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RESEARCH ARTICLE

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How do the perception of the technological and symbolic dimensions and the social context affect the green consumer adoption process of eco-innovations?

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Abstract

Environmental challenges have led to a shift toward more sustainable consumption and production patterns. Understanding the factors that influence consumers' choices toward green products is crucial for achieving sustainable development. This study investigates the adoption process of a low-involvement eco-innovation, examining the influence of the level of green consumerism, the perception of its technological and symbolic dimensions, social pressure, and social conspicuousness. A sample of 268 observations was examined using the PLS-SEM methodology. The results highlightthe indirect effect of the level of green consumption on low-involvement eco-innovation adoption through the perception of its technological and symbolic dimensions, as well as social pressure and social conspicuousness. These findings have important practical implications for the design of marketing strategies aimed at promoting low-involvement eco-innovations. By emphasizing the social benefits and the influence of others on adopting green behaviors, marketers can effectively target consumers and facilitate the transition toward more sustainable consumption patterns.

KEYWORDS
green consumerism, low-involvement eco-innovation, social conspicuousness, social pressure, symbolic attributes, technological attributes

1 | INTRODUCTION

Human activity is one of the major contributors to environmental degradation (Suki et al., 2022), as the environment has not always been a concern for individuals (Sharma et al., 2022). Consequently, there has been a shift toward more sustainable consumption and production patterns to address society's environmental challenges. One of the suggestions proposed by experts has been to broaden the use of lower carbon-intensive energy resources, such as wind, solar, and hydropower (Sharma et al., 2021), through the adoption and use of eco-innovations (Melander & Arvidsson, 2022; Sarkar, 2013).

Understanding what factors influence consumers' choice of green products compared to other alternatives is relevant (Sharma et al., 2022) as sustainable development will not be achieved without its consumption (Marcon et al., 2022). Previous studies have analyzed the adoption of high-involvement eco-innovations (Jansson, 2011).

Abbreviations: AD, Adoption of low-involvement eco-innovations; AEMET, Agencia Estatal de Meteorología (Meteorological Agency); AVE, Average Variance Extracted; CR, Composite Reliability; GC, Level of Green Consumption; HTMT, Heterotrait-Monotrait ratio; PLS, Partial Least Squares; PSI, Perceived Symbolic Innovation; PSP, Perceived Social Pressure; PTI, Perceived Technological Innovation; SC, Social Conspicuousness; SDG, Sustainable Development Goals; VIF, Variance Inflation Factor.

However, small consumerism choices may enormously contribute to the environment (Foteinis, 2020). Thus, understanding what factors influence consumers' adoption process of low-involvement eco-innovations is needed. In this regard, only a few studies have analyzed eco-innovations due to the lack of eco-friendly products in the past (Follows & Jobber, 2000; Jansson, 2011; Rezvani et al., 2018). Moreover, there has been little research and empirical study into how consumers perceive eco-innovation and its impact on pro-environmental consumer behavior (Sharma et al., 2022).

The United Nations General Assembly acknowledged the importance of human sustainability values for shaping attitudes and behaviors toward sustainable development (Kautish et al., 2020). Accordingly, some studies have analyzed how environmental concerns impact consumers' attitudes toward green products (Sharma et al., 2022). Others have emphasized the role of the personal (Kautish et al., 2020) and green values (do Paço et al., 2019) on consumers' green buying behavior. However, none of them has acknowledged how the level of green consumption impacts the adoption of eco-innovations.

Under this framework, this study addresses these research gaps by analyzing the factors influencing consumers to adopt low-involvement eco-innovations. To this end, this study expands the model proposed by Lee et al. (2013) by including the figure of the green consumer. Furthermore, given the relevance of eco-innovations for environmental development (Sahoo et al., 2022), we adapt this model by analyzing a low-involvement eco-innovation. Following this model, we study the effects of perceived technological and symbolic innovation, social pressure, and social conspicuousness (SC).

The context chosen to develop the investigation was Spain. This country committed in 2015 to implement the 2030 Agenda to improve people's lives, the natural environment, and the relationship between them (Del Rio et al., 2021). With this objective, Spain has given priority to the development and adoption of eco-innovations, becoming one of the countries of the "average eco-innovation performers group" according to the Eco-Innovation Index of the European Commission in 2022 (European Commission, 2022). This importance has been reflected in recent research. However, although there are a wide number of studies on the field of the development and adoption of eco-innovation by firms (Arranz et al., 2019; Jové-Llopis & Segarra-Blasco, 2018, 2020; Torrecillas & Fernández, 2022; Triguero et al., 2018), there is a lack of research focused on the individual level, with a few studies related to this topic (Aibar-Guzmán & Somohano-Rodríguez, 2021).

Based on the above, the research questions of the study are the following:

1. Do consumers' perceptions of eco-innovations attributes and social influence affect their adoption?
2. Is the adoption of eco-innovations affected by the level of green consumption?

Quantitative analysis on a sample of 268 observations has been carried out to answer the research questions. Data collection was done by means of a probabilistic survey in which individuals living in the Region of Murcia were interviewed about eco-innovation based on eco-technology. The territory of the Region of Murcia, located in the southeast of Spain, was chosen due to its climatic characteristics. SmartPLS software has been used to analyze the responses obtained. Results do not verify a direct relationship between the level of green consumption and the adoption of eco-innovation, but an indirect one through the perception of its technological and symbolic dimensions of eco-innovation, along with social pressure and social conspicuousness. Moreover, the findings show the importance of the perceived technological and symbolic attributes of eco-innovations and social influence on its adoption. These results reinforce the need for companies to develop the technological and symbolic attributes of eco-innovations, as green consumers will take these into account during the adoption process.

The following section defines the theoretical framework in which all the variables are defined, and the research hypotheses are proposed based on the literature. Next, the methodology used in the research and the results obtained are shown. Finally, the conclusions, implications, limitations of the study, and future lines of research are presented.

2 | THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 | Eco-innovations

Eco-innovations are defined as the development or improvement of products and processes that save energy, control pollution, recycle waste, or implement environmental management (Saunila et al., 2018) in a way that makes their use less harmful to the environment than other alternatives (Kemp & Pearson, 2007; Sharma et al., 2022). Eco-innovations are considered a subcategory of innovation that address environmental issues (Han & Chen, 2021). Indeed, all innovations (technological, product, service, or business practices) can be considered ecological if they prevent or reduce their environmental impact by optimizing the use of natural resources (Sarkar, 2013). Since eco-innovations can come from different sources or have other functions, Kemp and Pearson (2007) classify them into five types, being them eco-technologies (i.e., green energy technology), organizational innovations for the environment (i.e., pollution prevention schemes), ecological products and services, green systems, and new materials. Eco-innovations can also be classified according to its involvement, understood as an internal state variable that shows how much excitement, interest or drive a product class elicits (Candi et al., 2017). In this regard, eco-innovations can be categorized as high- or low-involvement products (Li et al., 2021). Whereas high-involvement eco-innovations can be distinguished by high price, risk, and technical complexity, low-involvement eco-innovations are often linked with everyday use, cheaper prices, and lesser risk (Li et al., 2021).

Noppers et al. (2015) classify the main attributes of eco-innovations into instrumental, which are those that show the functional result of their ownership and use; environmental, which are those that reflect the environmental impact derived from their ownership and use; and symbolic attributes, which are those that consumers use as a sign of self-identity and status. Eco-innovations seem to have fewer favorable instrumental attributes than the rest of the innovations, given their cost and uncertainty regarding some of their characteristics. In this context, Noppers et al. (2015) point out the strength of the symbolic attributes of eco-innovations, mainly when they are considered together with the instrumental attributes. In this sense, when consumers identify some flaw in the instrumental attributes of eco-innovations, the symbolic attributes play a crucial role when deciding whether to buy or not the product.

In this study, considering Hirschman's dimensions of innovations (Hirschman, 1982) and Noppers's attributes of eco-innovations, two independent dimensions are identified: technological and symbolic. On the one hand, the *technological dimension* is related to the characteristics and functioning of the product, including the instrumental and environmental attributes. On the other hand, the *symbolic dimension* is focused on the social meaning that the product provides, showing the symbolic attributes.

2.2 | The adoption of eco-innovation by green consumers

In recent years, there has been a growing interest in the academic community in analyzing consumers' pro-environmental behavior (Xiao et al., 2022). Scholars have followed different theories to explain which factors influence consumer behavior (i.e., adoption, willingness to pay or intention to recommend). In this regard, the theory of reasoned action has been used to explain the psychological and cognitive processes that influence individuals' decision-making processes. Other authors have used instead the theory of planned behavior with the same aim, which develops and improves the previous theory by including perceived behavioral control (do Paço et al., 2019; Paul et al., 2016). Despite the relevance of these theories, it has been shown that the study of individuals' green behavior needs other models that integrate social concerns and attitudes (do Paço et al., 2019).

Consumer behavior implies a behavioral change (Crudeli et al., 2022) motivated by their values (Jahangiri & Zarei, 2016). In the context of the adoption of eco-innovation, referring to the process by which individuals decide to buy and use an innovation (Rogers, 1995), there is a need to include the level of green consumption in new models driven by the rise in environmental awareness regarding the impact of consumption patterns in recent years (Suphasomboon & Vassanadumrongdee, 2022). Nowadays, consumers are more likely to buy green products, showing a preference for eco-friendly products (Clark et al., 2019). Scholars have approached this greener consumption tendency under the concept of "green consumerism," defined as the level to which someone is aware and knows their obligation to protect the environment by selectively buying ecological products or services (Mansvelt & Robbins, 2011). Green consumers are motivated by their green values and thus seek to analyze environmental care through their actions and purchases to protect the planet (Haws et al., 2014).

To the best of our understanding, no previous studies have analyzed the influence of the level of green consumption on the adoption of a low-involvement eco-innovation. However, studies with similar aims have been carried out. In this regard, Kautish et al. (2019) reported a positive influence of the willingness to be environmentally friendly on green purchase intention. Khare and Kautish (2020) showed that environmental knowledge influences green choices. Shang et al. (2023) revealed that personal environmental attitudes greatly affect attitudes toward green smart technology products. Other authors addressed the roles of green consumer values on ecological behavior, showing a significant relationship (Cheung et al., 2015; Haws et al., 2014; Sun et al., 2022). Similarly, Jansson et al. (2011) found that green consumers' values, beliefs, norms, and habits reduced behaviors that harm the environment, showing the disposition of green consumers to adopt eco-innovations. Since green consumers are aware of the need to protect the environment, they will have environmental knowledge andf green values and motivations to act pro-environmentally. Therefore, based on these studies, we understand that the level of green consumption will affect the intention to adopt low-involvement eco-innovations.

> **H1.** The level of green consumption (GC) will positively affect the adoption of low-involvement eco-innovations (AD).

2.3 | The adoption of eco-innovation in a social context

In addition to ecological values, green consumer behavior is affected by general prosocial attitudes (do Paço et al., 2019). By consuming sustainable products, consumers can show their environmental awareness and lifestyle, showing their loyalty to certain social groups (Kautish & Khare, 2022). In particular, studies on consumer behavior have shown the influence of personal and social norms (Melnyk et al., 2022). In the context of this study, we analyze how the perception of the technological and symbolic attributes of eco-innovations influence social SC and perceived social pressure (PSP) and the intention to adopt it.

2.3.1 | The effect of personal norms on the perceived attributes of the eco-innovation

Personal norms can be defined as the individual perception of consumers about what is (in)correct in a moral term (de Groot & Steg, 2008) and can be explained by the norm activation model (Schwartz, 1977). This model assumes that personal moral norms and the consumers' normative motivations are the main forces that lead consumers to behave in a specific way. In the context of green products, Jansson et al. (2011) found that the higher the level of individuals' moral norms regarding environmental care, the higher the intention of consumers to develop pro-environmental behavior.

Consumers' environmental behavior is affected by several variables, one of them the perception of the product's attributes (Khare & Kautish, 2020). Several studies have analyzed how this perception influences consumer behavior, focusing on symbolic and technological dimensions of innovations. For example, Lee et al. (2013) carried out a study applied to the adoption of smartphones in which they found that when consumers find products as symbolically and technologically innovative, there is a high probability of buying them due to social recognition. The results of this study also highlighted the relevance of the symbolic attributes, which were more important for consumers than the technological ones. Indeed, results showed that when an innovative technology fails to relate with some positive symbolic values, the product is usually rejected by consumers.

However, these studies have not considered the type of consumer in question. This is particularly important as the technological dimension of eco-innovations includes not only functional but also environmental attributes. Thus, the technological dimension of eco-innovations must be necessary for green consumers to the extent that they can achieve their environmental goals. In fact, Khare and Kautish (2020) found that the functionality of green products is a key attribute that motivates consumers to buy them. Given that green products outperform traditional or competing products in terms of environmental performance (Marcon et al., 2022), this study supports that green consumers will also be motivated by the product's environmental and technological attributes. Based on this reasoning, this study proposes the next two hypotheses.

H2. The level of green consumption (GC) will positively affect perceived technological innovation (PTI).

H3. The level of green consumption (GC) will positively affect perceived symbolic innovation (PSI).

2.3.2 | The effect of perceived attributes of the eco-innovation on perceived social influence

The term *social influence* can be defined as the compulsory social pressure that changes individuals' behavior due to their interactions with social groups (Lee et al., 2013; Rashotte, 2007), as well as voluntary pressure felt by consumers after observing a product in a social system (Lee et al., 2013). Recent studies have shown that eco-friendly behaviors are affected by social norms (Chi, 2022). This indicates that consumers are more likely to consume sustainably when there is sufficient regulatory pressure to motivate pro-environmental beliefs in actual green consumption behavior (Gabler et al., 2013). Once consumers internalize their social groups' behavior, they need to adopt the product (Lee et al., 2013).

In their study, Lee et al. (2013) found that this social influence is even more remarkable when consumers feel uncertain about innovative products. In this case, consumers are substantially more likely to choose the product based on their social interactions and the product's symbolic meaning in their social groups. Furthermore, these authors revealed that perceived symbolic innovation (PSI) has a more significant impact on PSP than perceived technological innovation (PTI). Accordingly, when products have social meanings and individuals can be more visible thanks to those products (a higher PSI), both social pressure (PSP) and SC are higher than when PSI is lower.

As symbolic attributes of sustainable innovations allow consumers to expose their concern for the environment, being considered a "social message" (Pettifor et al., 2020), they increase the PSP consumers feel. Furthermore, symbolic attributes help consumers to project themselves as individuals with a high economic status since eco-innovations tend to be priced higher than the market average, increasing the social notoriety associated with their adoption (Noppers et al., 2014). Thus, we propose the following hypotheses.

H4. The perceived technological innovation of eco-innovation (PTI) affects the perceived social pressure (PSP) associated with it.

H5. The perceived symbolic innovation of eco-innovation (PSI) affects the perceived social pressure (PSP) associated with it.

H6. The perceived symbolic innovation of eco-innovation (PSI) affects the social conspicuousness of consumers (SC) associated with it.

2.3.3 | Social influence on the adoption of eco-innovations

Social influence is key to understanding green consumer behavior (Xiao et al., 2022), playing a crucial role in actual green behavior (Gulzari et al., 2022). Several studies have analyzed the influence of subjective and social norms on the intention and the actual behavior of buying green products (Gulzari et al., 2022; Khare & Kautish, 2020; Sun et al., 2022; Yeow & Loo, 2022), showing a positive correlation. This means that consumers are more likely to engage in green consumption when there is enough pressure to motivate environmental awareness and green consumption (Gabler et al., 2013). By adopting green products, green consumers will obtain social gains derived from social recognition. Therefore, green consumers will be interested not only in the good functioning of the eco-product but also in the social recognition they will obtain because of its adoption. Based on the above, we can expect that consumers' PSP and SC will positively influence the adoption of low-involvement eco-innovations.

H7. The perceived social pressure of low-involvement eco-innovation (PSP) positively affects its adoption (AD).

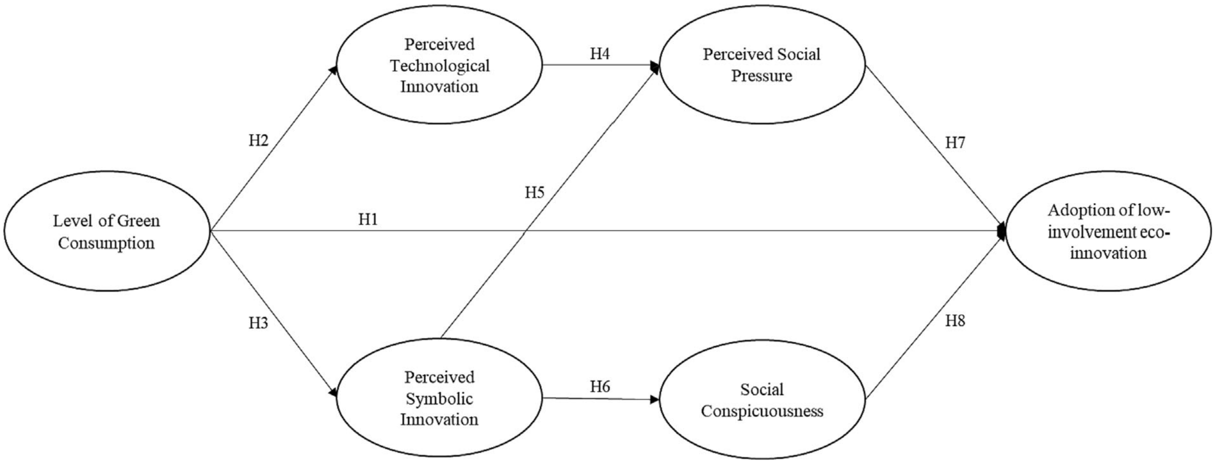

FIGURE 1 Research model.

FIGURE 2 Actual sun shield.

> **H8.** Social conspicuousness of low-involvement eco-innovation (SC) positively affects its adoption (AD).

Figure 1 shows the proposed model.

3 | METHODS

3.1 | Product and characteristics

To carry out the study, we analyzed a low-involvement eco-innovation based on electrochromic technology, classified as an eco-technology innovation (Kemp & Pearson, 2007). Electrochromic technology helps mitigate energy consumption since it uses photovoltaic cells to function, optimizing the use of natural resources. This technology has one characteristic that would place it in an advantageous position compared to other technologies: its energy consumption. Electrochromic devices have a memory effect: Once the color has changed, it remains stable without needing an energy supply, while their main competitors (LEDs and LCDs) need a continuous energy supply. Electrochromic technology has been developed for over 50 years, with the main application today being the mitigation of energy consumption in buildings by dynamically controlling light transmission through windows. Nevertheless, the only electrochromic application that has been successfully mass-marketed is the self-dimming interior rearview mirrors, whose function is to avoid glare from other vehicles.

Given the necessity to mitigate global warming by reducing energy consumption (Nundy et al., 2021), we have implemented the electrochromic technology on a smart sun shield in this study. The intelligent sun shield consists of glass made with polymers that automatically darkens thanks to a photovoltaic cell powered by sunlight (Figure 2). This product regulates the energy inside the car by solar energy, reducing the need to turn on the car's air conditioning or heating. It differs from the others in the market as it uses electrochromic technology allowing an automatic regulation where the vision is not blocked, compared to the traditional ones. Furthermore, with renewable energy and temperature balancing inside the car, the smart sun shield has a lower energy payback time (from 1 to 2 months) than other materials, such as silicon (from 2 to 3 years). In this vein, the energy payback time refers to the time required for a renewable energy system to produce the equivalent amount of energy to that used in its production (Tsuchiya et al., 2020).

TABLE 1 Measurement model evaluation.

Authors	Indicators	Constructs	Loads/Q2	(*p*-value)
do Paço et al. (2019)	**Level of green consumption: GC**			
	Cronbach's alpha:0.768; Dijkstra–Henseler's rho (ρA): 0.800; CR (ρc): 0.850; AVE: 0.588			
	GC_1	My purchase habits are affected by my concern for our environment	0.769	(0.000)
	GC_2	I am concerned about wasting the resources of our planet	0.680	(0.000)
	GC_3	I would describe myself as environmentally responsible	0.767	(0.000)
	GC_4	I am willing to be inconvenienced in order to take actions that are more environmentally friendly	0.842	(0.000)
Ali et al. (1995); Lee et al. (2013)	**Perceived technological innovation: PTI**			
	Cronbach's alpha: 0.799; Dijkstra–Henseler's rho: 0.806; CR: 0.884; AVE: 0.719			
	PTI_1	This product is expected to provide differentiated features from the one I have now	0.914/0.029	(0.000)
	PTI_2	This product is expected to have been made with cutting-edge technologies	0.736/0.015	(0.000)
	PTI_3	This product is expected to provide better features than the one I have now	0.884/0.030	(0.000)
Cappetta et al. (2006); Lee et al. (2013)	**Perceived symbolic innovation: PSI**			
	Cronbach's alpha: 0.843; Dijkstra–Henseler's rho: 0.856; CR: 0.905; AVE: 0.760			
	PSI_1	This product looks trendy	0.834/0.017	(0.000)
	PSI_2	This product looks cool	0.909/0.040	(0.000)
	PSI_3	This product looks sophisticated	0.871/0.031	(0.000)
Lee et al. (2013) based on Karahanna et al. (1999) and Taylor and Todd (1995)	**Perceived social pressure: PSP**			
	Cronbach's alpha: 0.886; Dijkstra–Henseler's rho: 0.890; CR: 0.946; AVE: 0.897			
	PSP_1	My friends will recommend this intelligent sun shield to other people	0.951/0.582	(0.000)
	PSP_2	I believe that my friends will think I have to use this intelligent sun shield	0.943/0.453	(0.000)
Lee et al. (2013); Moore and Benbasat (1991)	**Social conspicuousness: SC**			
	Cronbach's alpha:0.869; Dijkstra–Henseler's rho: 0.883; CR: 0.920; AVE: 0.792			
	SC_1	If I use this intelligent sun shield, people will think of me as a trendsetter	0.872/0.381	(0.000)
	SC_2	This intelligent sun shield will help me to be outstanding	0.936/0.305	(0.000)
	SC_3	This intelligent sun shield will help me show off myself	0.861/0.173	(0.000)
Lee et al. (2013)	**Adoption of low-involvement eco-innovation: AD**			
	Cronbach's alpha: 0.775; Dijkstra–Henseler's rho: 0.794; CR: 0.898; AVE: 0.815			
	AD_1	I have the intention to purchase this intelligent sun shield	0.884/0.260	(0.000)
	AD_2	When I replace my sun shield, I want to choose this intelligent sun shield	0.921/0.373	(0.000)

Notes: Q2 blindfolding indicator cross-validated redundancy. Bootstrapping based on $n = 10{,}000$ subsamples.
Abbreviations: AVE, average variance extracted; CR, composite reliability.

3.2 | Data, materials, and variables

The empirical study was developed in the Region of Murcia. This territory was chosen because its climatological characteristics are ideal for the product's functioning in terms of its photovoltaic operation. The Region of Murcia, located in the southeast of Spain, has a Mediterranean climate characterized by warm winters and hot summers. It benefits from many hours of sunshine throughout the year. According to the Spanish Meteorological Agency (AEMET), the Region of Murcia is estimated to receive around 3000 h of sunshine per year, equating to approximately 8 h of sun per day (AEMET, 2023).

Before implementing the questionnaire, a pilot test and an interview with four experts were conducted in order to identify possible problems or deficiencies in the questionnaire. A fieldwork company, previously trained to introduce the research to the participants, gathered data through a questionnaire. The participation of the subjects was random and voluntary. Individuals were informed of the anonymity of their responses and that there were no correct or incorrect answers, being free to answer honestly what they thought to evade biased answers (Podsakoff et al., 2003). This protocol reduced the chance of more socially desirable responses.

Information about the socio-demographic characteristics of the population was collected. Afterward, individuals were asked about their level of green consumption, PTI, PSI, PSP, SC, and aspects related to the adoption of eco-innovations.

The scales used to measure the variables are the next: PTI was adapted from Lee et al. (2013) and Ali et al. (1995); PSI was adapted from Lee et al. (2013) and Cappetta et al. (2006); PSP was adapted from Lee et al. (2013) based on Karahanna et al. (1999) and Taylor and Todd (1995); SC was adapted from Lee et al. (2013) and Moore and Benbasat (1991); and the level of green consumption was adapted from do Paço et al. (2019). The green consumption level was measured through a 5-point Likert scale (1 = *totally disagree* and 5 = *totally agree*), whereas the other variables were measured using a 5-point Likert scale (1 = *not at all* and 5 = *a lot*). Table 1 shows the specific items of the scales. Despite obtaining a total of 338 surveys, the elimination process of missing values gave 268 useful questionnaires. Taken into account that the population of cars in the Region of Murcia in 2022 was 21,523 according to the Centro Regional de la Región de Murcia (2021), a maximum imprecision percentage of 5% on a scale of 1–5 and in the most unfavorable of the variance over the range of the scale, the maximum absolute error of estimate built based on a precision factor of the measurement scale of the study variables would be 0.121 (Martínez & Martínez, 2008). 54.10% of the sample had between 46 and 65 years old. Furthermore, 65.67% of the sample were women. Concerning the educational level, those with a university degree predominated (45.52%). Finally, 28.73% earned more than 2000 net euros per month.

4 | ANALYSIS AND RESULTS

Before running the model, data were thoroughly screened. In this sense, the Kolmogorov–Smirnov test showed that all the indicators used in the model were not characterized by a normal distribution. The presence of outliers in the sample was analyzed with the Mahalanobis's distance criterion (Kautish & Sharma, 2019). The results reported a Mahalanobis's D (17) > 39.9 on $p < 0.001$, and 12 multivariate outliers were eliminated from the analysis as recommended by Hair et al. (2006). Common method variance was considered using Harman's one-factor test (Kautish & Sharma, 2019; Podsakoff & Organ, 1986). The exploratory factor analysis resulted from all the items in the model reported four factors that explained 58.71% of the total variance and the first factor explained less than 36%.

Consequently, common method variance was not relevant to the analysis. The proposed model was estimated using partial least square (PLS) path modeling (Chin, 1998). This method was appropriate because of its robustness and lower limitation for the data distribution (Hair et al., 2014). First, we evaluated the measurement model, and after assessing the suitability of the items used for each construct, we evaluated the results obtained from the structural model.

4.1 | Measurement model

We verified the reliability and convergent validity of the constructs considering the following indicators: factor loads (value and significance), Cronbach's alpha, compound reliability (Chin, 1998), the Dijkstra–Henseler rho ratio (Dijkstra & Henseler, 2015), and the extracted mean variance (AVE). The results show that two of the items used to measure the level of green consumption have loads less than 0.5, causing the AVE of that construct to be below the recommended limit (AVE: 0.469). Therefore, it is appropriate to proceed to eliminate these two items. After this elimination, AVE for the level of green consumption construct equals 0.588. This way, the model is estimated considering four items instead of six (see Table 1). The results show that the factor loads are close to the required minimum of 0.707, all of them being significant (p-value: 0.000). Although there are some items with factor loadings below that limit, we decided to keep them since the rest of the indicators related to reliability reach and exceed the proposed levels. Thus, Cronbach's alpha indicator is greater than 0.7 in all constructs. The same occurs in the composite reliability (ρc) and the Dijkstra–Henseler's (ρA), these three indicators verifying the reliability of the constructs, that is, their internal consistency (Cepeda-Carrion et al., 2019). The convergent validity is verified since the AVE of each construct exceeds 0.5 (Fornell &

TABLE 2 Discriminant validity based on the Fornell–Larcker criterion and *HTMT ratio criterion.*

	1	2	3	4	5	6
1. GC	**0.767**	*0.247*	*0.240*	*0.323*	*0.298*	*0.251*
2. PTI	0.198	**0.848**	*0.816*	*0.805*	*0.505*	*0.611*
3. PSI	0.206	0.665	**0.872**	*0.826*	*0.696*	*0.623*
4. PSP	0.279	0.678	0.719	**0.947**	*0.758*	*0.709*
5. SC	0.261	0.427	0.612	0.670	**0.890**	*0.673*
6. AD	0.197	0.489	0.513	0.594	0.556	**0.903**

Note: Fornell–Larcker criterion: the diagonal elements represent the square root of the variance shared between constructs and their measures (AVE).

Abbreviations: AD, adoption of low-involvement eco-innovation; GC, level of green consumption; PSI, perceived symbolic innovation; PSP, perceived social pressure; PTI, perceived technological innovation; SC, social conspicuousness.

Larcker, 1981). The Fornell–Larcker criterion and the heterotrait–monotrait ratio (HTMT) of Henseler et al. (2016) (see Table 2) show evidence of the discriminant validity of the constructs used in the model. Thus, the HTMT is less than the maximum of 0.85 stipulated by Henseler et al. (2016). Similarly, the square root of the AVE is higher than the correlation with the other constructs. Additionally, we evaluated the predictive ability using the blindfolding procedure to check that cross-validated commonalities and redundancies Q2 are superior to 0 (Sharma et al., 2022; Tenenhaus et al., 2005).

4.2 | Structural model

Bootstrapping analysis was carried out with 10,000 subsamples to analyze the significance of the relationships proposed in each hypothesis. Before analyzing these results, we verified that there is no multicollinearity problem in the internal model. Table 3 shows that in this model, the VIF values comply with that indicated by Hair et al. (2019) since they are less than 3.

The results shown in Table 4 allow us to verify all the hypotheses presented (H2, H3, H4, H5, H6, H7, and H8) except for the direct effect of the level of green consumption on the adoption of eco-innovations (H1). Thus, there is a significant and positive relationship between the level of green consumption and the perception of technological innovation (coefficient: 0.198; *p*-value: 0.001), so awareness of caring for the environment causes a positive effect on individuals' perception of the technological aspect (PTI). This positive relationship also exists, although to a greater extent when considering the symbolic dimension (PSI) (coefficient: 0.206; *p*-value: 0.001). As identified by Lee et al. (2013), PTI positively affects PSP (0.359; 0.002), and PSI positively influences PSP (coefficient: 0.481; *p*-value: 0.000) and SC (coefficient: 0.612; *p*-value:0.000). Consequently, it is confirmed that the more innovative consumers see eco-innovation, the more importance they give to what others will think about them and how they will see them when using it. Finally, the PSP and the SC positively and significantly affect the intention to adopt eco-innovation with coefficients above 0.2. The analysis of the indirect effects of the level of green consumption on the intention to adopt this eco-innovation shows that, although the direct effect is not significant, the total indirect effect is significant (coefficient: 0.104; *p*-value: 0.000). The study of the specific indirect effects shows that the influence of the green consumer variable is transmitted mainly through the social variable PSP since the coefficient linked to them is higher than the coefficient linked to the SC variable.

TABLE 3 VIF values of the internal model.

	AD	PSI	PSP	PTI	SC
GC	1.096	1.000		1.000	
PSI			1.793		1.000
PSP	1.853				
PTI			1.793		
SC	1.833				

Abbreviations: AD, adoption of low-involvement eco-innovation; GC, level of green consumption; PSI, perceived symbolic innovation; PSP, perceived social pressure; PTI, perceived technological innovation; SC, social conspicuousness.

TABLE 4 Structural model.

Relationships	Coefficients, *p*-value, confidence intervals	Supported
H1: GC–AD	0.012 (0.211) [−0.080; 0.098]	No
H2: GC–PTI	0.198 (0.001) [0.086; 0.288]	Yes
H3: GC–PSI	0.206 (0.001) [0.090; 0.298]	Yes
H4: PTI–PSP	0.359 (0.002) [0.261; 0.456]	Yes
H5: PSI–PSP	0.481 (0.000) [0.385; 0.566]	Yes
H6: PSI–SC	0.612 (0.000) [0.541; 0.668]	Yes
H7: PSP–AD	0.401 (0.000) [0.277; 0.518]	Yes
H8: SC–AD	0.284 (0.006) [0.172; 0.400]	Yes
Indirect effects green consumer–adoption	**Coefficients, *p*-value, confidence intervals**	
Level of green consumption–AD total indirect effect	0.104 (0.000) [0.050; 0.147]	
Level of green consumption–PSI–PSP–AD	0.040 (0.005) [0.018; 0.066]	
Level of green consumption–PTI–PSP–AD	0.028 (0.010) [0.012; 0.051]	
Level of green consumption–PSI–SC–AD	0.036 (0.009) [0.015; 0.064]	
Level of green consumption–AD total effect	0.115 (0.027) [0.027; 0.224]	
	Adjusted R^2	**Q2**
PTI	0.035	**0.025**
PSI	0.039	**0.029**
PSP	0.586	**0.518**
SC	0.372	**0.286**
AD	0.391	**0.317**

Note: Bootstrapping 95% confidence intervals (bias-corrected), between square brackets (based on $n = 10{,}000$ subsamples).
Abbreviations: AD, adoption of low-involvement eco-innovation; GC, level of green consumption; PSI, perceived symbolic innovation; PSP, perceived social pressure; PTI, perceived technological innovation; SC, social conspicuousness.

5 | DISCUSSION

5.1 | Theoretical contributions

In this study, a quantitative approach has been carried out to test a model that analyzes the eco-innovation adoption process of green consumers. The model, based on Lee et al. (2013), proposes two effects of the level of green consumption on the adoption of eco-innovation: a direct effect (H1) and an indirect effect through consumers' perceptions of the eco-innovation in a social context. Specifically, this study has addressed how green consumers perceive the technological and symbolic attributes associated with a low-involvement eco-innovation (H2 and H3). Furthermore, it has analyzed the effect of the latter on two critical social variables, such as PSP and SC (H4, H5, and H6). Finally, the relationships between social pressure and eco-innovation adoption have been studied (H7 and H8). The results obtained in this empirical study contribute to the existing literature on several issues.

To the best of our knowledge, this research is the first attempt to include the level of green consumption in models analyzing the adoption process of low-involvement eco-innovations. This study expands Lee et al.'s (2013) model to the context of low-involvement eco-innovations to test the importance of the social context on green consumer adoption. Nonetheless, findings do not support the proposed direct effect of being a green consumer on adopting eco-innovation (H1) but an indirect effect through their dimension perception and social influence. This result is in line with previous research in similar areas that have shown that the relationship between customer environmental concern and sustainable behavior is insignificant or trivial (Kautish et al., 2021; Kautish & Dash, 2017; Khare & Kautish, 2020; Sharma et al., 2021). Despite H1 not being fulfilled, there is a positive influence on how green consumers perceive and value the technological dimension of the eco-innovation (H2) and the symbolic one (H3). These results manifest the need to include the level of green consumption in green behavior intention models, as their motivations will influence how they perceive the products' symbolic, functional, and environmental attributes.

The findings also show that, as it occurred with innovations (Lee et al., 2013), the technological aspects of the low-involvement eco-innovation positively impact PSP (H4), while the symbolic aspects affect both PSP (H5) and SC (H6). These results report the importance of the symbolic attributes of eco-innovation in a social context, being in line with Noppers et al. (2014). The effect of social norms on the adoption of eco-innovation, operationalized in this study through PSP (H7) and SC (H8), has also been tested. Based on these results, green consumers will value the technological aspects of low-involvement eco-innovations, as they will value the novelty and the new characteristics and features associated with it, allowing them to consume more sustainably. Moreover, consumers will be motivated by the social recognition derived from its use as the social influence will affect their green behavior (Gulzari et al., 2022; Sun et al., 2022; Yeow & Loo, 2022). In this context, literature on low-involvement products support that these are unlikely to influence consumers' self-image (Li et al., 2021). Results of this study show that in the case of the eco-innovation, there is a strong social influence because, even if it is low-involvement, the fact that it is an innovation and, moreover, green, gives it meaning in the social context. These findings reveal that social influence in recent years is also permeating everyday activities or small gestures toward sustainability.

5.2 | Managerial implications

Many companies are developing strategies to modify the production process to incorporate an environmental perspective that enables the generation of eco-innovations (Sharma et al., 2022). In this regard, companies that want to promote green consumption and reach environmentally conscious consumers should prioritize not only the eco-innovation environmental attributes during the design and promotion phase (Marcon et al., 2022) but also the technological and symbolic ones. The results of this study show that consumers are looking for functionality in a product and for attributes that align with their values, lifestyle, and personality. Therefore, companies must understand how consumers perceive these attributes to tailor their products better to meet their needs and expectations. Likewise, taking these dimensions of eco-innovations into account can help the companies that develop them to create more attractive and relevant products for their target audience. In this way, if companies can showcase and highlight these attributes, they will reinforce their brand image, allowing consumers to see their products and services more attractive and relevantly.

Marketers can motivate consumers to green purchasing by understanding their mindset and promoting eco-innovation elements (Sharma et al., 2022). Considering that the adoption of eco-innovation is influenced by the perceived risk derived from its novelty, consumers will make the purchase choice following the utility maximization behavior. Accordingly, green consumers will consider the attributes of the alternatives they can evaluate (Moon et al., 2021). This may result in a choice of non-ecological products if they lack information regarding eco-innovation attributes. Therefore, communication actions and promotion activities should emphasize the symbolic and technological attributes clearly and broadly to make consumers feel confident and knowledgeable regarding the product they intend to buy. This includes creating advertising and communication messages highlighting relevant attributes and appealing to consumers' emotions and values.

Finally, this study has highlighted the importance of PSP and SC in the adoption of low-involvement eco-innovations. These results show the relevance of market research and trend analysis within companies, which allow companies to understand better the purchasing preferences and values of certain social groups. Also, given the relevance of social media in the 21st century, companies can monitor social networks, online forums, and other platforms where social groups express their opinions about products and needs. This can serve as a basis for the company to analyze and learn about the views, criticisms, and recommendations of specific social groups with which potential customers interact. Finally, it is crucial to stress the importance of transparency and effective communication for consumers. Companies must be able to clearly communicate detailed information about the entire eco-innovation production process, the origin of the products, the technologies used, etc. so that consumers feel identified with the company's values and can achieve social awareness by purchasing the product.

5.3 | Policy implications

In 2015, world leaders adopted a set of global goals known as the Sustainable Development Goals (SDG) to, among other things, protect the planet while ensuring economic and social prosperity. These objectives have specific goals that must be met by 2030. Despite there being progress and growing concern that the population is aware of the existing environmental problem (Sharma et al., 2022), governments must strengthen environmental policies to ensure that the 2030 Agenda will be met. Considering that the adoption of eco-innovations is crucial for sustainability (Melander & Arvidsson, 2022), the results of this study have relevant policy implications that governments must consider. Furthermore, in a context where sustainable consumption faces difficulties, including high costs and/or unavailability of green items (Kautish et al., 2020), governments must support companies and individuals that develop and adopt low-involvement eco-innovations, respectively.

One of the SDGs "Quality Education" aims to ensure on its goal 4.7 that all students acquire the theoretical and practical knowledge necessary to promote sustainable development (such as education for sustainable development and sustainable lifestyles). Governments must allocate economic funds to achieve greater environmental awareness, highlighting the need to use greener products such as eco-innovations. The results of this study have shown that small actions can make a significant contribution to change. Therefore, governments should reinforce educational policies, teaching and motivating future generations to make use of low-involvement eco-innovations. In addition, given the growth in demand for sustainable products and technologies, public research in research and development (R&D) related to sustainability and environmental protection should be strengthened. It should be noted that environmental awareness can be achieved with a public–private collaboration. In this context, it must be crucial for governments to collaborate with private organizations to educate and raise awareness among the population about the need to adopt more sustainable products. These alliances can result in joint policies, incentive programs, or communication campaigns aimed at the adoption of eco-innovations.

The results of this study also contribute to SDG 13: Climate Action. In this regard, we analyze consumer behavior toward a product that works thanks to renewable energy. In this context, governments can implement stricter regulations, set sustainability standards, and offer tax incentives to encourage development (at the organizational level) and adoption of these eco-innovations. From a global perspective, countries with regulations that encourage the adoption of eco-innovations will be able to take competitive advantages in terms of reputation and investment attraction.

6 | CONCLUSION

The research findings support previous literature regarding the effect of social influence and perceived attributes of innovations on their adoption (Lee et al., 2013). This work widens the context of previous studies by considering the level of green consumption and its influence on the adoption of low-involvement eco-innovations. In this regard, our research gives insight into the indirect effect of the level of green consumption on the adoption of eco-innovations mediated by the perceived technological and symbolic dimensions of eco-innovations and the PSP and SC. Then, the fact that there is no direct and significant relationship between the level of green consumption and the adoption of eco-innovation implies that the variables of the level of perceived innovation and social influence fully mediate this relationship.

Despite the results obtained, there are some limitations and future lines of research that should be highlighted. Firstly, regarding the study's limitations, we found difficulty accessing data as the new legislation even protects the individual's private information, making it hard to access databases whose individuals have accepted to participate in market research. Secondly, this research was carried out in the Region of Murcia. Therefore, the study's results cannot be generalized to other territories since environmental awareness, environmental regulation, and consumer behavior vary. Future research should analyze this model, testing its validity in other locations. Similarly, this model is tested in a specific low-involvement eco-innovation, so it cannot be generalized to other ecological innovations.

For additional future lines of research, it would also be interesting to know the application of the intelligent material we have used to other products where its application is easier perceived by consumers. Although the level of green consumption does not directly affect the adoption of eco-innovations, it is important to continue studying mediating variables, such as the risk perceived by consumers, environmental concern, variables related with the value–belief–norm theory, or innate innovativeness. Moreover, the micro level has been analyzed, which is the one that analyzes the product, service, process, and company. In the future, it would also be interesting to analyze eco-innovations from the other two levels proposed by Reid and Miedzinski (2008). These two levels are the meso level, which studies eco-innovations from the point of view of the sector, supply chain, region, and product/service system, and the macro level, which analyzes them from an economy-wide perspective.

Last but not least, future research should not forget the key element technology is currently playing in the market and how firms and consumers are receiving and embedding the technological rapid change in their decision-making process. Consumers demand more personalized, smart, and sustainable products, and companies need to adopt an organizational structure and a mode of work that allow them to adapt rapidly to these changes (Boccella et al., 2020). Industry 4.0 enablers may be crucial to support both the more environmentally friendly behavior of the consumers promoting the green consumer figure and the accomplishment of corporate social responsibility goals in many sectors; see Abbate et al. (2023) for the agri-food activity and Abbate et al. (2022) for the healthcare sector.

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