cost, although this was not statistically significant. This result aligns with consumers' unwillingness towards increasing prices for eco-friendly products reflecting that higher cost might discourage some buyers despite their environmental concerns.

Among the independent variables themselves, wrapping strategy and attractiveness had a statistically significant moderate positive correlation that is (r = 0.315, P < 0.05), suggesting that these two packaging attributes tend to be related, consumers who value innovative and hygienic wrapping also tend to appreciate attractive packaging designs. Overall, these findings indicate that while there is some positive association between sustainable packaging attributes and consumers' willingness to pay more, the strength of this relationship is uncertain. This implies that factors beyond packaging characteristics, such as price sensitivity or brand loyalty may also play important roles in consumer decision making regarding eco-friendly products.

(c) Nonparametric Correlations

Table 3: Spearman non parametric correlation

			IV1_Mean	IV2_Mean	IV3_Mean	IV4_Mean	Willing to pay extra for an eco-pack?
Spearman's rho	IV1_Mean	Correlation Coefficient	1.000	0.208	0.200	0.111	0.092
		Sig. (2-tailed)	.	0.144	0.159	0.437	0.520
		N	51	51	51	51	51
	IV2_Mean	Correlation Coefficient	0.208	1.000	0.384	-0.050	0.058
		Sig. (2-tailed)	0.144	.	0.005	0.725	0.685
		N	51	51	51	51	51
	IV3_Mean	Correlation Coefficient	0.200	0.384	1.000	-0.051	0.131
		Sig. (2-tailed)	0.159	0.005	.	0.720	0.358
		N	51	51	51	51	51
	IV4_Mean	Correlation Coefficient	0.111	-0.050	-0.051	1.000	-0.160
		Sig. (2-tailed)	0.437	0.725	0.720	.	0.261
		N	51	51	51	51	51
	Willing to pay extra for an eco-pack?	Correlation Coefficient	0.092	0.058	0.131	-0.160	1.000
		Sig. (2-tailed)	0.520	0.685	0.358	0.261	.
		N	51	51	51	51	51

Data Source: Author's Calculation and Compilations

Interpretation: The Spearman's correlation test was conducted to explore the relationship between the four independent variables related to sustainable packaging that is packing material and colour, wrapping strategy, attractiveness and extra cost perception and the dependable variable that is consumers' willingness to pay extra cost for eco-friendly packaging. This non parametric test is suitable given the ordinal nature of data collected through Likert scales.

The analysis reveals weak positive correlation between the packing attributes and willingness to pay extra cost. Product packaging material and colour shows a very weak positive correlation that is (r value = 0.092 and P > 0.05) with willingness to pay extra indicating a negligible association in consumer behavior.

Similarly wrapping strategy and attractiveness demonstrated weak positive correlation with willingness to pay extra with (r value = 0.058 and P > 0.05) and (r value = 0.131 and P > 0.05) respectively. These results suggest that while consumers might appreciate eco-friendly packaging material and attractive designs, these factors alone do not significantly influence their readiness to pay a premium. Extra cost perception had a negative correlation (r value = 0.160 and P > 0.05) with willingness to pay extra indicating that perceived higher cost could discourage consumers from selecting eco-friendly options, though this relationship was not statistically significant. Among the independent variables, the strongest and statistically significant correlation was observed between wrapping strategy and attractiveness (r value = 0.384 and P < 0.01). This implies (r value = 0.384 and P < 0.01). This implies that consumers who value innovative and hygienic packaging are also likely to be influenced by its visual appeal showing an interrelated perception of these packaging aspects. Overall, this Spearman correlation results align with the earlier Pearson findings, suggesting that sustainable packaging attributes relate positively to consumers' willingness to pay extra, the strength of this relationship is limited. It indicates that the complex nature of consumer buying decisions where multiple factors, beyond packaging alone, influence consumer's behavior towards eco-friendly products.

8. Concluding Observations

This study highlights that consumers' perception of sustainable packaging are influenced by various attributes such as packaging material and colour, wrapping strategy, attractiveness and cost considerations. Although, the correlation between these attributes and the willingness to pay extra for eco-friendly packaging were generally low and not statistically significant. The positive association observed with wrapping strategy and attractiveness suggest these factors may play a delicate role in shaping consumer attitudes. It is clear that consumers recognize the environmental importance of sustainable packaging but their readiness to pay premium is still limited, indicating that price sensitivity remains a significant barrier. Overall, the findings emphasize the complexity of consumer decision making when it comes to eco-friendly products and suggest that multiple packaging attributes together rather than any single factor influence buying behavior.

Future Recommendations

For businesses and policy makers aiming to promote sustainable packaging, it is crucial to focus on enhancing the appeal and perceived value of eco-friendly packaging without significantly increasing cost. Future research should expand the sample size and consider diverse demographic and geographic groups to better understand consumer heterogeneity. Additionally, exploring other psychological and social factors such as environmental awareness, brand loyalty and social influence could provide deeper insights. Policy makers should also consider stronger incentives and regulations to encourage manufacturers to adopt green packaging solutions attached with consumer education campaigns to raise awareness about the long-term benefits of sustainability. The combined approach may increase consumers' willingness to invest in eco-friendly packaging and drive meaningful change toward environmental sustainability.

Limitations of this Study

This study has some limitations that need to be considered when interpreting the results. The data was collected from a limited geographical area which may restrict the applicability of findings to the other regions with different consumer behaviours or cultural influences. The research focused only on a few key attributes of sustainable packaging, which may not cover all the factors influencing consumer's purchase decisions. Additionally, the study employed descriptive and correlation analysis without using other statistical techniques that could provide deeper insights into the relationship between the variables.

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