




Meat production and sustainability: Spanish consumers' perception

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HIGHLIGHTS

- Spanish meat consumers survey showed an alienation to sustainable development.
- Consumers value workers having a safe working environment.
- Meat firms' sustainability can be connected uniformly across all demographic groups.
- Spaniards are grouped into proactive, conscious, or skeptical on sustainable meat.

ABSTRACT

The meat sector is of significant economic importance to Spain. However, it is equally imperative that this sector operates in a manner that is both responsible and environmentally sustainable. The objective of this study was to determine the most valued sustainability attributes of the meat industry by consumers, with a view to enhancing the communication policy of companies. This work reduces the gap in how meat companies can connect their sustainability actions with consumers' concerns. A study was conducted to obtain Spanish consumers' opinions on evaluating thirteen sustainability attributes in the meat industry. This was achieved by means of a questionnaire (n = 505). The results obtained demonstrated a high level of interest in sustainable development. Furthermore, social responsibility aspects, particularly those related to the safety of the workplace, are of particular significance when compared to environmental and corporate sustainability parameters. Kruskal-Wallis test showed a higher concern of sustainable attributes in women compared to men. The segmentation analysis by K-means procedure showed three differentiated groups: proactives, conscious and skeptical. Based on these findings, interesting insights can be applied to communication strategies in meat firms.

1. Introduction

Meat consumption is a common practice of humanity since ancient times because of the nutritional value and added pleasure to eat it. In recent decades, the world meat demand has shown an increase of 58 % and the forecasts for the coming years are for it to continue growing (Cardona et al., 2023a). This increment is boosted in countries with middle income, since in high-income countries - which represent 32 % of total consumption - it is expected to demand stabilization due to the aging of society and novel trends in nutrition (OECD-FAO, 2024). These feed changes are based in a widespread concern about the damage caused by human action to the environment (Fróna et al., 2019). This awareness of environmental protection is particularly focused on the food industry, and particularly, in the meat sector. In the Agricultural Outlook (OECD-FAO, 2024) it is detailed that consumers worldwide are increasingly concerned about animal welfare and, in general, about environmental and health issues.

The Spanish meat industry is the largest food sector in turnover terms and the fourth largest in whole Spanish industry, with a significant contribution to the national GDP (Cardona et al., 2023b; ANICE, 2025). According to Font-i-Furnols and Guerrero (2022), national trends consumption is broken down as follows: omnivores percentage ranges between 62 and 87 %, of whom between 11 and 35 % are flexitarians, and vegetarian and vegan populations fluctuate between 2 and 6 %. Overall, Spain is a country with wide cuisine variety but, together with traditional eating habits (Blanco-Penedo et al., 2021). Thus, although meat production is a key activity in the economy, at the same time, responsible and eco-friendly behaviour is preferred (Font-i-Furnols and Guerrero, 2022). Consequently, it is required the modulation of company strategies that are susceptible to harming the environment, both to search for alternatives to reach lower deterioration of the environment and to achieve better positioning of the sector and reduce the consumers that stop buying meat for sustainable reasons.

Sustainability in production and consumption, in addition to being a

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sustainable development objective of the United Nations, is a major challenge and concern for society. Companies have increasing obligations in this regard, but also an interest in moving in this direction. Thus, following the ambitious growth strategy of the European Union, the Green Deal, the directive (EU) 2022/2464 on corporate sustainability reporting introduces some improvements respect the former regulation (EU, 2014/95): mainly, larger number of affected companies, non-financial information through more transparent and comparable measures (European Sustainability Reporting Standards) and procedures for verifying this information through audits. This European regulation, together with the Directive 2010/75/EU on Industrial Emissions, directly affects meat production due to the obligation to reduce methane emissions and the use of pesticides and antimicrobials in the EU. Furthermore, given the problems of water scarcity and contamination, and given that the meat sector (mainly pork) is one of the largest consumers of natural resources in Spain, it should be a heart point of water policies (de Miguel et al., 2015). In addition, European legislation (for instance, Regulation (EU) 2024/1727 and Regulation (EU) 2023/2803) addresses animal welfare to improve the rearing and transport conditions of the animals. According to Mateos et al. (2024), all these regulations are addressing problems in the main hotspots of the sector.

Companies can advance in sustainability beyond regulations because their stakeholders demand ethical behaviour from them. According to Freeman (1984), stakeholders are “any group or individual who can affect or is affected by the achievement of an organization's objectives”. Most firms' operations create externalities that impact many parties –stakeholders-, who increase pressure on companies to improve positive impacts and decrease the negative ones. Previous literature shows that the concern of society regarding the overall effects of industrial and commercial activities on the environment is growing, and that stakeholders have the power to influence companies' environmental values and procedures (Buyse and Verbeke, 2003; Darnall et al., 2010; Wu, 2015; Ferrón-Vilchez et al., 2017; Baah et al., 2021). Consequently, an organisation may possess a wide range of stakeholder relationships that are characterised by heterogeneity and varying degrees of influence (Ferrón-Vilchez et al., 2017; Baah et al., 2021). In this regard, consumers can be regarded as a pivotal stakeholder group for the company (Wu, 2015; Zhang and Zhu, 2019; Huang et al., 2023).

According to Buyse and Verbeke (2003), consumers are becoming more informed and conscious of how products affect the environment, which may lead them to expect companies to improve the environmental performance of their offer. Green consumerism may accelerate the shift toward more proactive environmental management, particularly in industries with direct household consumer contact. Aligned to the above, other authors point out the importance of developing effective strategies for marketing sustainable products and transparent communication of their sustainability attributes (Calveras and Ganuza, 2016; Bangsa and Schlegelmilch, 2020; Rastogi et al., 2024). The correlation between the depth of knowledge regarding the company's conduct and the subsequent increase in customer or investor numbers has been well-established (Baah et al., 2021).

Thus, companies have incentives not only to follow sustainable policies and actions but also to communicate them properly. In this process, they need a better understanding of the sensitivities and priorities of society. Beyond regulation enforcement, greater knowledge about aspects of sustainability that are most valued by citizens may guide the strategies that companies should pursue for increasing the trust between businesses and society (Borges et al., 2023). Meanwhile, looking into the heterogeneity of customers regarding their sustainability preferences can enhance communication conducted with each of the socio-demographic groups.

Considering the above-mentioned aspects, it is essential to assimilate the prevailing concerns and interpretations of consumers to carry out effective communication and obtain their attention regarding meat products, which is the purpose of this article. It is required to study the sustainability attributes of products that Spanish consumers consider

most important when making a purchase. In addition, it is essential to explore any differences in sensitivity based on the consumers' profiles. To address these objectives, we employed a comprehensive methodological approach. Starting from previous literature and sustainability strategies of large meat companies, we developed a questionnaire that was administered to a sample of Spanish customers that was representative in relation to the main sociodemographic variables, such as age, sex, and residence region. We ranked sustainability criteria and identified the most and least valued. Subsequent, we examined whether socio-demographic characteristics lead to valuation differences, using multiple analysis of variables and Kruskal-Wallis tests. In addition, we explored heterogeneity using a joint combination of factor and cluster analysis, which comprises a version of reduced K-means and factorial K-means (Markos et al., 2019).

Numerous studies have investigated the relationship between sustainable products and consumer purchasing decisions (Bangsa and Schlegelmilch, 2020). This work seeks to advance this line of research by not only examining the influence of sustainability, but also contribute to the existing literature, specifically identifying which sustainability attributes (e.g., recycled materials, carbon footprint reduction, animal welfare, ethical labour conditions, etc.) are most valued by consumers when choosing a product. A thorough understanding of the most highly valued aspects could allow companies to guide their strategic decisions toward more sustainable production and distribution. This would facilitate an enhancement in their social and environmental commitment, as well as assist them in formulating their communication policy. Thus, this would reduce the lack of information that meat companies have on how to approach consumers to communicate their sustainability policies. This research attempts to contribute to and augment the existing body of knowledge in this field.

Furthermore, as consumers adopt increasingly diverse lifestyles, the food system becomes more complex. Citizens in the Western world are faced with a wide variety of food product options, and consumption behaviour becomes more varied and heterogeneous (Funk et al., 2021). According to Wu (2015), internal heterogeneity within a single stakeholder group has not been widely examined in the literature, and even less attention has been given to differences between customer types. Therefore, it is of interest to characterize food consumers based on sociodemographic data to investigate whether differences exist in their sensitivity to the sustainability attributes of meat products.

2. Background and research questions

To obtain a responsible environmental response from the meat industry, in addition to the companies' commitment, it is crucial to involve consumers, recognize their opinion, and include them in sustainable development. In this regard, many authors (Grunert, 2011; Lazzarini et al., 2016; Funk et al., 2021; Van Bussel et al., 2022) point out that consumers play an essential role in the reduction of the negative environmental impact of the food industry through their food purchase choices. In addition, consumers who do not consider sustainability as a choice factor in food procurement are due to the lack of knowledge about sustainability, and they even have difficulties defining the sustainability concept (Van Bussel et al., 2022). Therefore, to ensure the most sustainable choice in food acquisition, it must be adequately communicated, as Grunert (2011) suggested. This is aligned with Lazzarini et al. (2016), who support the requirement to enhance information systems that allow consumers to evaluate the impact caused by food products, thereby facilitating the choice of the most sustainable alternatives. Toussaint et al. (2021) examined the behaviour of consumers (in developing and developed countries) regarding the procurement of food products, as well as the influence that environmental and social sustainability has on their decision process. The study corroborates the consumer's awareness of these topics, and the authors conclude that companies with responsible behaviour must communicate their sustainable strategies. Furthermore, Araújo et al. (2022) suggested that

animal welfare and environmental impact have become key attributes of consumer perception, and the information that consumers receive through the media greatly influences their perception and behaviour.

In previous literature, several publications addressed the relationship between the behaviour of consumers and the environmental impact of food production. Grunert et al. (2014) carried out an investigation with European consumers from different countries on the knowledge and use of food green labels. The results showed that the greatest sustainability concerns were the poor working conditions, excessive use of natural resources, non-recyclable packaging, along with the amount of packaging used in products, animal abuse, and the negative environmental impact of human activities on water and land sources. Similarly, Lazzarini et al. (2016) concluded that Swiss consumers have a better perception of high protein foodstuffs that are tagged with the origin of the product and with the ecological label.

Focusing specifically on the meat industry, Burnier et al. (2021b) analysed the influence of social and environmental aspects on beef purchasing decisions by Brazilian consumers, showing that animal welfare and traceability were determining factors. Rolfe et al. (2023), using a sample of Australian consumers, find that health is the most important factor in the decision to purchase meat, as it is considered an essential food in a healthy diet. These authors point out that the greenhouse gas footprint is important, especially for women and younger people, but it is less decisive than other factors. In a study performed in the UK, Apostolidis and McLeay (2019) observed different groups of meat consumers. The study identified six intra-group segments based on their preferences for the different food labels, where only “empowered meat eaters” and “meat reducers” were motivated to buy more sustainable meat products, and are decreasing meat consumption due to sustainability reasons, respectively. Likewise, Klink-Lehmann et al. (2022) carried out a study in Germany about the identification of relevant sustainable attributes for consumers and who consumers consider bears the responsibility of ensuring a sustainable value chain. Consumers consider that animal welfare is the most determining aspect, and social and environmental issues have less relevance, attributing the responsibility to other stakeholders but not themselves. However, the latter authors assert that the meat industry requires the involvement of all stakeholders, including consumers, to reach more sustainable sectors. In a subsequent study, Hübel and Schaltegger (2022) surveyed German meat industry actors showing interrelated barriers that hinder the development of sustainable practices, including the confrontation to change, emotional disconnection with the industrial production impacts, sociocultural standards that favour conventional meat production, specialized industrial infrastructures or contradictory regulations that discourage the adoption of sustainable practices and the lack of political incentives and lack of knowledge of more sustainable protein production options or practices.

In the Spanish meat context, Gaspar et al. (2022) observed that price is the most important attribute for consumers to buy Iberian cured products. Moreover, the study showed that consumers identify sustainability aspects with an increase in added value, which can meet new consumer demands, including animal welfare as one of the most important features. In the Spanish beef meat sector, Font-i-Furnols and Guerrero (2022) showed that consumers gave priority to meat produced under organic and ecological conditions and labelled with animal welfare. These preferences were diverse in three different groups, with the “millennials” being the consumers with the least awareness of production under environmentally friendly conditions. Cardona et al. (2023b) found that the most relevant factors for consumers when choosing hamburgers and minced meat are price, expiration date, origin, and appearance. The authors identified additional non-priority attributes, including animal welfare, organic production and environmental concerns, which have a lesser impact on the purchasing decision.

Considering the above-mentioned aspects, it is essential to know consumers’ concerns and understand their interpretation to communicate effectively, i.e., to attract their attention and increase their

commitment to sustainability based on major knowledge. However, as Blanco-Penedo et al. (2021) point out, there is scarce empirical information on the perceptions of Spanish consumers regarding sustainable consumption and, in addition a gap regarding how companies should approach their sustainability communication policies. Thus, our first group of research questions would be.

- R1: Which sustainability criteria are more/less valued?

Diverse opinions on sustainability can vary depending on personal and social circumstances, making it the initial step to explore the sensitivity of sustainability based on sex, age, region, education, or income. Although sociodemographic variables are not the only possible segmentation criteria, they are useful for describing the consumer segments identified (Funk et al., 2021). Indeed, women are more likely than men to develop a sustainable consumer behaviour (Luchs and Moordian, 2012; Grunert et al., 2014). Regarding the Spanish case, Blanco-Penedo et al. (2021) observed differences in consumer attitudes, behaviour, and preferences based on their sociodemographic characteristics. In their research, this segmentation is considered to offer valuable information, but they point out that it is a topic not deeply explored in literature. Therefore, to delve into this issue, our second group of research questions would be.

- R2: Are there differences in sustainability criteria valuation according to socio-demographic factors?

In this way, if socio-demographic differences were found, a specific group of people (for instance, young women or men living in North Spain) could be targeted with certain sustainability criteria to which they are more sensitive. Otherwise, a unique communication campaign could be launched across regions and social groups.

With the exception of sustainability criteria and socio-demographic questions, no further inquiries are made to maintain the simplicity and ease of completion of the questionnaire. It is acknowledged, however, that alternative value scales and behaviours, which are not aligned with sustainability, are present within society. Indeed, as Funk et al. (2021) state, in addition to socio-demographic, behavioural, and attitudinal variables, they are very useful as a basis for informing policy-making. Also, using non-demographic segmentation from the beginning would provide clearer direction (Funk et al., 2021). Likewise, Blanco-Penedo et al. (2021) and Font-i-Furnols and Guerrero (2022) suggest that when designing a communication strategy, the use of other segmentation criteria such as lifestyle, eating habits or culinary skills are also necessary. Therefore, we pose a third group of questions.

- R3: Could other segments be identified independently of the socio-demographic variables?

This could also provide additional keys on sustainability communication.

3. Methodology

3.1. Main sustainability strategies and the questionnaire

Sustainability conceptualization has undergone a continuing evolution, giving rise to several definitions. In the late 1980s, a triple dimension was introduced, containing the economic, social, and environmental attributes, which are the current pillars of sustainability (Catlin et al., 2017; Geissdoerfer et al., 2017; Massuça et al., 2023).

Social sustainability is the least developed dimension; however, from the perspective of stakeholders, social issues are the second highest priority after environmental concerns, ranking above economic concerns (Massuça et al., 2023). The social dimension indicates the related issues among workers, suppliers, consumers, and communities. The

environmental attribute refers to the natural resources, involving animals, plants, and ecosystems, and thus relates to waste, pollution, or contamination. The economic dimension directly impacts the long-term survival of the company, which falls squarely within of management, rather than consumers (Bangsa and Schlegelmilch, 2020). Therefore, the present study focuses on the environmental and social dimensions of sustainability, as these are the aspects closest to consumers and more associated with the attributes of sustainability (Catlin et al., 2017; Bangsa and Schlegelmilch, 2020).

For the selection of the specific attributes explored in the present study, previous research on meat industry reveals that the sustainability of products is focused on diverse issues including the impact of meat production emissions, the carbon footprint, animal welfare, working conditions, and healthy living (Gaspar et al., 2022; Klink-Lehmann et al., 2022; Cardona et al., 2023b; Rolfe et al., 2023). In addition, to have a current vision from a business perspective, the sustainability strategies of two large international and representative meat companies were studied to extract their main actions. In a corporate sustainability context, firms regard the ESG criteria (environmental, social, and governance) to assess the impact of their activities. The first criterion analyses ecological impact and the use of natural resources; the second considers aspects related to labour conditions and human rights; and the governance criterion assesses transparency, business ethics, and management. These criteria constitute a comprehensive framework for evaluating companies in accordance with the 2030 Agenda. Maple Leaf Foods is a Canadian company dedicated exclusively to producing and selling packaged meats. In the communication of its main sustainability objectives, it can be found: antibiotic-free production, animal welfare, food safety, as well as reducing the environmental footprint of energy used, water consumption, and generated waste. Danish Crown is a Danish company that specializes in the production and processing of pork and beef. It is a leading producer in Europe and operates in 130 countries. The company's objectives, as outlined in its 2021–2026 Strategy, include reducing its carbon footprint, minimizing packaging waste, and using sustainable and recycled materials. Additionally, it aims to ensure job security and promote healthy eating habits. In both cases, their sustainability activities cover a broad range of ESG areas. Following a thorough analysis of the sustainability strategies employed by both companies, a comparison was performed with a Spanish company: Vall Companys Group that produces pork, poultry and beef meat and is a leading company in the agri-food sector in Spain in terms of turnover. For this purpose, a series of meetings were held with its managers. Its sustainability strategy plan aims to achieve the SDGs by 2030 and includes five main axes that reach ESG criteria: (1) climate and circularity, (2) animal welfare, (3) people, (4) quality, safety, and innovation, and (5) ethical and responsible management.

Therefore, based on a review of the literature, the sustainability strategies of the two international companies mentioned, and above all, meetings held with the managers of the Spanish business group and the ESG criteria, the items finally chosen are as follows.

1. Sustainable and safe mobility, in terms of the commercial distribution fleet and employees.
2. Management of greenhouse emissions: reducing and compensating them.
3. Promotion of energy efficiency: using less energy and greener.
4. Circularity of resources and minimization of waste, including water consumption.
5. Animal welfare: ensuring the care of animals.
6. Promotion of a culture of sustainability throughout the business group, with special support for the sustainable development of farms and the rural environment.
7. Safe and healthy workplace: respecting human rights, promoting equality, diversity, and conciliation.
8. Development of talent and innovation in sustainable foods: with the aim of improving technical processes and producing healthier

and more innovative foods, guaranteeing high food safety and optimal quality.

9. Promote a healthy lifestyle and responsible consumption: providing consumers with the necessary information.
10. Packaging management: reducing the impact of packaging by recycled materials and the reduction of single-use packaging.
11. Systematization of sustainability management, transversally throughout the business group, in an ethical, responsible, and transparent manner.
12. Clear and transparent information on labelling: providing information on the sustainable characteristics of the product.
13. Sustainable purchasing (suppliers): ensuring a sustainable supply chain.

The survey developed in the present study included the 13 attributes mentioned above and a characterization of the sample using socio-demographic classification questions which included the age, sex, educational level, living residence region, current employment situation and family income range.

3.2. Statistical analysis

After reporting internal consistency of the 13 items respect to meat production sustainability a basic analysis of the main statistics of each of the 13 sustainability attributes was carried out to determine which aspects are best valued by the consumers surveyed and the form of their distributions. The normality of the variables was contrasted. Subsequently, a multiple analysis of variance (MANOVA) was performed to check if there was any relationship between sustainability items and sociodemographic characteristics. It is a generalization of the analysis of variance in which there are more than two dependent variables simultaneously, with a theoretical relationship between them. Specifically, a robust MANOVA was implemented in the absence of normality and homogeneity in the variance (Friedrich et al., 2019; Friedrich and Pauly, 2018). When the hypothesis of equality of means between the different categories of a sociodemographic variable was rejected, the study was extended with a nonparametric Kruskal-Wallis tests to identify which sustainability attributes show differences between groups. As in the multivariate case, this procedure does not assume normality in the data.

In a second phase, various groups of consumers were identified in terms of their sensitivity to sustainability issues in the meat industry. Cluster analysis allows for classification of individuals into several homogeneous classes based on the scores on several variables. If the set of variables is large, the usual practice is to first perform the reduction of the dimension of the variables and then introduce these results into clustering algorithms (tandem approach), but it may not yield an optimal cluster allocation, as the two methods optimize different criteria. Dimension reduction typically aims to retain as few dimensions as possible and maximize variance, whereas cluster analysis aims to allocate the observations accordingly to clusters by finding similarities and dissimilarities (Markos et al., 2019). In addition, some variables can hinder the underlying cluster structure (Timmerman et al., 2010) or can harm clustering (Yamamoto and Hwang, 2014). To deal with these problems, a procedure (Markos et al., 2019; Yamamoto and Hwang, 2014) is used that simultaneously reduces the dimension of the 13 attributes and determines consumer groups. Specifically, a compromise version of reduced K-means (De Soete and Carroll, 1994) and factorial K-means (Vichi and Kiers, 2001) is considered, which assumes that cluster centroids lie in a subspace of the variables (Timmerman et al., 2010).

4. Data

4.1. Data collection

A pilot questionnaire was carried out to verify the suitability of the

survey. To this end, a 5-point rating scale was employed. The question posed to participants pertained to the rating assigned to each attribute in relation to meat production, with a range from 1 = not at all important to 5 = very important. This survey was performed between January and February 2022 on Google Forms platform and a total of 167 responses were obtained. Subsequently, during March and April 2022, the survey was conducted by a marketing research company, Ikerfel, with a representative sample of Spanish consumers. A quota sampling was performed by sex, age and living residence region and the consumer population (adult people who usually do the shopping) was considered as the reference. In comparison to the pilot questionnaire, a wider scale was chosen, from 0 to 10 points, aiming to obtain greater evaluation differences and, thus, giving respondents the opportunity to be more concise in the evaluation. Sample size was determined based on a 4.5 % maximum error and a confidence level of 95.5 % ($k = 2$), which for a maximum ignorance situation to obtain the information ($p = 0.5$), resulted in a sample size of 494 for an infinite population. Eventually, a total of 506 valid responses were obtained.

4.2. Sample composition

Table 1 presents the percentages of the different categories in the sample and in the population. Given that the differences are small, the sample is considered representative (at least for the variables sex, age and autonomous community) and conditions are met to generalize the results of this work to the consumer population. Considering the importance of the sex variable and the low representation of the other category, this observation was finally discarded, so a sample size of 505 was used.

5. Results

High values for Cronbach's alpha coefficients were found, 0.9 for the

Table 1
Survey sample composition by sex, age and living residence region.

	Number of responses	Sample (%)	Census (%) ⁽¹⁾
Sex			
Man	235	46.4 %	49 %
Woman	270	53.4 %	51 %
Other	1	0.2 %	
Age			
25–34 years old	115	22.7 %	19.9 %
35–44 years old	144	28.5 %	26.3 %
45–54 years old	135	26.7 %	29.1 %
55–64 years old	112	22.1 %	24.7 %
Living residence region			
Andalucía	87	17.2 %	17.9 %
Aragón	16	3.2 %	2.8 %
Asturias	13	2.6 %	2.1 %
Islas Baleares	12	2.4 %	2.5 %
Canarias	22	4.4 %	4.6 %
Cantabria	7	1.4 %	1.2 %
Castilla y León	26	5.1 %	5 %
Castilla-La Mancha	22	4.4 %	4.3 %
Cataluña	79	15.6 %	16.4 %
C. Valenciana	53	10.5 %	10.7 %
Extremadura	11	2.2 %	2.2 %
Galicia	33	6.5 %	5.7 %
C. Madrid	73	14.4 %	14.2 %
Murcia	15	3 %	3.2 %
Navarra	7	1.4 %	1.4 %
País Vasco	25	4.9 %	4.7 %
La Rioja	3	0.6 %	0.7 %
Ceuta	1	0.2 %	0.2 %
Melilla	1	0.2 %	0.2 %

(1) Source: Spanish Statistical Office, 2021

pilot sample and 0.96 for the representative one. These results imply internal consistency of the 13 items and support the idea they are determined by same unidimensional underlying concern for meat production sustainability. Given the presence of nonnormal data, robust alternatives were tried (Zhang and Yuan, 2016), with similar figures, 0.89 and 0.97, respectively.

5.1. Relevance of sustainability criteria

Table 2 presents the basic statistics, ordered from highest to lowest according to the mean value of the attribute. These averages show great consumer concern for sustainable meat production, although it is important to clarify that other factors that influence consumers' purchasing decisions, such as price, sensory quality, or the origin of the meat, are not included (Gaspar et al., 2022; Cardona et al., 2023b). The most valued attributes also have a lower variability, which increases as the average value decreases. The kurtosis and asymmetry statisticians indicate that all distributions are propped up and with higher concentration at the top of the scale. This indicates that these variables are not normal, as confirmed by the Jarque-Bera statistic (Jarque and Bera, 1980), which rejects the hypothesis of normality in all cases.

The most valued attribute is the well-being of employees, which includes respect for human rights, the promotion of equality, diversity and work-life balance. It seems that Spanish consumers value social responsibility aspects. It does not only have the highest average, also the smallest variability. Therefore, there is a strong consensus that this attribute is the most valued one. The second most important attribute for respondents is animal welfare, i.e. ensuring comfortable and healthy living conditions for animals. The third and fourth important attributes are promotion of a healthy lifestyle and transparency on labelling, respectively. That is, consumers appreciated that producers provide information related to a healthy, safety and responsible diet. The following attributes in importance cover different environmental issues: resource circularity (fifth), packaging management (sixth), energy efficiency (seventh) and greenhouse gas emissions (eighth). Thus, the importance of the natural environment emerged after attributes related to the life of humans and animals. The attributes rated the lowest are related to more internal or organizational aspects: sustainable innovation development (ninth), guarantee of sustainable suppliers (tenth), sustainable mobility (eleventh), promotion of sustainability across the company (twelfth), and the least important aspect is the systematization of sustainability management throughout the corporate group (thirtieth).

5.2. Sustainability across socio-demographic factors

The MANOVA results carried out to explore relationships between sustainability items and sociodemographic characteristics are presented in Table 3. Significant differences were only observed in the sex variable. In age, region of residence and income level, no significant differences were observed in the rating of sustainability attributes, even when statistics assuming normality were applied. Regarding the level of studies and occupation of the respondents, a significant relationship is observed in a first approximation considering normality, but it disappears when using the appropriate statistic for the distribution of the data, which is the one that does not assume normality.

The Kruskal-Wallis test was used to examine this question in greater depth and to determine the differences in the ratings between women and men. This analysis showed that such differences occurred in the valuation of all sustainability attributes (Fig. 1). Not only the central values, but the shape of the distribution is different between men and women in all sustainability attributes. Particularly, women are in the upper values of the scale to a greater extent than men in all cases. Thus, the results obtained reveal that women gave higher scores for all items.

As for the ranking of the items, the most important attribute for both groups is the worker welfare; however, the most notable differences are

Table 2
Basic statistics of sustainability attributes and normality test.

Attribute	Average	SD	Curtosis	Asymmetry	Jarque Bera	Jarque Bera p-value
worker_welfare	8.6	1.7	3.2	-1.5	411	0.00***
animal_welfare	8.4	2.0	2.5	-1.5	308	0.00***
promotion_healthy_consumption	8.4	1.8	3.1	-1.5	383	0.00***
transparent_labeling	8.3	1.8	3.1	-1.5	379	0.00***
circularity_resources	8.3	1.9	2.5	-1.4	285	0.00***
packaging_management	8.2	1.9	2.6	-1.4	303	0.00***
energy_efficiency	8.2	2.0	2.5	-1.4	292	0.00***
greenhouse_gas_emissions	8.0	2.1	2.4	-1.4	279	0.00***
sustainable_innovation_development	8.0	1.9	2.1	-1.2	212	0.00***
sustainable_suppliers	7.9	2.1	2.4	-1.4	275	0.00***
sustainable_mobility	7.9	2.1	2.7	-1.4	312	0.00***
sustainable_culture	7.8	2.1	1.9	-1.2	204	0.00***
sustainable_systematization	7.8	2.0	2.1	-1.2	212	0.00***

SD, Standard deviation. (***) p-value < 0.001.

Table 3
MANOVA analysis.

	approx F	p-value	MATS	p-value
Sex	3.02	0.00***	204	0.00***
Age	1.46	0.13	27	0.68
Region	0.33	0.99	200	0.36
Studies	2.17	0.01	18	0.60
Occupation	2.16	0.01	81	0.18
Income	1.11	0.35	45	0.77

MATS: Multivariate ANOVA type statistic (Friedrich and Pauly, 2018). (***) p-value < 0.001.

found in animal welfare, the fifth most important attribute for men, while it is the second most important for women. On the other hand, the least relevant aspect for women is sustainable mobility, while it is a factor somewhat more highly valued by men, who rank it ninth. The least important item for men is the promotion of the culture of sustainability throughout the business group, which is also considered of little importance for women (third least important). Thus, despite the above-mentioned differences, in general, the order assigned to the different attributes is similar.

5.3. Segmentation

The joint procedure of reduced K-means and factorial K-means (Markos et al., 2019; Yamamoto and Hwang, 2014) was used with the original matrix of 505 responses to 13 sustainability items, weighting equally dimension reduction of the attributes and optimal cluster allocation of the observations. To bypass local minima, the algorithm was initialized with 100 random starts. For clustering selection, a combination of Silhouette index (Kaufman and Rousseeuw, 2009; Rousseeuw, 1987), that show reasonable similarity within each group and dissimilarity between groups, and own interpretation was used. Although average Silhouette index provides the best value for two clusters with one factor, we chose the second best, three clusters with two factors because it allowed us to distinguish between consumers with medium sustainability perceptions from others with lower values. It seemed to us an interesting contribution to quantify the number of respondents in this last category. These three groups explain 79.85 % of the total variability. Given the 13 items of this dataset are highly correlated and they do not contain much variance across orthogonal directions, reduced K-means and the sequential tandem approach provide very similar clustering to the joint procedure implemented. Varimax rotation was used, but other ones (e.g. promax) drove to the same clustering.

Based on the average attribute ratings, the three groups were called: Proactives, Conscious and Skeptical. The average values of the sustainability attributes for each group can be seen in Fig. 2. Highly concerned

is the largest group (48.62 % of the sample), with all average attribute values above nine, and outstandingly aware of the relevance of all aspects of sustainable meat production. Fairly concerned group is smaller but remains large (39.13 %) and positioned slightly below the previous group, generally between 7 and 8. The third group of consumers in the sample, sceptic, is much smaller (12.25 %), valuing below six all sustainability attributes, and more than half of them below 5. The important finding in this section is perhaps this: the group of people who are not concerned about the sustainability of meat production is not too high; in fact, it accounts for one eighth of the sample.

Many of the comments made in Section 5.1 are applicable within the groups. For example, the well-being of workers is the most important attribute in all three groups. Other attributes such as animal welfare, promotion of a healthy lifestyle and transparency on labelling are also among the most prominent attributes in the three groups. The order of the attributes from left to right in Fig. 2 corresponds to the descending order of the averages in the total sample. In general, that descending order is maintained in all groups, although it is also observed a greater decrease between maximum and minimum average attribute value in group 2 (1.01) compared to group 1 (0.53) and higher in group 3 (1.71) than in the previous two. And the same pattern was found respect to variability within each group attribute. Therefore, greater concern about sustainable meat production means a greater appreciation of the importance of all its components. In contrast, where sustainability is not a primary concern, individuals have different priorities when it comes to certain aspects, leading to greater heterogeneity, as in group 3.

Respect to socio-demographic variables, a rather different composition of male/female between groups was found. Indeed, women are the majority, 65.0 %, in Proactive group, this percentage decreases, 44.9 %, in Conscious, and even more, 34.4 %, in Skeptical. No appreciable difference was encountered between groups on age, region, studies, occupation and income.

6. Discussion

To comply with current regulations and meet the new demands of society contained in the 2030 Agenda, companies must make the effort to adapt their production and marketing systems. Facing these challenges requires adopting responsible behaviour in the long term based on ESG criteria. To this end, the aim of this work was to identify the sustainability aspects that consumers value most at the purchase event to be able to improve their communication policy. This work highlights consumers' growing concerns about sustainable development and how companies' policies can affect purchasing decisions. While the concept of sustainability is open to different interpretations and may even be somewhat abstract for many people who have difficulties in defining it (Blanco-Penedo et al., 2021; Van Bussel et al., 2022), most agree that it is

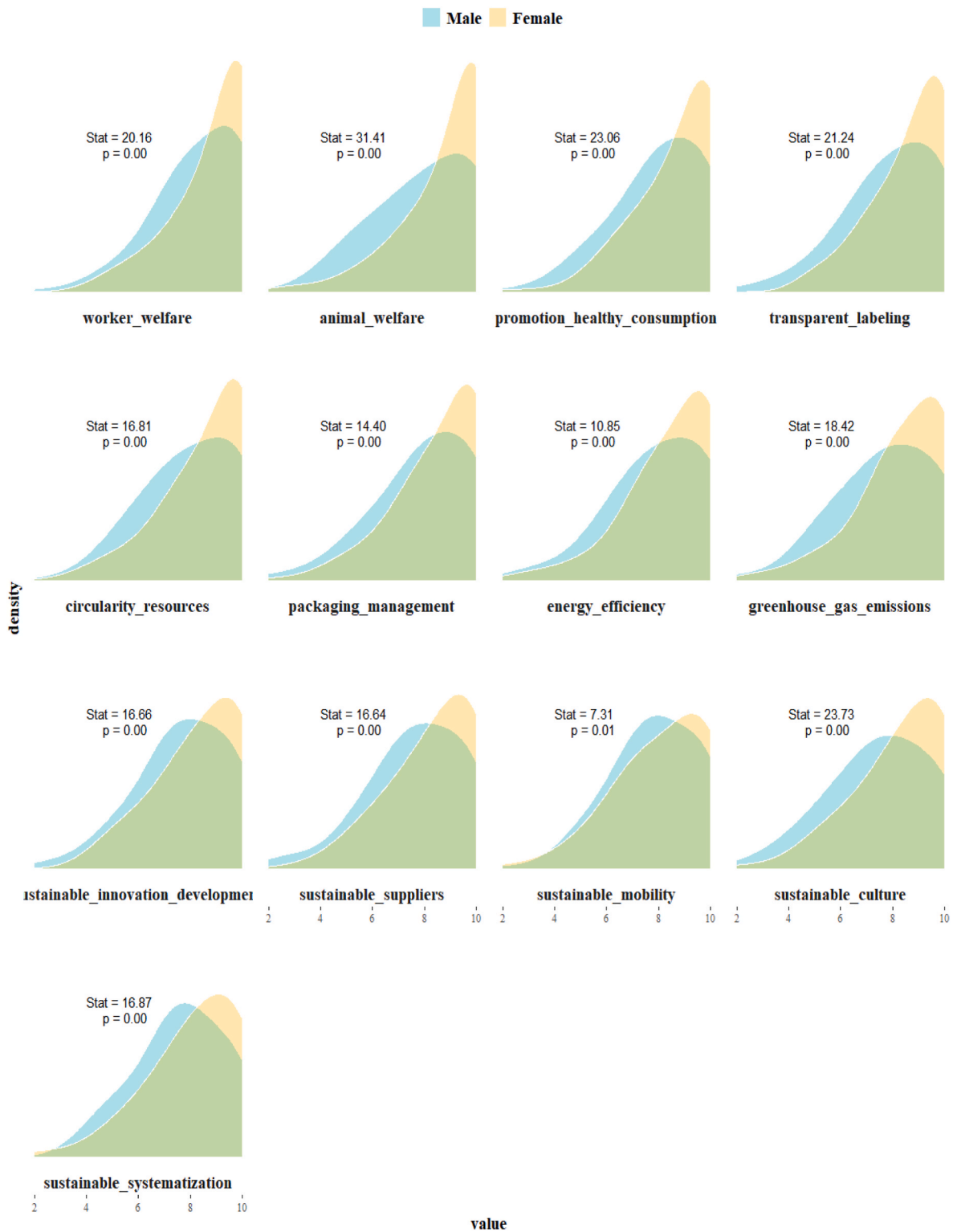


Fig. 1. Density functions and Kruskal-Wallis statistics (with p-values) of sustainability attributes by sex.

something good and important. Companies should therefore consider all aspects related to environmental care, without neglecting social issues.

It seems that Spanish consumers prioritize the safety conditions of workers over environmental and governance parameters. These results, as social responsibility, are consistent with other previous work (Grunert et al., 2014; Toussaint et al., 2021; Van Bussel et al., 2022). However, they contradict others who got the right opposite, showing that the working conditions of employees were one of the least relevant aspects

(Klink-Lehmann et al., 2022). One possible explanation is that enhanced working conditions in a country, less relevance attach to social aspects. Thus, in the latest European Working Conditions Survey (EWCS, 2021), among other indicators, workers on indefinite contracts account for 61 % in Spain compared with 78 % in Germany. These differences in the working environment would lead to greater concern about the social aspects of Spanish consumers in our study compared to the Germans of Klink-Lehmann et al. (2022). It is therefore a priority to ensure job

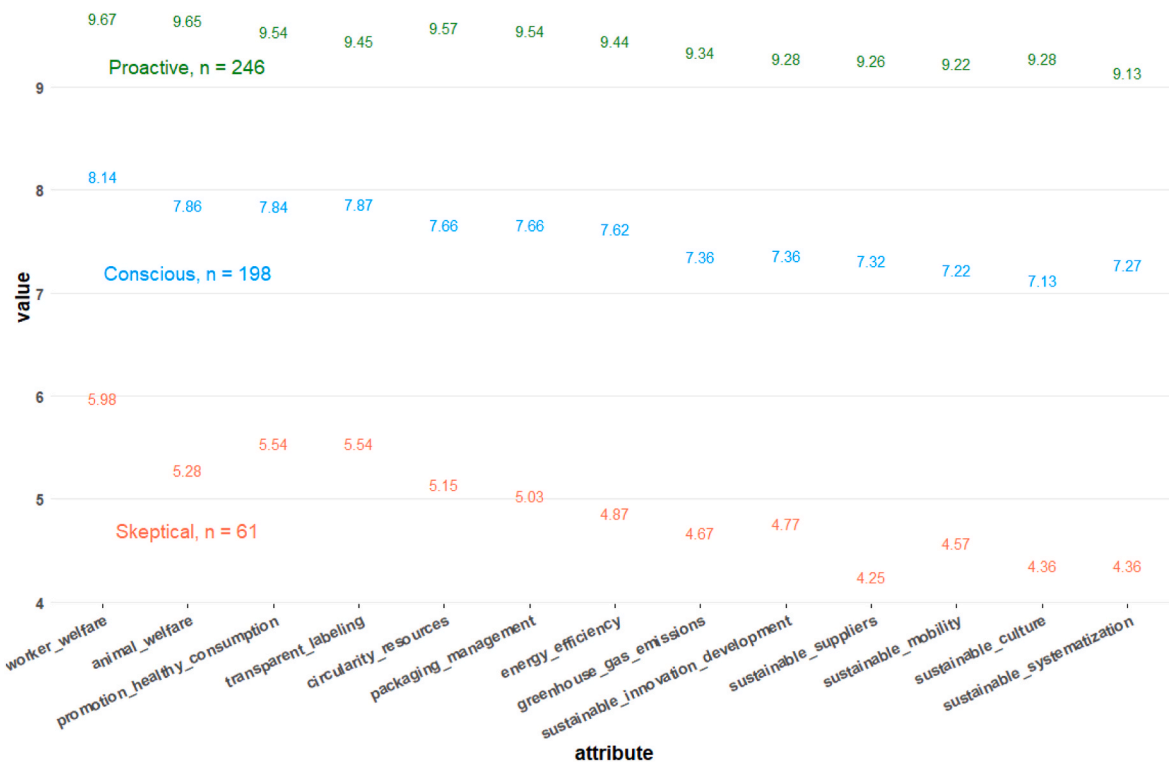


Fig. 2. Average values of the attributes by group.

security to make consumers more aware of other issues that require attention, such as the preservation of the natural environment. While sustainability must be understood as a holistic concept, encompassing the three dimensions (social, economic and environmental) the reality shows that the actions carried out must take account of contextual differences. As Geissdoerfer et al. (2017) and Rastogi et al. (2024) point out, it is plausible to design policies with a greater environmental focus in rich countries, but to do more on social aspects in countries with a lower level of development.

The attributes related to environmental sustainability include animal welfare over other factors directly related to global warming such as greenhouse emissions. These results are in line with consumers literature (Burnier et al., 2021b; Gaspar et al., 2022; Grunert et al., 2014; Klink-Lehmann et al., 2022; Cardona et al., 2023b). Burnier et al. (2021b) suggested that the animal welfare preference may point to the fact that it is easier for the consumer to understand the importance of animal care than other attributes. In this case, animal welfare has emotional implications for consumers, while pollution may remain undefined or vague, potentially addressing the question of why Spaniards prioritize labels related to animal welfare (i.e., antibiotic-free) over labels describing environmental impact. Therefore, the communication strategies should be adjusted by the empathy and logic attributes. Aligned to latter, Alonso et al. (2020) suggest that the consumer demand of products manufactured under high animal welfare standards coexists with lack of knowledge about main livestock issues and particularly, with animal welfare. Several factors have been associated with the conception of animal welfare in consumers, which is based more on perceptions than facts, such as the physical distance among producers and consumers or the negative information media campaigns (Alonso et al., 2020). In this regard, it seems logical to suggest that further explanation is needed on the meaning and implications of the different sustainability attributes. Although it can be found that small farmers present heterogeneous attitudes to improving animal conditions in livestock farming (Von Hardenberg and Heise, 2018), producers' associations and the meat industry have been strongly committed to animal welfare in recent years (Klink-Lehmann et al., 2022). Interestingly,

Burnier et al. (2021a) developed a scale to measure consumers' perception of sustainability regarding the beef production process in Brazil. The scale included six variables such as traceability, social responsibility, legality, environmental responsibility, sanitation in slaughterhouses, and animal welfare. The variables were formulated based on 18 items, and the study affirms that they can capture compatible results. For further research in whole meat industry, it would be useful to develop a similar scale to standardize the collection of consumers' sustainability perception.

The third and fourth important attributes are related to providing information to consumers for a healthy, safety and responsible diet in a clear and simple way. Some studies suggest that this concern has been increased by food scandals and COVID-19 (Indrawan et al., 2021; Rieger et al., 2017; Yang, 2020).

The attributes rated the lowest are related to more internal or organizational aspects. A hypothesis that may explain why consumers do not consider these attributes as relevant may be that they are to a certain extent intangible for them from the point of view of the purchasing process. However, these attributes related to transparency and good governance are of vital importance in the business environment and are necessary for the achievement of sustainable development despite not being valued by the average consumer.

As Spanish consumers seem to appreciate the social rather than the environmental dimension more, combined with the fact that the latter has been much more studied by literature (Bangsa and Schlegelmilch, 2020; Massuça et al., 2023), it allows us to suggest the relevance of further research into social aspects and their influence on consumer behaviour.

The analysis of socio-demographic variables suggests that a uniform communication of the strategy for the sustainability of meat companies can be made since no differences were found in attributes assessments by age, region, study, occupation and income. Significant differences were only observed in the sex variable, in line with previous work. For example, Luchs and Mooradian (2012) and Grunert et al. (2014) found significant differences by gender, with women being more concerned about sustainability than men. Since the order assigned to the attributes

is almost the same, communicative actions could be carried out with a similar message for both sexes. Similarly, the results show that there are no significant differences in the valuations based on the other socio-demographic variables. This is an interesting finding, as this confirms the possibility of designing a uniform communication strategy for the whole national territory, for all ages and income levels. In line with [Catlin et al. \(2017\)](#), communication policies are more important to take into account the sustainability dimension to be addressed than the socio-demographic profile of the consumer.

Considering the three distinct segments identified among respondents (Proactive, Conscious, and Skeptical), it would be advisable for companies to develop communication strategies that address the different levels of public sensitivity. In this regard, although the skeptical group is small and heterogeneous, it would be advisable to develop specific actions that contribute to raising awareness among this consumers group. In fact, their lower commitment may be due to greenwashing and a lack of communication transparency by some companies, making it difficult for consumers to distinguish truly sustainable products. Low trust can lead to an increase in people who do not participate or show interest in the sustainability attributes of products. Therefore, companies need to behave responsibly and not show a positive environmental image which do not align with actual performance. In this regard, Directive 2024/825/EU (in force since March 26, 2026) seeks to prevent misleading marketing practices and help consumers easily identify such practices. Our findings are quite consistent with those reported by [Blanco-Penedo et al. \(2021\)](#) and [Funk et al. \(2021\)](#), who identified similar patterns of consumer segmentation in the context of food consumption. Thus, the lack of significant differences in socio-demographic characteristics (apart from gender) also supports this suggestion. It would be interesting to explore other factors in further research (e.g., lifestyles, culture, political ideology, etc.) that can motivate the emergence of these clusters.

7. Conclusions

7.1. Implications

According to stakeholder theory, a company activity is embedded in a network of relationships with various individuals or groups that are affected by or have an interest in its operations; the better a firm knows and understands these relationships, the better it will be able to meet the interests of its main stakeholders ([Darnall et al., 2010](#); [Zhang and Zhu, 2019](#); [Baah et al., 2021](#)). Out of all the stakeholders, since household consumers are immediately impacted, they are most concerned about the health and environmental hazards linked with products offered by companies in the market, especially when it comes to food. Thus, the primary goal of this manuscript is to enhance the understanding of consumers' current environmental concerns and determine whether sociodemographic differences exist in their preferences regarding sustainability attributes in the meat industry. This aims to contribute to strengthening the company's social and environmental commitment by guiding its decision-making processes oriented towards more sustainable production and distribution, as well as by improving its communication strategies with consumers.

From a theoretical perspective, this study adds to the academic discussion by deepening the understanding of external factors that influence a company's orientation toward sustainable development goals. It provides a more nuanced perspective of stakeholder theory by specifically focusing on household consumers.

This manuscript also makes interesting practical implication for both practitioners and consumers. As far as business managers are concerned, they need to understand the interests and influence of their stakeholders to build and maintain a strong relationship with them. Knowledge of the sustainability attributes most valued by customers provides the necessary information to properly manage pressure and respond to their expectations by designing appropriate communication campaigns. In

addition, managers need to be committed to reducing the environmental impact of the company's activities. To do this, they can project customers' environmental concerns into future scenarios to help them make strategic decisions, such as how best to modify the attributes of their current product offering or even develop new products to better meet customer demands.

In relation to household consumers, they must assume their share of responsibility and actively support the improvement of sustainability, both through their individual actions and in their interaction with companies. We agree with [Buysse and Verbeke \(2003\)](#), [Zhang and Zhu \(2019\)](#) and [Rastogi et al. \(2024\)](#) that as consumers become more knowledgeable and aware of the impacts of production on the environment, they may demand that firms adopt sustainable practices. Thus, consumer pressure seemed like an important driver for companies to adopt socially and environmentally responsible behaviour. Businesses and consumers must commit to reducing their harmful effects on the environment, and since both parties are involved in the process, they must work together to minimize negative impacts and contribute to sustainable development.

7.2. Main limitations and future research

This study focuses primarily on the social and environmental dimensions of sustainability issues in the meat sector. This limitation reveals opportunities for future research, including the economic and sensory quality aspects of these products. In this regard, [Gaspar et al. \(2022\)](#) showed that the Spanish Iberian cured meat study prioritizes cost above sustainability certifications. Although different economic dynamics characterize the Spanish Iberian cured meat, it could be extrapolated to our study, and thus, the exclusion of economic aspects can skew perceived consumer priorities. Moreover, new production or manufacturing strategies have the potential to engender increased costs, which may in turn influence consumers' purchasing decisions. In the questionnaire, certain limitations were identified. Apart from price, other aspects such as expiration date, sensory quality or country of origin are not included, which the literature shows have an influence on consumers' purchasing decisions ([Cardona et al., 2023b](#)). In the context of forthcoming surveys within this sector, it is recommended that respondents be queried on their purchasing and consumption attitudes, in addition to their daily dietary habits and behaviours and implement additional tests to confirm the real relevance that consumers place all studied aspects. This would facilitate the identification of salient behavioural patterns within the sector, thus assisting the way for the development of novel sales and production strategies.

It is important to note that the survey's focus is exclusively on Spain. The decision to conduct a survey within a single region or country is often influenced by cultural, traditional, and/or lifestyle factors. It is also remarkable that Spanish meat production is increasingly exported to other European Union countries and to third countries, including China. Consequently, it would be worthwhile to extend this survey to encompass the countries to which Spain exports its production, with a view to enhancing companies' decision-making from a sustainability perspective. Finally, it is proposed that further research can be focused on tracking actual purchases to bridge the gap between intention and action.

CRediT authorship contribution statement

Javier Herrero-Encinas: Writing – review & editing, Writing – original draft, Methodology, Investigation. **Cristina López-Cózar-Navarro:** Writing – original draft, Supervision, Methodology, Conceptualization. **Carlos Castro-Gil:** Methodology, Investigation, Formal analysis, Data curation. **Silverio Alarcón:** Writing – original draft, Supervision, Methodology, Investigation, Formal analysis, Data curation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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