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Consumer Perception of Food and Beverage Packaging Attributes: A Multidimensional Study of Visual, Functional and Sustainability Dimensions in Chennai

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Abstract

Packaging has evolved beyond its conventional functions of product containment and protection to become an important medium through which consumers evaluate product attractiveness, convenience, and environmental responsibility. However, prior studies have largely examined visual, functional, and sustainability packaging attributes in isolation, and little empirical work has integrated all three dimensions within a single model linking them to consumer perception and purchase intention, particularly in the Indian context; this gap motivates the present study. This study explores consumer perception in terms of three aspects of food and beverage packaging: visual, functional, and sustainability aspects, and analyzes the effect of overall perception of packaging on the buying decisions of consumers in Chennai. The study employs a descriptive and explanatory research design and a structured questionnaire, and the data obtained are 400 usable responses that are used for model analysis. The constructs are measured using a five-point Likert scale, while the tools used are reliability analysis, Confirmatory Factor Analysis (CFA), and Structural Equation Modelling (SEM). All three categories of packaging attributes, such as visual packaging attributes ($\beta = 0.243$, $p < 0.001$), functional packaging attributes ($\beta = 0.386$, $p < 0.001$), and sustainability packaging attributes ($\beta = 0.298$, $p < 0.001$), were found to be significant and positive to consumer perception. The most powerful predictor is functional attributes. The 3 dimensions account for 58.4% of the variance of consumer perception. Consumer perception, on the other hand, has a significant influence on purchase intention with a beta value of 0.641 and a p value of < 0.001 , explaining 41.1% of the variance in the purchase intention. The study concludes that successful food and beverage packaging should combine all of these elements – visual appeal, practical, and perceived environmental responsibility – and not focus on one element alone. The results have implications for manufacturers, marketers and packaging designers who want to provide an attractive, informative message while ensuring convenience and sustainability for consumers. The study is limited by its focus on Chennai, its use of convenience sampling, and a simulated dataset developed for methodological demonstration, and self-reported purchase intention rather than observed behavior; future research should draw on empirical data from a broader, more representative consumer base and examine actual purchasing behavior across product categories.

Keywords: Consumer Perception, Food and Beverage Packaging, Visual Packaging Attributes, Functional Packaging Attributes, Sustainable Packaging, Purchase Intention.

Introduction

Packaging has evolved from a protective and containment role to a key element of product communication, convenience, brand differentiation, and environmental responsibility.

This new function is especially important in the food and beverage industry, as customers often have to select from competing products, and packaging is one of the most salient physical attributes of the product before consumption. Thus, packaging can influence customer expectations and perceptions of the product based on its visual appearance, functionality, information, and perceived environmental performance (Marsh & Bugusu, 2007; Rundh, 2009).

Food and beverage packaging is judged by several cues, such as color, graphics, typography, shape, material, information, convenience, protection, and recyclability and disposal. Previous studies have identified packaging characteristics that can influence consumer decision-making processes and preferences (Silayoi & Speece, 2007; Wells et al., 2007; Koutsimanis et al., 2012). Therefore, packaging should not be considered as a container, but as a multidimensional interface of the consumer.

The first packaging signal is visual attributes. Color, shape, graphics, and other product design elements can be used to draw attention, differentiate products, and create expectations of product features. Food coloring has been found to affect perceptions of food healthiness and purchase intention (Huang & Lu, 2016), and the use of color and shape has been found to affect product preferences and associations with taste and healthiness (Marques da Rosa et al., 2019). In general, sensory attributes such as visual design influence the choice of food and consumer product experiences (Spence & Velasco, 2018; Vermeir & Roose, 2020). While visual attractiveness cannot be used to summarize overall consumer perception, it does contribute an important part of the picture.

Another key dimension is functional attributes. Food and beverage packaging should be designed to ensure the safety of the product during transportation, handling, opening, storage, consumption, and disposal. Poor packaging can be a cause of food loss, whereas an appropriate design can help preserve food and minimize deterioration (Wohner et al., 2019). Therefore, consumer assessment is not only based on the appearance of the package provided, but also on the service it provides during the use of the product.

With regards to the packaging materials, waste and environmental concerns, sustainability has grown in importance and has become even more crucial. The attributes of environmentally responsible packaging that are known to consumers include reusability, use of fewer materials, environmentally preferable materials, and recyclability. However, consumers' perception of the environmental performance of packaging does not always match the scientifically assessed environmental performance (Lindh et al., 2016; Otto et al., 2021). In this sense, the differences are important and relevant to consumer-behaviour research.

The triangle of visual aesthetics, function, and sustainability is complicated. An attractive package can be noticed, but it is deemed cumbersome or harmful to the environment. However, if the environmental qualities of packaging harm the protection of the product or its usability to the consumer, it will not be accepted. Other studies of sustainable packaging reveal that visual cues, communication of the environment, and consumer environmental concerns can all affect consumer response (Magnier & Schoormans, 2015). Packaging materials and graphics can also influence perceptions and product evaluations with regard to sustainability (Steenis et al., 2017).

Therefore, the present study takes an integrated approach as it investigates the visual, functional, and sustainability packaging attributes simultaneously. It has been directed towards the users of packaged food and beverage products in Chennai and has studied the role that these play in the overall perception of the user and how the user's perception may affect the intention to purchase the product. From an academic point of view, this study combines aspects of packaging dimensions that are often studied in isolation. Managerially, it can help manufacturers, marketers, and packaging designers meet the challenges of balancing the elements of visual communication, functional utility, and perceived environmental responsibility.

Review of Literature

Visual Packaging Attributes and Consumer Perception.

The visual features of packaging include color, graphics, typography, shape, imagery, and layout. These attributes serve as product cues that are not intrinsic to the actual product itself and help shape consumers' impressions prior to product exposure. Packaging design can thus help create product differentiation and consumer evaluation (Gelici-Zeko et al. 2013).

Color plays an important role because it can imply a product's category, taste, naturalness, and healthiness. Huang and Lu (2016) discovered that package color, in addition to nutrition-content information, affects perceived food healthiness and buy intention. Marques da Rosa et al. (2019) also showed that the packaging color and shape influence preference and associations with taste and healthiness, which depend on product context.

There are also collective elements in the visuals. It is probable that consumers will respond to combinations of packaging design elements that will give them a clear product image because packaging design research has indicated that more than just a single design is important. For instance, Matthews et al. (2019) showed that the congruence of several design elements influenced people's sense of anticipation regarding taste. Spence and Velasco (2018) noted the various ways in which packaging color can impact consumer behavior and product experience. The broader literature suggests that visual design is an influential factor in food choice (Vermeir & Roose, 2020).

Visual packaging is thus more than just a decorative presentation. It conveys product-related nuances and helps differentiate and influences initial consumers' evaluations. On this basis:

H₁: Visual packaging attributes make significant and positive contributions to the perception of food and beverage packaging.

Functional Packaging Attributes and Consumer Perception

Packaging can attract attention through visual attributes, but it must serve an important functional role. Functional attributes include product protection, convenience, portability, ease of product opening, storage, re-closeability, information utility, and disposal. These attributes are more significant for

food and beverage products, as consumers engage with packaging beyond eating and drinking.

Protection continues to be the basic duty. The purpose of packaging is to provide protection from physical and environmental factors and to ensure safety and quality (Marsh & Bugusu, 2007). Food losses and food waste can also be affected by packaging design, if the packaging is inadequate, the deterioration or damage of a food product occurs. (Wohner et al., 2019) Therefore, a reduction in packaging material, without regard for its protective function, may not yield a better environmental result.

Functionality also translates to consumer ease of handling and use. When consumers consider the convenience and utility of the product, packaging attributes can influence the purchase decision (Silayoi & Speece, 2007; Koutsimanis et al., 2012). Consumer attitudes towards food products are also affected by the presentation and packaging format (Eldesouky & Mesias, 2014). Packaging is a part of the consumer experience, and for it to be functional, it must be perceived as such – which is not simply an effect of visual design.

The packaging system should therefore ensure the protection of the product and facilitate handling during transport, storage, use, and disposal. Accordingly:

Packaging functional attributes significantly and positively affect food and beverage packaging perception.

Sustainability Packaging Attributes and Consumer Perception

The growing concern about packaging waste, resource utilization, and disposal makes sustainability an important factor in packaging evaluation. Recyclable, reusable, renewable, biodegradable, and material-efficient packaging solutions are all forms of sustainable packaging. Nevertheless, consumer assessment of environmental performance is often based on perceived rather than complete life-cycle information.

Lindh et al. (2016) showed that consumers' considerations for the environmental impacts of packaging were significant, and Otto et al. (2021) highlighted that consumer perceptions of packaging sustainability differed from scientific evaluations of environmental impacts. It is therefore important to

keep in mind that the perception of sustainability is not necessarily related to actual performance.

Consumers are largely concerned with environmental issues stemming from food packaging, but they may not know much about specific environmentally friendly packaging solutions (Ketelsen et al., 2020). Sustainability perceptions and evaluations also relate to packaging materials and visual graphics (Steenis et al., 2017). Likewise, the visual appearance of sustainable packaging and the environmental claims, combined with environmental concerns, have the potential to influence consumer responses to sustainable packaging (Magnier & Schoormans, 2015).

Although there is a positive link between sustainability perceptions and intentions to behave, it does not necessarily translate to actual purchases. For Indian consumers, Prakash and Pathak (2017) showed that attitudes, personal norms, environmental concern, and willingness to pay are the factors that influence the purchase intention of eco-friendly packaged products. Sustainable packaging must be both environmentally responsible and bear recognizably known, understood, and appreciated characteristics by the consumer. Broader shifts in retail, such as zero-packaging grocery formats, illustrate the scale of structural change being explored to reduce the environmental footprint of the food supply chain (Beitzen-Heineke et al., 2017), while consumer-facing studies in the UK and Finland show that people's understanding of sustainable packaging centers on concrete, everyday cues such as recyclability symbols, material type, and disposal guidance rather than technical environmental criteria (Norton et al., 2022; Sonck-Rautio et al., 2024).

In the current study, sustainability is not scientific environmental sustainability but an individual's perception of packaging sustainability. Accordingly:

Sustainable packaging attributes have a significant and positive impact on consumer perception of food and beverage packaging.

Consumer Perception and Purchase Intention

Consumer perception is a cognitive process that involves the interpretation and overall assessment of packaging cues. The characteristics of packaging become behavioral once they become visible and

are assessed by the consumers. This is because it is crucial to distinguish between objective packaging characteristics and what consumers infer.

Previous studies have shown the relationships between packaging and purchase-related behavior. Packaging attributes affect purchasing decisions (Koutsimanis et al., 2012) and package color and nutrition information can affect perceived healthiness and purchase intention (Huang & Lu, 2016). The package visual characteristics are also colour-related and may affect the product's preference and expectations (Marques da Rosa et al., 2019). Furthermore, packaging materials and graphics contribute to the perception of sustainability and product evaluations (Steenis et al., 2017).

Consumer attitudes towards food packaging should be considered as a sum of different evaluations of the packaging rather than based on one single attribute (Arboretti Giancristofaro & Bordignon, 2016). The package then exists as a whole set of cues that act as a guide for the consumer to evaluate the product prior to purchase.

Thus, the present study suggests that positive overall packaging perceptions will be positively correlated with purchase intention.

H4: Consumers' perception of food and beverage packaging has a significant and positive relationship with purchase intention.

The gap in knowledge and problem statement are clearly defined. The research gap and S. O. P. are clearly defined.

Previous studies have proven that packaging design, consumer preference, functionality, and sustainability are crucial. However, most of the literature focuses on specific attributes or limited sets of packaging attributes. Research on visual design tends to focus on color, graphics, shape, or appearance, whereas sustainable-packaging research tends to focus on environmental concerns, material, recycling, and green purchase behavior. Functional requirements such as protection, usability, storage, and convenience are also acknowledged but are less commonly linked to the visual and sustainability aspects in a user-perception model.

The separation causes problems, as consumers are exposed to whole packaging, not just limited packaging traits. A package may not be evaluated

favorably if it is not easy to use. Environmentally responsible packaging can be appreciated, but can face challenges when it comes to protection, storage, or convenience. On the other hand, a highly functional package could end up having a negative perception if people consider the use of the packaging to be environmentally inappropriate.

Previous studies also point to a difference between the actual packaging attributes and the perceived attributes by consumers. Consumer assessments of sustainability, in particular, can differ from objective environmental assessments (Lindh et al., 2016; Otto et al., 2021). Thus, consumer perception can be an important link between packaging characteristics and behavioral intentions.

This integrated investigation is further corroborated by the Indian context. Researchers have investigated the purchase willingness of Indian consumers for eco-friendly packaged products, but no studies have used models that determine the relative contribution of visual appearance, practical functionality, and perceived sustainability on the overall packaging perception.

The current study fills this gap by presenting a multidimensional approach to food and beverage packaging (visual, functional, and sustainability attributes) and exploring the relative influence of these attributes on overall consumer perception. It then examines whether the positive attitude of consumers towards the product affects their buying intention to buy the product in Chennai.

In this Regard, the Central Research Question is as Follows

How strong is the influence of the various dimensions of visual, functional, and sustainability packaging on the overall perception of food and beverage packaging; which dimension of the packaging has the greatest influence on the overall perception of food and beverage packaging and does the favorable packaging perception lead to high purchase intention among consumers in Chennai?

Need for the Study

This study is needed from an academic and managerial perspective. Research on packaging has followed a line of separate streams that have

concentrated on visual, functional, and environmental aspects. However, consumers taste these qualities at the same time when they consider packaged products. An integrated approach can thus offer a more holistic understanding of consumer behavior related to packaging.

The study is also significant because a packaging attribute cannot influence consumer behavior unless the consumer recognizes, interprets, and values the attribute. This, in turn, offers a powerful tool for connecting visual, functional, and sustainability attributes to the intention to purchase, as reflected in overall consumer perception.

From a management perspective, packaging decisions are those that require an investment of resources in packaging materials, packaging structure, printing and labeling, protection, convenience, and packaging improvement in the environment. Knowing the relative importance of the packaging dimensions can help packaging manufacturers, marketers, and designers spend their resources more effectively and avoid overemphasizing one dimension over another. The study also offers qualitative evidence from consumers at a specific time and place, albeit with the caveat of having a certain sampling design.

The aim of this study was to identify the objectives of the study.

The main aim is to understand the perception of food and beverage packaging attributes in Chennai from visual, functional, and sustainability perspectives among consumers. The particular objectives are:

1. To explore consumers' attitudes towards the visual, functional, and sustainability aspects of food and beverage packaging.
2. To analyze the effect of visual packaging attributes on overall consumer perception.
3. To assess the impact of the functional properties of packaging on consumer perceptions.
4. To understand how sustainability packaging attributes affect overall consumer perception.
5. To investigate the impact of consumer perception of the entire product on purchase intention.
6. To determine the extent to which visual, functional, and sustainability aspects contribute to consumer perception of food and beverage packaging.

Based on the theoretical arguments and empirical literature, the following hypotheses are formulated.

H₁: Visual packaging attributes significantly and positively influence consumer perception of food and beverage packaging.

H₂: Functional packaging attributes significantly and positively influence consumer perceptions of food and beverage packaging.

H₃: Sustainable packaging attributes significantly and positively influence consumer perception of food and beverage packaging.

H₄: Consumer perception of food and beverage packaging significantly and positively influences purchase intention.

Conceptual Framework

The conceptual framework treats visual, functional, and sustainability packaging attributes as three independent dimensions that contribute to consumers' overall perception of food and beverage packaging. Subsequently, overall consumer perception influences purchase intention.

Visual Packaging Attributes → Consumer Perception

Functional Packaging Attributes → Consumer Perception

Sustainability Packaging Attributes → Consumer Perception

Consumer Perception → Purchase Intention

Visual packaging attributes represent consumers' evaluations of characteristics such as color, graphics, typography, shape, layout, and overall appearance. Functional attributes represent practical performance, including product protection, ease of opening, handling, storage, resealability, and information utility. Sustainability attributes represent perceived environmental characteristics, including recyclability, environmentally responsible materials, reduction of unnecessary packaging, reusability, and appropriate disposal.

Consumer perception represents the overall evaluation formed after interpreting these packaging characteristics, whereas purchase intention refers to consumers' reported likelihood or willingness to select products whose packaging is evaluated favorably. The framework therefore permits comparison of the relative contributions of the

three packaging dimensions while examining the subsequent behavioral influence of overall packaging perception.

Scope of the Study

This study focuses on adult consumers of packaged food and beverage products in Chennai, Tamil Nadu. It examines consumer evaluations of packaging rather than conducting technical assessments of individual packaging materials. Accordingly, sustainability represents perceived packaging sustainability and not scientifically measured environmental performance.

The principal constructs are visual packaging attributes, functional packaging attributes, sustainability packaging attributes, overall consumer perception, and purchase intention. Food and beverage products are considered at a general consumer level rather than restricting the analysis to a single product category. Consequently, generalization beyond Chennai and beyond the characteristics represented in the selected sample should be undertaken cautiously.

Research Methodology

Research Design and Study Area

This study is a descriptive and explanatory quantitative research design. The descriptive part analyzes consumers' perceptions of packaging attributes, and the explanatory part analyzes the relationship between visual, functional, and sustainability attributes, as well as the overall consumer perception of the packaging and purchase intention.

The methodology employed is a structured questionnaire survey because there are several latent constructs in the conceptual framework that are measured using observed indicators. The unit of analysis is the consumer of packaged food and beverage products in Chennai. Eligible respondents were adults (18+ years or older) who had purchased packaged food and beverage products and could assess the characteristics of the packaging.

Number of people sampled and the method used to sample the population. Sample size and sampling technique.

The target population was adults who consume packaged food and beverage items in Chennai. There was no complete sampling frame available in which all consumers who were eligible for the sample can be found; therefore, a non-probability convenience sampling technique was used. The respondents were chosen based on accessibility and eligibility, and all respondents must have a screening condition of having prior experience in purchasing packaged food or beverages.

The usable responses for the model analysis were 400. This is a good sample size to use for the proposed CFA and SEM procedures with five latent constructs and multiple observed indicators.

However, convenience sampling limits the results to a broader population of consumers in Chennai.

Sources of Data and Research Instrument

Primary data were collected using a structured questionnaire, and secondary data were literature survey data related to packaging design, packaging functions, sustainable packaging, consumer perception, and consumer buying intention.

The questionnaire had five substantive constructs and a demographic and consumption profile. The construct statements were rated from 1 = Strongly Disagree to 5 = Strongly Agree.

Table 1 Measurement of Study Constructs

Construct	Items	Major Dimensions Measured	Literature Basis
Visual Packaging Attributes (VPA)	6	Colour, graphics, shape, typography, layout and overall design	Marques da Rosa et al. (2019); Spence & Velasco (2018)
Functional Packaging Attributes (FPA)	6	Protection, opening, handling, storage, resealability and information	Marsh & Bugusu (2007); Koutsimanis et al. (2012)
Sustainability Packaging Attributes (SPA)	6	Recyclability, materials, material reduction, reuse and disposal	Lindh et al. (2016); Otto et al. (2021)
Consumer Perception (CP)	4	Overall impression and evaluation of packaging	Packaging-perception literature
Purchase Intention (PI)	4	Likelihood and willingness to purchase	Consumer-behaviour literature

The substantive measurement model therefore contains 26 items across five latent constructs.

Measurement of Constructs

The six items represent the extent to which the combination of colors, graphic elements, packaging shape, typography, packaging layout, and design overall impact on consumers' evaluation of food and beverage packaging. This matches the evidence that visual packaging features are determinants of consumer preference and product association (Marques da Rosa et al., 2019).

Functional Packaging Attributes: Six attributes were evaluated to assess product protection, ease of opening/using the package, convenient handling, storage, resealability/transparency of product, usage, and disposal information. These qualities are a product of real-life consumer-packaging relationships during the product-use cycle.

The Sustainability Packaging Attributes include six items that evaluate preferences for recyclable

packaging, environmentally responsible materials, unnecessary packaging, usefulness of use, instructions for recycling and disposing of packaging, and considering environmental impact. The construct intentionally reflects perceived sustainability, which acknowledges that consumer perceptions of sustainability can vary from environmental assessments. (Lindh et al., 2016; Otto et al., 2021).

Consumer Perception: There are four items that measure the overall impressions that the respondents have about well-designed packaging, the usefulness of packaging characteristics in product evaluation, perceptions of packages that are both attractive and support environmental responsibility and convenience, and confidence generated by good packaging.

Purchase Intention: Four items measure the probability of buying products with favorable evaluations of the packaging, willingness to choose packaging that meets expectations, and preference for well-packaged products when similar alternatives

exist. Instead of being a measure of actual purchasing behavior, purchase intention is considered a behavioral intention.

The results are presented as a pilot study with reliability.

The questionnaire was subjected to a pilot assessment before the main survey to check for clarity and comprehensibility, along with initial reliability. A pilot survey of 50 eligible consumers was conducted for the model study. Minor changes were made where the statements were ambiguous or repetitive.

Internal consistency was assessed by measuring Cronbach's alpha and composite reliability (CR).

Table 2 Reliability and Convergent Validity

Construct	Cronbach's Alpha	CR	AVE
Visual Packaging Attributes	0.874	0.879	0.549
Functional Packaging Attributes	0.891	0.894	0.585
Sustainability Packaging Attributes	0.903	0.905	0.615
Consumer Perception	0.862	0.866	0.619
Purchase Intention	0.881	0.884	0.656

Source: Simulated/ Model data

The Cronbach's alpha coefficients ranged from 0.862 to 0.903, while the CR values ranged from 0.866 to 0.905, indicating satisfactory internal consistency. The AVE values ranged from 0.549 to 0.656, supporting convergent validity.

Validity and Confirmatory Factor Analysis

Content validity is addressed through literature-based construct development and should be strengthened through expert assessment of the final questionnaire. Confirmatory Factor Analysis (CFA) was employed to determine whether the observed indicators adequately represented the five proposed latent constructs.

The standardized factor loadings in the model range from 0.69 to 0.84, indicating a satisfactory representation of the respective constructs. Convergent validity was evaluated through factor loadings, composite reliability, and average variance extracted.

Discriminant validity is assessed using the Heterotrait-Monotrait (HTMT) ratio. The model HTMT values ranged from 0.55 to 0.78, remaining below the conservative threshold of 0.85 and indicating that visual, functional, and sustainability attributes, consumer perception, and purchase intention are empirically distinguishable constructs.

Statistical Tools

Data analysis involved descriptive statistics and multivariate techniques. Descriptive statistics were used to summarize respondent characteristics and construct evaluations. Cronbach's alpha assesses internal consistency, while CFA evaluates the measurement properties of the five constructs. Composite reliability and AVE assess construct reliability and convergent validity, and HTMT is employed for discriminant validity.

Structural Equation Modelling (SEM) was subsequently used to test the following structural paths:

VPA → Consumer Perception
FPA → Consumer Perception
SPA → Consumer Perception

Consumer Perception → Purchase Intention

Standardized structural coefficients, standard errors, critical ratios, p-values, and the explanatory power (R^2) of the endogenous constructs were used to evaluate the hypotheses.

Ethical Considerations

Participation in the survey was voluntary, and respondents were informed about the academic purpose of the study. Responses will be treated confidentially and used solely for academic analysis. Where institutional ethics approval or formal research permission is required, the appropriate approval details should be incorporated into the final manuscript.

Model-Data Declaration

The numerical values reported in the present model—including the sample size, pilot-study size, reliability coefficients, validity statistics, and subsequent statistical findings—represent simulated/ model values developed for methodological and

manuscript-development purposes. They should not be presented as observations obtained from actual respondents. Before the study is reported as completed empirical research, these values must be replaced with statistics derived from the researcher's actual dataset.

Data Analysis and Findings

The proposed conceptual model was evaluated using descriptive statistics, Confirmatory Factor Analysis (CFA), and Structural Equation Modelling (SEM). For the model analysis, a simulated dataset comprising 400 usable responses was considered. The analysis first assessed the demographic profile and descriptive characteristics of the constructs, followed by the evaluation of the measurement model and testing of the hypothesized structural relationships.

Profile of Respondents

The model sample consisted of 400 respondents, with relatively balanced gender representation: 198 males (49.5%) and 202 females (50.5%). Respondents aged 26–35 years constituted the largest group (32.0%), followed by 18–25 years (23.0%), 36–45 years (22.8%), 46–55 years (13.8%), and above 55 years (8.5%). Regarding educational qualification, 38.3% were postgraduates, 35.8% undergraduates, 14.0% possessed professional/research degrees, and 12.0% had qualifications up to the higher secondary level.

With respect to purchase frequency, 38.0% purchased packaged food or beverages approximately once a week, 27.3% several times a week, 22.3% two or three times a month, and 12.5% once a month or less. Thus, a substantial proportion of respondents reported regular exposure to packaged food and beverage purchasing decisions.

Descriptive Statistics

The descriptive statistics of the five constructs are presented in Table 3.

Table 3 Descriptive Statistics of Study Constructs

Construct	No. of Items	Mean	Standard Deviation
Visual Packaging Attributes	6	3.78	0.64
Functional Packaging Attributes	6	4.02	0.61
Sustainability Packaging Attributes	6	3.86	0.67
Consumer Perception	4	3.91	0.63
Purchase Intention	4	3.82	0.68

Source: Simulated/model data

Among the three packaging dimensions, functional packaging attributes recorded the highest mean ($M = 4.02$), followed by sustainability attributes ($M = 3.86$) and visual attributes ($M = 3.78$). This descriptive pattern indicates comparatively favorable evaluations of practical packaging characteristics, such as product protection, convenience, handling, and storage. However, the relative influence of these dimensions on consumer perception cannot be determined from mean scores alone and is therefore evaluated through SEM.

Measurement Model Assessment

CFA was employed to examine whether the observed indicators adequately represented five proposed latent constructs. The standardized factor loadings ranged from 0.69 to 0.84. Most indicators exceeded 0.70, while the lowest loading (0.69) remained theoretically relevant to its construct.

As reported earlier, Cronbach's alpha coefficients ranged from 0.862 to 0.903, composite reliability values from 0.866 to 0.905, and AVE values from 0.549 to 0.656. These results support the internal consistency and convergent validity of the measurement model. The HTMT values ranged from 0.55 to 0.78 and remained below 0.85, providing evidence of discriminant validity among the five constructs.

Measurement Model Fit

Multiple goodness-of-fit indices were examined to assess the adequacy of the CFA model.

Table 4 Measurement Model Fit

Fit Index	Model Value	Indicative Criterion	Interpretation
χ^2/df	2.18	< 3.00	Good
GFI	0.914	≥ 0.90	Acceptable
AGFI	0.892	Around 0.90	Acceptable
CFI	0.953	≥ 0.90	Good
TLI	0.946	≥ 0.90	Good
NFI	0.919	≥ 0.90	Acceptable
RMR	0.041	< 0.08	Good
RMSEA	0.054	< 0.08	Good
SRMR	0.047	< 0.08	Good

Source: Simulated/model data

The fit indices collectively indicate a satisfactory measurement model fit. The χ^2/df value of 2.18 is below 3.00, while CFI, TLI, and NFI exceed 0.90. RMSEA and SRMR are also below 0.08. Although AGFI (0.892) is marginally below 0.90, the overall combination of indices indicates an acceptable measurement model.

Structural Model and Hypothesis Testing

After establishing the adequacy of the measurement model, SEM was employed to

examine the hypothesised relationships among visual packaging attributes, functional packaging attributes, sustainability packaging attributes, consumer perception and purchase intention.

The structural model also demonstrated acceptable fit: $\chi^2/df = 2.31$, GFI = 0.906, AGFI = 0.886, CFI = 0.947, TLI = 0.940, NFI = 0.913, RMR = 0.044, RMSEA = 0.057, and SRMR = 0.051. Collectively, these indices indicate that the model is suitable for interpreting the proposed structural relationships.

Table 5 Structural Path Estimates and Hypothesis Testing

Hypothesis	Structural Relationship	Standardised β	S.E.	C.R.	p-value	Decision
H ₁	Visual Attributes $\rightarrow$ Consumer Perception	0.243	0.046	5.28	<0.001	Supported
H ₂	Functional Attributes $\rightarrow$ Consumer Perception	0.386	0.051	7.57	<0.001	Supported
H ₃	Sustainability Attributes $\rightarrow$ Consumer Perception	0.298	0.048	6.21	<0.001	Supported
H ₄	Consumer Perception $\rightarrow$ Purchase Intention	0.641	0.044	14.57	<0.001	Supported

Source: Simulated/model data

All four proposed structural relationships were positive and statistically significant.

Visual Packaging Attributes and Consumer Perception

H1 proposed that visual packaging attributes significantly and positively influence consumer perception. The results demonstrate a significant positive relationship ($\beta = 0.243$, C.R. = 5.28, $p < 0.001$); therefore, H1 is supported.

The results indicate that favorable evaluations of color, graphics, typography, shape, layout, and overall visual design positively contribute to consumers' overall perceptions of food and beverage packaging. This finding is consistent with previous research showing that visual packaging characteristics influence product evaluation, preference, and expectations (Huang & Lu, 2016; Marques da Rosa et al., 2019). However, the magnitude of the relationship is lower than that observed for functional and sustainability attributes,

suggesting that visual attractiveness contributes to, but does not independently determine, overall packaging perception.

Functional Packaging Attributes and Consumer Perception

H2 proposed that functional packaging attributes have a significant positive influence on consumer perception. The structural coefficient is positive and significant ($\beta = 0.386$, C.R. = 7.57, $p < 0.001$); consequently, H2 is supported.

Functional packaging attributes demonstrate the strongest effect among the three antecedents of consumer perception. This finding suggests that practical characteristics, such as product protection, ease of opening, convenient handling, storage, resealability, and useful information, make an important contribution to consumers' overall packaging evaluations.

This result is consistent with the broader packaging literature, which emphasizes the protective and practical functions of packaging (Marsh & Bugusu, 2007; Koutsimanis et al., 2012; Wohner et al., 2019). Consumers interact physically with packaging throughout transportation, storage, and consumption; consequently, practical performance represents an integral component of the consumer experience.

Sustainability Packaging Attributes and Consumer Perception

H3 proposed that sustainable packaging attributes significantly and positively influence consumer perception. The results reveal a positive and statistically significant relationship ($\beta = 0.298$, C.R. = 6.21, $p < 0.001$); therefore, H3 is supported.

The results indicate that perceived recyclability, environmentally responsible materials, reduced unnecessary packaging, reuse potential, and clear disposal information contribute positively to consumers' overall evaluations of packaging. Sustainability demonstrated the second strongest influence, exceeding the visual dimension but remaining below functionality.

The result is consistent with research indicating that consumers consider environmental characteristics when evaluating food packaging (Ketelsen et

al., 2020). However, consumer perceptions of sustainability may not always correspond with scientifically established environmental performance (Lindh et al., 2016; Otto et al., 2021). The present finding should therefore be interpreted specifically in terms of perceived sustainability.

Consumer Perception and Purchase Intention

H4 proposed that the overall consumer perception of food and beverage packaging significantly and positively influences purchase intention. The structural path is strong and statistically significant ($\beta = 0.641$, C.R. = 14.57, $p < 0.001$); hence, H4 is supported.

This finding indicates that consumers who form favorable overall perceptions of packaging demonstrate stronger intentions to consider purchasing the associated food and beverage products. This supports previous evidence linking packaging-related evaluations to purchase responses (Huang & Lu, 2016; Koutsimanis et al., 2012; Marques da Rosa et al., 2019).

Nevertheless, this finding concerns purchase intention rather than confirmed purchasing behavior. Packaging should therefore be considered an influential component of consumer decision-making rather than the sole determinant of actual purchase.

Explanatory Power and Relative Influence

The explanatory power of the structural model was assessed using the coefficient of determination (R^2).

Table 6 Explanatory Power of the Structural Model

Endogenous Construct	R^2	Variance Explained
Consumer Perception	0.584	58.4%
Purchase Intention	0.411	41.1%

Source: Simulated/model data

Visual, functional, and sustainability packaging attributes jointly explain 58.4% of the variance in consumer perception. The remaining 41.6% may be attributable to factors outside the present framework, including brand familiarity, price, product category, previous experience, perceived product quality,

nutritional information, and individual consumer characteristics. Consumer perception explains 41.1% of the variance in purchase intention. This indicates substantial explanatory relevance, while also confirming that purchase intention may depend on additional variables, such as price, taste, brand reputation, product quality, availability, and previous consumption experiences.

The comparison of standardized coefficients establishes the following order of influence on consumer perception:

Functional attributes ($\beta = 0.386$) > Sustainability attributes ($\beta = 0.298$) > Visual attributes ($\beta = 0.243$).

Thus, functional packaging attributes constitute the strongest predictor, followed by sustainability and visual attributes. This finding does not imply that visual design is unimportant; rather, it suggests that consumers' overall packaging evaluations are more strongly associated with practical performance and perceived environmental responsibility.

Major Findings

The principal findings of this study are summarized as follows.

1. Visual packaging attributes significantly influence consumer perception ($\beta = 0.243$, $p < 0.001$), demonstrating that color, graphics, typography, shape, layout, and overall appearance remain meaningful components of packaging evaluation.
2. Functional packaging attributes exert the strongest influence on consumer perception ($\beta = 0.386$, $p < 0.001$). Product protection, ease of use, handling, storage, resealability, and information utility therefore represent particularly important packaging characteristics.
3. Sustainability packaging attributes significantly influence consumer perception ($\beta = 0.298$, $p < 0.001$), indicating that perceived recyclability, environmentally responsible materials, material reduction, reuse, and disposal characteristics contribute meaningfully to packaging evaluation.
4. The three packaging dimensions collectively explained 58.4% of the variance in consumer perception, supporting the multidimensional framework adopted in this study.
5. Consumer perception strongly and positively influenced purchase intention ($\beta = 0.641$, $p <$

0.001), explaining 41.1% of its variance.

6. All four hypotheses are supported, confirming the proposed relationships among packaging attributes, consumer perception, and purchase intention.

Overall, the findings demonstrate that food and beverage packaging should not be evaluated through visual appearance, functionality, or sustainability independently. Consumer perception is more appropriately understood as the outcome of multiple packaging dimensions operating simultaneously.

Discussion of Findings

The results corroborate the main hypothesis that the perception of food and beverage packaging is multidimensional. Consumer perception takes place with the contributions of all visual, functional, and sustainability properties, but to a different extent. Together, the three dimensions account for 58.4% of consumer perception and consumer perception accounts for 41.1% of purchase intention.

The strong visual attributes effect ($\beta = 0.243$) agrees with previous research that showed that the visual attributes of packaging can influence product evaluations. Huang and Lu (2016) found that package color impacted the perceived healthiness and purchase intention of the food, and Marques da Rosa et al. (2019) showed that color and shape can affect consumer preference and associations with taste and healthiness. Thus, visual cues still play a vital role in the attention-grabbing process and the transmission of meanings related to products. However, their relatively poor coefficient means that beauty alone might not lead to the best overall assessment in packaging.

Functional attributes have the highest impact on consumer perception ($\beta = 0.386$). This finding highlights the fact that consumers consider packaging as a tool or medium rather than just something they are looking at. Packaging should be used to keep the product safe but also make it easy to open, handle, store, and consume. The functionality is emphasized and matches research findings that package attributes are important factors affecting consumer choice and product experience (Silayoi & Speece, 2007; Koutsimanis et al., 2012). It also highlights the overall protective characteristics of food packaging,

as found by Marsh and Bugusu (2007), and the pack–food loss effect, as found by Wohner et al. (2019). Second, sustainability attributes have the most significant impact on consumer perception ($\beta = 0.298$). This suggests that consumers perceive recyclability, environmental responsibility, reduced material utilization, and proper disposal as significant. This aligns with evidence of consumers' concern about sustainable food packaging (Ketelsen et al., 2020). However, sustainability in perception does not mean sustainability in reality, as consumers may perceive materials and environmental aspects differently than scientific evaluation (Lindh et al., 2016; Otto et al., 2021).

The results additionally show that functionality and sustainability are not mutually exclusive goals. Packaging that is not sustainable may be problematic because it does not protect the product and/or is not convenient for the consumer; at the other end of the spectrum, packaging that is too functional and thus seen as unnecessary waste can raise environmental concerns. Hence, all three sides of packaging have positive effects, and a holistic approach to packaging design is therefore recommended.

Finally, the impact of consumer perception on purchase intention is shown with a positive value of $\beta = 0.641$. Consumers do not see packages as packages; they see them as packaged products, which they begin to notice, interpret, and evaluate. This relationship is in line with the general literature that shows that packaging attributes are related to product assessment and purchase intentions (Huang & Lu, 2016; Marques da Rosa et al., 2019).

However, 41.1% of purchase intention is accounted for by consumer perception. Other factors such as price, taste, brand recognition, perceived quality, nutritional properties, availability, and past experience can also contribute to the decision of purchasing. Thus, packaging should not be seen as the consumer's only choice, but rather an integral part of the choice.

In general, the relative influence—

The pedestal is the lowest quality option and/or the least environmentally friendly.

Effective packaging is a balance: Visual design is what catches and communicates, functionality

is what helps to protect the product and use it by the consumer, and sustainability is what helps in environmental evaluation. The best consumer response is likely to occur when these dimensions reinforce each other.

Suggestions

The results indicate that food/beverage companies need to take a holistic view of packaging development and avoid focusing only on aesthetics. Because functional attributes have the greatest effect on consumer perception, packaging should provide effective protection of the product, facilitate opening, handling, and ease of use, and, if appropriate, allow for easy storage and re-sealing.

Packaging information must be clearly organized for consumers to easily access important information on ingredients, use, storage, product dates, and disposal. Typography, graphics, and information hierarchy should thus promote readability while providing visual differentiation.

A sustainability initiative should be directed towards improving the environment while maintaining the necessary functions of packaging. Wherever possible, manufacturers should minimize unnecessary packaging while providing sufficient protection from leakage, contamination, breakage, or product deterioration. The recyclability and reusability of packaging should be supported by clear and understandable disposal instructions.

Consumers may not view improved technology as sustainable; therefore, environmental benefits must be communicated credibly. The packaging development team should, therefore, consider visuals along with functionality and sustainability in the design and testing phases. Regular consumer research can also enable companies to adapt to evolving expectations regarding convenience and packaging materials and sustainability.

Managerial and Practical Implications

The results offer several implications for food and beverage manufacturers, marketers, and packaging designers. The first is that investment in packaging should not focus too much on visually redesigning the packaging. While visuality remains relevant, functionality seems to be more significant, so consumer convenience and functional interaction play a major role in packaging innovation.

Second, functionality must be considered as a component of the overall customer experience. Packaging that is difficult to open, fails to handle well, is not stored properly, is not easily resealed, or the instructions are not understood will have a negative impact on overall product evaluation, as it will cause consumer problems after purchase.

Third, sustainable strategies must include environmental enhancement and consumer awareness. Consumers' perceptions of sustainable packaging can differ from actual environmental performance measurements (Lindh et al., 2016; Otto et al., 2021). As a result, recycling information and environmental statements and details of disposal should be specific, understandable, and credible.

Fourth, sustainable packaging should be functional. Material reduction or other materials should not affect product protection, safety, or convenience. This is especially important in food packaging because poor packaging can be a factor in product loss and waste (Wohner et al., 2019).

Fifth, packaging designers must view the package as a full consumer interface involving visual communication, physical interaction, and end-of-life problems. The graphics and structures should be attractive, as well as easy to read, easy to use, protected, and have understandable disposal instructions.

Lastly, positive packaging attitudes have a strong influence on purchase intention, but product value is essential and cannot be outdone by packaging perception. Therefore, packaging strategies should be used to augment product quality, price, brand positioning, and availability, and not as a replacement.

Conclusion

Packaging has evolved from its traditional define-and-protect-product purpose to become a significant interface that consumers use to interact with and assess food and beverage products. With the growing significance of visual communication, convenience, and environmental care, a multi-dimensional understanding of packaging is relevant.

In this study, the perceived attributes of food and beverage packaging were explored under the three main dimensions: visual packaging attributes,

functional packaging attributes, and sustainability packaging attributes. The effect of overall consumer perception on the purchasing intention of consumers in Chennai was also analyzed.

The results obtained from the model showed that all three packaging dimensions had a positive and significant effect on consumer perception, with functional attributes emerging as the strongest contributor, followed by sustainability and visual attributes, respectively. Hypotheses H1, H2, and H3 are therefore supported.

The results show that consumers' packaging evaluations have a strong correlation with performance in practice. Product protection, ease of opening, handling, storage, resealability, and information utility are not just technical attributes but parts of consumers' experience with packaged products.

There is also a place for sustainability. Recyclability, environmentally responsible packaging material, reduction in unnecessary packaging waste, and reusability, and information on disposal can enhance packaging assessment. However, the basic criteria of protection and convenience must still be met in sustainable packaging.

Packaging characteristics are also important visual factors that influence consumers' perceptions. The color, graphics, typography, shape, and layout of the package can capture attention and convey product-related messages. However, their structural coefficient is comparatively smaller, which suggests that a good appearance is not enough to result in the highest overall packaging assessment.

Therefore, an important contribution of this study is the demonstration of the complementary nature of packaging dimensions. Consumers are presented with 'whole packages' instead of individual design elements. There is a need for a balance in the visual communication of the product, utility, and environmental responsibility for effective packaging.

Together, the three packaging dimensions account for a substantial share of the variance in consumer perception, and consumer perception, in turn, shows a strong and significant influence on purchase intention, confirming H4. Thus, the principal contribution of this study is to demonstrate that visual, functional, and sustainability attributes

act as complementary rather than competing drivers of consumer response, with a clear behavioral link between packaging perception and purchase intention.

However, packaging should not be seen as the only influence on buying behavior. Other factors, such as price, taste, product quality, brand recognition, nutritional features, availability, promotions, and past experiences, can also play a role in consumer choices.

Based on this study, it can be concluded that the packaging of food and beverages is inherently a multidimensional phenomenon. Consumer evaluations will be more positive if packaging strategies are successful in creating a meaningful visual design, with practical functions and an environmentally responsible identity. This means that packaging ought to be used not only as a protective casing or promotional surface but also as a part of the consumer experience.

This study contributes to the literature by validating an integrated model that links visual, functional, and sustainability packaging attributes to overall consumer perception and purchase intention. Managerially, this study offers packaging manufacturers, marketers, and designers a practical basis for balancing aesthetic, functional, and sustainability investments to strengthen consumer responses rather than treating these dimensions as trade-offs.

This study had some limitations.

The results should be considered in the context of the following limitations. First, the area is limited to only the city of Chennai and hence the results must be treated with caution while generalizing to the consumers across Tamil Nadu and India.

Second, this study uses non-probability convenience sampling. This approach allows access to consumers who are eligible for sampling, but when a comprehensive sampling frame is not available, it does not make the sample of consumers statistically representative.

Third, the study was self-reported. The perceptions and intentions reported in this survey do not necessarily equate with actual actions when it comes to purchasing.

Fourth, their intent to purchase is studied, instead of their actual purchasing behaviour. When consumers say they want to buy, it could be a different reaction when they are faced with real prices, competing products, and availability.

Fifth, there is a broad level examination of food and beverage packaging. Packaging characteristics can be more or less relevant for different types of beverages, dairy products, snacks, ready-to-eat products, etc.

Sixthly, sustainability is assessed from consumer perception rather than from life cycle assessment or other objective environmental assessments. Thus, the positive perception of sustainability should not be understood to mean that the environmental performance is superior.

Lastly, all the numerical results obtained in the present manuscript were obtained from a simulated/model dataset developed for the purposes of methodology and manuscript development. Before the manuscript can be considered empirical research, these numerical results should be substituted with the researcher's own empirical results.

Future Research Directions

This study could be expanded to other cities and replicated to compare consumers between cities, districts, or states. Comparative analysis might lead to the identification of variations in the regional and/or socioeconomic importance of the relative impact of different aspects of visual, functional, and sustainability packaging attributes.

In some cases, where appropriate sampling frames are available, probability-based sampling techniques can be used to achieve better population representation. There could also be product-category specific studies to see if there are differences in packaging priorities between beverages, dairy, snacks, ready-to-eat foods, and other packaged products.

Experimental studies can involve changing various aspects of color, shape, material, environmental information, or opening mechanisms, and the impact on product evaluation and choice can be observed. Future research can also explore actual purchasing behavior in a field experiment through a simulated shopping environment or using a choice-based approach.

The perception vs. actual packaging sustainability should be explored further with additional research, as consumers' environmental perceptions can differ from scientific measurements. Moderators can also include environmental knowledge, environmental concern, price sensitivity, and willingness to pay.

Other opportunities for extending the model include brand familiarity, brand trust, perceived quality, and demographic characteristics. Future research can test whether the visual, functional, and sustainability attributes have a direct impact on purchase intention or if the impact is more through overall consumer perception.

Overall, future studies should continue to explore the potential of combining the three elements of visual attractiveness, functional utility, and environmental responsibility without compromising them.

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