“Effects of sustainable packaging cues on perceived sustainability, purchase intention and price acceptance of cosmetic products”

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EFFECTS OF SUSTAINABLE PACKAGING CUES ON PERCEIVED SUSTAINABILITY, PURCHASE INTENTION AND PRICE ACCEPTANCE OF COSMETIC PRODUCTS

Abstract

Sustainable cosmetic packaging is increasingly important as consumers use packaging-related cues to evaluate the environmental attributes and value of products. However, empirical evidence on consumer responses to different sustainable packaging configurations and communication cues remains limited in Central and Eastern Europe. This study examines perceived environmental sustainability, purchase intention and price acceptance across cosmetic packaging configurations featuring conventional plastic, biodegradable plastic and glass, as well as consumer evaluations of Vegan and Cruelty-Free labels and QR-code cues. A quantitative within-subject study was conducted among 204 adult Slovak consumers using an online questionnaire with nine visual stimuli. Data were analyzed using the Friedman test, Wilcoxon signed-rank test and Spearman's rank correlation coefficient. Significant differences were identified across packaging configurations in perceived sustainability ($\chi^2(2) = 8.21$, $p = 0.016$), purchase intention ($\chi^2(2) = 16.09$, $p < 0.001$) and price acceptance at the premium price level ($\chi^2(2) = 28.48$, $p < 0.001$). Perceived sustainability was strongly and positively associated with purchase intention ($\rho = 0.686$, $p < 0.001$). Configurations featuring biodegradable plastic and glass received higher perceived sustainability evaluations than those featuring conventional plastic, while no significant difference was detected between biodegradable plastic and glass configurations. Biodegradable plastic and glass configurations generated higher purchase intentions than conventional plastic. At the premium price level, the glass configuration received higher price acceptance evaluations than both conventional and biodegradable plastic configurations. No statistically significant differences in perceived sustainability were detected between the Vegan or Cruelty-Free labels and the QR-code cue. The findings provide empirical evidence on consumer responses to sustainable cosmetic packaging configurations and offer practical insights for packaging design and sustainability communication strategies.

Keywords sustainable packaging, cosmetic packaging, packaging configurations, perceived sustainability, purchase intention, eco-labels, QR-code cues

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INTRODUCTION

Environmental sustainability has emerged as one of the most important drivers of consumer behavior and corporate strategies over the last decade. Growing environmental awareness, concerns regarding climate change and increasing pressure to reduce resource consumption have substantially transformed both production systems and consumption patterns. These developments are closely aligned with the objectives of the European Green Deal (European Commission, 2019) and the Circular Economy Action Plan (European Commission, 2020), which emphasize the transition towards a more sustainable and resource-efficient economy. Numerous studies have documented that

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consumers increasingly prefer environmentally responsible products and expect companies to actively implement sustainability principles throughout the product life cycle (White et al., 2019; Ketelsen et al., 2020; Steenis et al., 2017).

Among the various elements contributing to the environmental footprint of consumer goods, packaging represents one of the most important challenges. In addition to its protective, logistical and communication functions, packaging generates a substantial amount of waste and therefore plays a crucial role in the transition towards sustainable consumption (Ncube et al., 2020). According to Eurostat (2026), the amount of packaging waste generated in the European Union reached 177.8 kg per capita in 2023. Although Slovakia reported a considerably lower value of 103.94 kg per capita, packaging waste remains an important environmental issue, highlighting the need for more sustainable packaging solutions and improved resource efficiency.

The cosmetics industry has experienced increasing pressure to adopt environmentally responsible practices. The global cosmetics market has expanded considerably over the last decade, accompanied by growing concerns regarding packaging waste, resource consumption and ethical production processes. According to Cosmetics Europe (2022), the European cosmetics and personal care industry represents one of the largest consumer goods sectors, serving more than 500 million consumers and generating substantial economic value annually. At the same time, sustainability-related attributes have become increasingly important determinants of consumer choice in the beauty and personal care sector (Amberg & Fogarassy, 2019).

Despite the growing body of literature devoted to sustainable packaging, several research gaps remain. First, relatively little attention has been paid to consumer responses to cosmetic packaging configurations featuring different packaging materials in terms of perceived sustainability, purchase intention and price acceptance within the cosmetics industry. Second, empirical evidence concerning consumer evaluations of traditional sustainability labels and digital information tools remains scarce. Third, although sustainable consumption has become an increasingly important topic across Europe, most previous studies have focused on Western European countries, whereas evidence from Central and Eastern Europe remains limited. In particular, research examining Slovak consumers' responses to sustainable packaging solutions remains underdeveloped. These research gaps demonstrate the need for further empirical investigation of consumer responses to different sustainable packaging configurations and communication cues, particularly in the context of Central and Eastern Europe, where empirical evidence remains limited.

1. LITERATURE REVIEW AND HYPOTHESES

Sustainable packaging has become an increasingly important topic in both academic research and business practice. Packaging is no longer perceived solely as a protective or logistical component of a product but also as an important communication tool capable of shaping consumers' perceptions, attitudes and purchase decisions (Underwood, 2003; Rundh, 2009). Previous studies have demonstrated that packaging characteristics serve as informational cues from which consumers infer product quality and environmental friendliness (Olson, 1972; Orth & Malkewitz, 2008).

From the perspective of sustainable consumption, packaging plays a dual role. While it performs essential functions such as protection, transportation and communication, it simultaneously represents a major source of waste and environmental burden (Ncube et al., 2020). Consequently, both consumers and policymakers have increasingly emphasized the importance of environmentally friendly packaging solutions within the framework of the circular economy (European Commission, 2020).

Research suggests that consumers are becoming increasingly sensitive to sustainability-related product attributes (White et al., 2019). In partic-

ular, packaging material has emerged as an important cue influencing consumers' perceptions of environmental sustainability and overall product evaluations (Steenis et al., 2017; Ketelsen et al., 2020). According to cue utilization theory, consumers rely on observable product characteristics when evaluating quality and other product attributes under conditions of incomplete information (Olson, 1972). Consequently, packaging material and design characteristics may significantly influence consumer responses and purchase decisions.

Previous research consistently indicates that packaging material represents one of the most influential determinants of perceived environmental sustainability. Consumers tend to associate natural, recyclable and biodegradable materials with greater environmental responsibility, whereas conventional plastic packaging is generally perceived less favorably due to its environmental impact (Ketelsen et al., 2020; Ncube et al., 2020).

Consistent with cue utilization theory (Olson, 1972), packaging material serves as an important extrinsic cue from which consumers infer product quality, environmental friendliness, and overall product value. Previous studies have demonstrated that packaging characteristics significantly influence product evaluations and consumer perceptions (Orth & Malkewitz, 2008).

Steenis et al. (2017) demonstrated that packaging material significantly affects both product evaluations and perceptions of environmental sustainability. Similarly, Magnier et al. (2016) reported that sustainable packaging positively influences consumers' perceptions of quality and environmental friendliness. Materials such as glass and biodegradable alternatives are generally evaluated more favourably than conventional plastic packaging because they evoke associations with recyclability, naturalness and reduced environmental impact (Perret et al., 2025).

Furthermore, environmentally friendly packaging materials have been shown to positively influence consumers' willingness to purchase green products and their willingness to pay premium prices (Prakash & Pathak, 2017). Testa et al. (2019) emphasized that sustainability-related product attributes represent important drivers of sustainable consumption behavior. Recent evidence provided by Plotkina et al. (2025) further supports these findings, demonstrating that biodegradable packaging generates higher purchase intentions and willingness to pay compared to conventional alternatives.

In product categories where sustainability represents an increasingly important purchase criterion, environmentally friendly packaging may contribute to brand differentiation and constitute an important source of competitive advantage (Amberg & Fogarassy, 2019). This issue appears particularly relevant in the cosmetics industry, where consumers increasingly seek products that combine functional benefits with environmental responsibility.

Purchase intention represents one of the most frequently examined outcomes in sustainable consumer behavior research. According to the Theory of Planned Behavior, behavioral intentions are influenced by attitudes, subjective norms and perceived behavioral control (Ajzen, 1991). In the context of sustainable consumption, positive attitudes towards environmentally responsible products are expected to translate into stronger purchase intentions.

Previous studies have demonstrated that sustainability-related product attributes increasingly influence consumers' purchasing decisions (Joshi & Rahman, 2015; White et al., 2019). Kumar et al. (2017) further emphasized that environmental concerns and positive evaluations of green product characteristics represent important antecedents of purchase intentions. Likewise, Prakash and Pathak (2017) reported that environmentally friendly packaging positively affects consumers' intentions to purchase green products.

Several studies have shown that packaging attributes significantly influence consumers' willingness to purchase products. Magnier and Schoormans (2015) demonstrated that sustainable packaging positively affects product evaluations and purchase intentions. Similarly, Testa et al. (2019) highlighted the role of sustainability-related product attributes in shaping sustainable consumption behavior. Recent evidence provided by Plotkina et al. (2025) further indicated that biodegradable packaging positively affects consum-

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ers' willingness to purchase and their willingness to pay premium prices.

In the cosmetics sector, sustainable packaging has become an important source of differentiation. Amberg and Fogarassy (2019) observed that consumers are increasingly willing to support brands that actively reduce their environmental impact. Consequently, packaging material may represent an important factor influencing consumers' behavioral intentions and their preference for environmentally responsible products.

Consumers who perceive products as environmentally responsible are generally more likely to express favorable attitudes and stronger intentions to purchase them (Joshi & Rahman, 2015). White et al. (2019) argue that sustainable consumption can be encouraged when products effectively communicate their environmental benefits. In the cosmetics market, Amberg and Fogarassy (2019) demonstrated that environmental awareness and ethical considerations significantly influence purchasing decisions. Moreover, Plotkina et al. (2025) showed that sustainable packaging contributes to a stronger green brand image, which subsequently enhances purchase intentions and willingness to pay. Therefore, it can be assumed that consumers who perceive cosmetic products as environmentally sustainable will exhibit higher purchase intentions.

Consumers' willingness to accept higher prices for environmentally friendly products has become an important topic in sustainable marketing research. Previous studies suggest that consumers may be willing to pay premium prices when they perceive additional environmental and functional value associated with products (Magnier et al., 2016; Prakash & Pathak, 2017).

Packaging material itself can influence perceptions of quality and value. Consumers often associate glass packaging with premium quality and higher product value, which may contribute to greater price acceptance compared with conventional plastic alternatives (Magnier et al., 2016; Perret et al., 2025). More generally, packaging materials capable of conveying sustainability and premium attributes may positively affect consumers' evaluations of product value and willingness to pay (Testa et al., 2019).

Similarly, Plotkina et al. (2025) reported that environmentally friendly packaging positively affects consumers' willingness to pay, particularly in the case of biodegradable materials. These findings suggest that packaging material may influence not only sustainability perceptions but also consumers' willingness to accept higher prices.

Besides packaging material, sustainability-related information is frequently communicated through eco-labels and certifications. Eco-labels reduce information asymmetry and help consumers identify environmentally responsible products (D'Souza et al., 2006; Taufique et al., 2014). Previous studies have shown that sustainability labels positively affect consumers' trust and purchase intentions by increasing the perceived credibility of environmental claims (Thøgersen et al., 2010; Taufique et al., 2014).

Among the most common sustainability-related labels in the cosmetics industry are Vegan and Cruelty-Free certifications, which provide consumers with information regarding ethical and environmental aspects of production. Such labels have become increasingly important due to growing concerns about animal welfare and sustainable lifestyles (Amberg & Fogarassy, 2019). Consumers generally perceive certified products more favorably because eco-labels simplify information processing and serve as signals of product responsibility (Grunert et al., 2014).

More recently, digital technologies have emerged as alternative tools for sustainability communication. QR codes enable brands to provide extensive and transparent information regarding ingredients, sourcing practices and environmental impacts, thereby facilitating consumers' access to sustainability-related information. Previous studies suggest that digital information tools may enhance transparency and improve consumer engagement, although empirical evidence regarding their effectiveness relative to traditional sustainability labels remains limited (Vecchio & Annunziata, 2015; Pancer et al., 2017). Recent research further indicates that QR-code-based communication may promote environmental consciousness and support more informed consumption decisions (Kutschera & Crowell, 2026).

The reviewed literature indicates that sustainable packaging cues, including packaging materials, traditional sustainability labels and QR-code-based sustainability information, play an important role in shaping consumers' evaluations of cosmetic products. Overall, previous studies consistently suggest that environmentally friendly packaging materials enhance perceived sustainability, purchase intentions and willingness to pay, whereas empirical evidence comparing traditional sustainability labels with QR-code-based information remains limited. These research gaps justify further empirical investigation, particularly in the context of Central and Eastern European consumers.

This study aimed to examine consumer responses to sustainable cosmetic packaging configurations featuring different packaging materials and to selected sustainability communication cues, namely traditional sustainability labels and QR codes, in terms of perceived environmental sustainability, purchase intention and price acceptance.

Based on the reviewed literature and the identified research gaps, the following research hypotheses were formulated:

H1: There are statistically significant differences in perceived environmental sustainability among cosmetic packaging configurations featuring different packaging materials.

H2: There are statistically significant differences in purchase intention among cosmetic packaging configurations featuring different packaging materials.

H3: Perceived environmental sustainability is positively associated with purchase intention.

H4: There are statistically significant differences in price acceptance among cosmetic packaging configurations featuring different packaging materials at the highest price level.

H5: There is a statistically significant difference in perceived environmental sustainability between products displaying a Vegan label and those displaying a QR-code cue.

H6: There is a statistically significant difference in perceived environmental sustainability between products displaying a Cruelty-Free label and those displaying a QR-code cue.

2. METHOD

The present study employed a quantitative research design to investigate consumers' responses to sustainable packaging solutions in the cosmetics industry. Specifically, the study examined differences in perceived environmental sustainability, purchase intention and price acceptance across cosmetic packaging configurations featuring different packaging materials. Besides, the study compared consumer evaluations of traditional sustainability labels and QR-code cues.

Primary data were collected through a structured online questionnaire incorporating experimentally manipulated visual stimuli representing cosmetic products that differed in terms of packaging material, sustainability-related cues and price levels. The study adopted a within-subject design, allowing respondents to evaluate multiple product variants under controlled conditions. This approach facilitated direct comparisons of consumer responses across different packaging configurations while reducing the influence of interindividual variability.

The nine visual stimuli were presented to all respondents in the same fixed order. No randomization or counterbalancing of stimulus presentation was applied. Consequently, potential order, fatigue and demand effects cannot be fully excluded.

2.1. Development of experimental stimuli

To eliminate the potential influence of pre-existing brand attitudes and familiarity, a fictitious cosmetic brand named Purity was developed specifically for the purposes of this study. The visual stimuli represented facial cream packaging and were designed to resemble commercially available products while maintaining visual consistency across all experimental conditions. The use of a fictitious brand minimized potential biases associated with prior brand knowledge and facilitated greater experimental control.

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The initial product images were generated using artificial intelligence-based image generation tools and subsequently refined using the Canva graphic platform. This procedure enabled the development of a set of visually comparable packaging configurations incorporating different packaging materials, price levels and sustainability-related cues. Specifically, selected design elements and sustainability-related attributes were incorporated while preserving a broadly consistent overall layout and brand presentation. However, because the stimuli simultaneously varied in several packaging characteristics, the design does not allow the observed differences in consumer evaluations to be attributed exclusively to packaging material. Accordingly, the material-related comparisons in this study are interpreted as comparisons between packaging configurations featuring different materials rather than as isolated causal effects of packaging material.

The development of the visual stimuli was inspired by the study conducted by Perret et al. (2025), which investigated consumers' perceptions of sustainable cosmetic packaging. The selection of packaging materials, sustainability-related cues and price levels followed the experimental framework proposed by these authors, thereby enabling greater comparability of findings across different cultural contexts.

Nine visual stimuli were created as distinct cosmetic packaging configurations featuring three packaging materials and three price levels, together with selected sustainability-related visual cues. The investigated materials included conventional plastic, biodegradable plastic and glass packaging. Each material variant was presented at three different price levels (€15.95, €19.95 and €23.95), representing low, medium and premium price categories. The selected price levels reflected realistic price ranges commonly observed in the cosmetics market and were adapted from the study by Perret et al. (2025). Consequently, a total of nine product configurations were obtained.

To ensure that respondents correctly identified the investigated packaging materials, each visual stimulus included a textual indication specifying the type of packaging material. This approach reduced the risk of misinterpretation arising from purely visual assessment and increased the validity of the experimental manipulation.

In addition to packaging material and price, the study also examined consumers' perceptions of selected sustainability communication cues. Specifically, selected product variants incorporated Vegan and Cruelty-Free labels, whereas others displayed a QR code as a visual sustainability communication cue. Respondents were not instructed to scan the QR code, and no additional sustainability information accessed through the QR code was evaluated as part of the study. Therefore, the QR-code condition represents consumers' evaluation of the presence of a QR-code cue on the packaging rather than their response to the sustainability information that could potentially be accessed through it. The inclusion of these elements enabled a comparison between traditional sustainability labels and the visual presence of a QR-code cue on the packaging.

Throughout the development of the experimental stimuli, particular attention was paid to maintaining consistency in brand presentation and the general visual structure of the stimuli. Nevertheless, the packaging configurations differed not only in material and price but also in colour and selected sustainability-related visual cues. These variations were therefore considered part of the overall packaging configurations, and their potential confounding role is acknowledged when interpreting the material-related comparisons.

2.2. Questionnaire development

Primary data were collected using a structured questionnaire administered via Google Forms. Before completing the questionnaire, respondents were informed about the purpose of the study, the voluntary nature of participation, and the anonymity and confidentiality of the collected data. Participation was based on informed consent, and respondents were free to discontinue the questionnaire at any stage without providing a reason. All information obtained was used exclusively for scientific purposes.

The questionnaire was designed to capture the key constructs identified in the literature as determi-

Table 1. Overview of constructs included in the present analysis

Source: Own processing (2026), based on Perret et al. (2025).

Construct	Measurement	Description	Source
Perceived sustainability	9 stimuli	Perceived environmental friendliness of individual product configurations	Perret et al. (2025)
Purchase intention	9 stimuli	Consumers' willingness to purchase individual product configurations	Perret et al. (2025)
Price acceptance	9 stimuli	Perceived appropriateness of the presented prices	Developed by the authors
Sustainability communication cues	Matrix question	Perceived environmental sustainability associated with Vegan, Cruelty-Free and QR-code cues	Developed by the authors

nants of consumer responses to sustainable cosmetic packaging. The selected items were derived from the theoretical framework presented in the literature review and reflected the main variables investigated in this study, namely perceived environmental sustainability, purchase intentions, price acceptance and sustainability communication cues. The combination of adapted and newly developed items enabled the measurement of both established constructs and variables specific to the objectives of the present study. The present analysis focuses specifically on the variables corresponding to the research hypotheses and does not aim to examine all constructs included in the broader questionnaire.

The questionnaire consisted of four main parts, each comprising several thematic sections. The first part included socio-demographic questions, the second focused on attitudes towards sustainable cosmetics, the third comprised evaluations of the visual stimuli, and the fourth contained additional measures related to sustainable consumer responses. For the purposes of the present study, the analysis was restricted to perceived environmental sustainability, purchase intention, price acceptance and the selected sustainability communication cues directly corresponding to *H1–H6*.

Most items were measured using a five-point Likert scale ranging from 1 ("strongly disagree" or "very low") to 5 ("strongly agree" or "very high").

The measurement scales employed in the study were based partly on previously validated constructs and partly on items developed by the authors to capture consumer evaluations in the context of sustainable cosmetic packaging. The measures of perceived sustainability and purchase intention used in the present analysis were adapted from Perret et al. (2025), whereas price acceptance and the evaluation of sustainability communication cues were measured using items developed by the authors. Table 1 provides an overview of the constructs included in the present analysis and their sources.

Prior to the main data collection, the questionnaire was pilot-tested with twelve respondents. Based on the feedback obtained, minor modifications were made to improve the clarity and comprehensibility of several items. In particular, a brief explanatory definition of a sustainable cosmetic product was included in the final version of the questionnaire to ensure a more consistent interpretation of the investigated concept. The pilot testing confirmed the suitability of the measurement instrument and the appropriateness of the questionnaire completion time. The complete questionnaire is provided in Appendix B to facilitate transparency and support the reproducibility of the research.

2.3. Sample characteristics and data collection

Data collection was conducted between February and March 2026. The data collection period reflected the availability of respondents and enabled the collection of a sufficiently large sample within a relatively short time frame.

The questionnaire was distributed primarily through social media platforms, including Facebook and Instagram, as well as through personal contacts using QR codes. Participation was voluntary and based on informed consent. Before completing the questionnaire, respondents were informed about the purpose of the study, the

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anonymous and confidential processing of the collected data, and their right to discontinue participation at any stage without providing a reason. No personally identifiable information was collected, all data were processed exclusively for scientific purposes, and the study involved minimal risk to participants.

Slovakia was selected because empirical evidence regarding consumer responses to sustainable cosmetic packaging in Central and Eastern Europe remains limited, despite the growing importance of sustainable consumption within the region.

A convenience sampling approach was employed due to its efficiency and accessibility. Although this non-probability sampling technique limits the generalizability of the findings, it is commonly used in exploratory consumer behavior research.

The original dataset consisted of 216 respondents. Twelve respondents younger than 18 years were excluded from the present analysis. Consequently, the final analytical sample consisted of 204 adult respondents from Slovakia. Women represented 65.69% of the sample (n = 134), while men accounted for 33.82% (n = 69). One respondent selected the option "other/prefer not to say" (0.49%). Participants ranged in age from 18 to 67 years, with a mean age of 24.37 years (SD = 7.91), indicating that the sample was predominantly composed of younger adults. A detailed overview of the sample characteristics is presented in Table 2.

2.4. Data analysis

The collected data were exported and subsequently analysed using the Gretl statistical software package.

Before hypothesis testing, the assumption of normality was examined using the Shapiro-Wilk test. Since the results indicated significant deviations from normality across all investigated variables ($p < 0.05$), non-parametric statistical techniques were employed.

Differences among repeated measurements were assessed using the Friedman test. This test was selected to account for the within-subject structure of the data, as the same respondents evaluated multiple packaging configurations. When statistically significant differences were identified,

Table 2. Sample characteristics (N = 204)

Variable	Category	n	%
Gender	Female	134	65.69
	Male	69	33.82
	Other / Prefer not to say	1	0.49
Age	Mean ± SD	24.37 ± 7.91 years	–
	Median	22 years	–
	Mode	20 and 21 years	–
	Range	18–67 years	–
Educational attainment	Secondary education	110	53.92
	Bachelor's degree	69	33.82
	Master's degree	21	10.29
	PhD degree	4	1.96
Place of residence	Urban area	113	55.39
	Rural area	91	44.61
Household size	One member	3	1.47
	Two members	33	16.18
	Three members	48	23.53
	Four members	51	25.00
	Five members	54	26.47
	Six or seven members	15	7.35
Monthly household income	Up to €1,000	25	12.25
	€1,001–2,000	70	34.31
	€2,001–3,000	53	25.98
	More than €3,000	34	16.67
	Prefer not to say	22	10.78

post hoc pairwise comparisons were performed using the Wilcoxon signed-rank test. To reduce the probability of Type I error associated with multiple comparisons, the Bonferroni correction was applied, resulting in an adjusted significance level of $\alpha = 0.0167$. Kendall's W was reported as an effect-size measure for the Friedman tests.

Furthermore, Spearman's rank correlation coefficient was used to examine the strength and direction of the relationship between perceived environmental sustainability and purchase intention. The use of Spearman's correlation was considered appropriate given the non-normal distribution of the analyzed variables.

The analytical strategy was restricted to the variables directly corresponding to hypotheses *H1–H6*. The broader questionnaire included additional constructs that were outside the analytical scope of the present study.

For all statistical analyses, the significance level was set at $\alpha = 0.05$, except for the post hoc pairwise comparisons, for which the Bonferroni-adjusted significance level of $\alpha = 0.0167$ was applied.

3. RESULTS

3.1. Perceived sustainability across packaging configurations

To examine differences in perceived environmental sustainability across cosmetic packaging configurations featuring different materials, respondents evaluated configurations featuring conventional plastic, biodegradable plastic and glass.

Packaging configurations featuring biodegradable plastic achieved the highest perceived sustainability score ($M = 3.34$, $SD = 0.76$), followed by configurations featuring glass ($M = 3.31$, $SD = 0.88$), whereas configurations featuring conventional plastic received the lowest evaluations ($M = 3.11$, $SD = 0.78$).

The Friedman test revealed statistically significant differences in perceived environmental sustainability across the three packaging configurations ($\chi^2(2) = 8.21$, $p = 0.016$, Kendall's $W = 0.020$). Subsequent pairwise comparisons using the Wilcoxon signed-rank test with Bonferroni correction indicated statistically significant differences between configurations featuring conventional plastic and biodegradable plastic ($p = 0.0002$) and between configurations featuring conventional plastic and glass ($p = 0.0148$). No statistically significant difference was detected between configurations featuring biodegradable plastic and glass ($p = 0.6885$).

These findings indicate significant variation in perceived sustainability across the evaluated packaging configurations. Configurations featuring both biodegradable plastic and glass received significantly higher evaluations than those featuring conventional plastic, whereas no statistically significant difference was detected between biodegradable plastic and glass configurations.

Table 3. Descriptive statistics for perceived sustainability across packaging configurations

Packaging configuration	Mean (M)	SD
Conventional plastic	3.11	0.78
Biodegradable plastic	3.34	0.76
Glass	3.31	0.88

Table 4. Differences in perceived sustainability across packaging configurations

Comparison	Test statistic	p-value
Friedman $\chi^2(2)$	8.212	0.016
Kendall's W	0.020	–
Conventional plastic vs. biodegradable plastic	–	0.0002*
Conventional plastic vs. glass	–	0.0148*
Biodegradable plastic vs. glass	–	0.6885

Note: $p < 0.0167$ indicates statistical significance after Bonferroni correction.

3.2. Purchase intention across packaging configurations

To determine whether purchase intention differed across cosmetic packaging configurations featuring different materials, respondents evaluated their purchase intentions for each packaging variant.

Packaging configurations featuring glass achieved the highest purchase intention score ($M = 3.14$, $SD = 0.84$), followed by configurations featuring biodegradable plastic ($M = 3.10$, $SD = 0.79$), whereas configurations featuring conventional plastic received the lowest evaluations ($M = 2.93$, $SD = 0.79$).

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The Friedman test indicated statistically significant differences in purchase intention across the three packaging configurations ($\chi^2(2) = 16.086$, $p < 0.001$, Kendall's $W = 0.039$). Subsequent pairwise comparisons using the Wilcoxon signed-rank test with Bonferroni correction revealed statistically significant differences between configurations featuring conventional plastic and biodegradable plastic ($p = 0.0002$) and between configurations featuring conventional plastic and glass ($p = 0.0021$). No statistically significant difference was identified between configurations featuring biodegradable plastic and glass ($p = 0.2270$).

These findings indicate significant variation in purchase intention across the evaluated packaging configurations. Configurations featuring biodegradable plastic and glass received significantly higher purchase-intention evaluations than configurations featuring conventional plastic, whereas no statistically significant difference was detected between biodegradable plastic and glass configurations. A detailed overview of the results is provided in Tables 5 and 6.

Table 5. Descriptive statistics for purchase intention across packaging configurations

Packaging configuration	Mean (M)	SD
Conventional plastic	2.93	0.79
Biodegradable plastic	3.10	0.79
Glass	3.14	0.84

Table 6. Differences in purchase intention across packaging configurations

Comparison	Test statistic	p-value
Friedman $\chi^2(2)$	16.086	<0.001
Kendall's W	0.039	–
Conventional plastic vs. biodegradable plastic	–	0.0002*
Conventional plastic vs. glass	–	0.0021*
Biodegradable plastic vs. glass	–	0.2270

Note: $p < 0.0167$ indicates statistical significance after Bonferroni correction.

3.3. Relationship between perceived sustainability and purchase intention

To examine the relationship between perceived environmental sustainability and purchase intention, Spearman's rank correlation coefficient was employed.

The analysis revealed a strong and statistically significant positive relationship between the two variables ($\rho = 0.686$, $p < 0.001$). This finding indicates that respondents who perceived cosmetic products as more environmentally sustainable also reported stronger intentions to purchase them.

A strong positive association was observed between perceived environmental sustainability and purchase intention. The corresponding correlation results are presented in Table 7.

Table 7. Correlation between perceived environmental sustainability and purchase intention

Variables	Spearman's ρ	p-value
Perceived sustainability – Purchase intention	0.686	<0.001

3.4. Price acceptance across packaging configurations

Differences in price acceptance across packaging configurations featuring different materials were examined at the highest price level (€23.95), corresponding to the premium product positioning.

The packaging configuration featuring glass achieved the highest price acceptance score ($M = 2.84$, $SD = 1.14$), whereas configurations featuring conventional plastic ($M = 2.54$, $SD = 1.17$) and biodegradable plastic ($M = 2.51$, $SD = 1.11$) received lower evaluations.

The Friedman test revealed statistically significant differences across the three packaging configurations ($\chi^2(2) = 28.48$, $p < 0.001$, Kendall's $W = 0.070$). Pairwise comparisons conducted using the Wilcoxon signed-rank test with Bonferroni correction revealed statistically significant differences between configurations featuring glass and conventional plastic ($p < 0.001$) and between configurations featuring glass and biodegradable plastic ($p < 0.001$). In contrast, no statistically significant difference was detected between configurations featuring conventional plastic and biodegradable plastic ($p = 0.570$).

These findings indicate that the packaging configuration featuring glass received significantly higher price acceptance evaluations than config-

urations featuring either conventional or biodegradable plastic at the premium price level. Tables 8 and 9 present the detailed statistical results.

Table 8. Descriptive statistics for price acceptance across packaging configurations at the highest price level (€23.95)

Packaging configuration	Mean (M)	SD
Conventional plastic	2.54	1.17
Biodegradable plastic	2.51	1.11
Glass	2.84	1.14

Table 9. Differences in price acceptance across packaging configurations at the highest price level (€23.95)

Comparison	Test statistic	p-value
Friedman $\chi^2(2)$	28.477	<0.001
Kendall's W	0.070	–
Glass vs. conventional plastic	–	<0.001*
Glass vs. biodegradable plastic	–	<0.001*
Biodegradable plastic vs. conventional plastic	–	0.570

Note: p < 0.0167 indicates statistical significance after Bonferroni correction.

3.5. Comparison of sustainability labels and the QR-code cue

The study further investigated whether consumers evaluated traditional sustainability labels differently from a QR-code cue displayed as a sustainability-related packaging element.

The Vegan label achieved a mean score of 3.10 (SD = 1.12), while the QR-code cue achieved a mean score of 3.18 (SD = 1.26). Similarly, the Cruelty-Free label achieved a mean score of 3.06 (SD = 1.10).

Pairwise comparisons using the Wilcoxon signed-rank test revealed no statistically significant difference between the Vegan label and the QR-code cue (Z = –1.096, p = 0.273). Likewise, no statistically significant difference was detected between the Cruelty-Free label and the QR-code cue (Z = –1.617, p = 0.106).

Thus, *H5* and *H6* were not supported, as neither comparison reached statistical significance. These non-significant results are not interpreted as evidence of equivalence or similarity between the sustainability labels and the QR-code cue. A detailed comparison is presented in Tables 10 and 11.

Table 10. Descriptive statistics for sustainability labels and the QR-code cue

Sustainability cue	Mean (M)	SD
Vegan label	3.10	1.12
Cruelty-Free label	3.06	1.10
QR-code cue	3.18	1.26

Table 11. Comparison between sustainability labels and the QR-code cue

Comparison	Z	p-value
Vegan label vs. QR-code cue	–1.096	0.273
Cruelty-Free label vs. QR-code cue	–1.617	0.106

3.6. Summary of hypotheses testing

Overall, four of the six proposed hypotheses were supported. Statistically significant differences were identified across packaging configurations featuring different materials in perceived environmental sustainability, purchase intention and price acceptance, while perceived environmental sustainability was strongly associated with purchase intention. Conversely, no statistically significant differences were identified between traditional sustainability labels and the QR-code cue. The results of hypothesis testing are summarized in Table 12.

Table 12. Summary of hypotheses testing

Hypothesis	Statement	Result
H1	Perceived environmental sustainability differs across cosmetic packaging configurations featuring different packaging materials.	Supported
H2	Purchase intention differs across cosmetic packaging configurations featuring different packaging materials.	Supported
H3	Perceived environmental sustainability is positively associated with purchase intention.	Supported
H4	Price acceptance differs across cosmetic packaging configurations featuring different packaging materials at the highest price level.	Supported
H5	Perceived environmental sustainability differs between products displaying a Vegan label and those displaying a QR-code cue.	Not supported
H6	Perceived environmental sustainability differs between products displaying a Cruelty-Free label and those displaying a QR-code cue.	Not supported

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The obtained results provide empirical evidence of differences in consumer responses across the evaluated packaging configurations, while no statistically significant differences in perceived sustainability were detected between the Vegan or Cruelty-Free labels and the QR-code cue.

4. DISCUSSION

The results demonstrated statistically significant differences in consumers' perceptions of environmental sustainability across packaging configurations featuring different materials. In particular, configurations featuring biodegradable plastic and glass received more favorable evaluations than those featuring conventional plastic, while no statistically significant difference was observed between configurations featuring biodegradable plastic and glass. These findings are consistent with the view that packaging material may function as an important sustainability-related cue; however, given the simultaneous variation in other packaging characteristics, the observed differences cannot be attributed exclusively to material. This interpretation is consistent with previous studies emphasizing the role of packaging material as an important sustainability cue (Steenis et al., 2017; Ketelsen et al., 2020; Perret et al., 2025). Similarly, Orth and Malkewitz (2008) argued that package design shapes consumers' impressions of products and brands, whereas Magnier et al. (2016) suggested that sustainable packaging enhances perceptions of environmental responsibility and product quality.

The findings further revealed statistically significant differences in purchase intention across packaging configurations featuring different materials. Configurations featuring biodegradable plastic and glass received higher purchase intention scores than those featuring conventional plastic. The present findings therefore indicate that packaging configurations incorporating materials commonly associated with sustainability were also evaluated more favorably in terms of purchase intention. However, these differences should be interpreted as responses to the overall packaging configurations rather than as isolated effects of packaging material. These findings are in line with previous research demonstrating that consumers increasingly prefer environmentally friendly packaging alternatives (Amberg & Fogarassy, 2019; Plotkina et al., 2025).

An important finding of the present study is the strong positive association between perceived sustainability and purchase intention. Respondents who perceived cosmetic products as more environmentally sustainable also expressed stronger intentions to purchase them. Therefore, the present findings suggest that sustainability-related product evaluations represent an important mechanism linking environmental concerns with marketplace behavior. These findings also support previous evidence emphasizing the importance of sustainability-related perceptions and environmental values in shaping behavioral intentions (Joshi & Rahman, 2015; White et al., 2019). Likewise, Amberg and Fogarassy (2019) highlighted the increasing role of environmental awareness in consumer choices within the cosmetics industry.

The analysis also demonstrated statistically significant differences in price acceptance across packaging configurations at the premium price level. In particular, configurations featuring glass were associated with higher price acceptance than those featuring conventional or biodegradable plastic. One possible explanation is that glass packaging is commonly associated with higher product quality and premium positioning, which may increase consumers' willingness to accept higher prices. This explanation is supported by the findings of Magnier et al. (2016), who suggested that sustainable packaging contributes to perceptions of product quality and value. Nevertheless, because other characteristics of the configurations also varied, the higher price acceptance observed for the glass configuration cannot be attributed exclusively to the packaging material.

Another finding concerns the comparison between traditional sustainability labels and the visual QR-code cue. No statistically significant differences in perceived sustainability were detected between the Vegan label and the QR-code cue or between the Cruelty-Free label and the QR-code cue. These non-significant results should not be interpreted as evidence that the communication cues are equivalent or perceived similarly, as no formal equivalence testing was conducted. Furthermore, respondents were not instructed to

scan the QR code and therefore did not evaluate additional sustainability information accessible through it. Accordingly, the findings relate specifically to the visual presence of a QR-code cue on the packaging rather than to the effectiveness, credibility or informativeness of QR-code-based sustainability communication. Future research could examine whether actively accessing sustainability information through QR codes produces different consumer responses compared with the mere visual presence of a QR code.

Taken together, the findings reinforce the importance of sustainable packaging configurations in consumer evaluation. Significant differences in perceived sustainability, purchase intention and price acceptance were identified across configurations featuring different packaging materials. However, the present analyses do not provide a statistical basis for concluding that packaging material represents a stronger cue than sustainability labels or QR-code cues, because the magnitudes of these effects were not directly compared. By providing empirical evidence from the Slovak cosmetics market, the present study extends previous findings and contributes to a better understanding of consumer responses to different sustainable packaging configurations and communication cues.

Although statistically significant differences were found, the observed effect sizes were relatively small, suggesting that the differences among the evaluated packaging configurations were modest and that consumer evaluations are likely shaped by multiple packaging-, product- and consumer-related factors. Therefore, additional attributes, such as brand familiarity, product quality, ingredients and previous consumption experiences, may also play an important role in consumers' decision-making processes.

Overall, the findings indicate that consumer evaluations differed across the examined sustainable packaging configurations, while no statistically significant differences in perceived sustainability were detected between the evaluated sustainability labels and the QR-code cue. Given the design of the stimuli, these findings should be interpreted at the level of overall packaging configurations rather than as isolated causal effects of individual packaging attributes. These findings also provide useful insights for cosmetic manufacturers and marketers seeking to design packaging and sustainability communication strategies that better reflect consumer preferences.

4.1. Limitations and future research

Despite providing valuable insights, the study has several limitations. The convenience sample was dominated by younger respondents and women, limiting the generalizability of the findings. Moreover, the study relied on self-reported evaluations, which may not translate into actual purchasing behavior (Joshi & Rahman, 2015).

Importantly, the experimental stimuli simultaneously varied in packaging material, price, colour and sustainability-related visual cues. Therefore, the observed differences cannot be attributed exclusively to packaging material but should be interpreted as differences between overall packaging configurations. The fixed presentation order without randomization or counterbalancing also means that potential order, fatigue and demand effects cannot be excluded. Furthermore, the QR-code condition represented only the visual presence of the code, as respondents did not access additional information through it. The findings therefore do not establish the effectiveness or equivalence of QR-code-based sustainability communication relative to traditional labels.

The use of a fictitious brand and the exclusive focus on Slovak consumers further limit the ecological validity and generalizability of the findings. Future research should employ more controlled experimental designs, randomized stimulus presentation, more diverse and cross-country samples, and real purchase situations.

Neuromarketing methods, including eye tracking, electroencephalography, galvanic skin response and facial expression analysis, could complement self-reported evaluations by providing insights into visual attention and emotional responses to sustainable packaging cues. More advanced analytical approaches, particularly mixed-effects models, structural equation modelling and discrete choice experiments, could further examine consumer responses while better accounting for repeated observations and individual-level differences.

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CONCLUSION

This study aimed to examine consumer responses to sustainable cosmetic packaging configurations featuring different packaging materials and selected sustainability communication cues, namely traditional sustainability labels and QR-code cues, in terms of perceived environmental sustainability, purchase intention and price acceptance.

The findings revealed statistically significant differences in consumer evaluations across packaging configurations featuring different materials. Configurations featuring biodegradable plastic and glass received more favourable perceptions of environmental sustainability than those featuring conventional plastic, with no statistically significant difference between biodegradable plastic and glass configurations. Configurations featuring biodegradable plastic and glass also received higher purchase intention scores than those featuring conventional plastic. Furthermore, higher perceptions of environmental sustainability were associated with stronger purchase intentions, suggesting that sustainability evaluations play an important role in consumers' purchasing decisions.

Another important finding concerns price perception. Packaging configurations featuring glass were associated with greater acceptance of the premium price than configurations featuring conventional or biodegradable plastic. This finding may reflect consumer associations between glass packaging and attributes such as higher product quality or premium positioning. However, given the simultaneous variation in other packaging characteristics, this difference cannot be attributed exclusively to packaging material.

No statistically significant differences in perceived sustainability were detected between the Vegan label and the QR-code cue or between the Cruelty-Free label and the QR-code cue. These results should not be interpreted as evidence of equivalence between these communication cues. Moreover, because respondents did not access additional information through the QR code, the findings relate specifically to the visual presence of the QR-code cue rather than to the effectiveness of QR-code-based sustainability information.

Overall, the study indicates that consumers respond differently to sustainable cosmetic packaging configurations and that perceived sustainability is positively associated with purchase intention. Given the design of the stimuli, the findings should be interpreted as differences between overall packaging configurations rather than as isolated causal effects of individual packaging attributes. By providing empirical evidence from the Slovak cosmetics market, this study contributes to a broader understanding of consumer responses to sustainable packaging configurations and selected sustainability communication cues.

AUTHOR CONTRIBUTIONS

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APPENDIX A. QUESTIONNAIRE

Appendix A presents the questionnaire items used in the present analysis.

Section C. Evaluation of cosmetic packaging stimuli

Note: Respondents were presented with nine cosmetic packaging stimuli that differed in packaging characteristics, including packaging material (conventional plastic, biodegradable plastic, and glass), packaging color (white, green, earth tones), sustainability-related packaging cues (e.g., Vegan label, Cruelty-Free label, refill symbol, and QR code), and price (€15.95, €19.95, and €23.95). Each stimulus was evaluated individually using the following three questions.

For each stimulus, respondents answered:

1. Perceived environmental sustainability

To what extent do you perceive this product as environmentally sustainable?
1 = Not at all environmentally sustainable; 5 = Very environmentally sustainable

2. Purchase intention

To what extent would you be interested in purchasing this product?
1 = Definitely not interested; 5 = Definitely interested

3. Price acceptance

To what extent do you consider the displayed price to be appropriate?
1 = Completely inappropriate; 5 = Completely appropriate

Note: The price presented in the third question corresponded to the price displayed in each individual stimulus (€15.95, €19.95, or €23.95).

Section D. Perceptions of individual packaging elements

To what extent do the following packaging elements indicate that a cosmetic product is environmentally sustainable?

Please indicate your response for each item using a five-point Likert scale (1 = not at all; 5 = very much).

Packaging element	1 Not at all	2	3	4	5 Very much
Glass packaging	o	o	o	o	o
Recycled plastic	o	o	o	o	o
Biodegradable material	o	o	o	o	o
Green packaging color	o	o	o	o	o
Natural/earth-tone colors (e.g., brown, beige)	o	o	o	o	o
Vegan certification	o	o	o	o	o
Cruelty-Free certification	o	o	o	o	o
Refill option	o	o	o	o	o
QR code providing sustainability information	o	o	o	o	o
Paper/cardboard packaging	o	o	o	o	o

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