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Sustainable Packaging Trends in the Beverage Industry: A Study on Production, Supply Chain, and Consumer Behavior

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ABSTRACT

This study investigates the factors that influence sustainable packaging trends in the beverage industry, focused on sustainable manufacturing, global supply chain coordination, and consumer behavior in emerging regions. While previous studies examined environmental innovation and consumer preferences separately, this study integrates both by analyzing firm practices, willingness to pay (WTP), and the moderating role of consumer perception. A quantitative approach was used, with 385 responses collected through stratified random selection from four stakeholder groups: customers, students, retail workers, and sustainability specialists. SPSS and AMOS were used to conduct data analysis, which included EFA, CFA, SEM, and moderation. Sustainable manufacturing has a positive influence on global supply chain (β=0.622) and a considerable impact on packaging outcomes, both directly (β=0.362) and through the global supply chain (indirect effect =0.243), which in turn has a direct impact (β=0.391) on sustainable packaging trends in the beverage industry. Accordingly, WTP increases packaging adoption (β=0.251), which is further amplified by positive consumer perception (β=0.557). The study provides new insights into how circular economy activities and perceptual alignment might promote sustainable packaging reform and offers actionable recommendations for beverage companies and governments to align operational practices.

1. INTRODUCTION

The issue of "sustainable packaging trends in the beverage industry" is becoming increasingly urgent as environmental concerns and consumer expectations evolve. Despite growing interest, the sector still faces fragmented implementation, cost constraints, and technological restrictions [1]. According to scholars, while sustainable materials such as bioplastics or recycled content are accessible, their widespread adoption is hampered by varying regulatory standards and scaling concerns [2]. Furthermore, the disparity between company sustainability promises and real customer behavior complicates strategic alignment [3]. A fundamental gap exists in understanding how systemic industrial reforms can balance profitability and environmental stewardship, particularly in international supply chains. Addressing this research issue is critical for enabling the beverage industry to adopt circular economy principles while maintaining customer trust and long-term competitiveness.

Existing studies highlight the importance of sustainable packaging in the beverage industry, with a focus on consumer behavior [3] and manufacturing practice changes [1]. While these studies provide useful insights, they frequently approach supply chains as peripheral elements, rarely investigating their function in moderating the relationship between sustainable production and packaging trends. Similarly, the moderating influence of customer perception on the relationship between willingness to pay (WTP) and sustainable packaging uptake is not well understood [2]. This study addresses these gaps by looking into a comprehensive framework that considers consumer behavior, sustainable manufacturing, global supply chain mediation, and perceptual moderation. This provides a more detailed knowledge of how these components interact to drive sustainable packaging trends in the beverage industry.

To increase theoretical understanding of this topic, the study involves addressing the following research questions:

How does the adoption of a sustainable production affect sustainable packaging trends in the beverage sector?

What is the relationship between sustainable production and the global sustainable supply chain (GSSC)?

To what extent does the GSSC positively impact sustainable packaging trends in the beverage industry through the influence of sustainable production?

To what extent does consumers' WTP influence sustainable packaging trends in the beverage industry?

How does customer perception moderate the relationship between consumers' WTP and sustainable packaging trends in the beverage industry?

This study, guided by five research questions, seeks to comprehensively explore the key elements impacting sustainable packaging developments in the beverage industry. It aims to determine the extent to which customers' WTP drives sustainable packaging adoption, as well as how sustainable production contributes to the development of environmentally friendly packaging options. In doing so, the study investigates the relationship between sustainable production practices and the GSSC, assessing how the latter mediates the impact of production on packaging trends. Furthermore, it looks into how customer perception influences the relationship between consumer WTP and acceptance of sustainable packaging. Aside from these empirical goals, the study aims to add to the theoretical discourse by incorporating perspectives on sustainable production, supply chain dynamics, and consumer behavior. Finally, the research delivers strategic recommendations to industry stakeholders and policymakers on how to create successful, scalable, and consumer-centered packaging strategies that are in line with global sustainability goals.

2. LITERATURE REVIEW

2.1 Sustainable packaging trends in the global beverage industry

Sustainable packaging refers to packaging solutions designed to minimize environmental impact across their entire lifecycle, from production to disposal [4]. In the beverage sector, this involves using materials and designs that conserve resources, enhance recyclability, and reduce greenhouse gas emissions [5]. It reflects a balance between environmental responsibility and cost-efficiency [6].

Key trends in sustainable beverage packaging include material innovation, weight reduction, and recycling initiatives. To improve recycling rates, companies are investing in supportive infrastructure and engaging consumers. Lightweight and compact packaging not only conserves materials but also enhances transport efficiency by reducing fuel use and emissions [7]. These practices help companies meet international environmental standards and streamline global operations. Furthermore, adopting sustainable packaging strengthens brand image and appeals to environmentally conscious consumers worldwide [8].

2.2 Anchoring the theoretical framework

2.2.1 The theory of planned behavior

The theory of planned behavior (TPB), first suggested by Ajzen [9], offers a valuable theoretical framework for understanding consumer decision-making in the context of sustainable packaging. According to TPB, three major elements influence an individual's intention to engage in a specific action: attitude toward the behavior, subjective norms, and perceived behavioral control. Consumers' WTP is influenced by their attitudes toward environmental responsibility, perceived social expectations around sustainability, and their perceived ability to buy environmentally friendly packaging. This theory helps to explain how *customer perception moderates the impact of WTP on sustainable packaging trends*. Customer perception, determined by awareness, product labeling, and marketing communication, determines how consumers weigh the environmental advantages versus the cost. Empirical evidence confirms the importance of TPB in sustainability studies. For example, Yadav and Pathak [10] discovered that good customer attitudes and social norms strongly influence WTP for green products.

Based on this, the study assumes WTP for sustainable packaging is influenced by their environmental attitudes, perceived social pressure, and sense of control over buying green items [9]. Furthermore, it is anticipated that customer perception, shaped by awareness, labeling, and marketing, moderates this relationship by determining how strongly WTP translates into genuine support for sustainable packaging [11].

2.2.2 The natural-resource-based view

Hart [12] introduced the natural-resource-based view (NRBV), which offers a compelling perspective on how companies' *sustainable production* strategies contribute to competitive advantage and industry-wide *sustainability trends*. According to NRBV, enterprises can obtain long-term competitive advantage by developing capabilities in three critical areas: pollution avoidance, product stewardship, and sustainable development. In the beverage industry, the adoption of sustainable production, such as implementing biodegradable packaging, enhancing energy efficiency, and lowering carbon footprints, aligns with these capabilities, driving industry-wide moves towards sustainable packaging trends. The NRBV framework also supports the GSSC's function in mediating the transition from sustainable production to widespread acceptance of sustainable packaging. Empirical evidence supports the use of NRBV in sustainable development plans. Cheng et al. [13] discovered that organizations that invest in green innovation not only lower their environmental impact but also improve their market reputation and customer loyalty. By stressing resource efficiency and environmental responsibility, NRBV highlights the interdependence of production methods, supply chain dynamics, and industry-wide sustainability trends. Firms that align their strategy goals with NRBV principles are better positioned to meet regulatory requirements, consumer expectations, and market pressures for environmentally friendly packaging solutions. This theoretical integration contributes to the study's framework by demonstrating how sustainable production, facilitated by a GSSC, promotes the transformation of packaging trends in the beverage industry.

Based on the NRBV, this study assumes that companies that implement sustainable production practices, such as lowering emissions, increasing energy efficiency, and employing biodegradable materials, will enjoy a long-term competitive advantage and contribute to sustainable packaging trends [12]. It further proposes that the GSSC mediates this link by allowing for the effective adoption and scaling of these sustainable practices across manufacturing and distribution networks [14]. As a result, organizations that incorporate sustainability into both their operations and supply chains are more likely to shape packaging practices across the industry.

2.3 Determinants of sustainable packaging trends in the beverage industry

2.3.1 Sustainable production

Sustainable production is defined as “the creation of goods and services using processes and systems that are non-polluting, conserve energy and natural resources, are economically viable, and safe for workers, communities, and consumers” [15]. It integrates the three pillars of sustainable development, environmental, social, and economic,

throughout the value chain. Its role in the socioeconomic landscape is pivotal, balancing profitability with environmental and social responsibility to enhance long-term competitiveness [16].

Well-managed sustainable manufacturing can significantly influence packaging trends in the beverage industry. Companies that employ eco-friendly materials and methods can reduce their environmental impact while achieving customer expectations for sustainability. For example, using biodegradable packaging enhances environmental outcomes and strengthens brand reputation and customer loyalty [13]. Empirical studies show that sustainable production has a positive impact on packaging trends. Hassan et al. [17] discovered that integrating sustainability into supply chains improves efficiency and resilience, with sustainable supply chains mediating the adoption of eco-friendly packaging. Furthermore, client demand for ecologically friendly products has driven companies to innovate in packaging, culminating in an industry-wide shift toward sustainability [18].

There is an ongoing debate over the extent to which sustainable production influences packaging patterns. Some study suggests a high positive correlation, meaning that sustainable manufacturing practices instantly lead to more sustainable packaging possibilities [19]. Other research, however, reveals a more nuanced link, moderated by factors like as consumer education, regulatory frameworks, and economic incentives [20]. Grounded in ecological economics, sustainable production challenges neoclassical models by emphasizing environmental limits, resource efficiency, and long-term resilience over short-term gains [21]. The beverage industry's sustainable production encourages closed-loop solutions and low-carbon packaging, which align with circular economy goals [22]. Companies that take this approach increase their supply chain resilience and market credibility, establishing sustainability as a strategic driver of packaging innovation [23].

This study contends, using the TPB and the NRBV, that sustainable production influences packaging trends through both external and internal forces. TPB describes how customers' WTP, influenced by environmental sentiments, social conventions, and perceived control, drives demand for sustainable packaging. In response, NRBV emphasizes how companies get a competitive edge by implementing environmentally friendly practices such as employing biodegradable materials and increasing energy efficiency [11, 17]. Collectively, these perspectives support:

Hypothesis 1: Sustainable production positively affects sustainable packaging trends in the global beverage industry.

2.3.2 Impact of sustainable production on the GSSC in the beverage industry

Implementing sustainable production effectively enhances GSSC in the beverage industry by incorporating environmental, ethical, and efficiency factors into upstream sourcing, core manufacturing, and downstream logistics. Beverage companies that use cleaner manufacturing methods, lower emissions, and practice responsible sourcing not only minimize environmental risks but also produce ripple effects that improve transparency, traceability, and ethical accountability across the supply chain [24]. These practices contribute to stronger supplier relationships, better compliance with international standards, and lower exposure to reputational and operational hazards.

Numerous studies have demonstrated the powerful and positive influence of sustainable manufacturing on GSSC development. Saad et al. [25] discovered that sustainability-focused manufacturers have better alignment with international buyers, stronger supplier integration, and more supply resilience in uncertain markets. Similarly, Schaltegger et al. [26] contended that sustainability-oriented production serves as a strategic competency, allowing businesses to create and organize supply networks that are not only efficient but also environmentally and socially sound.

The impact of sustainable production is especially noticeable in global beverage companies attempting to reach SDG-aligned commitments. For instance, Coca-Cola's water-neutral production initiatives in India and Brazil spurred suppliers to adopt water recycling and agroecological practices [27]. The organizational shifts demonstrate sustainable manufacturing not only improves internal efficiency but promotes sector-wide adoption of responsible practices, hence improving sustainability of global value chains [23].

Nonetheless, some research suggests that the relationship between sustainable production and GSSC outcomes is context-dependent, influenced by institutional infrastructure, regulatory pressure, and cost feasibility. According to Saqib and Zhang [28], major benefits arise only where regulatory and institutional conditions are favorable; otherwise, the impact may be limited. This disagreement is based on ecological modernization theory, which claims that environmental improvements can coexist with economic expansion through technical innovation and institutional reform [29]. From a conceptual standpoint, institutional economics emphasizes the importance of norms and governance in directing organizational behavior towards sustainability [30].

Drawing on the NRBV and the TPB, this study proposes that sustainable production is critical to strengthening the beverage industry's GSSC. NRBV highlights that companies that embrace sustainable practices, such as lowering emissions, conserving resources, and sourcing ethically, create competencies that improve long-term competitiveness and supply chain resilience [17]. At the same time, TPB explains how customer expectations, driven by pro-environmental attitudes and perceived norms, apply external pressure on businesses to adopt these sustainable practices, influencing how supply chains are constructed and handled [11]. Together, these ideas argue that sustainable manufacturing serves as both a strategic response to consumer-driven sustainability demands and a driver for enhanced environmental and ethical performance across global supply chains. Thus, the authors propose:

Hypothesis 2: Sustainable production positively impacts GSSC in global beverage industry.

2.3.3 Global sustainable supply chain

A global sustainable supply chain (SSC) refers to the strategic coordination of supply chain activities across countries that incorporate environmental, social, and economic sustainability objectives [31]. Carter and Rogers [32] also define sustainable supply chain management as strategically coordinating supply activities across borders with sustainability goals, where sustainable production drives packaging outcomes in the beverage industry. As stated by Gao et al. [33], in emerging economies, the need to balance sustainability with operational efficiency has made SSC a competitive necessity in sectors such as food and beverage.

Sustainable production is expected to improve packaging

sustainability outcomes, but such improvements are realized through SSCs by sourcing biodegradable materials, enforcing labor and environmental standards, and enabling recycling logistics. According to Seuring and Müller [34], sustainable supply chains are seen as mechanisms that translate upstream production decisions into downstream sustainable outcomes, thus acting as an active conduit for system-wide sustainability. In the beverage sector, Verghese and Lewis [35] emphasize that packaging sustainability relies not only on internal design but also on the coordination of supply networks that facilitate eco-innovation throughout all stages. The research shows that when SSC practices are fully adopted, the influence of sustainable production on packaging outcomes is significantly amplified. Philosophically, this reflects an ethics-of-care approach, where sustainability is embedded in long-term relationships across borders [36]. Economically, this is supported by Porter and van der Linde [37], who argue that proactive environmental strategies through supply chains can create “innovation offsets” and reduce total system costs.

Conversely, other studies suggest that SSC’s role as a mediator can be conditional or neutral. Pagell and Shevchenko [38] warn that sustainability in supply chains often collapses under conflicting pressures like cost constraints, lack of supplier readiness, or weak institutional support. From a utilitarian economic perspective, firms tend to adopt sustainability only when it aligns with profit motives. Without enabling infrastructure, SSC becomes a symbolic gesture rather than an effective mediator [39]. Thus, SSCs plays a critical yet contingent mediating role, strengthening the link between sustainable production and packaging when supported by ethics, regulation, and market alignment, but vulnerable to real-world barriers in developing contexts.

According to NRBV, firms that incorporate environmental sustainability into their operations gain strategic advantages by coordinating capabilities across their supply networks, whereas TPB contends that rising consumer expectations, driven by environmental attitudes and perceived social norms, put pressure on firms to meet sustainability targets, particularly in packaging [17]. A well-functioning SSC operationalizes these pressures by allowing for the acquisition of environmentally friendly materials, enforcing ethical standards, and encouraging recycling logistics, thereby increasing the impact of sustainable production on packaging trends [40]. When linked with both internal strategies (NRBV) and external behavioral expectations (TPB), SSC serves as a critical channel for establishing system-wide sustainability. Thus, the authors propose:

Hypothesis 3: A GSSC positively impacts sustainable packaging trends in the beverage industry through the influence of sustainable production.

2.3.4 Consumers' WTP

A consumer’s WTP is the highest price a customer is willing to pay for a product or service [41]. This statistic is critical for organizations seeking to set prices that attract customers while increasing profitability. WTP is influenced by a variety of factors, including economic conditions, market trends, geographical location, product quality, and brand loyalty. It can be assessed using a variety of approaches, including the Gabor-Granger method, Van Westendorp's price sensitivity meter, and conjoint analysis [41].

The theoretical framework of WTP is rooted in several economic and psychological theories, such as the TPB and Behavioral Economic Factors, that explain how consumers evaluate value and make purchase decisions. Under TPB, favorable product attitudes, perceived social pressure, and financial confidence all increase intention to pay [42]. Empirical studies have verified this concept; for example, a study by Doli et al. [43] on urban park conservation discovered that visitors' favorable attitudes and moral obligation significantly predicted their WTP for park maintenance. Philosophically, WTP is tied to how people assign value, as seen in utilitarianism, which uses WTP to estimate individual preferences and social welfare [44]. However, this link is challenged by wealth disparity—those with greater means may express higher WTP not due to greater utility, but because they can afford more. Bar-Gill [45] explores how wealth can distort WTP as a reflection of true preferences. Furthermore, Spash et al. [46]'s work critiques choice utilitarianism by challenging the premise that WTP correctly reflects individuals' preferences, particularly in environmental circumstances.

In the beverage industry, WTP for sustainable packaging varies by country, influenced by environmental awareness, cultural attitudes, and economic conditions. According to a 2019 survey by De Canio [47], 41% of Italian customers are unwilling to pay more for environmentally friendly packaging. In contrast, 24% indicated that they were willing to pay 5% to 10% extra for sustainable packaging materials. Consumers' WTP for sustainable beverage packaging has a substantial impact on industry behavior. Trivium Packaging's global survey indicated that 74% of consumers are willing to pay more for sustainable packaging, with over 25% willing to accept a 10% price increase or more [48]. This consumer demand has encouraged beverage businesses to consider sustainable packaging options. To summarize, customers' WTP not only reflects demand but also plays a key role in driving sustainable packaging innovations in the beverage industry.

Based on the TPB and supplemented by the NRBV, this study proposes that WTP is a significant driver of sustainable packaging trends in the beverage sector. According to TPB, customers are more inclined to pay for eco-friendly packaging when they have positive environmental attitudes, sense societal support for sustainable purchasing, and believe they can afford it. These psychological factors define the purpose that impacts purchasing behavior [11]. NRBV argues that enterprises respond strategically to altering customer preferences by creating environmentally responsible capabilities, such as sustainable packaging innovation, in order to obtain a competitive advantage [17]. Companies are incentivized to connect their production and packaging strategies with consumers' growing WTP for green packaging, as evidenced by global surveys and market responses. As a result, WTP does more than just reflect demand; it triggers a loop of behavior change and strategic reaction, reinforcing sustainability trends [41]. Based on this integration, the authors propose:

Hypothesis 4: Consumers’ WTP positively affects sustainable packaging trends in the beverage industry.

2.3.5 Moderating role of consumer perception

Consumer perception refers to how people interpret and form opinions about a product, service, or brand based on their previous experiences, expectations, and external factors [49]. Marketing, packaging, reviews, word-of-mouth, personal preferences, and cultural influences all impact the development of consumer perception. According to Gestalt psychology, perception is holistic, meaning that buyers

evaluate the entire experience rather than specific product features [50]. Beverage consumers may perceive a product as ecologically friendly depending on its packaging design, color, labeling, and messaging. If these features are consistent with sustainability values, they will create good impressions, increasing WTP [51]. Customers are more inclined to accept a higher price if they see sustainable packaging as a benefit, such as helping to protect the environment. However, if people see it as a negative, such as reduced durability and inconvenience, their WTP will fall. According to the philosophical perspective of Katz [52], Rationalism contends that perception is formed by logical reasoning rather than experience. Consumers rely not only on sensory experiences but also on facts, arguments, and moral reasoning. They may assess sustainable packaging using scientific data on environmental advantages, carbon footprint reduction, or recyclability statistics. Even with limited knowledge, a rationale that aligns with personal values can shape a favorable perception.

While many customers express an interest in sustainability, their WTP for sustainable packaging is heavily influenced by their perception of the package's value, quality, and convenience. Perceptions differ worldwide due to cultural values, economic realities, government restrictions, and consumer perceptions. Consumers in Europe, particularly in Germany, France, and Sweden, are very ecologically sensitive, which influences their impressions of sustainable beverage packaging. Germany's Pfand (deposit-refund system) has raised consumer awareness of recycling, resulting in better acceptance of glass bottles and paper cartons. In the United States, perceptions vary by demographic. Millennials and Gen Z tend to value biodegradable and plant-based bottles and are more willing to pay a premium, while many still prioritize convenience and affordability. In China, sustainability awareness is growing, particularly among high-income metropolitan customers. However, pricing remains the most influential issue in consumer perceptions. Overall, beverage firms must deliberately manage customer perception through effective branding, open communication, and education programs to enhance the relationship between WTP and sustainable packaging trends.

As a result, consumer perception may act as a moderator, either enhancing or diminishing the influence of WTP on actual purchase behavior. When the perception of sustainable packaging is favorable, for example, regarded as high-quality, aligned with values, or convenient, WTP is more likely to convert into actual demand and impact packaging trends.

Based on the TPB, this study contends that consumer perception modifies the relationship between WTP and sustainable packaging trends in the beverage industry. TPB contends that intention-driven behavior is influenced not just by attitudes and social conventions, but also by perceived behavioral control—which is strongly related to how customers perceive product value, quality, and feasibility [10]. When customers see sustainable packaging as advantageous, high-quality, and consistent with their environmental ideals, their WTP is more likely to transfer into actual purchase behavior, affecting packaging industry trends. Labeling, branding, environmental messaging, and prior experiences all influence how people perceive something [53]. Furthermore, psychological theories argue that perceived benefits, rather than real product qualities, ultimately influence consumer behavior. As a result, a favorable view can increase the impact of WTP on sustainable choices, whereas a negative perception can reduce it. Based on this synthesis, the authors propose:

Hypothesis 5: Consumer perception positively moderates the impact of consumers' WTP on sustainable packaging trends in the beverage industry.

With the hypotheses firmly rooted in a sound theoretical base, this research advances its scholarly relevance by introducing the following conceptual framework illustrated in Figure 1.

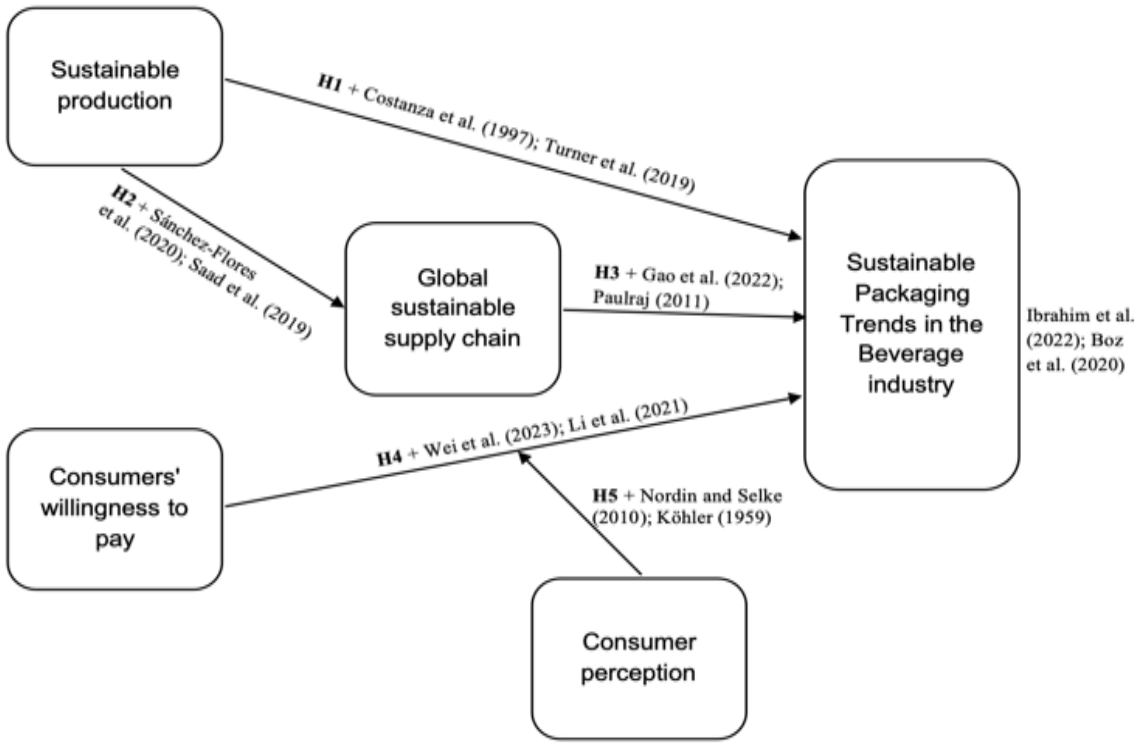


Figure 1. The paper's conceptual framework
Source: Authors, 2025

3. METHODOLOGY

3.1 Research approach

The authors employ a quantitative method in this study. The quantitative research approach involves collecting and analyzing numerical data to evaluate and validate phenomena [54]. This strategy frequently employs statistical methods to analyze data, enabling quantifiable and objective conclusions [55].

3.2 Participants

This study uses a probability sample approach [56], with a stratified sampling technique to achieve balanced representation across important consumer and professional groups in emerging markets. A structured questionnaire with a 5-point Likert scale [57] was distributed to four key target groups: (1) young urban consumers aged 18-35, (2) undergraduate and graduate students in business, marketing, and environmental science, (3) retail employees working in beverage outlets and FMCG chains, and (4) sustainability or supply chain professionals in the packaging or beverage industry. This distribution was created to include both demand-side and operational-side viewpoints on sustainable packaging trends. The first two groups, urban consumers and university students, make up 70% of the sample due to their active involvement in purchasing decisions, environmental awareness, and influence on future market trends. The remaining 30% is split equally between store staff and professionals who provide contextual insights into product visibility, market response, and sustainable packaging supply chain practices.

To broaden reach and improve contextual accuracy, the survey was administered both online and in person. The online distribution focused on academic and professional networks in emerging countries, including university mailing lists at Vietnam National University HCMC, and Universitas Indonesia. It also featured professional outreach through LinkedIn and regional industry groups such as the Asian Packaging Network. Due to geographic constraints, in-person data collection was limited to Vietnam. However, participants were drawn from international firms that represent emerging markets and operate in Vietnam, such as URC Vietnam (Philippines), and Ajinomoto Vietnam. This dual-channel method maintained geographic practicality while remaining closely aligned with the study's emerging market focus. Then, a total of 726 replies were gathered, with 385 valid responses chosen at random to ensure statistical reliability and reduce selection bias. This multi-channel data gathering strategy ensures complete stakeholder coverage and improves the representativeness of findings across consumer and operational levels in emerging market situations.

3.3 Measure

3.3.1 Reliability analysis

Cronbach's Alpha is a statistical method for determining the dependability of a series of scaled questions. It assesses the internal consistency of measures inside a scale, or the degree to which all measure items measure the same element or concept [58].

As presented in Table 1, Cronbach's Alpha coefficient =0.9>0.6 and comparison with Cronbach's Alpha if Item Deleted of SPT1=0.877 shows that the overall Cronbach's Alpha is larger than that of Cronbach's Alpha if Item Deleted of SPT1 [59]. Next, the Corrected Item-Total Correlation index of the SPT1 variable is 0.76, this index is greater than 0.3, so the research model is accepted. Besides, Cronbach's Alpha if Item Deleted is larger than Corrected Item-Total Correlation (0.877>0.76). As a result, none of the items were excluded from the analysis. Similar results were obtained for the Cronbach's alpha values of the remaining variables [59].

3.3.2 Exploratory factors analysis

Exploratory Factor Analysis (EFA) is a statistical technique for investigating the potential structure of multivariate data. EFA is based on the assumption that there are latent (unobservable) factors influencing the observed variables. The purpose of EFA is to identify the number of possible factors and how they interact with the variables observed [60].

Table 1. Reliability statistics and item-total statistics of "Sustainable packaging trends"

Reliability Statistics				
Cronbach's Alpha			N of Items	
.900			5	
Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SPT1	16.37	14.504	.760	.877
SPT2	16.34	15.182	.729	.883
SPT3	16.36	14.404	.739	.882
SPT4	16.37	14.755	.758	.877
SPT5	16.41	14.487	.777	.873

Table 2. Rotated component matrix

Rotated Component Matrix[a]			
	Component		
	1	**2**	**3**
WTP1	.778		
WTP2	.775		
WTP3	.806		
WTP4	.782		
WTP5	.725		
SP1		.772	
SP2		.760	
SP3		.719	
SP4		.753	
SP5		.766	
SSC1			.759
SSC2			.773
SSC3			.778
SSC4			.755
SSC5			.722

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Note: where, WTP1 to WTP5; SP1 to, SP5; SSC1 to, SSC5 are coded for survey questions of consumers' willingness to pay, sustainable production and global sustainable supply chain respectively.

Table 2 presents the rotated component matrix, which classifies the 15 observed variables into three distinct constructs reflecting the two independent variables, and the mediator. A similar analysis is made for the dependent and moderator variable. Additionally, as shown in the Table 3 components with a high degree of correlation for all observed variables are extracted as follows: Component 1 including

WTP1 (0.778), WTP2 (0.775), WTP3 (0.806), WTP4 (0.782), and WTP5 (0.725); Component 2 SP1 (0.772), SP2 (0.760), SP3 (0.719), SP4 (0.753), and SP5 (0.766); Component 3 SSC1 (0.759), SSC2 (0.773), SSC3 (0.778), SSC4 (0.755), and SSC5 (0.722).

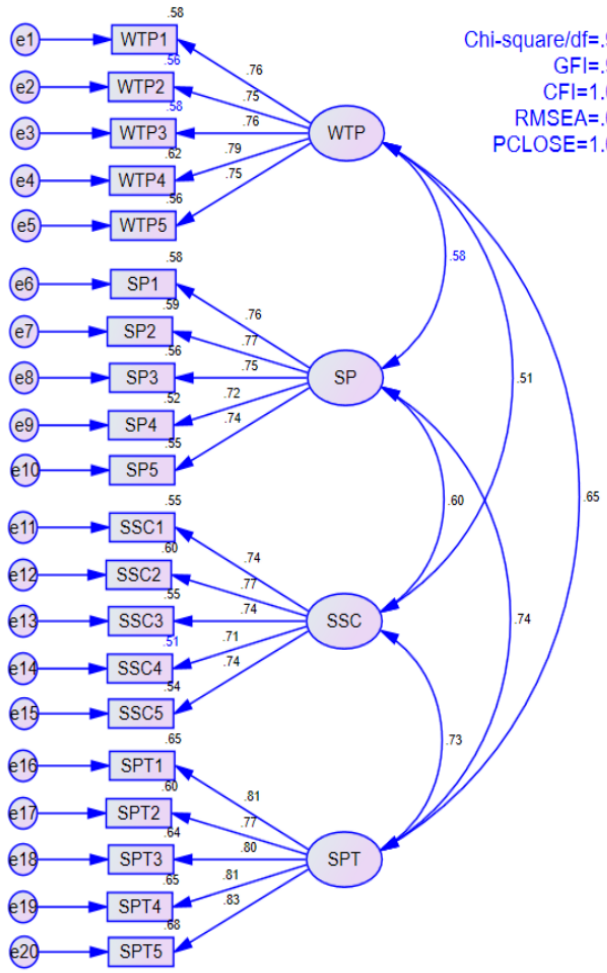
Table 3. Convergent and discriminant validity assessment

	CR	AVE	MSV	MaxR(H)	SSC	WTP	SP	SPT
SSC	0.859	0.550	0.536	0.860	**0.741**			
WTP	0.873	0.579	0.423	0.873	0.513	**0.761**		
SP	0.865	0.562	0.543	0.866	0.603	0.576	**0.750**	
SPT	0.901	0.644	0.543	0.901	0.732	0.650	0.737	**0.803**

The table structure consists of two parts: CR, AVE, MSV, MaxR(H) indexes (part 1) and a Fornell and Larcker table (part 2).

3.3.3 Confirmatory factor analysis

According to Kyriazos [61], confirmatory Factor Analysis (CFA) is a test used to evaluate the overall fit of the data using model fit indices such as Chisquare/df, CFI, TLI, GFI, RMSEA...; evaluate the quality of observed variables, and confirm the factor structures.



where, **SPT**: mean of SPT1 to SPT5; **WTP**: mean of WTP1 to WTP5; **SP**: mean of SP1 to SP5; **SSC**: mean of SSC1 to SSC5.

Figure 2. Diagram CFA

Based on the CFA results in Figure 2, the model demonstrates an excellent fit with the data. All fit indices fall within the recommended thresholds set by [62]. Specifically, the CFI of 1.000 and RMSEA of 0.000 indicate a perfect model fit, while GFI=0.963 and CMIN/df=0.921 further confirm the model's robustness. Moreover, the PCLOSE value of 1.000 reinforces that the RMSEA is not significantly different from zero. Therefore, the measurement model is both valid and reliable, and all latent constructs are well represented by their observed indicators.

Convergent validity and discriminant validity. According to Hair et al. [63], we use the Average Variance Extracted (AVE) index, Maximum Shared Variance (MSV) index and Fornell and Larcker tables to evaluate the convergence and discriminantness of the scale.

In the result above, the AVE index of SSC, WTP, SP, and SPT are respectively 0.550, 0.579, 0.562, and 0.644. All indexes are more than 0.5, so the convergence of the scale is guaranteed.

The MSV index of SSC (0.536) is less than the AVE index of SSC (0.550). The MSV index of WTP (0.423) is less than the AVE index of WTP (0.579). The MSV index of SP (0.543) is less than the AVE index of SP (0.562). The MSV index of SPT (0.543) is less than the AVE index of SPT (0.644). Also, the variable SSC has square root AVE of 0.741 which is larger than the correlation of SSC with WTP, SP, and SPT which is 0.513, 0.603, 0.732, respectively. The variable WTP has square root AVE of 0.761 which is larger than the correlation of WTP with SP and SPT which is 0.576, 0.650, respectively. The variable SP has square root AVE of 0.750 which is larger than the correlation of SP with SPT which is 0.737. Therefore, the discriminant is guaranteed.

4. RESULTS

4.1 Descriptive statistics

Table 4. Descriptive statistics of "sustainable packaging trends"

Statistics						
		SPT1	SPT2	SPT3	SPT4	SPT5
N	Valid	385	385	385	385	385
	Missing	0	0	0	0	0
	Mean	4.09	4.13	4.10	4.09	4.05
	Mode	5	5	5	5	5

Source: The authors, 2025

Note: where, SPT1, SPT2, SPT3, SPT4 are coded for survey questions 1, 2, 3, 4 of sustainable packaging trends in the beverage industry respectively.

From Table 4, the mean of SPT1=4.09 indicates that, on average, respondents agree that sustainable packaging is important in global logistics because it improves efficiency while minimizing environmental effects. According to the mode of SPT1=5, the majority of participants strongly agree that sustainable packaging plays a key role in global logistics by enhancing efficiency and reducing environmental impact. Descriptive statistics were also conducted similarly for the other sub-variables for all variables.

4.2 Structural equation modeling (SEM)

4.2.1 Regression weights

As illustrated in Table 5, all variables have a sig equal to 0.000 (AMOS sign *** means sig equal to 0.000), so these relationships are significant. Thus, there are 3 variables affecting SPT including SP, SSC, WTP; and 1 variable affecting SSC is SP. Thus, the author can accept all four hypotheses as H1, H2, H3 and H4.

Table 5. Regression weights: (Group number 1-Default model)

			Estimate	S.E.	C.R.	P	Label
SSC	<--	SP	.596	.061	9.795	***	
SPT	<--	SP	.368	.067	5.526	***	
SPT	<--	SSC	.414	.060	6.892	***	
SPT	<--	WTP	.255	.052	4.892	***	
WTP1	<--	WTP	1.000				
WTP2	<--	WTP	.952	.065	14.543	***	
WTP3	<--	WTP	1.000	.067	14.828	***	
WTP4	<--	WTP	.988	.065	15.294	***	
WTP5	<--	WTP	.913	.063	14.525	***	
SP1	<--	SP	1.000				
SP2	<--	SP	1.016	.068	14.963	***	
SP3	<--	SP	.926	.064	14.550	***	
SP4	<--	SP	.891	.064	14.014	***	
SP5	<--	SP	.956	.066	14.413	***	
SSC1	<--	SSC	1.000				
SSC2	<--	SSC	1.034	.071	14.483	***	
SSC3	<--	SSC	1.002	.072	13.849	***	
SSC4	<--	SSC	.930	.070	13.361	***	
SSC5	<--	SSC	.930	.068	13.735	***	
SPT1	<--	SPT	1.000				
SPT2	<--	SPT	.898	.054	16.679	***	
SPT3	<--	SPT	1.020	.059	17.341	***	
SPT4	<--	SPT	.965	.055	17.590	***	
SPT5	<---	SPT	1.010	.055	18.237	***	

4.2.2 Standardized regression weights

Figure 3 presents the results of Structural Equation Modeling (SEM), which visually and statistically support the hypothesized relationships among sustainable production (SP), global sustainable supply chain (SSC), WTP, and sustainable packaging trends (SPT) in the beverage industry. The model demonstrates that all three independent variables—SP, SSC, and WTP—have a positive impact on SPT, albeit to various degrees. SSC has the highest direct effect on SPT (standardized path coefficient =0.391), followed by SP (0.362) and WTP (0.251). This implies that SSC has the greatest impact on pushing sustainable packaging practices, most likely because it operationalizes sustainability goals across manufacturing, sourcing, and logistics.

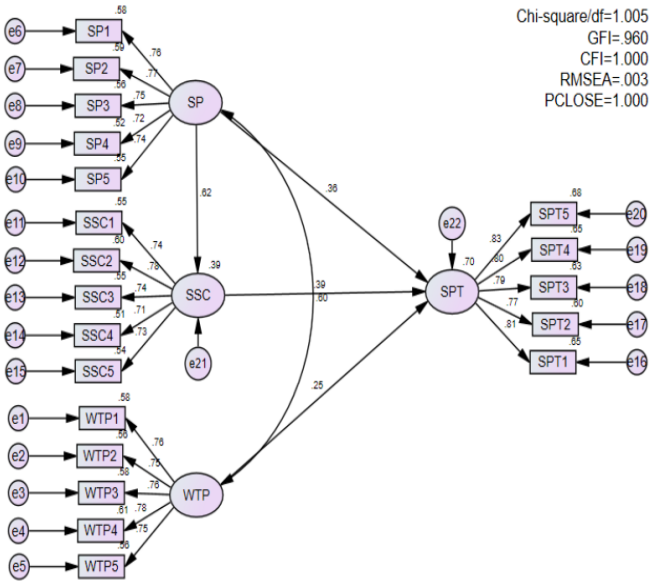


Figure 3. Structural equation modeling

To assess the mediating role of the global sustainable supply chain (SSC) between sustainable production (SP) and sustainable packaging trends (SPT), the indirect effect was calculated by multiplying the path coefficient from SP to SSC (0.622) with the coefficient from SSC to SPT (0.391), resulting in an indirect effect of 0.243. This calculation follows the approach suggested by Hair et al. [63], which states that the indirect effect in a structural equation model is determined by the product of the coefficients along the mediating path.

The resulting regression equations are as follows:

$$SPT = 0.391*SSC + 0.362*SP + 0.251WTP + u \quad (1)$$

$$SSC = 0.622*SP + u \quad (2)$$

These equations represent the model's structural dependencies and highlight the interwoven roles of production strategy, consumer behavior, and supply chain integration. The overall model fit is excellent, as demonstrated by the provided indices: Chi-square/df=1.005, GFI=0.960, CFI=1.000, RMSEA=0.003, and PCLOSE=1.000, all of which show the proposed theoretical framework is well aligned with the observed data. In conclusion, Figure 3 validates the study's conceptual framework and confirms an integrated approach—including both consumer-side and firm-level dynamics—is critical for understanding and promoting sustainable packaging trends in the beverage industry.

4.3 Moderator analysis

Moderator analysis examines whether the relationship between independent and dependent variables changes under different levels of a third variable [64], classifies $\beta<0.1$ as weak, 0.1-0.3 as moderate, and ≥ 0.3 as strong.

Table 6. Results analysis of "customer perception

Model	1
Y	SPT
X	WTP
W	CP
Sample Size	385

****

OUTCOME VARIABLE: SPT

Model Summary

R	R-sq	MSE	F	dl1	dl2	p
.732	.710	.565	5.218	3.000	381.000	.000

Model

	Coeff	se	t	p	LLCI	ULCI
constant	6.875	.209	78.588	.000	5.678	5.421
WTP	.644	.495	3.581	.000	.364	.353
CP	.684	.537	3.589	.000	.298	.287
Int_1	.557	.456	4.625	.000	.246	.234

Source: (The authors, 2025)

Note: where, CP: mean of CP1, CP2, CP3, CP4

As shown in Table 6, the p-value for the interaction term (Int_1) is 0.000, which is significantly below the 0.05 threshold, confirming the statistical significance of the interaction effect. With an interaction coefficient of 0.557, the results suggest that higher customer perception strengthens the positive influence of consumers' WTP on and sustainable packaging in the beverage industry. Therefore, hypothesis H5 is validated.

5. DISCUSSION

5.1 Results summary

The global sustainable supply chain (SSC) and WTP have positive impacts on sustainable packaging trends in the beverage industry, with coefficients of 0.391 and 0.251, respectively. Sustainable production has a direct and indirect impact (0.362 and 0.243) on sustainable packaging trends and a direct one (0.622) on global sustainable supply chain. Additionally, consumer perception positively moderates the effect of WTP on sustainable packaging trends, with a moderation coefficient of 0.557. As a result, the five research questions have received clear and definitive responses.

5.2 Theoretical implications

The study supports the NRBV [12], finding that sustainable production has a significant direct effect (0.362) on sustainable packaging trends, validating claims made by Cheng et al. [13] and Schaltegger and Burritt [23] that eco-innovation promotes packaging transformation. However, this finding contradicts McKinsey and Company [20], which warned that regulatory and consumer gaps diminish production's packaging impact. Unlike Costanza et al. [21], who contend that sustainability frequently compromises profitability, this study supports the ecological economics viewpoint by demonstrating that it can provide competitive advantage and branding value. As a result, the data strongly agree with Brewer World [19] but reject reductionist skepticism regarding the production's packaging efficacy.

Empirical results significantly indicate the strategic importance of sustainable production in improving global supply chain integration (path coefficient: 0.622), which is consistent with Saad et al. [25]. This lends support to Mol and Sonnenfeld's [29] ecological modernization theory, which emphasizes the relationship between environmental change and operational efficiency. Our findings, however, differ from those of Saqib and Zhang [28], who argue that the impact varies by geography. With a focus on emerging markets, this study finds less dependence on institutional maturity than previously thought, aligning partially with institutional economics [30] while emphasizing internal production commitment over regulatory infrastructure.

The findings reinforce the theoretical view that a global SSC functions as a proactive mechanism for enhancing sustainable packaging trends (β=0.391) by facilitating eco-innovation and enabling systemic coordination [35]. This empirical result validates SSC's role in operationalizing sustainability goals across the supply network [32]. Additionally, the significant mediation effect (indirect impact: 0.243) supports the NRBV-based arguments of Seuring and Müller [34] SSC channels upstream sustainability into downstream packaging innovation. The findings directly contradict Pagell and Shevchenko's [38] claim SSC fails under competing pressures and cost restrictions. In contrast, this study demonstrates that in well-aligned systems, particularly among Vietnam-based operations in emerging countries, SSC allows for visibility, innovation transfer, and packaging design convergence. Thus, the analysis strongly agrees with Verghese and Lewis [35], confirming SSC may be an active driver of sustainability if it is integrated into all processes.

This analysis confirms a significant direct impact (0.251), supporting TPB-driven statements [9] that intention and WTP predict green behavior. However, it also reveals the limited reliability of WTP as a market signal, especially in emerging markets [45]. Despite statements of high WTP [48], many customers remain price-sensitive [47], indicating an intention-behavior mismatch. As a result, the evidence both confirms and clarifies TPB, indicating that WTP is necessary yet insufficient in the absence of substantial perception alignment.

The moderating impact (interaction coefficient: 0.557) demonstrates that WTP only leads to packaging adoption when mediated through positive views, supporting Gestalt psychology [50] and TPB extensions [10]. This directly contradicts utilitarian simplifications that take WTP as a stand-alone desire [44]. Instead, perception influences behavioral intentions through visual clues, categorization, and cognitive rationality [52]. This study reveals that WTP's influence is anchored by perception rather than usefulness. Thus, branding and communication tactics are equally as important as price positioning in promoting sustainable packaging adoption.

5.3 Practical implications

Sustainable production has a significant impact on packaging trends (β=0.362), emphasizing the need to incorporate ecological concepts into beverage manufacturing operations. Using biodegradable materials, lowering emissions, and increasing energy efficiency not only improves sustainability credentials but also boosts long-term brand equity [13]. Strategic investments in green production serve as the foundation for a larger transition. To implement this, beverage companies should implement internal sustainability audits in line with ISO 14001, enforce supplier codes of conduct on the use of eco-friendly materials, and mandate life cycle assessments (LCA) before implementing new packaging lines [65]. In turn, policymakers can support this shift by providing tax incentives for companies that achieve reductions in carbon intensity per unit of production to ensure packaging waste is effectively recovered and reused [66].

Sustainable production considerably improves the global sustainable supply chain (SSC) (β=0.62), highlighting the need to align internal green efforts with upstream and downstream partners. Effective cooperation with suppliers, especially in terms of ethical sourcing and logistics transparency, ensures that sustainability gains are realized throughout the value chain [26]. As a result, companies should include sustainability terms in their procurement contracts and invest in capability-building initiatives for suppliers in emerging markets. Beverage companies can adopt supplier scorecards that track environmental performance metrics and require third-party sustainability certification as part of their supplier standards [67]. Implementing green logistics platforms that leverage real-time tracking, route optimization, and carbon footprint monitoring technologies can help reduce emissions across distribution channels [65]. Additionally, partnering with local NGOs or universities to train small suppliers on sustainable practices can help build resilience and alignment in global supply chains [68].

This alignment is even more important given the study's validation of SSC as both a mediating mechanism (indirect effect=0.243) and a direct driver of sustainable packaging trends (direct effect=0.391). This dual role emphasizes the idea that supply chains are no longer passive conveyors of production outputs, but rather strategic venues where sustainability can be magnified or diluted. When companies implement shared environmental standards throughout their

supply chains, they promote systemic innovation in packaging design and material adoption [34]. In particular, beverage companies should establish digital product passports to track packaging materials from source to end-of-life to improve post-consumer packaging collection and recycling [69]. Additionally, companies should adopt circular procurement policies that prioritize recyclable or reusable packaging and implement data-sharing platforms on supplier sustainability performance to promote cross-border accountability [65]. Firms that invest in traceability systems, blockchain certification, and lifecycle-based supplier evaluation are more likely to achieve consistent and scalable improvements in packaging sustainability.

Simultaneously, consumer dynamics must not be disregarded. Environmentally conscious consumers continue to drive packaging trends, as seen by the influence of WTP (β=0.251). However, this force is limited by the pervasive intention-behavior gap [47]. The success of WTP is significantly dependent on user perception (interaction β=0.557). When perceptions are aligned—via credible labels, clear design, and instructive content—purchase intention becomes action [10]. Beverage companies should simplify on-pack messaging to highlight environmental benefits and incorporate QR codes that lead to interactive educational content about sustainability impacts [70]. In-store and online campaigns that link green packaging to social values, such as supporting local recyclers or reducing marine litter, can bridge the gap between intention and action [71]. Therefore, marketing departments must work with sustainability teams to co-create brand narratives that emphasize both the functional and ethical benefits of eco-packaging.

6. CONCLUSION

This study suggests that improving sustainable packaging in the beverage industry necessitates a comprehensive approach in which sustainable production, customer WTP, supply chain alignment, and perception all work in tandem. Internal green initiatives and consumer demand are necessary but insufficient without integrated supply chain policies and effective communication tactics to bridge the intention-behavior gap. While theoretical frameworks like as the NRBV and the TPB are still useful, they must be contextualized for current market situations and consumer categories. However, the study's generalizability is restricted by its concentration on Vietnam and use of self-reported, cross-sectional data, which may be biased and unable to capture long-term trends. Future studies should use longitudinal or experimental approaches, compare results from developed and emerging nations, and add industry-specific criteria like carbon disclosure or packaging innovation scores. Segmentation by age and psychographics, combined with qualitative interviews, would help to identify which consumer groups drive change and what supply chain constraints exist in implementing sustainability.

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