What do Female Consumers Think about Sustainable Packaging?

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Abstract
This study explores the level of knowledge among Spanish consumers regarding sustainability and their opinions on new sustainable packaging options, such as bio-based materials or bagasse. We conducted an online questionnaire at a national level, followed by multivariate analysis to derive conclusive results. Our findings, based on 254 participants, indicate that only 44% of consumers integrate sustainability into their daily lives. Key characteristics deemed important for sustainable packaging include environmental friendliness (85%), use of clean energy (72.5%), ease of reuse (85.8%), and recyclable materials (80.8%). Factor analysis reveals three categories: manufacturing characteristics, security, and price. Cluster analysis identifies two groups: one concerned with container safety and another seeking achievable sustainability.

Introduction

A shift in food demand is underway, precipitating changes in purchasing behaviors toward healthier and more environmentally and animal-friendly options (Martínez-Alvarez et al., 2021). FAOSTAT data over the last 30 years show a steady global increase in average daily dietary energy intake in kcal per day (Vasileska & Rechkoska, 2012). Presently, there's a low intake of fruits and vegetables and a high consumption of fatty, salty products, leading to cardiovascular and cancer risks (Vasileska & Rechkoska, 2012). These factors drive a trend towards healthier consumption and eating habits.

Societal evolution towards more developed societies and changes in family structures and lifestyles are catalysts for these new food consumption trends (Martínez-Alvarez et al., 2021). These shifts directly impact the food industry, leading to the creation of more ready-to-eat products and an increase in fresh and seasonal offerings.

Moreover, increased citizen and governmental awareness of environmental issues and animal welfare has spiked demand for environmentally-friendly products like organic items, sustainable packaging materials, and animal-friendly products such as vegan diets. These factors contribute to a societal shift towards more sustainable, healthy consumption practices that respect both animals and the environment.

Our objective is to assess Spanish consumers' knowledge of sustainability and their opinions on new sustainable packaging options, such as bio-based materials or bagasse. We

conducted a national-level online questionnaire in Spain, with 254 participants. Only 44% of consumers incorporate sustainability into their daily lives. The study identified characteristics that consumers prioritize in sustainable packaging, including environmental friendliness (85%), clean energy usage (72.5%). Cluster analysis revealed two clusters: safety-conscious consumers and those seeking achievable sustainability. The study structure comprises a theoretical framework discussing sustainability and new trends in food packaging, followed by a methodology section, discussion of survey results, and concluding with recommendations.

1. Theoretical Framework
1.1. Concept of Sustainability

The term "sustainability" originated in the 1987 United Nations report titled "Our Common Future." It defines sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987).

Over time, sustainability has evolved to integrate environmental health, social equity, and economic vitality, aiming to create thriving, diverse, and resilient communities for current and future generations (UCLA University, n.d.).

1.2. Dimensions of Sustainability

According to a 1997 UN report, sustainability encompasses three dimensions: economic, social, and environmental. The economic dimension ensures that agricultural production systems meet current consumption levels without jeopardizing future needs (Choi & Ng, 2011; Fernández García, 2011).

Figure 1. Dimensions of sustainability

The social dimension focuses on aspects of equity, accessibility, participation, security and institutional stability (Kim, 2018). Finally, the environmental dimension refers to the natural environment and how it remains productive and resilient to sustain human life; that is, it requires that the resources be used at a rate no greater than that of regeneration, and that the waste it receives be emitted no faster than it can be assimilated (Choi & Ng, 2011; ONU, 1997).

Source: Own elaboration.

1.3. The New Era of Sustainability

The societal shift towards heightened environmental awareness has spurred new consumption patterns towards sustainability (Martínez-Alvarez et al., 2021). Consequently, there´s been a surge in the consumption of eco-friendly products such as organics and sustainable food packaging utilizing novel materials. Traditional packaging, discarded after use, includes materials like paper, plastic, glass, and aluminium, posing environmental challenges despite recycling efforts (Jeevahan & Chandrasekaran, 2019). Hence, the food industry seeks sustainable alternatives.

Some of these alternatives for a more sustainable packaging are sustainable materials like bioplastics and bagasse have gained traction.

- Bioplastics are polymers derived from natural or renewable sources like sugar cane or corn, some being biodegradable and compostable (Jain & Tiwari, 2015; Rudin & Choi, 2013).
- Bagasse comprises plant residues from crushing or macerating crops, offering a compostable and renewable alternative to plastics and foam in packaging applications.

2. Methods

In an investigation, when it is required to obtain information from a certain population on a specific subject, the survey is usually used as a method to obtain this data and later analyze it (Rocco & Oliari, 2007). In research investigations requiring data collection from specific populations, surveys are commonly utilized (Rocco & Oliari, 2007) this method offers several advantages, including the ability to gather responses quickly and cost-effectively, especially when employing online questionnaires.

For our study, data collection was facilitated through an online questionnaire created using Google Forms, targeting Spanish consumers. The survey has 31 questions divided into 4 blocks; each block designed for the respondents to answer on a topic of the research that is being carried out. The questionnaire begins with an introduction where we explain to those surveyed the topic and the approximate time it will take them to answer the entire questionnaire. The first block deals with consumer knowledge about sustainability. The second block deals with new consumer trends. The third block focuses on packaging trends. And finally, the last block inquiries about the purchasing and sociodemographic profile of the respondents.

The target population is the group of individuals that the study intends to conduct research in and draw conclusions from (Gregory et al., 2017), our target group are consumers over 18 years and Spanish nationality. We followed a non-probabilistic method, the non-probabilistic demonstrated is a proven method that uses non-random criteria such as geographic proximity or knowledge of the people to be investigated to answer a research question, or in this case, a questionnaire (Yin, 2011). This type of sample is normally used when the population parameters are unknown or it is not possible to identify them individually.

The questionnaire was distributed via email and various social media platforms (WhatsApp, Twitter, and Instagram) over a month-long period from April 10th to May 16th, 2023. To enhance result generalization and minimize sample bias, the questionnaire was sent at different times, to different groups of populations, and to different Spanish regions. Detailed sampling information is available in Table 1 of the technical data sheet.

Table 1. Technical details of the survey

Characteristics	Details
Population	Consumers of Spain, over 18 years old
Area	Spain
Sample type	Non-probabilistic sampling
Sample size	254
Confidence level	95%
Method of collecting data	Online survey (Google Forms) Self-administered
Realization date	April 2023

Source: Own elaboration.

To analyze the results of the survey we used the SPSS Statistics 26 program, where we will be performed univariate, bivariate and multivariate analyses. Univariate analysis involves the examination of each studied variable separately, focusing on a single variable. It employs basic statistical measures such as mean, median, mode, variance, and percentages to assess a variable (Orange, 2011). Bivariate data analysis is a form of statistical analysis in which the

level of covariance between two variables is quantified at a descriptive and inferential level, thus realizing the relationship between two variables (Sulbarán, 2012). Multivariate analysis refers to a set of statistical techniques used to analyze multiple variables simultaneously, typically involving more than two variables (Hair et al., 1979). For multivariate analysis, two tests were conducted: factor analysis and cluster analysis.

- **Factor analysis** is utilized to condense a large number of variables into fewer factors or groups. It aims to extract the maximum common variance of all variables and allocate them to a common score (Ness, 2021b). The SPSS program was used to perform the factor analysis, the analysis used is "reduction of dimensions; factor".
- **Cluster analysis**, also known as segmentation or taxonomy analysis, identifies structures within the data to detect homogeneous groups of cases. It is exploratory in nature and does not distinguish between dependent and independent variables (Ness, 2021a). The Spss program was used to perform the cluster analysis, the analysis used is "bipolar cluster".

3. Results

The survey received 254 complete responses, with no exclusions, resulting in the analysis of all 254 responses. Demographically, the majority of respondents were women (71%) from various regions of Spain, primarily from Catalonia, Castilla y León, and the Community of Madrid, with high levels of education and/or training.

3.1. Factor Analysis

Factor analysis serves as a method to condense numerous variables into fewer factors or groups. In our survey, we applied factor analysis to streamline sustainable packaging characteristics into a smaller set of summary factors. This approach was suitable given the metric nature of our data, ranging from 1 (strongly disagree) to 5 (totally agree). By employing factor analysis, we aimed to enhance the interpretability of the data while retaining its essential insights.

We assessed the correlation of the data using the Kaiser-Meyer-Olkin (KMO) index and the Bartlett test. The null hypothesis (H0) states that the data is not correlated, while the alternative hypothesis (H1) suggests the data is correlated. To reject the null hypothesis and accept the alternative, the significance level must be less than 5% (0.050). With our value at 0.001, which is less than 0.050, we reject the null hypothesis and accept the alternative, indicating correlated data. Additionally, the KMO index of 0.902 suggests excellent results. Table 2 displays the results of the KMO and Bartlett test.

Table 2. KMO and Bartlett's Test applied to sustainable packaging characteristics

KMO and Bartlett test		
Kaiser-Meyer-Olkin measure of sampling adequacy		**0,902**
Bartlett's test of sphericity	Approx. Chi-square	2290,627
	gl	105
	Sig.	**0,001**

Source: Own elaboration.

After conducting the KMO and Bartlett test, we proceeded with Component Analysis and Varimax rotation. Table 3 illustrates the selected factors ordered by their eigenvalues. Employing the variance criterion, a 3-factor solution emerged, elucidating 66.488% of the variance in the original data. These results are deemed acceptable as they surpass the minimum threshold of 60%. Table 4 indicates that all variables possess communalities exceeding 50%, signifying acceptable outcomes.

Table 3. Factor Analysis: Selection of components based on eigen-value and total variance explained

Total explained variance									
Component	Initial eigenvalues			Sums of Squared Extraction Charges			Sums of squared charges of rotation		
	Total	% of variance	% accumulated	Total	% of variance	% accumulated	Total	% of variance	%
1	7,092	47,280	47,280	7,092	47,280	47,280	5,744	38,291	38,291
2	1,660	11,070	58,350	1,660	11,070	58,350	2,784	18,561	56,853
3	1,221	8,138	66,488	1,221	8,138	**66,488**	1,445	9,635	66,488
4	0,754	5,024	71,511						
5	0,699	4,662	76,173						
6	0,672	4,477	80,650						
7	0,529	3,524	84,174						
8	0,469	3,125	87,299						
9	0,423	2,821	90,120						
10	0,351	2,343	92,463						
11	0,292	1,944	94,407						
12	0,269	1,792	96,199						
13	0,236	1,575	97,775						
14	0,193	1,284	99,058						
15	0,141	0,942	100,000						

Source: Own elaboration.

Table 4. Communalities in the Factor Analysis applied to sustainable packaging characteristics

Communalities	Initial	Extraction
Produced with clean energy (eg. solar, wind energy)	1,000	**0,593**
Produced with recyclable materials	1,000	**0,667**
Manufactured with reduced costs	1,000	**0,631**
That extends its expiration	1,000	**0,709**
That they do not use toxic substances in their preparation	1,000	**0,659**
That satisfies the needs of the consumer (that is comfortable, useful and safe)	1,000	**0,559**
Made from vegetable matter (eg. corn, cellulose)	1,000	**0,623**
Easy to break down and reuse in making new products	1,000	**0,772**
Decomposes in the environment (biodegradable)	1,000	**0,673**
What can be made into fertilizer (compostable)	1,000	**0,716**
Less safe for the product than a plastic or petroleum-derived container	1,000	**0,654**
Environmentally friendly	1,000	**0,774**
Composed with recycled materials	1,000	**0,670**
More expensive than a plastic or petroleum-derived container	1,000	**0,698**
That consumes less energy and generates less waste in its production	1,000	**0,576**

Source: Own elaboration.

Lastly, Table 5 delineates the composition of each component. The first component correlates with characteristics related to the production process, while the second component pertains to the pricing of sustainable packaging. The third and final component addresses the safety considerations associated with sustainable packaging. Consequently, we infer the presence of three components, namely "Characteristics of Production," "Safety of Sustainable Packaging," and "Price of Sustainable Packaging".

Table 5. Rotated Component Matrix

| Component matrix			
	Component		
	1	**2**	**3**
Produced with clean energy (e.g., solar, wind energy)	**0,729**	0,010	-0,247
Produced with recyclable materials	**0,802**	-0,150	-0,041
Manufactured with reduced costs	**0,591**	0,488	-0,210
That extends its expiration	**0,554**	0,534	-0,342
That they do not use toxic substances in their preparation	**0,760**	0,057	-0,280
That satisfies the needs of the consumer (that is comfortable, useful and safe)	**0,504**	0,473	-0,284
Made from vegetable matter (e.g., corn, cellulose)	**0,738**	-0,173	0,221
Easy to break down and reuse in making new products	**0,844**	-0,245	0,022
Decomposes in the environment (biodegradable)	**0,783**	-0,159	0,186
What can be made into fertilizer (compostable)	**0,744**	-0,197	0,350
Less safe for the product than a plastic or petroleum-derived container	0,139	**0,669**	0,432
Environmentally friendly	**0,846**	-0,222	0,093
Composed with recycled materials	**0,811**	-0,101	0,047
More expensive than a plastic or petroleum-derived container	0,219	0,466	**0,657**
That consumes less energy and generates less waste in its production	**0,752**	-0,097	-0,034

Source: Own elaboration.

3.2. Cluster analysis

Cluster analysis was conducted to profile consumers, aiming to group Spanish consumers based on their characteristics. This analysis amalgamates respondents' lifestyle, demographics, and perspectives on sustainable packaging characteristics. Factors derived from the factorial analysis and variables from the dataset were utilized in the cluster analysis.

Initially, the two-step clustering method was implemented on the SPSS software dataset utilized in the study. This method was selected due to its ability to accommodate both continuous and categorical variables in determining clusters. Through this approach, it was determined that the most suitable number of clusters for the survey dataset was 2.

In the analysis, 51.6% of consumers were classified into the first cluster, while 48.8% were allocated to the second cluster.

Figure 2. Cluster Sizes
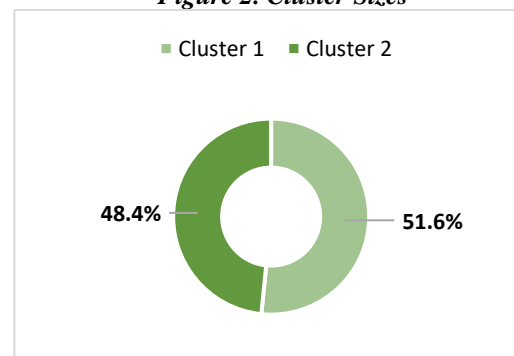
Source: Own elaboration.

Upon examining the demographic characteristics of the clusters, the first group, on average, falls within the age range of 18 to 24 years. Furthermore, this cluster predominantly comprises women, with most being university students holding bachelor's, diploma, or degree qualifications.

In contrast, Cluster 2 primarily consists of women with an average age ranging from 45 to 54 years. The majority of consumers in this cluster are employed, either in private companies or the public sector, and also possess university degrees (Bachelor, Diploma, or Degree).

Table 7. Cluster centres to identify the membership in each group

	Cluster 1	Cluster 2
Characteristics	-0,02	0,02
Price	0,20	-0,21
Safety	-0,07	0,07

Source: Own elaboration.

When examining the demographic characteristics of the first group, it becomes evident that consumers within this cluster have a lower perception of sustainable packaging characteristics, particularly in terms of its manufacturing process and safety. Notably, the safety factor yields the lowest negative value, indicating that consumers in this group harbor concerns regarding the safety of sustainable packaging compared to conventional alternatives. Furthermore, consumers in this cluster exhibit a heightened perception of pricing, believing that sustainable packaging is more expensive than conventional options.

In contrast, consumers in the second cluster demonstrate a lower price perception. Unlike their counterparts in the first group, they do not agree that sustainable packaging commands a higher price. Regarding the "characteristics of its manufacture" and the "safety of the container," consumers in this group exhibit a positive perception. Notably, safety of the container emerges as the most significant factor for consumers in the second cluster.

Consequently, the first cluster, comprised of young women with university education, demonstrates an understanding of the intricacies involved in sustainable packaging development. They acknowledge the necessity for sustainable packaging to command a higher price but express concerns about its safety. Therefore, this cluster is labeled as "consumers concerned about the safety of the container".

Conversely, the second cluster, consisting of adult women with university degrees, exhibits a heightened awareness of sustainable packaging manufacturing characteristics. Unlike the first cluster, they believe that sustainable packaging is as safe as conventional options and do not perceive a need for a higher price. Consequently, this group is labeled as "consumers seeking achievable sustainability".

Conclusions, limitations and future directions

The factorial analysis conducted aimed to condense the characteristics of sustainable packaging into three main factors: manufacturing characteristics, security provided, and pricing. This suggests that the packaging industry should prioritize the manufacturing process, pricing, and safety of sustainable containers.

Furthermore, cluster analysis successfully categorized sociodemographic data into two groups based on the aforementioned factors. The analysis revealed two distinct consumer groups: one, labeled as "consumers concerned about the safety of the container," comprises women aged 18-24, primarily students, who acknowledge the higher cost of sustainable packaging compared to conventional options. The other group, termed "consumers seeking achievable sustainability," consists of women aged 45-54, predominantly employed, who prioritize packaging safety and its production characteristics.

The findings highlight that young women prioritize the safety provided by sustainable packaging and are willing to pay a premium for it, reflecting their heightened awareness and access to information, aided by technological advancements and educational initiatives like the 2030 agenda. In contrast, older women perceive sustainable packaging as equally safe as

conventional options but are reluctant to pay extra, prioritizing economic stability amid crises, as observed in previous studies (Carrasco, 2009; Perkins, 2017).

These insights underscore the nuanced consumer perceptions of sustainable packaging and underscore the importance of tailoring marketing strategies and product offerings to different demographic segments to promote sustainable consumption patterns.

This study's limitations include its specific sample profile and the use of a questionnaire to gather information on Spanish consumers' perceptions of sustainable packaging, which inherently reflects subjective opinions. Additionally, while online questionnaires offer expediency, they also present limitations, particularly in predicting the sample composition. Notably, our study received more responses from women than men, indicating a potential gender bias.

Another limitation that is seen is that the factor we have made has given 3 components, 1 with 13 elements and the other two 2 with 1 element each. For future studies it would be necessary not only to expand the number of characteristics to study and also to make them more varied, so that more elements can appear in each component, or even more have more than 3 components in the study. These results would also help us to perform the cluster analysis.

Future research endeavors should aim to address these limitations by striving for a more representative sample and focusing on specific regions within Spain to ascertain localized insights.

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