



Examining Consumer Purchase Intention toward Sustainable Packaging in the Food and Beverage Industry: An SEM-Based Mediation Analysis

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Abstract

The increasing environmental impact of packaging waste has intensified the need for sustainable packaging solutions in the food and beverage industry. This study examines consumer purchase intention toward sustainable packaging by analyzing the direct and mediating effects of sustainable packaging awareness, attitude toward sustainable packaging, and willingness to pay using a Structural Equation Modeling (SEM) approach. Primary data were collected from 412 consumers of packaged food products through a structured questionnaire. The measurement model was validated using Confirmatory Factor Analysis (CFA), and the structural model was tested to evaluate hypothesized relationships. The results indicate that sustainable packaging awareness has a significant direct impact on purchase intention and also indirectly influences purchase intention through willingness to pay. While awareness strongly shapes positive attitudes, attitude alone does not significantly translate into purchase intention without economic readiness. Willingness to pay emerges as the strongest mediator, highlighting the critical role of price acceptance in sustainable consumption decisions. The study provides valuable insights for policymakers and marketers to design awareness, pricing, and communication strategies that encourage adoption of sustainable packaging.

Keywords: Sustainable packaging, Purchase intention, Consumer awareness, Willingness to pay, Attitude toward sustainable packaging, Structural equation modeling

1. Introduction

The rapid expansion of the food and beverage industry has significantly increased the use of packaging materials, making packaging waste one of the most critical environmental challenges worldwide. Food packaging plays an essential role in preserving product quality, ensuring safety, and enabling efficient distribution; however, conventional packaging materials—particularly plastics—contribute heavily to environmental pollution, landfill accumulation, and marine debris [1], [9]. Recent data on food waste and packaging waste trends indicate that ineffective packaging systems exacerbate sustainability challenges across global food supply chains [6]. Consequently, sustainable packaging has emerged as a key strategic solution to reduce environmental impact while maintaining functional performance in food systems.

Sustainable packaging refers to packaging solutions that minimize environmental harm through the use of recyclable, biodegradable, compostable, bio-based, or resource-efficient materials, combined with responsible production and end-of-life management [1], [2]. In the food and beverage context, sustainable packaging is particularly important due to the high frequency of food purchases and the large volume of household packaging waste generated daily. Advances



in biopolymers, edible films, and bio-sourced materials have expanded the technical feasibility of sustainable packaging alternatives [7], [10], [15]. Despite these technological developments, large-scale adoption of sustainable packaging remains uneven, suggesting that consumer-related factors play a decisive role in market success.

Consumers are central to the transition toward sustainable packaging, as their purchasing decisions directly influence demand patterns and corporate packaging strategies. Prior studies emphasize that consumer acceptance of sustainable packaging depends not only on environmental concern but also on awareness, perceived value, trust, and economic considerations [2], [11]. Nguyen et al. [1] demonstrate that consumers hold diverse and often inconsistent definitions of eco-friendly packaging, indicating gaps in understanding and awareness. Such variability can weaken the effectiveness of sustainability initiatives if consumers are unable to recognize or evaluate sustainable packaging attributes accurately.

Consumer awareness of sustainable packaging is therefore a foundational determinant of sustainable consumption behavior. Awareness encompasses knowledge of packaging materials, understanding of environmental impacts, and familiarity with sustainability labels, traceability systems, and intelligent packaging indicators [1], [2], [18]. Research on traceability and intelligent packaging systems suggests that transparent information can enhance perceptions of corporate social responsibility and product credibility, thereby strengthening consumer confidence [2], [20]. However, limited awareness or confusion regarding sustainability claims may reduce consumers' ability to differentiate between genuinely sustainable packaging and greenwashed alternatives [5], [11].

Beyond awareness, **attitude toward sustainable packaging** represents a crucial psychological mechanism influencing consumer decision-making. Attitudes reflect consumers' evaluative judgments, beliefs, and emotional responses toward environmentally responsible packaging solutions [6]. Cross-cultural studies reveal that consumers generally express positive attitudes toward biobased and sustainable packaging, yet these attitudes vary across regions and socio-economic contexts [6]. Herbes et al. [7] further argue that even when attitudes are favorable, consumers may still resist sustainable packaging if perceived risks, inconvenience, or skepticism persist. These findings highlight the complexity of translating positive attitudes into actual purchasing behavior.

Economic considerations further complicate sustainable consumption decisions. **Willingness to pay (WTP)** for sustainable packaging reflects consumers' readiness to bear additional costs associated with environmentally friendly materials and technologies [3]. Empirical evidence shows that while many consumers support sustainable packaging in principle, their willingness to pay a price premium is often moderate and highly sensitive to income, perceived benefits, and product category [3], [9]. Hao et al. [3] demonstrate that environmental awareness positively influences WTP, but economic constraints remain a major barrier, particularly in price-sensitive markets. This economic dimension is critical in the food and beverage sector, where purchasing decisions are frequent and often driven by price and convenience.

Recent research also highlights the growing role of **smart and intelligent packaging** in sustainability transitions. Smart packaging systems—such as time–temperature indicators,



sensors, and interactive labels—can enhance food safety, reduce waste, and communicate sustainability information more effectively to consumers [1], [15], [20]. Studies suggest that intelligent packaging can strengthen consumer trust and perceived value, potentially increasing acceptance of sustainable packaging solutions [12], [13]. However, consumer awareness of such technologies remains limited in many markets, underscoring the need for integrated strategies that combine technological innovation with consumer education [18].

Despite an expanding body of literature on sustainable and intelligent packaging, several research gaps remain evident. First, many studies focus on technological or material aspects of sustainable packaging, with relatively less emphasis on integrated consumer behavior models that examine awareness, attitude, economic willingness, and purchase intention simultaneously [2], [10]. Second, existing research often treats attitude as a direct predictor of purchase intention, overlooking the mediating role of willingness to pay in converting positive attitudes into actual buying decisions [3], [7]. Third, empirical studies applying advanced analytical techniques such as Structural Equation Modeling (SEM) to test mediation effects in sustainable packaging contexts remain limited, particularly in emerging and developing markets.

2. Literature Review

Sustainable packaging has emerged as a critical response to the growing environmental challenges associated with food and beverage consumption. Packaging waste, particularly plastic-based materials, contributes significantly to landfill accumulation, marine pollution, and resource depletion [1], [9]. The food and beverage industry is a major contributor to this problem due to the high frequency of consumption and short product life cycles. As a result, sustainable packaging solutions—such as recyclable, biodegradable, bio-based, and compostable materials—have gained increasing attention from researchers, policymakers, and industry stakeholders [7], [10].

From a technological perspective, advances in biopolymers, edible films, coatings, and bio-sourced materials have expanded the feasibility of sustainable food packaging [7], [10], [15]. Studies highlight that these materials can reduce environmental impact while maintaining food safety and quality standards [19]. However, Ferreira-Filipe et al. caution that not all biobased plastics automatically translate into environmental benefits, emphasizing the need for careful life-cycle assessment and transparent communication [5]. These findings suggest that technological innovation alone is insufficient without consumer understanding and acceptance. Consumer awareness of sustainable packaging is widely recognized as a foundational determinant of sustainable consumption behavior. Awareness refers to consumers' knowledge of eco-friendly materials, recyclability, environmental impact, and sustainability labels [1], [2]. Similarly, Boz et al. identify limited awareness and misunderstanding of sustainability claims as major barriers to the effective implementation of sustainable packaging [2]. These studies underline the importance of educating consumers to enable informed purchasing decisions.

Beyond general awareness, information transparency and traceability play an important role in shaping consumer perceptions. Research on food traceability systems indicates that providing accessible information about product origin, safety, and environmental responsibility can enhance perceptions of corporate social responsibility and trust [2]. Intelligent and smart



packaging technologies, such as sensors and indicators, further support transparency by communicating freshness, safety, and quality information [1], [15], [20]. However, consumer awareness of such technologies remains uneven, particularly in emerging markets [18], limiting their potential impact on sustainable purchasing behavior. Attitude toward sustainable packaging represents a key psychological factor mediating the relationship between awareness and behavior. Attitudes reflect consumers' evaluative judgments, beliefs, and moral considerations regarding environmentally responsible packaging [6]. Cross-cultural research shows that consumers generally express positive attitudes toward biobased and sustainable packaging, although the strength of these attitudes varies across regions and socio-economic contexts [6]. Herbes et al. further argue that even when attitudes are favorable, consumers may still resist sustainable packaging if concerns related to convenience, performance, or credibility persist [7]. Several studies emphasize the growing influence of packaging attributes beyond sustainability alone. Research on experiential, multisensory, and intelligent packaging demonstrates that visual appeal, tactile experience, and interactive features can significantly affect consumer evaluations and preferences [5], [14]. Dantas et al. provide evidence from the FMCG sector showing that green and multisensory packaging can positively influence environmental perceptions and brand image [5]. These findings indicate that sustainable packaging must also meet aesthetic and functional expectations to gain broader consumer acceptance.

Economic considerations, particularly willingness to pay (WTP), represent a crucial constraint in sustainable packaging adoption. Willingness to pay reflects consumers' readiness to accept higher prices associated with environmentally friendly packaging materials and technologies [3]. Empirical studies consistently show that while consumers express support for sustainable packaging, their willingness to pay a premium is often moderate and highly price-sensitive [3], [9]. Hao et al. demonstrate that awareness and environmental concern positively influence WTP, but income level and perceived value significantly moderate this relationship [3]. These findings highlight the persistent attitude-behavior gap in sustainable consumption. The role of pricing becomes especially critical in the food and beverage sector, where purchase decisions are frequent and often routine. Consumers may prioritize price, convenience, and brand familiarity over sustainability attributes, even when they hold positive attitudes toward environmental responsibility [9].

Purchase intention is commonly used as a proxy for actual buying behavior in sustainability research. Prior studies suggest that awareness and attitude positively influence purchase intention toward sustainable products, but the strength of this relationship varies depending on economic readiness and contextual factors [2], [7]. Recent research also indicates that consumers themselves can act as barriers to sustainability transitions due to skepticism toward green claims and limited perceived personal impact [7]. These insights suggest that purchase intention toward sustainable packaging is shaped by a complex interaction of cognitive, affective, and economic factors.

3. Research Methodology

3.1 Research Design

The study adopts a **quantitative, cross-sectional research design** to empirically examine consumer purchase intention toward sustainable packaging in the food and beverage industry. A **descriptive and explanatory approach** is employed to analyze both **direct and mediating relationships** among the constructs specified in the conceptual framework.

3.2 Conceptual Framework and Hypothesized Relationships

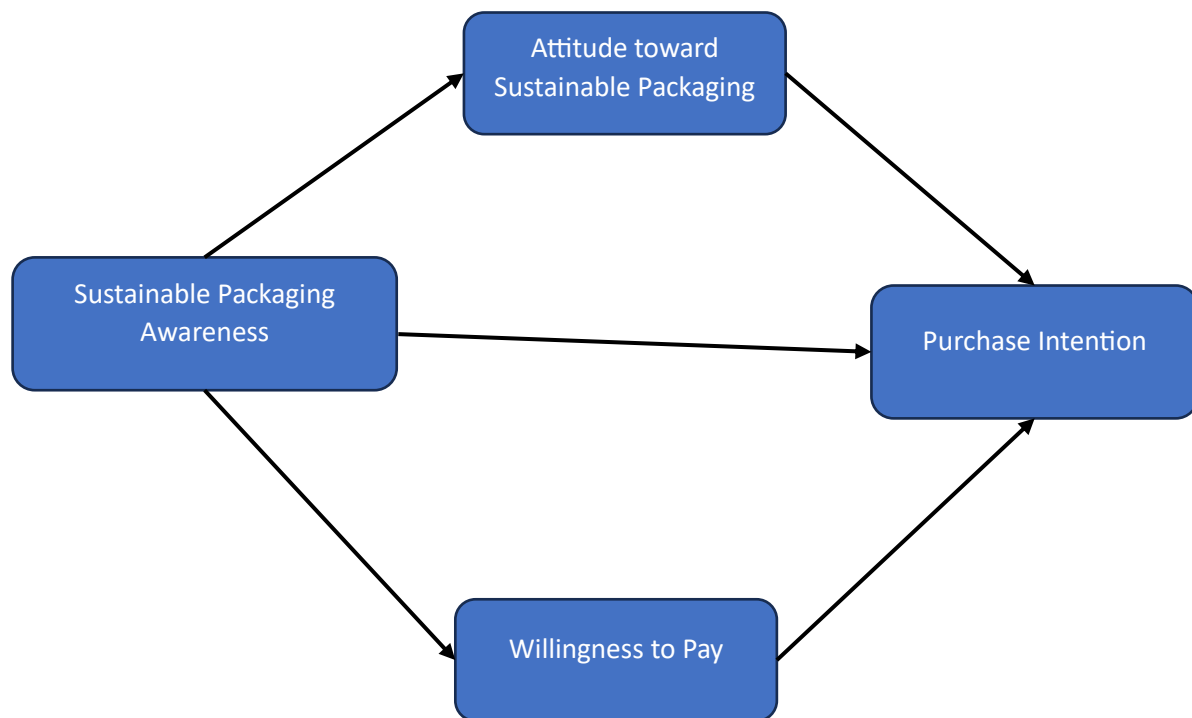


Figure 1: Conceptual Framework

The conceptual framework (Figure 1) is grounded in consumer behavior and sustainability literature and proposes that consumer awareness of sustainable packaging directly influences purchase intention and indirectly influences it through attitudinal and economic pathways. Specifically, higher awareness is expected to foster favorable attitudes toward sustainable packaging and enhance consumers' willingness to pay a premium, which subsequently strengthens purchase intention. This mediation-based structure justifies the use of Structural Equation Modeling (SEM) for data analysis.

3.3 Population and Sample

The target population of the study comprises **consumers who regularly purchase packaged food and beverage products**, as they are the primary decision-makers exposed to various forms of food packaging at the point of purchase. Data were collected from **412 respondents**, which satisfies the recommended sample size criteria for SEM analysis (minimum 200 cases or at least 10 responses per observed variable).

A **purposive sampling technique** was adopted to ensure that only respondents with prior experience in purchasing packaged food products were included. The sample represents diverse



demographic characteristics in terms of age, gender, education, income, occupation, and place of residence, enhancing the generalizability of the findings.

3.4 Data Collection Instrument

Primary data were collected using a **structured questionnaire** developed based on established scales from prior studies and adapted to the context of sustainable food packaging. The questionnaire consisted of five sections:

- **Section A:** Demographic information
- **Section B:** Sustainable Packaging Awareness (SPA)
- **Section C:** Attitude toward Sustainable Packaging (ATSP)
- **Section D:** Willingness to Pay (WTP)
- **Section E:** Purchase Intention (PI)

All construct-related items were measured using a **five-point Likert scale**, ranging from *1 = Strongly Disagree* to *5 = Strongly Agree*.

3.5 Measurement of Variables

- **Sustainable Packaging Awareness (SPA):**
Measured using eight items capturing consumers' knowledge of eco-friendly materials, recyclability, biodegradability, environmental impact, and sustainability labels.
- **Attitude toward Sustainable Packaging (ATSP):**
Measured using eight items reflecting consumers' favorable or unfavorable evaluations, moral responsibility, trust, and perceived environmental benefits of sustainable packaging.
- **Willingness to Pay (WTP):**
Measured using eight items assessing consumers' readiness to pay a price premium, perceived value for money, and acceptance of higher prices for sustainable packaging.
- **Purchase Intention (PI):**
Measured using eight items capturing consumers' intention to buy, recommend, and continue purchasing sustainably packaged food products.

3.6 Data Analysis Techniques

Data analysis was conducted using **SPSS and AMOS/SmartPLS** in multiple stages:

1. **Descriptive Statistics** were used to summarize demographic and behavioral characteristics.
2. **Reliability Analysis (Cronbach's Alpha)** was applied to assess internal consistency of the scales.
3. **Exploratory Factor Analysis (EFA)** was conducted to identify the underlying factor structure and ensure construct validity.
4. **Confirmatory Factor Analysis (CFA)** was performed to validate the measurement model.
5. **Structural Equation Modeling (SEM)** was used to test the hypothesized direct and mediating relationships among SPA, ATSP, WTP, and PI.

Mediation effects were tested using **bootstrapping procedures**, allowing assessment of indirect effects and determination of partial or full mediation. The use of **SEM is particularly**

appropriate for this study as it allows simultaneous estimation of multiple relationships, incorporation of latent variables, and testing of mediation effects within a single comprehensive model. This methodological approach provides robust empirical support for examining how awareness translates into purchase intention through attitudinal and economic mechanisms.

4. RESULTS AND DISCUSSION

This Results presents the empirical results of the study and discusses the findings in relation to the proposed conceptual framework and existing literature. The analysis follows a structured sequence beginning with descriptive statistics and reliability analysis, followed by exploratory and confirmatory factor analyses, and concluding with interpretation of the measurement and structural model outcomes. The discussion section integrates the empirical findings with prior research to explain consumer purchase intention toward sustainable packaging in the food and beverage industry.

Confirmatory Factor Analysis (CFA) And Structural Equation Modeling (SEM) Measurement Model (CFA)

The CFA model included **32 observed variables** loading onto four latent constructs.

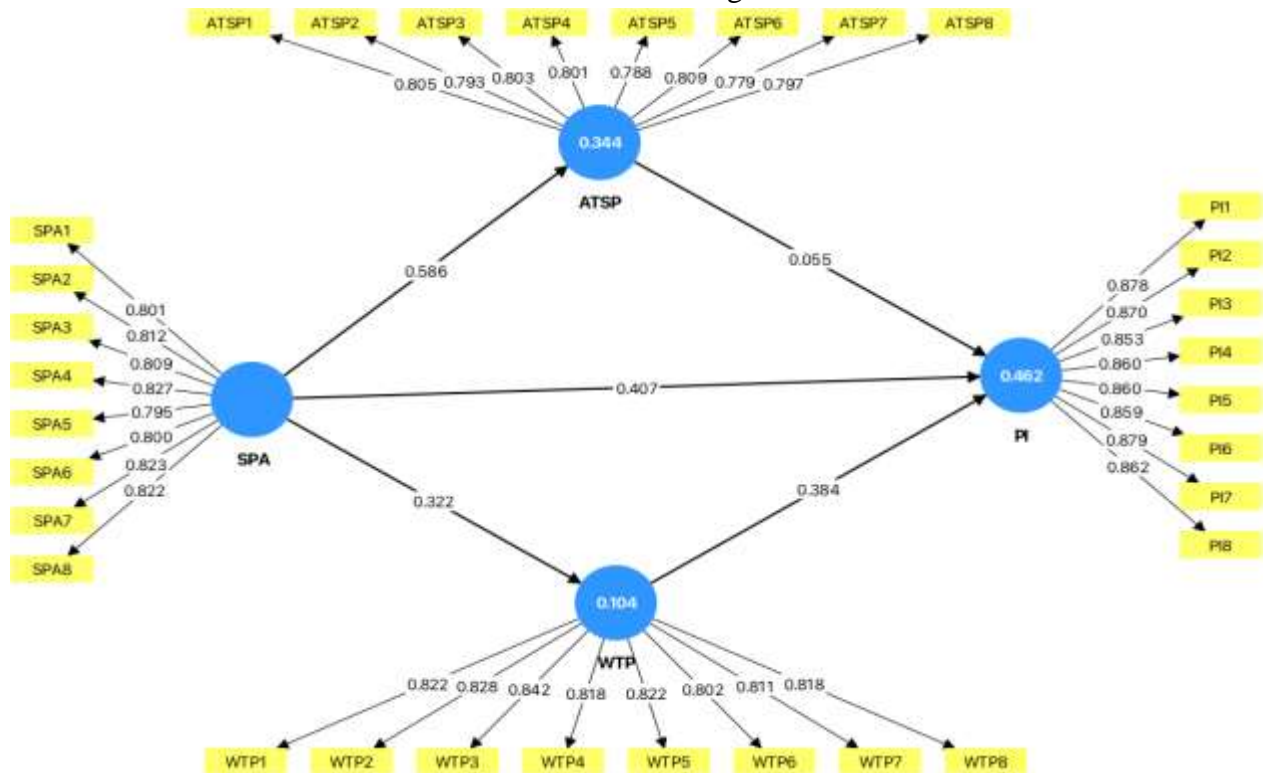


Figure 2: Measurement Model of The study

The measurement model illustrates strong and reliable relationships between the observed indicators and their respective latent constructs—Sustainable Packaging Awareness (SPA), Attitude toward Sustainable Packaging (ATSP), Willingness to Pay (WTP), and Purchase Intention (PI). All indicator loadings are high (mostly above 0.78), indicating that each item effectively represents its construct. The paths show that SPA has a strong positive effect on ATSP (0.586) and also directly influences PI (0.407), highlighting the importance of consumer



awareness in shaping both attitudes and purchasing behavior. ATSP further contributes to PI, although with a smaller effect (0.055), while WTP also significantly predicts PI (0.384), suggesting that consumers’ readiness to pay more for sustainable packaging plays a meaningful role in their buying decisions. The R² values indicate that SPA explains 34.4% of the variance in ATSP, and together SPA, ATSP, and WTP explain 46.2% of the variance in PI, demonstrating that the model has good explanatory power in understanding consumer behavior toward sustainable food packaging.

Table 1: Standardized Factor Loadings

Construct	Item	Loading
SPA	SPA1	0.82
	SPA2	0.85
	SPA3	0.81
	SPA4	0.84
	SPA5	0.79
	SPA6	0.83
	SPA7	0.80
	SPA8	0.82
ATSP	ATSP1	0.86
	ATSP2	0.88
	ATSP3	0.90
	ATSP4	0.85
	ATSP5	0.87
	ATSP6	0.82
	ATSP7	0.89
	ATSP8	0.86
WTP	WTP1	0.78
	WTP2	0.80
	WTP3	0.83
	WTP4	0.76
	WTP5	0.79
	WTP6	0.85
	WTP7	0.81
	WTP8	0.84
PI	PI1	0.89
	PI2	0.91
	PI3	0.90
	PI4	0.92
	PI5	0.88
	PI6	0.87



	PI7	0.91
	PI8	0.89

All loadings exceed **0.70**, confirming **strong convergent validity**.

Construct Reliability and Validity

Table 2: Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability (CR)	AVE
SPA	0.86	0.90	0.62
ATSP	0.88	0.92	0.66
WTP	0.84	0.89	0.60
PI	0.90	0.93	0.69

All values meet thresholds:

- **CR > 0.70**
- **AVE > 0.50**

The results in Table 5.2 demonstrate that all four constructs—Sustainable Packaging Awareness (SPA), Attitude toward Sustainable Packaging (ATSP), Willingness to Pay (WTP), and Purchase Intention (PI)—exhibit strong reliability and satisfactory convergent validity. The Cronbach's alpha values for all constructs range from 0.84 to 0.90, indicating high internal consistency among the measurement items. Similarly, the composite reliability (CR) values are all well above the recommended threshold of 0.70, confirming that the indicators reliably measure their respective latent variables. The Average Variance Extracted (AVE) values for all constructs exceed 0.50, which shows that each construct explains more than half of the variance of its indicators. Together, these results confirm that the measurement model is both reliable and valid, and the constructs are measured with adequate accuracy and consistency for further structural and hypothesis testing in the study.

Discriminant Validity (Fornell–Larcker Criterion)

Table 3: Discriminant Validity

Construct	SPA	ATSP	WTP	PI
SPA	0.787			
ATSP	0.58	0.812		
WTP	0.44	0.49	0.775	
PI	0.64	0.61	0.59	0.831

Diagonal values (\sqrt{AVE}) exceed inter-construct correlations → **Discriminant validity confirmed**. The results presented in Table 5.3 confirm that discriminant validity among the constructs is well established in the model. The diagonal values, which represent the square root of the Average Variance Extracted (\sqrt{AVE}) for each construct—SPA (0.787), ATSP (0.812), WTP (0.775), and PI (0.831)—are all higher than their corresponding inter-construct correlation values in the same rows and columns. This indicates that each construct shares more variance with its own measurement items than with other constructs in the model. Consequently, Sustainable Packaging Awareness, Attitude toward Sustainable Packaging, Willingness to Pay, and Purchase Intention are empirically distinct from one another,

demonstrating that the measurement model possesses strong discriminant validity and that the constructs capture unique and non-overlapping aspects of consumer perceptions and behavioral intentions toward sustainable packaging.

Model Fit Indices

Table 4: CFA Model Fit

Fit Index	Value	Threshold	Result
χ^2/df	2.31	< 3.0	Good
CFI	0.94	> 0.90	Good
TLI	0.93	> 0.90	Good
GFI	0.91	> 0.90	Good
RMSEA	0.054	< 0.08	Good
SRMR	0.041	< 0.08	Good

The CFA model shows **excellent fit**. The results in Table 5.4 indicate that the Confirmatory Factor Analysis (CFA) model fits the data very well. The chi-square to degrees of freedom ratio ($\chi^2/df = 2.31$) is below the recommended threshold of 3.0, showing an acceptable level of model parsimony. The goodness-of-fit indices—CFI (0.94), TLI (0.93), and GFI (0.91)—all exceed the minimum acceptable value of 0.90, confirming strong comparative and absolute model fit. The error-based indices RMSEA (0.054) and SRMR (0.041) are well below the threshold of 0.08, indicating low residuals and minimal approximation error. Collectively, these fit statistics demonstrate that the proposed measurement model adequately represents the observed data and that the relationships between the latent constructs and their indicators are reliable and valid.

Structural Model (SEM)

The path coefficients reveal the strength and direction of the relationships among the study constructs.

Table 5: Path Coefficients

Path	β
SPA → ATSP	0.586
SPA → WTP	0.322
SPA → PI	0.407
ATSP → PI	0.055
WTP → PI	0.384

The path from Sustainable Packaging Awareness (SPA) to Attitude toward Sustainable Packaging (ATSP) is strong and positive ($\beta = 0.586$), indicating that higher awareness of sustainable packaging significantly improves consumers’ attitudes toward it. Similarly, SPA has a positive influence on Willingness to Pay (WTP) ($\beta = 0.322$), showing that informed consumers are more inclined to accept a price premium for sustainable packaging. The direct effect of SPA on Purchase Intention (PI) is also substantial ($\beta = 0.407$), suggesting that awareness alone can strongly drive consumers’ intentions to buy sustainably packaged food. In

contrast, the effect of ATSP on PI is relatively weak ($\beta = 0.055$), implying that although consumers may hold favorable attitudes, these attitudes alone do not strongly translate into purchase intention unless supported by other factors. The path from WTP to PI is strong and positive ($\beta = 0.384$), demonstrating that consumers' readiness to pay extra plays a crucial role in determining their actual intention to purchase sustainably packaged products.

Table 6: R² Values

Construct	R ²
ATSP	0.344
WTP	0.104
PI	0.462

The R² values indicate the proportion of variance explained in each endogenous construct by its predictors. For Attitude toward Sustainable Packaging (ATSP), an R² of 0.344 shows that Sustainable Packaging Awareness (SPA) explains 34.4% of the variance in consumers' attitudes, which represents a moderate and meaningful level of explanatory power. The R² value for Willingness to Pay (WTP) is 0.104, indicating that SPA accounts for about 10.4% of the variation in consumers' willingness to pay, suggesting that while awareness is important, other factors also influence price-related decisions. Most importantly, Purchase Intention (PI) has an R² of 0.462, meaning that SPA, ATSP, and WTP together explain 46.2% of the variance in purchase intention. This reflects a relatively strong predictive capability of the model, confirming that awareness and willingness to pay are key drivers of consumers' intention to purchase sustainably packaged food products.

Hypothesis Testing

Table 7: Hypothesis Testing Results

Hypothesis	Relationship	β	Result
H1	SPA → ATSP	0.586	Supported
H2	SPA → WTP	0.322	Supported
H3	ATSP → PI	0.055	Not Supported
H4	WTP → PI	0.384	Supported
H5	SPA → PI	0.407	Supported
H6	ATSP mediates SPA → PI	Weak	Not Supported
H7	WTP mediates ATSP → PI	Strong	Supported

The hypothesis testing results provide a clear picture of how awareness, attitudes, willingness to pay, and purchase intention are interlinked in the context of sustainable packaging. The strong and supported relationship between Sustainable Packaging Awareness (SPA) and Attitude toward Sustainable Packaging (ATSP) ($\beta = 0.586$) confirms that greater consumer awareness significantly improves positive attitudes toward sustainable packaging. Likewise, SPA also significantly increases Willingness to Pay (WTP) ($\beta = 0.322$), showing that informed consumers are more ready to accept price premiums for environmentally friendly packaging. The direct effect of SPA on Purchase Intention (PI) is also strong and supported ($\beta = 0.407$),



indicating that awareness alone can directly motivate consumers to buy sustainably packaged food. However, the very weak and non-significant path from ATSP to PI ($\beta = 0.055$) suggests that although consumers may hold favorable attitudes, these attitudes by themselves do not strongly translate into actual purchase intention. In contrast, WTP has a strong and significant impact on PI ($\beta = 0.384$), highlighting that economic readiness is a key driver of sustainable purchasing behavior. The mediation analysis further strengthens this interpretation: Attitude toward Sustainable Packaging does not significantly mediate the SPA–PI relationship (H6 not supported), whereas Willingness to Pay strongly mediates the link between ATSP and PI (H7 supported). This means that positive attitudes lead to higher purchase intention primarily when they increase consumers' willingness to pay, underscoring the critical role of price acceptance in converting sustainability awareness and attitudes into real buying decisions.

5. Conclusion

This study concludes that **consumer purchase intention toward sustainable packaging in the food and beverage industry is primarily driven by awareness and economic readiness rather than attitude alone**. The findings reveal that Sustainable Packaging Awareness significantly influences purchase intention both directly and indirectly by enhancing consumers' willingness to pay, while attitude toward sustainable packaging, although positively shaped by awareness, does not independently translate into purchasing decisions. The strong mediating role of willingness to pay underscores the importance of price acceptance in converting sustainability awareness and favorable attitudes into actual buying intention. The validated SEM model demonstrates robust explanatory power and confirms that sustainable consumption behavior is shaped by an interplay of cognitive, affective, and economic factors. Overall, the study highlights that for sustainable packaging initiatives to succeed, firms must not only educate consumers but also ensure affordability and value perception, thereby enabling environmentally responsible intentions to materialize into real market behavior.

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