Technology in Society 81 (2025) 102842

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Rational and normative determinants in electric vehicle adoption: Willingness to pay and moderating variables

L. Javier Cabeza-Ramírez [a], Abel Rosales-Tristancho [b,*], Sandra M. Sánchez-Cañizares [a], Beatriz Palacios-Florencio [c]

[a] Department of Business Organization, University of Cordoba, Puerta Nueva s/n, 14071, Cordoba, Spain
[b] Department of Applied Economics I, University of Seville, Avda. Ramón y Cajal, 1, 41018, Seville, Spain
[c] Departamento de Organización de Empresas y Marketing, Universidad Pablo de Olavide, Carretera de Utrera, Km 1, 41013, Seville, Spain

ARTICLE INFO

Keywords:
Electric vehicles
Theory of planned behaviour
Norm activation model
Risk perception
Social norm
Purchase decision

ABSTRACT

The adoption of electric vehicles has been promoted as a possible environmentally friendly solution in the field of transport. However, uptake is uneven across European countries. The impact of factors influencing the adoption of electric vehicles has been highlighted in recent literature. Nevertheless, this literature has scarcely considered willingness to pay, the risks associated with the purchase, and the moderating variables in consumers' purchase intention. This research addresses this gap and aims to analyze these factors. To this end, these variables are incorporated into a model based on the theory of planned behavior (TPB) and the norm activation model (NAM). The model estimation was developed through the data collected from a questionnaire given to regular drivers in Spain (n = 1241) and analyzed using partial least squares structural equation modelling (PLS-SEM). The results indicate that awareness of environmental issues and consequences of one's actions, along with social pressure, activate the individual personal norm, channeling these effects towards intention, and with greater intensity towards willingness to pay. In addition, the influence of performance and financial risks was confirmed, albeit with a lower impact than expected on purchase intention. The analysis also reveals significant moderating effects, with variations observed based on age, income, primary vehicle use, and prior experience with electric or hybrid vehicles.

1. Introduction

The use of traditional fuels in transport significantly contributes to greenhouse gas emissions (Andersson & Börjesson, 2021; da Silva et al., 2022; Huo et al., 2012). As such, the transport sector occupies a critical position in the fight against climate change and efforts to protect the environment (Cifuentes-Faura, 2022; Vajjarapu et al., 2019). Road mobility, in particular, has a notable impact on environmental degradation and the depletion of natural resources (Cifuentes-Faura, 2022). Furthermore, combustion engines in road traffic negatively affect air quality and increase noise pollution in urban areas (Jacyna et al., 2017; Nieuwenhuijsen, 2021). One way to tackle these problems is through the application of alternative propulsion technologies, such as those used in electric and hybrid vehicles (Adu-Gyamfi, Song, Obuobi, et al., 2022; Kandidayeni et al., 2022; Lu et al., 2020; Onat & Kucukvar, 2022). These technologies have the potential to reduce our dependence on fossil fuels and lower pollutant emissions. Pure electric vehicles are considered zero-emission vehicles (ZEVs). According to Rosales-Tristancho et al. (2022), they are one of the most solid options for overcoming the problems associated with conventional mobility.

Electric vehicles offer several advantages over conventional vehicles that make them attractive to consumers: they produce no polluting emissions, handle well, are easy to drive, and have low noise pollution levels (Rosales-Tristancho et al., 2021). However, despite the similarities in product categories between electric and traditional vehicles, market penetration rates for electric vehicles vary significantly. In some countries, the electric vehicle registration rate lies around just 1% (Cyprus, Poland, the Czech Republic and Slovakia), while in others it exceeds 80% (Norway) (Agency, 2022). This disparity is likely due to barriers that hinder mass adoption, such as higher purchase prices, lack of charging infrastructure, limited range, or long charging times (Rosales-Tristancho et al., 2022). Additionally, psychological factors, such as values, perceptions, and attitudes towards the product and the environment, may also play a role (Li et al., 2017; Vafaei-Zadeh et al.,

* Corresponding author.
E-mail address: artristancho@us.es (A. Rosales-Tristancho).

https://doi.org/10.1016/j.techsoc.2025.102842
Received 8 April 2023; Received in revised form 17 July 2024; Accepted 12 February 2025
Available online 15 February 2025

2022; Wang et al., 2016). In relation to this, it seems that the countries with the highest electric vehicle adoption rates (IEA, 2022) tend to be those with higher household disposable income (OECD, 2022) and more deeply-rooted environmental values and ecological culture (Halman et al., 2022; Rodríguez, 2021).

The ongoing debate about the transition to electric vehicles has sparked significant interest among academics and professionals in identifying effective strategies to accelerate environmental efficiency while meeting consumer mobility needs (Nayum & Thøgersen, 2022). Recent evidence indicates that consumers' purchasing decisions are influenced by both moral environmental awareness (altruistic behavior) and the cost-benefit and social repercussions of their decisions (rational behavior) (Adu-Gyamfi, Song, Obuobi, et al., 2022; Asadi et al., 2021; Bösehans et al., 2023; Gunawan et al., 2022; Hasan, 2021; Huang et al., 2021; Li et al., 2017). From the perspective of environmental psychology, several theories have capitalized on research on purchase intention (Asadi et al., 2021; Singh et al., 2020; Vafaei-Zadeh et al., 2022). Two of the most prominent are the theory of planned behavior (TPB) (Hasan, 2021; Li et al., 2020; Shalender & Sharma, 2021; Wang et al., 2016), and the norm activation model (NAM) (Ashraf Javid et al., 2021; He & Zhan, 2018; Nordlund et al., 2018). The TPB focuses on rational decision-making by potential adopters (Ajzen, 1991; Egbue & Long, 2012; Secinaro, Calandra, Lanzalonga, & Ferraris, 2022), whereas the NAM includes less rational components, such as conscience and moral norms (Schwartz, 1977; Schwartz & Howard, 1981, pp. 189–211).

While the literature on factors influencing electric vehicle adoption is extensive, recent systematic reviews in sustainable mobility reveal knowledge gaps that require further empirical research (Adnan et al., 2017; Coffman et al., 2017; Das et al., 2020; Kandidayeni et al., 2022; Kumar & Alok, 2020; Li et al., 2017, 2019; Onat & Kucukvar, 2022; Qazi et al., 2019; Singh et al., 2020). Firstly, most studies on purchase behavior use intention as the sole dependent variable (Bjerkan et al., 2016; Hamzah & Tanwir, 2021). This approach provides partial information since it is not known if the intention ultimately translates into greater willingness to assume the purchase costs. Secondly, the studies that have merged the TPB and the NAM, as reviewed by Hamzah and Tanwir (2021), reveal the need to extend the integrated framework to include a greater number of triggers of electric vehicle adoption, in order to increase its explanatory power. That is, it should incorporate demographic characteristics (e.g. personal and family), situational aspects (e.g. technical characteristics), psychological attributes (e.g. experience, social influence and values) (Li et al., 2017; Tunçel, 2022), as well as the risks associated with the purchase (Kumar & Alok, 2020). Lastly, almost all the studies that integrated the TPB and the NAM were conducted in developing (Asadi et al., 2021; Hamzah & Tanwir, 2021) or established non-European economies (Dong et al., 2020); consequently, there is a need for new evidence that allows cross-cultural comparisons of the results obtained.

The present study seeks to fill the gap described above by investigating the underexplored areas of willingness to pay and the integration of additional triggers (risks associated with the purchase) in the TPB and NAM frameworks. This includes the examination of moderating variables, such as demographic and situational factors. By so doing, it can provide researchers, professionals from the automotive sector and public policymakers with useful information about the aspects that determine the choice of electric vehicles (Kumar & Alok, 2020; Singh et al., 2020). In particular, it can shed light on the complex psychological process underlying the intention to buying and willingness to pay for an environmentally friendly product that is more expensive than the product it replaces (IEA, 2022). On this basis, three questions guide our analysis: Is the intention to purchase an electric vehicle connected to willingness to pay? What impact do financial and performance risks have on purchase intention and willingness to pay? Do consumers' demographic and situational variables moderate the relationships of the psychological constructs of the NAM and the TPB with purchase intention and willingness to pay? In order to answer these questions, we propose a extended framework based on a combination of the TPB (Ajzen, 1991) and the NAM (Schwartz, 1977; Schwartz & Howard, 1981, pp. 189–211). Accordingly, the objective of this study is to develop a psychosocial model of electric vehicle adoption to identify the predictors of drivers' purchase intention and willingness to pay. The resulting hypotheses are tested on a sample of 1241 regular Spanish drivers. Spain may be an especially useful case to study as it is a European economy with average household disposable income (OECD, 2022), an electric vehicle adoption rate lower than the average of its surrounding countries (ANFAC, 2022), and with a sales share of new electric cars that barely reaches 8% (IEA, 2022).

In general, the contribution of this study to the literature is twofold: firstly, although intention can be a good indicator of electric vehicle purchase behaviour, the effects of personal norm and intention on the willingness to pay more for an environmentally friendly product should not be overlooked (Bhutto et al., 2021; Ferguson et al., 2018; Hidrue et al., 2011). On the other hand, we offer a novel perspective by extending the integration of the TPB and the NAM to consider how financial and performance risks might lessen intention and willingness to pay (Kumar & Alok, 2020). Furthermore, previous analyses based on the TPB and the NAM do not delve into the possible moderating effects of situational variables relating to the consumer (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021): age, gender, family income, possibility of installing a charging point, main use of the vehicle, proximity to charging points, and previous driving experience (Li et al., 2017; Tunçel, 2022).

2. Literature review and hypothesis development

2.1. Background

In 2018, transport activities were responsible for about 29% of total CO_2 emissions in the European Union (European Parliament, 2020). Growing institutional concern has led to ambitious new legislative proposals: *"To raise the contribution of the road transport sector to the EU's climate targets, the proposal sets more ambitious 2030 targets for reducing the CO_2 emissions of new cars and vans and allows only zero-emission vehicles from 2035"* (European Parliament, 2022). The rise in regulation on the CO_2 emissions generated by the transport sector has stimulated the growth of the European electric vehicle market during the period 2016–2021 (IEA, 2022). In 2021, even with the mobility restrictions stemming from the Covid-19 pandemic, electric cars accounted for 17% of total car sales in Europe, and in the last quarter of the year they exceeded diesel car registrations for the first time. However, the distribution of new electric car sales is uneven across countries, with Norway (86%), Iceland (72%), Sweden (43%), the Netherlands (30%), and Germany (26%) leading the market, followed at some distance by France (19%), Italy (9%), and Spain (8%) (IEA, 2022). Germany, a country that offers some of the highest subsidies in Europe to support the transition to electric vehicles, is the largest market in terms of total number of electric vehicles in circulation (IEA, 2022). Despite this growth, it is still expensive to buy an electric car in Europe. In fact, over the course of 2021, the average price of battery electric vehicles and plug-in hybrids rose by 3% and 4% compared to 2020, to an average of 50,000 and 57,000 dollars, respectively—well above the average for a diesel or gasoline vehicle. With this upward trend set to continue for the next few years due to the conflict in Ukraine and problems with the supply of raw materials (IEA, 2022), some European countries will find it difficult to meet the proposed goals for more sustainable mobility in 2035 (European Parliament, 2022).

In these circumstances, organizations such as the Spanish Association of Automobile and Truck Manufacturers (ANFAC) recently warned that the distance between Spain and other countries in terms of electromobility continues to increase (ANFAC, 2022). Indeed, although sales of electric and hybrid vehicles are rising, they represent barely 3.5% of the total vehicles in circulation in Spain. In addition, for every new

passenger car that is registered, almost two are sold that are over 10 years old. What is more, one in four of these second-hand units is over 20 years old, which implies that some cars kept in circulation do not incorporate the necessary technological advances in safety, sustainability and emission reduction (ANFAC, 2022). On the other hand, this organization also points out that new economic subsidies are urgently needed to tackle the renewal of the stock of cars on the road and awareness-raising measures, as well as to increase the deployment of charging infrastructure, which is at a level four times lower than that demanded by the market (ANFAC, 2022).

2.2. Theory of planned behaviour (TPB)

The theoretical framework of the TPB proposed by Ajzen (1991) emerged with the aim of perfecting the predictive power of the theory of reasoned action (Fishbein & Ajzen, 1977; Kumar & Nayak, 2022). Both approaches were designed to understand the behaviour arising under volitional control (Hankins et al., 2000). The basic premise of the psychosocial model of the TPB is that attitudes, subjective norms and perceived control are the fundamental determinants of a person's intentions to perform a specific behaviour (Ajzen, 1991; Kumar & Nayak, 2022). Kumar and Nayak (2022), in their recent meta-analysis of the behaviours linked to the use of green energy, presented the original definitions of the three basic constructs of the model as follows: attitude, *"the individual's positive or negative evaluation of performing the behavior"; subjective norm, "the person's perception of social pressure put on him to perform or not perform the behaviour in question"; and perceived behavioural control, "the person's belief as to how easy or difficult performance of the behaviour is likely to be"* (p. 149). According to the TPB, intention is the immediate antecedent of effective behaviour (Ajzen, 1991). Under this premise, it is postulated that if the intention is strong enough, the chances of performing a certain behaviour increase substantially (Kumar & Nayak, 2022). Additionally, Ajzen (1991) recommended extending his model to adapt it to different behaviours, taking into account a series of conditions for new inclusions (Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b; Meng & Choi, 2016): "*they must be imperative factors that affect the decision-making process, they must be conceptually independent of the original, and they must be potentially appropriate for gaining an understanding of a specific behaviour*".

The extended model of the TPB has been used repeatedly in research on electric vehicle adoption, demonstrating its effectiveness in advancing the understanding of the determining factors of adoption (Moon, 2021; Singh et al., 2020; Wang et al., 2016). For example, in the context of China, where electric vehicles are much more economical (IEA, 2022), Li et al. (2020) applied an extension of the TPB including the personal norm as an additional variable, along with direct and moderating effects of a set of variables related to electric vehicle adoption policies (consistency, coherence, credibility, comprehensiveness). According to their results, attitude was the predictor that made the most powerful contribution to intention, followed by the personal norm. Meanwhile, Shalender and Sharma (2021), focusing on India, a country where buying an electric car entails a substantial effort (IEA, 2022), added the influence of the moral norm and environmental concern; however, the impact of these variables was found to be less than expected, well below that of the other, original TPB variables. In other studies, by contrast, researchers opted to integrate the TPB with some other theoretical framework, such as the technology acceptance model (TAM) (Adu-Gyamfi, Song, Obuobi, et al., 2022; Huang et al., 2021; Thøgersen & Ebsen, 2019; Tu & Yang, 2019; Vafaei-Zadeh et al., 2022); diffusion of innovation (DOI) theory (Bösehans et al., 2023; Moon, 2021; Tu & Yang, 2019); the norm activation model (NAM) (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021), or the unified theory of acceptance and use of technology (Gunawan et al., 2022). These studies confirmed that the three main variables of the TPB had a significant influence on intention.

2.3. The norm activation model (NAM)

The theoretical model NAM was developed to explain intention and behaviour in altruistic pro-social contexts (Schwartz, 1977): *"altruistic behaviour is causally influenced by feelings of moral obligation to act on one's personally held norms"*. It is framework based on people's interest in acting in favour of other people and society. A specific example would be the case of pro-environmental behaviour (Bobeth & Kastner, 2020; De Groot & Steg, 2009). The basic premise is that people feel morally obliged to act in a manner that is beneficial to the environment in line with their internal feelings, referred to as their personal norm (PN). This norm guides their decisions such that they perceive their behaviour to be morally acceptable (Bobeth & Kastner, 2020).

Unlike the TPB, there are different interpretations of the NAM in the framework of environmental psychology (Klöckner, 2013a). This is because its formal structure was not fully developed (Klöckner, 2013a, 2013b; Schwartz & Howard, 1981, pp. 189–211). In its original conception, there were three antecedents of altruistic behaviour: a) awareness of consequences (AC), that is, a personal understanding of the results of individual actions for the collective well-being; b) ascription of responsibility (AR), the individual assignment of obligation for the actions performed; and c) personal norm (PN), a reflection of the individual value system in a given situation (Klöckner, 2013a; Schwartz & Howard, 1981, pp. 189–211). The model can be approached in terms of either mediation or moderation (De Groot & Steg, 2009; Kim et al., 2018). In the first form, it is configured sequentially; that is, the awareness of the consequences influences the ascription of responsibility, which in turn determines the personal norm, and finally leads to intention. In the second approach, the personal norm determines intention, although this relationship is moderated by the ascription of responsibility and the awareness of the consequences (Gunawan et al., 2022; Sovacool, 2014). Both rationales are plausible. However, comparative studies yielded clearer results with the mediator model (De Groot & Steg, 2009; Kim et al., 2018; Onwezen et al., 2013).

As with the TPB, the NAM can be extended by including new variables or being combined with other theories (Klöckner, 2013a, 2013b). In the field of research on the acceptance of electric mobility, the extended or integrated framework has demonstrated its versatility for shedding light on the determinants of electric car purchases (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021; He & Zhan, 2018; Nordlund et al., 2018). Focusing on China, He and Zhan (2018), proposed a model adding in the external costs (perceived price and perceived complexity), as well as perceived consumer effectiveness, showing that this last variable has a particular influence on the personal norm. For the same country, Dong et al. (2020) integrated the TPB and the NAM along with other cost factors (purchase price, daily energy consumption costs, and maintenance costs). They showed how, in the presence of subsidies, costs did not significantly influence intention, while the personal norm was found to be the fourth most important predictor (after attitudes, subjective norm and perceived control). Furthermore, two studies focusing on Malaysia integrated the TPB and the NAM (Asadi et al., 2021; Hamzah & Tanwir, 2021). As additional variables incorporated into the resulting model, the first study examined perceived value and effectiveness, and incentive policies, while the second examined environmental knowledge as a moderating variable. The two studies found significant links between the personal norm and the intention of adoption. In the European context (Sweden), Nordlund et al. (2018) investigated whether the perception of justice and the effectiveness of electric vehicle stimulus measures were related to the norm activation process in three groups of car owners, revealing that individuals with prior experience owning an electric vehicle exhibited greater environmental awareness, higher self-efficacy, and a stronger personal norm.

2.4. The integration of the TPB and the NAM

The review conducted by Adnan et al. (2017) highlighted the importance of incorporating environmental moral obligations in the TPB-based studies applied to the adoption of electric vehicles. In response to this call, recent studies have justified the combination of the TPB and the NAM as a way of including both the consumer's rational factors and altruism in decision-making about electric vehicle adoption (Asadi et al., 2021; Hamzah & Tanwir, 2021). This captures the dual nature of the electric vehicle, instrumental and pro-environmental (Onat & Kucukvar, 2022; Rosales-Tristancho et al., 2022). Moreover, the integration of the two theories allows a more complete explanation of electric vehicle purchasing behaviour (Adnan et al., 2017). This argument is supported by the research of Huijts et al. (2013) and Ong and Musa (2011), who pointed out that the TPB would only be able to explain rational pro-environmental decisions based on social influence and a cost-benefit calculation. However, when both frameworks are combined, the resulting model includes the rational aspects and the pro-social incentives arising from the consumer's moral obligation (He & Zhan, 2018). Nevertheless, the firm consensus on the benefits of integrating the TPB and the NAM (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021) fades away when it comes to addressing the proposed relationships between the variables and the structure of the resulting model. Hamzah and Tanwir (2021), in their study of the intention to purchase hybrid vehicles, reviewed a set of studies demonstrating this.

In this regard, Klöckner (2013a), in his meta-analysis involving a comprehensive model of the psychology of environmental behaviour, explained that if the personal norm is activated in a person—that is, when the personal value system is aligned with the fight against environmental deterioration—it would have an effect on intention (I). In this case, the NAM variables are positioned as antecedents of the variables included in the TPB (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021), with purchase intention (I) positioned a dependent variable in the combined model. Klöckner (2013a) identified four activators of the personal norm (PN): 1) awareness of the existence of a need or problem; 2) awareness of the repercussions of performing the behaviour; 3) acceptance of responsibility for one's actions; and 4) a perceived ability to perform the actions in question. In the previous literature, the activators, as well as the terms used to describe them, have varied according to the interpretation of the NAM (Hamzah & Tanwir, 2021; Klöckner, 2013a; Schwartz & Howard, 1981, pp. 189–211).

In this paper, we follow the adaptation used by Hunecke et al. (2001) and applied by Bobeth and Kastner (2020) to make adjustments to the NAM. In the context of this study, potential buyers of an electric vehicle will have their personal norm activated when they accept their responsibility and become aware of an environmental problem (Problem Awareness, PA), in turn becoming aware of the beneficial consequences for the environment of purchasing an electric vehicle (Awareness of Consequences, AC). These two variables, as defined by Bobeth and Kastner (2020), include the first three activators proposed by Klöckner (2013a), while the fourth is equivalent to the perceived behavioural control (PBC) of the TPB. In addition, Bobeth and Kastner (2020) propose a new activator, the social norm (SN), defined as the influence that society and opinion leaders have on the personal norm (PN). This accounts for the social impact as an important part of electric vehicle adoption. This activator was included as relevant element in the seminal paper on the NAM by Schwartz and Howard (1981, pp. 189–211). In turn, the social norm (SN) has two components: the descriptive social norm (DSN), that is, what people perceive is appropriate to do in society, based on what is happening around them; and the **injunctive** social norm (ISN), referring to the behavioural expectations generated by their closest personal referents (friends, partner, family, colleagues) (Bobeth & Kastner, 2020). In the TPB, the two components are usually incorporated together in the subjective norm with no distinction made between them, although they can be considered separately (Ajzen, 1991; Cialdini et al., 1990; Minton et al., 2018).

Based on the above, we propose the first hypotheses of the model.

H1. Awareness of the environmental consequences (AC) of buying an electric vehicle positively influences personal norms (PN).

H2. The awareness of the environmental problem (PA) positively influences the personal norm (PN).

H3. The descriptive social norm (DSN) positively influences the personal norm (PN).

H4. The **injunctive** social norm (ISN) positively influences the personal norm (PN).

H5. The personal norm (PN) positively influences the intention to purchase an electric vehicle (I).

H6. Perceived behavioural control (PBC) positively influences the intention to purchase an electric vehicle (I).

When breaking down the social norm into descriptive and **injunctive** elements (Ajzen, 1991; Cialdini et al., 1990; Minton et al., 2018), we assume that the **injunctive** social norm forms part of the subjective norm of the standard TPB model (Ajzen, 1991). As explained by White et al. (2009), instead of considering norms as a unitary construct, it is more appropriate to differentiate them into descriptive and injunctive norms. Descriptive norms reflect perceptions of what others do, while injunctive norms reflect perceptions of what others approve of or think one should do. In this sense, the subjective norm component of the TPB can be better understood as an injunctive social norm, as it deals with the perceived social pressures from significant others to perform a specific behavior. It is therefore necessary to address the direct connections between the descriptive and **injunctive** social norm (as well as the relation to purchase intention). Bobeth and Kastner (2020) point out that the descriptive social norm plays an informative role, while the **injunctive** social norm exerts the social pressure from the close personal referents. Different studies support the direct effects between the components of descriptive and **injunctive** social norms (Klöckner, 2014; Sang & Bekhet, 2015), and the meta-analysis of Klöckner (2013a) lends empirical support to the two roles of the social norm (Bobeth & Kastner, 2020). Based on the above, we propose the following hypotheses.

H7. The descriptive social norm (DSN) positively influences the **injunctive** social norm (ISN).

H8. The **injunctive** social norm (ISN) positively influences the intention to purchase an electric vehicle.

Although previous empirical evidence has confirmed the relationships proposed above that form the basis of the combined TPB and NAM (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021), one of the latest meta-analyses on the application of the TPB to predict green energy behaviour indicates that attitude (A) is the most crucial antecedent of intention (I) (Kumar & Nayak, 2022). In this sense, both the awareness of the environmental problem (PA) and the awareness of consequences (AC) should have some kind of direct positive effect on the TPB construct attitude (A) (Bobeth & Kastner, 2020; Klöckner, 2013a). It therefore seems reasonable to think that people who are more aware of the environmental problem and the consequences of pro-environmental actions tend to have a more favourable disposition towards electric vehicles. This idea is backed by previous analyses. For example, Teksoz et al. (2012) indicated that environmental concern is significantly associated with attitudes towards the environment. More recently, Bala et al. (2022) showed that people with greater sensitivity to their environment develop positive attitudes towards pro-environmental behaviour. This prompts us to propose the last hypotheses of the integrated NAM-TPB model.

H9. Awareness of the environmental problem (PA) positively

influences attitudes towards electric vehicles (A).

H10. Awareness of the environmental consequences (AC) of buying an electric vehicle positively influences attitudes towards electric vehicles (A).

H11. Attitudes towards electric vehicles (A) exert a positive influence on intention (I).

2.5. Willingness to pay for electric vehicle adoption

Research on the introduction of health and environmental protection measures has defined willingness to pay as the monetary value a user would be prepared to pay for a positive change (Ramdas & Mohamed, 2014; Sánchez-Cañizares et al., 2021). It is an indicator used to measure the cost that would be assumed for enjoying an improvement or willingness to accept in the quality of a good. In addition, it is used as an instrument to assess behaviours aimed at beneficial transitions (Ramdas & Mohamed, 2014). Therefore, willingness to pay is considered an appropriate tool for evaluating resources that do not have a specific market value, such as the environment (Ramdas & Mohamed, 2014; Sánchez-Cañizares et al., 2021). Thus, the environmental improvement achieved by reducing polluting emissions from combustion vehicles would be a clear example of a global public good; in other words, despite the fact that countries and individuals face individual costs in reducing emissions, the advantages of such endeavors are distributed amongst all, regardless of their individual contributions (Hasson et al., 2010). The recent study by Ssebbugga-Kimeze (2022) applies game theory (von Neumann & Morgenstern, 1944) and the prisoner's dilemma to put the focus on the quandary facing the user: to buy a more expensive vehicle and cooperate in advancing the global good, or to wait and buy a standard car. This author recalls the existence of "*free riders*", in this case, those unwilling to compensate for the negative externalities derived from their consumption (Ramdas & Mohamed, 2014). He also references the tragedy of the commons (Hardin, 1968) to refer to those who will not take action because of the cost, out of self-interest, out of fear that their investment will be exploited by others, or out of hopelessness and feelings that their contribution will make no difference (Ssebbugga-Kimeze, 2022). The author also focuses on possible adjustments: incentivizing aid to taxpayers, coercion through laws and taxes, and encouraging behavioural changes through learning and awareness-raising (Ssebbugga-Kimeze, 2022). Nevertheless, the effects of the first two may not be long-lasting and may depend on national policy. For example, in the case of Spain, there are purchase incentives for electric vehicles (Plan MOVES III) of up to 7000 euros (MTERD, 2021), but they cannot reach the entire population. Moreover, even with the subsidy, an electric car is still more expensive than a conventional one. On the other hand, coercive measures to adapt to European regulations (European Parliament, 2020), such as the regulation introducing low-emission zones, have only been partially effective in dissuading people from buying combustion vehicles, and such zones are being implemented gradually (ANFAC, 2022; IEA, 2022). In contrast, the third way is linked to the strength of the public's environmental awareness and their personal norm (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021). In any case, the adopter must be willing to pay a higher amount to cooperate with the fight against climate change (ANFAC, 2022; IEA, 2022). The relationship between the strength of the personal norm (PN) and the predictive power of the altruistic model of Schwartz (1977) was evidenced by Guagnano et al. (1994): *"The Schwartz model explains stated WTP for environmental quality, except when payments are framed as taxes"*. Based on this, we propose.

H12. The personal norm (PN) positively influences willingness to pay for the purchase of an electric vehicle (WTP).

At the same time, there is a good deal of evidence on the use of the willingness to pay variable to quantify the monetary value that potential adopters would find acceptable for the purchase of an electric vehicle (Ardeshiri & Rashidi, 2020; Hidrue et al., 2011; Parsons et al., 2014). By comparison, there are very few studies that consider willingness to pay as a direct antecedent of behaviour (Shi et al., 2023; Zheng et al., 2022). It seems probable that a person who is willing to pay more for an electric vehicle would be more likely to perform the behaviour. From this perspective, Shi et al. (2023) indicate that, unlike intention, willingness to pay specifically determines the economic sacrifice; therefore, in the absence of information about the actual behaviour, it can be taken as a second predictor to be analyzed. This reasoning has previously been applied in the context of Covid-19 safety measures (Sánchez-Cañizares et al., 2021), ecotourism (Hultman et al., 2015), and electric vehicles (Shi et al., 2023). Therefore, we propose.

H13. The intention to purchase an electric vehicle (I) positively influences the willingness to pay for an electric vehicle (WTP)

2.6. Risks associated with electric vehicle adoption

Since Bauer (1960) formally proposed *"that consumer behaviour be viewed as risk taking"* (Taylor, 1974), the role of risk has been extensively examined in studies on the purchase of different products and services (Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b; Luo et al., 2010; Siegrist & Árvai, 2020; Weegels & Kanis, 2000), including electric vehicles (Featherman et al., 2021; Wang et al., 2018). Likewise, the variable has been applied to understand the way in which consumers evaluate recommendations to buy a product (Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b). As pointed out by Wang et al. (2018), risk is a multifaceted psychological construction defined as *"the expected negative utility that consumers associate with the purchase of a particular product or service"* (Dunn et al., 1986). Consequently, perceived risk involves consumers considering in advance a possible loss related to the purchase and grading the level of uncertainty that they feel when weighing up their purchase, as well as incorporating beliefs about possible unfulfilled expectations (Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b; Kim et al., 2008). Most of the related studies that have considered risk have identified several types: financial, performance, physical, psychological, social, time, and opportunity cost risk (Jacoby & Kaplan, 1972; Kim et al., 2008). For example, Featherman et al. (2021) presented a complete conceptualization of the seven dimensions applied specifically to electric vehicles. Barriers to electric vehicle adoption have also been observed. Rosales-Tristancho et al. (2022) compiled and categorized previous studies on this subject, highlighting barriers such as a lack of infrastructure, limited range, higher purchase price, and others related to the performance and characteristics of the batteries. The International Energy Agency and some manufacturers' organizations (ANFAC, 2022; IEA, 2022) have particularly emphasized the barriers related to user finances and possible performance problems arising from a lack of infrastructure. Therefore, it seems reasonable to link the barriers to adoption with the risks perceived by the potential adopter (Featherman et al., 2021; Rosales-Tristancho et al., 2022; Wang et al., 2018). Based on this, our analysis focuses on two dimensions of risk: financial (PFR), defined as the anticipated possibility of an economic loss derived from the purchase and maintenance of the vehicle (Featherman et al., 2021); and performance (PPR), conceptualized as the anticipated potential occurrence of problems arising from the lack of range, absence of charging points, and complex repair and maintenance (Featherman et al., 2021).

In addition, perceived risk has proven to be a determining factor in the decision-making process for the purchase of an electric vehicle (Featherman et al., 2021; Jain et al., 2022; Wang et al., 2018). In this regard, the study by Wang et al. (2018) showed how perceived risk negatively affected attitudes to electric vehicle adoption and purchase intention. Similarly, Featherman et al. (2021) confirmed the relationship of perceived risk with intention, pointing to this construct as the second most important in their proposed model. Also, Jain et al. (2022) showed how performance expectations positively affected adoption

intention, while risks reduced purchase intention. The three aforementioned studies were conducted in different contexts: China, the United States and India, respectively, and a notable influence of risk perception was found in all of them. More recently, the same relationship was found in smaller population segments (Generation Y in Malaysia) (Vafaei-Zadeh et al., 2022). Based on this, we propose the hypotheses.

H14a. b Perceived financial (PFR) and performance (PPR) risks negatively influence the attitude towards electric vehicles (A).

H15a. b Perceived financial (PFR) and performance risks (PPR) negatively influence the intention to purchase an electric vehicle (I).

Finally, as far as we know, the direct relationship between perceived risk and willingness to pay remains practically unexplored in the field of electric vehicles. This is not the case in the field of health, where Hunter et al. (2012) stated that "*Work has shown that an individual's WTP for health-risk reductions is also dependent on their perception of- and attitude towards those risks*". More recently, Liu et al. (2019), in their research on self-driving vehicles, confirmed that perceived risks had a negative influence on willingness to pay. More specifically, they found that people who were familiar with this class of vehicles reported greater confidence, higher willingness to pay, and perceived greater benefits and lower risks. Accordingly, we propose.

H16a. b Perceived financial (PFR) and performance (PPR) risks negatively influence the willingness to pay for the purchase of an electric vehicle (WTP).

2.7. Proposed extended model: effects of demographic and situational variables

Previous research on electric vehicles has been divided into two main streams (Secinaro et al., 2022). The first centres on recognizing and developing the debate about electric vehicles, highlighting issues that support their adoption, while the second focuses on exploring the barriers perceived by consumers when weighing up the purchase of an electric vehicle. These two major lines of research converge when addressing the antecedents to the purchase decision. In this respect, in addition to the factors discussed above, it has been shown that the influence of demographic factors (personal and family characteristics) and situational factors (proximity to charging points, previous experience, etc.) could moderate the proposed relationships (Kumar & Alok, 2020; Li et al., 2017; Tunçel, 2022). Based on this, the model is completed with the inclusion of seven control variables: age, gender, income level, possibility of installing a charging point, proximity to a charging point, main use of the vehicle (short/long trips), and previous experience with electric or hybrid vehicles. Fig. 1 shows the extended integrated NAM-TPB model we propose in this study.

3. Research method

The analysis method used was structural equation modeling. According to Duncan (1966), this method allows for the modeling of potential causal effects based on the specification of variables and the relationships identified by established theories (Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b). The PLS-SEM method was chosen over CB-SEM because it is suitable for evaluating complex models (Chin, 1998) and useful when constructs have not been sufficiently explored in previous theoretical developments (Dash & Paul, 2021). This approach has proven effective in explaining the effects of variables that determine electric vehicle adoption (Adu-Gyamfi, Song, Nketiah, et al., 2022; Huang et al., 2021; Moon, 2021). The theoretical model was developed around 11 constructs: 3 from NAM—Awareness of Consequences (AC), Problem Awareness (PA), Personal Norm (PN); 5 from TPB—Attitude (A), Descriptive Social Norm (DSN), Injunctive Social Norm (ISN),

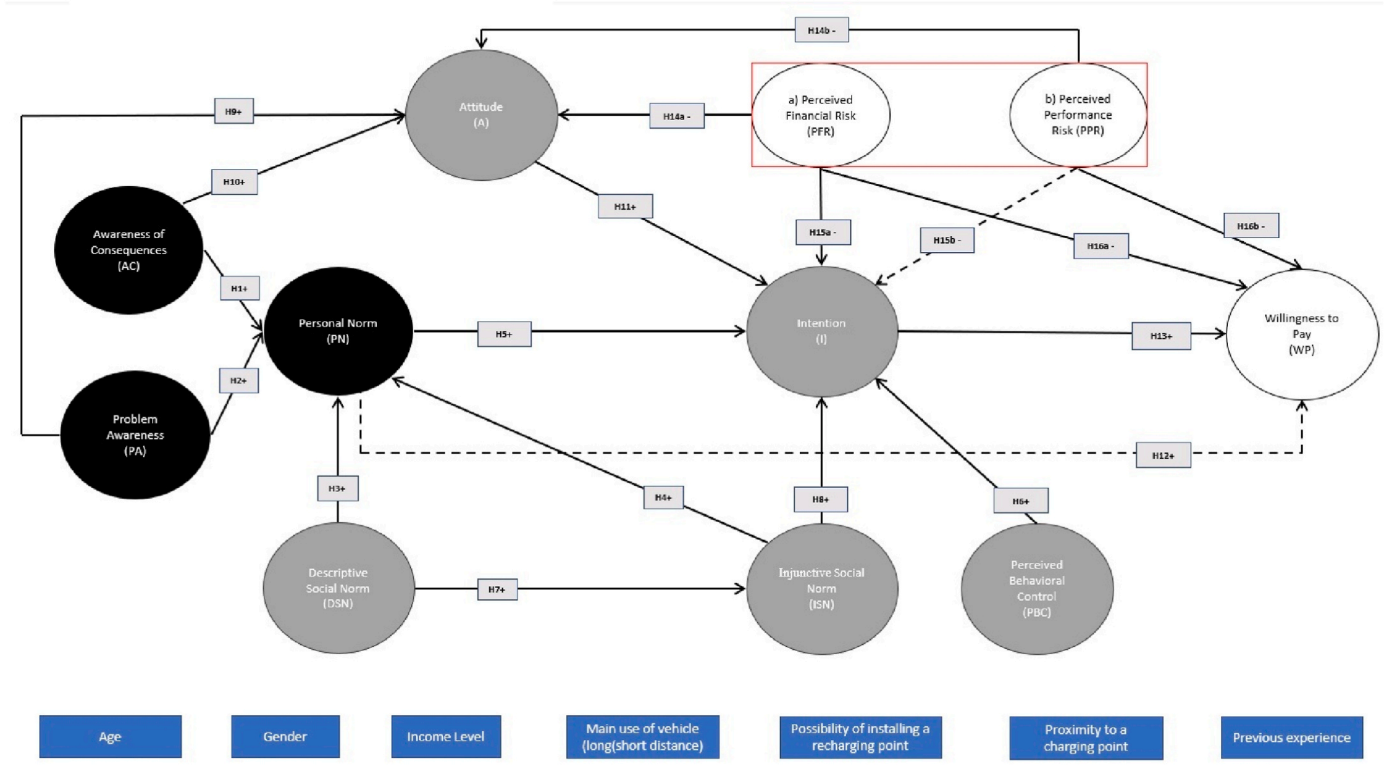

Fig. 1. Research model*.
* To make it easier to follow the model, the hypotheses appear in the order established in the literature review section. The NAM constructs are depicted in black and the TPB constructs in grey. The constructs that extend the integrated model (risk perception and willingness to pay) appear in white, and the control variables in blue. Both risks (financial and performance) are highlighted in red.

Perceived Behavioral Control (PBC), Intention (I); and 3 that expand on the merger of both theories—Perceived Financial Risks (PFR), Perceived Performance Risks (PPR), and Willingness to Pay (WTP). Each construct was specified using a reflective measurement model, following the factors noted by Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b based on Coltman et al. (2008): construct's indicators are interchangeable, and it's possible to exclude specific items without altering the construct's meaning as long as it maintains adequate reliability.

Non-probability sampling techniques were applied, as they are suitable for studying new proposals about relationships or variables that could affect a certain phenomenon (electric vehicle adoption) (Lehdonvirta et al., 2021; Schreuder et al., 2001). Probabilistic sampling was discarded due to the exploratory nature of the study and the incomplete knowledge of the target population framework (Penn et al., 2023). Potential adopters are people who drive regularly and possess a driving license, although they are not necessarily vehicle owners. In most households, one or more vehicles may be shared among different family members for commuting to work, traveling to educational institutions, and performing other daily tasks. More specifically, convenience sampling and snowball sampling were used (Emerson, 2015). Both procedures make it possible to connect the potential of social networks in order to simply, cheaply and efficiently access a large set of participants (Lehdonvirta et al., 2021). To this end, a questionnaire was developed using the distinct methods identified in the previously considered literature. The questionnaire addresses the hypotheses generated from the model shown in Fig. 1, in line with the objective and research questions posed at the outset. This sampling technique was chosen as it is not possible to know the number of potential regular drivers adopting an electric vehicle in Spain. This is because, although the Directorate-General for Traffic (DGT, 2023) provides updated information on the driving licenses issued, a group of industry experts indicated that appearing in this database does not guarantee the holder is a regular driver, nor a potential buyer. Examples could include families where several members have a driving license, but only one family member drives; or people who get their driving license to improve their job prospects, but do not buy a car or drive until they have sufficient income.

3.1. Data collection and sample design

Before collecting the information, the corresponding author's university ethics committee was consulted to ensure the study was viable and the participants' rights were respected. Having confirmed compliance with their recommendations, the guidelines of the Declaration of Helsinki were checked before starting the fieldwork. The target population was Spaniards over 18 years of age who are regular car drivers (making at least one trip a week as the driver). To guarantee the highest level of randomness in the responses, no additional limitations were placed on the selection criteria.

Before starting the data collection, a first draft of the questionnaire was developed by drawing on the previous literature. Following Jain et al. (2022), we consulted with four external academics and five professionals from the automotive industry, who evaluated the validity of the content of the questionnaire. Next, a pilot test was carried out using convenience sampling through sharing on Facebook ($n = 25$). The results were discussed with the group of academics and experts, and following their advice, the questions were reordered and items that could be confusing for future respondents were reworded. The 25 test questionnaires were discarded for the final analysis. The data collection for the final sample was carried out using the SurveyMonkey online tool. A link and a QR code to share the survey were created and posted on Facebook, Instagram, LinkedIn and online drivers' forums. The survey remained open from November 11, 2021 to February 11, 2022 (a period without any Covid-related mobility restrictions). The post included information on the objective of the study, the rights related to voluntary participation, the guarantee of anonymity and confidentiality, approximate duration (10–15 min), and a short text encouraging participants to share the questionnaire among their circle of contacts. It also informed respondents that clicking on the questionnaire meant they were giving their informed consent to participate in the study.

Following this procedure, a total of 1241 valid questionnaires were obtained, from 629 women and 612 men. Table 1 compiles the information related to the sociodemographic data of the sample. The majority of the respondents lay within the widest age group of 18–30 years old (60.34%) and were mostly people with a higher educational level (62.4% between higher VET and undergraduate, master's or doctorate degree). Among the respondents, people who declared that they were studying predominated (47.25%), as did a monthly household income of less than €2000 (48.5%). The majority lived with three other people (43.74%), and mostly in two-car households. Regarding the vehicle regularly used by the respondents, the predominant fuel was diesel, followed by gasoline. Only 0.87% claimed to own an electric vehicle, while 5.87% drove a hybrid vehicle. On the other hand, the majority of men and women stated that they had no intention of purchasing a vehicle in the near future (59.97% and 65.61%, respectively). In both cases, the vehicle was used mainly for trips of more than 200 km, although the frequency of these trips ranged less markedly between once a month and once a year. Although 67.97% of the participants had enclosed parking for their vehicle, most declared that it would not be possible to install a charging point in their building (68.27%) or did not have a charging point near their home (80.7%). This demographic distribution aligns with the study's objective of testing a sociopsychological adoption model, including moderating variables. Specifically, the gender distribution is well-balanced. The age demographics include a large group of young people and students, who are potential early adopters of new technologies and whose behaviors and preferences can significantly influence future market trends. This allows for comparisons between younger and older adopters. Recent studies, such as Buhmann and Criado (2023), have used similar samples to determine the influence of sociodemographic variables, car attributes, and external environmental factors on consumer psychological variables.

3.2. Measurement instrument and scales

In addition to the section on the sociodemographic characteristics of the sample (Table 1), the questionnaire developed specifically for this research was divided into four blocks: the first corresponded to the NAM model constructs (Awareness of Consequences, Problem Awareness, Personal Norm); this was followed by a section including the TPB variables (Descriptive Social Norm, **Injunctive** Social Norm, Attitude, Perceived Behavioural Control); the third section contained questions about the perceived financial and performance risks; and the last part asked about the dependent variables purchase intention and willingness to pay. As shown in Table 2, the latent variables corresponding to these blocks were measured with a five-point Likert scale adapted from the previous literature (1 totally disagree; 5 totally agree), with the exception of willingness to pay, which was presented as a series of percentages that the potential buyer would be willing to pay on top of the average price of a conventional vehicle (0, 10%, 20%, 30%, 40%) (Table 1).

The previous table presents the scales used, previously validated with the support of a professional translator who ensured minimal modifications and maintained the comprehensibility of all items in the Spanish context. Items for Awareness of Consequences (AC), Problem Awareness (PA), and Personal Norm (PN) were adapted from Bobeth and Kastner (2020). For items related to Descriptive Social Norm (DSN) and Injunctive Social Norm (ISN), original theoretical sources were used, including Ajzen (1991) and Cialdini et al. (1990), and their application in the works of Minton et al. (2018) and Bobeth and Kastner (2020). Items for Attitude (A) and Perceived Behavioral Control (PBC) were obtained from Ajzen's original study (1991) and empirical works like Dong et al. (2020), Asadi et al. (2021), and Hamzah and Tanwir (2021). Items for Perceived Financial Risk (PFR) and Perceived

Table 1
Sociodemographic profile of the sample.

Variable	Categories	Female %	Male %	Total %
Age (years)	18–30	65.82	54.99	60.34
	31–40	8.43	9.98	9.18
	41–50	11.29	18.82	15
	51–60	11.76	10.80	11.49
	>60	2.70	5.40	3.99
Educational level	Primary or less	2.86	3.76	3.27
	Lower secondary	7.00	6.86	6.93
	Upper secondary/ VET	23.53	31.70	27.41
	University studies/Higher VET	56.12	46.24	51.24
	Masters/Doctorate	10.49	11.44	11.16
Employment status	Self-employed	4.45	8.01	6.22
	Salaried employee in the private sector	19.24	28.43	23.67
	Civil servant or public employee	12.56	14.71	13.71
	Student	52.31	42.32	47.25
	Retired	2.54	3.76	3.27
	Homemaker	3.66	0.00	1.83
	Unemployed	5.25	2.78	4.06
Net monthly household income	< €2000	57.47	39.70	48.5
	€2001-3000	26.79	26.19	26.43
	€3001-4000	8.60	20.26	14.31
	€4001-5000	3.25	7.74	5.42
	> €5000	3.90	6.10	5.34
Number of people in the household including the respondent	1	5.10	4.58	4.79
	2	15.15	14.38	14.76
	3	22.49	25.49	23.86
	4	46.25	41.67	43.74
	>4	11.00	13.89	12.85
Number of cars in the household	0	4.29	5.23	4.78
	1	31.96	32.19	31.95
	2	44.67	43.79	44.22
	>2	19.08	18.79	19.04
Planning to purchase a vehicle in the near future	Yes	34.39	40.03	37.08
	No	65.61	59.97	62.92
Type of engine of the regularly used vehicle	Gasoline	40.42	29.94	34.89
	Diesel	53.27	62.79	58.04
	Hybrid	5.84	5.61	5.87
	Pure electric	0.23	1.25	0.87
	Other	0.23	0.42	0.33
Use of that vehicle for long trips (more than 200 km)	Yes	68.53	77.71	73.48
	No	31.47	22.29	26.52
Frequency of long trips (if the answer to the previous question was yes)	About once a month	20.52	30.33	25.96
	About once every 3 months	23.11	24.48	23.88
	About once every 6 months	12.03	14.23	13.14
	About once a year	17.22	10.88	13.69
	I don't make long trips with the car	27.12	20.08	23.33
Availability of enclosed parking for that vehicle	Yes	63.17	71.93	67.97
	No	36.83	28.07	32.03
Possibility of installing a charging point in the building	Yes	23.13	39.46	31.73
	No	76.87	60.54	68.27
Availability of a charging point for electric vehicles near the home	Yes	19.39	19.00	19.3
	No	80.61	81.00	80.7
Willingness to pay more for an electric vehicle over the average price of a traditional vehicle?	Nothing	23.78	27.03	25.46
	10% extra	32.75	28.76	30.74
	20% extra	33.33	33.20	33.14
	30% extra	8.97	9.46	9.22
	40 % extra or more	1.17	1.54	1.44

Performance Risk (PPR) were taken from Giansoldati et al. (2020) and Rosales-Tristancho et al. (2022), addressing perceptions of financial and performance concerns. Items for Intention (I) were obtained from Ajzen's study (1991) and various empirical studies (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021). Finally, items for Willingness to Pay (WTP) were adapted by consulting different contexts, including the study by Sánchez-Cañizares et al. (2021), which evaluates willingness to pay more for additional safety measures in the COVID-19 context, and the study by Shi et al. (2023), focused on electric vehicles.

4. Results

4.1. Common method bias and multicollinearity test

In a step prior to the estimation, it was checked whether the results could be affected by common method bias (CMB) (Kock & Lynn, 2012). To that end, it was corroborated that there was no collinearity or common method bias (CMB), as none of the variance inflation factor (VIF) values surpassed 3.3, which is considered an indication of such issues (Kock, 2015; Kock & Lynn, 2012). Given that none of the latent variables exceeded the limit of 2.90, it was concluded that the results were free of this type of bias.

4.2. Measurement model

The theoretical model was evaluated through structural equation modeling (SEM) using partial least squares (PLS) with the SmartPLS 4.0 software. The model's validation was performed by assessing the reliability of the individual indicators via their loadings (as shown in Table 2). The outer loadings, except for two items, one from perceived financial risk (PFR) and the other from descriptive social norm (DSN), exceeded the 0.707 threshold recommended by Carmines and Zeller (1979). However, both were kept in the model as they belonged to different constructs. Furthermore, these items exceeded the value of 0.4 proposed by Henseler et al. (2009). Table 3 displays the analysis of the constructs' internal consistency, as well as their convergent and discriminant validity.

To confirm the statistical validity of the outer loadings, a bootstrapping method with 5000 iterations was conducted. The results of the Student t-test showed that all obtained p-values were below 0.01. Table 3 illustrates the reliability and validity measures of the constructs using Cronbach's Alpha, composite reliability (CR), and the average variance extracted (AVE). Apart from perceived financial risk (PFR), all constructs surpassed the recommended threshold for a reliable estimation proposed by Nunnally and Bernstein (1994). However, a value of over 0.6 can be considered an acceptable measure of consistency (Churchill, 1979; Kim et al., 2021; Taber, 2018). As far as the convergent validity is concerned, all the constructs exceeded the cut-off of 0.5 established by Fornell and Larcker (1981). Following the indications by Amora (2021) and Henseler et al. (2009), each construct explains a minimum of 50% of the assigned indicators' variance. Additionally, discriminant validity was established, as indicated by the bold diagonal entries in Table 3, which represent the variance shared between each construct and its measurements, being higher than the correlations between each construct and the others, (Hair Jr et al., 2021). As additional assurance, the Heterotrait-Monotrait (HTMT) approach was used, which is more sensitive to possible problems with discriminant validity (Henseler et al., 2016). All the HTMT ratio values fell below the 0.90 threshold indicated by Gold et al. (2001), confirming the fit. Additionally, a complete bootstrapping was performed to test the null hypothesis HTMT $\geq$1 (Hair Jr et al., 2021). The result showed values equal to or greater than 1, which reinforces the discriminant validity of the model. Therefore, based on the analysis, it was determined that the 11 constructs of the model were statistically distinct from one another, thus enabling their use in estimating the structural model.

Table 2
Measurement model and factor loadings.

Constructs	Items	Factor loading	Mean (Standard Deviation)	Adapted from
Awareness of Consequences (AC)	AC1. Driving electric vehicles now will help save more natural resources.	0.915	3.948 (1.033)	Bobeth and Kastner (2020)
	AC2. Driving electric vehicles now will help to prevent global warming.	0.936	4.013 (1.025)	
	AC3. Driving electric vehicles will improve the quality of life of the coming generations.	0.930	4.025 (0.976)	
Problem Awareness (PA)	PA1. I am aware of the problem posed by the polluting emissions of traditional vehicles.	0.851	4.33 (0.878)	Bobeth and Kastner (2020)
	PA2. I am aware of the natural resources saved by using electric vehicles.	0.861	4.007 (1.018)	
	PA3. Continuing to use gasoline or diesel vehicles is an environmental problem.	0.877	4.112 (1.01)	
Personal Norm (PN)	PN1. My principles/values tell me that buying an electric vehicle is the right thing to do.	0.813	3.58 (1.027)	Bobeth and Kastner (2020)
	PN2. I would feel guilty about the environment if I bought a non-electric vehicle.	0.797	3.005 (1.122)	
	PN3. I feel that it is my responsibility to do everything possible to take care of the environment.	0.825	3.874 (1.002)	
	PN4. I feel that it is my responsibility to contribute to saving energy and natural resources.	0.830	3.863 (1.011)	
Descriptive Social Norm (DSN)	DSN1. I think buying an electric vehicle is a status symbol.	0.681	3.068 (1.139)	(Ajzen, 1991; Bobeth & Kastner, 2020; Cialdini et al., 1990; Minton et al., 2018)
	DSN2. I think buying an electric vehicle is fashionable.	0.735	3.284 (1.035)	
	DSN3. I have noticed that people in my social environment have electric vehicles.	0.764	2.571 (1.163)	
	DSN4. It seems like a social trend to have an electric vehicle.	0.816	3.188 (1.05)	
Injunctive Social Norm (ISN)	ISN1. My friends/colleagues think it's a good idea to buy an electric vehicle.	0.894	3.437 (0.937)	(Ajzen, 1991; Bobeth & Kastner, 2020; Cialdini et al., 1990; Minton et al., 2018)
	ISN2. My family members/relatives think it's a good idea to buy an electric vehicle.	0.903	3.349 (0.946)	
	ISN3. The people important to me would support me if I decided to buy an electric vehicle.	0.817	3.803 (0.988)	
Attitude (A)	A1. I think it is a positive thing to buy an electric vehicle.	0.914	3.856 (0.989)	(Ajzen, 1991; Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021)
	A2. I am attracted to the idea of buying an electric vehicle.	0.913	3.548 (1.099)	
Perceived Behavioural Control (PBC)	PBC1. If I wanted to, I could effortlessly adapt to an electric vehicle.	0.813	3.464 (1.116)	(Ajzen, 1991; Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021)
	PBC2. If I wanted to, I could get the financing to buy an electric vehicle.	0.804	3.312 (0.971)	
	PBC3. I have enough information to buy an electric vehicle.	0.804	3.868 (1.057)	
Perceived Financial Risk (PFR)	PFR1. It is a risk to buy an electric vehicle because it is more expensive than a traditional vehicle.	0.797	3.832 (0.963)	(Giansoldati et al., 2020; Rosales-Tristancho et al., 2022)
	PFR2. The constantly rising price of electricity makes it riskier to buy an electric vehicle.	0.635	4.147 (0.878)	
	PFR3. The maintenance of an electric vehicle is more expensive than that of a traditional vehicle.	0.809	3.507 (1.055)	
Perceived Performance Risk (PPR)	PPR1. It's risky to buy an electric vehicle because I wouldn't be able to travel many kilometres without having to recharge the battery.	0.863	3.79 (0.94)	(Giansoldati et al., 2020; Rosales-Tristancho et al., 2022)
	PPR2. It's risky to buy an electric vehicle because there are not enough charging points yet.	0.811	4.125 (0.88)	
	PPR3. Not all mechanics are familiar with the technology of the electric vehicle for repair and maintenance.	0.723	3.884 (1.005)	
Intention (I)	I1. I intend to buy an electric vehicle in the future.	0.912	3.383 (1.116)	(Ajzen, 1991; Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021)
	I2. I intend to use an electric vehicle in the future.	0.926	3.591 (1.07)	
	I3. I would recommend family members/relatives buy an electric vehicle.	0.898	3.446 (1.044)	
Willingness to Pay (WTP)	WTP. How much extra would you be willing to pay for an electric vehicle over the average price of a traditional vehicle?	1.000	2.305 (0.907)	(Sánchez-Cañizares et al., 2021; Shi et al., 2023)

4.3. Structural model

The structural model, path coefficients, and R^2 values (Hair Jr et al., 2021) illustrate the causal relationships among the constructs. This analysis enables the testing of the proposed hypotheses and helps determine if they are supported by the data. Additionally, the R^2 value measures the model's predictive accuracy. As this is a measure used in different disciplines, its interpretation is based on an approximate general rule. An R^2 of 0.75 or higher is generally considered to represent a substantial value, 0.50 a moderate value, with 0.25 or less being weak (Hair Jr et al., 2018). However, these values are just a guide and should be contextualized to the specific problem and the data used. For example Moroni et al. (2022) states that *"R^2 values of 0.20 are considered high in disciplines such as consumer behaviour"*. Table 4 shows the R^2 values for the endogenous variables ranged between 0.3 and 0.57, except willingness to pay with 0.17. As such, the values are considered acceptable for an exploratory model of behaviour (Cabeza-Ramírez, Sánchez-Cañizares, et al., 2022a,b). Additionally, the predictive relevance of the exogenous constructs was calculated from the Q^2 statistic. The values were obtained using a blindfolding procedure, and in all cases they turned out to be strictly positive, thus guaranteeing the predictive significance of the exogenous variables for the corresponding endogenous ones (Hair Jr et al., 2021).

Regarding the significance of the path coefficients of the proposed hypotheses, Table 5 and Fig. 2 show the results according to each β_i coefficient, along with the p-value of the Student t-test. The obtained

Table 3
Internal consistency, convergent validity and discriminant validity of the measurement model[a].

	Cronb. Alpha	Rho_A	CR	AVE	Fornell-Larcker Criterion										
					AC	PA	PN	DSN	A	I	PBC	ISN	PFR	PPR	WTP
AC	0.919	0.919	0.949	0.860	**0.927**										
PA	0.830	0.835	0.898	0.745	0.783	**0.863**									
PN	0.834	0.839	0.889	0.667	0.654	0.658	**0.816**								
DSN	0.744	0.756	0.837	0.563	0.323	0.277	0.393	**0.750**							
A	0.803	0.803	0.910	0.835	0.696	0.651	0.723	0.390	**0.914**						
I	0.899	0.900	0.937	0.832	0.534	0.516	0.587	0.399	0.701	**0.912**					
PBC	0.733	0.733	0.848	0.651	0.481	0.474	0.450	0.415	0.474	0.485	**0.807**				
ISN	0.842	0.843	0.905	0.761	0.594	0.534	0.604	0.565	0.644	0.632	0.508	**0.872**			
PFR	0.637	0.670	0.793	0.564	0.009	0.033	−0.055	−0.058	−0.078	−0.134	−0.111	−0.078	**0.751**		
PPR	0.725	0.765	0.842	0.641	−0.054	0.000	−0.082	−0.142	−0.152	−0.161	−0.110	−0.151	0.574	**0.801**	
WTP	1	1	1	1	0.291	0.248	0.293	0.230	0.355	0.319	0.221	0.264	−0.212	−0.268	**1.000**

[a] Awareness of Consequences (AC); Problem Awareness (PA); Personal Norm (PN); Descriptive Social Norm (DSN); **Injunctive** Social Norm (ISN); Attitude (A); Perceived Behavioral Control (PBC); Perceived Financial Risk (PFR); Perceived Performance Risk (PPR); Intention (I); Willingness to Pay (WTP).

Table 4
Structural model. R^2 and Q^2.

Variable	R^2	Q^2
A	0.530	0.526
I	0.565	0.385
PN	0.545	0.501
ISN	0.319	0.317
WTP	0.172	0.151

Table 5
Hypothesis testing (bootstrapping procedure - 5000 sub-samples).

Hypothesis	Independent variable/ Dependent variable	Path coefficient (p-value)	Result
H1	AC →PN	0.223 (0.000) ***	Supported
H2	PA →PN	0.327 (0.000) ***	Supported
H3	DSN →PN	0.092 (0.001) ***	Supported
H4	ISN →PN	0.245 (0.000) ***	Supported
H5	PN →I	0.071 (0.046) **	Supported
H6	PBC →I	0.116 (0.000) ***	Supported
H7	DSN →ISN	0.565 (0.000) ***	Supported
H8	ISN →I	0.248 (0.000) ***	Supported
H9	PA→A	0.287 (0.000) ***	Supported
H10	AC →A	0.466 (0.000) ***	Supported
H11	A →I	0.430 (0.000) ***	Supported
H12	PN →WTP	0.167 (0.000) ***	Supported
H13	I →WTP	0.182 (0.000) ***	Supported
H14a	PFR →A	−0.028 (0.302)	Not supported
H14b	PPR →A	−0.111 (0.000) ***	Supported
H15a	PFR →I	−0.062 (0.023) **	Supported
H15b	PPR →I	−0.004 (0.892)	Not supported
H16a	PFR →WTP	−0.074 (0.049) **	Supported
H16b	PPR →WTP	−0.183 (0.000) ***	Supported

AC = Awareness of Consequences; A = Attitude; I= Intention; PA = Problem Awareness; PBC = Perceived Behavioral Control; PN = Personal Norms; PFR= Perceived Financial Risk; PPR = Perceived Performance Risk; ISN = Injunctive Social Norm; DSN = Descriptive Social Norms; WTP = Willingness to Pay.
*** p-value <0.01; ** p-value <0.05.

coefficients denote that all hypotheses were supported, except for H14a and H15b. It was not possible to confirm a statistically significant influence of the perception of financial risk on attitudes towards electric vehicles (H14a), nor of the perception of performance risk on purchase intention (H15b).

Finally, the standardized root mean square residual (SRMR) was calculated, yielding a value of 0.061, which confirmed the goodness of fit of the model, given that Ringle et al. (2009) indicated that this value should be below 0.10.

4.4. PLS-MGA multi-group analysis

To conclude the empirical analysis, a multigroup moderation analysis was applied: bootstrap-based multigroup (PLS-MGA) (Cheah et al., 2023). This approach starts out from the assumption of the existence of categorical variables that potentially affect all the relationships of the internal model (Hair Jr et al., 2014). It was used to study the possible influence of seven variables: gender (female/male), age (>30 years/≤ 30 years), income level (>€2000/≤ €2000), possibility of installing a charging point in the building (Yes/No), proximity to a charging point (Yes/No), use of the vehicle (short trips ≤200 km/long trips >200 km), and previous experience with electric or hybrid vehicles (Yes/No). Table 6 shows only the statistically significant relationships found between the different subgroups.

Prior to the PLS-MGA procedure, measurement invariance was checked. To ensure accurate comparisons between the various groups regarding the coefficients of the structural model, it was crucial to satisfy this criterion. The measurement invariance of composite models (MICOM) technique was employed. (Cheah et al., 2020; Henseler et al., 2016). The three steps of this procedure can be summarized as follows: assessment of configural invariance, assessment of compositional invariance, and compliance with equality of means and variances across groups. If the first two requirements are met, it indicates partial measurement invariance. In this case, we are in position to make comparisons between path coefficients. Moreover, if the third condition is also met, it is possible to affirm that total measurement invariance is reached. In our case, we use a somewhat more flexible criterion, allowing a maximum of two constructs to not fulfil the requirement of compositional invariance (step 2), as other studies have done (Higueras-Castillo et al., 2019). Taking into account this flexibility, partial invariance was confirmed for only four variables (age, income, main use and previous experience).

Table 6 shows the coefficients of the structural model restricted to each group, the difference between the two and the significance of the PLS-MGA results using two different procedures, Henseler's MGA, and the Welch-Satterthwaite test (Henseler et al., 2009; Matthews, 2017). It can thus be observed that the influence of the personal norm (PN) on intention (I) is greater in people under 30; in fact, the effect is negative in those over 30. In addition, the effect of the descriptive social norm (DSN) on the **injunctive** social norm (ISN), as well as intention (I) on willingness to pay (WTP), is higher in the older subsample. This last difference turned out to be significant only with the Welch-Satterthwaite test. On the other hand, the **injunctive** social norm (ISN) has a greater effect on intention (I) in the subgroup earning more than €2000. Lastly, it can be seen that the descriptive social norm (DSN) has a greater effect on the **injunctive** social norm (ISN) in the group of people who mainly use their car for long trips, and in those who have previous experience with electric or hybrid vehicles.

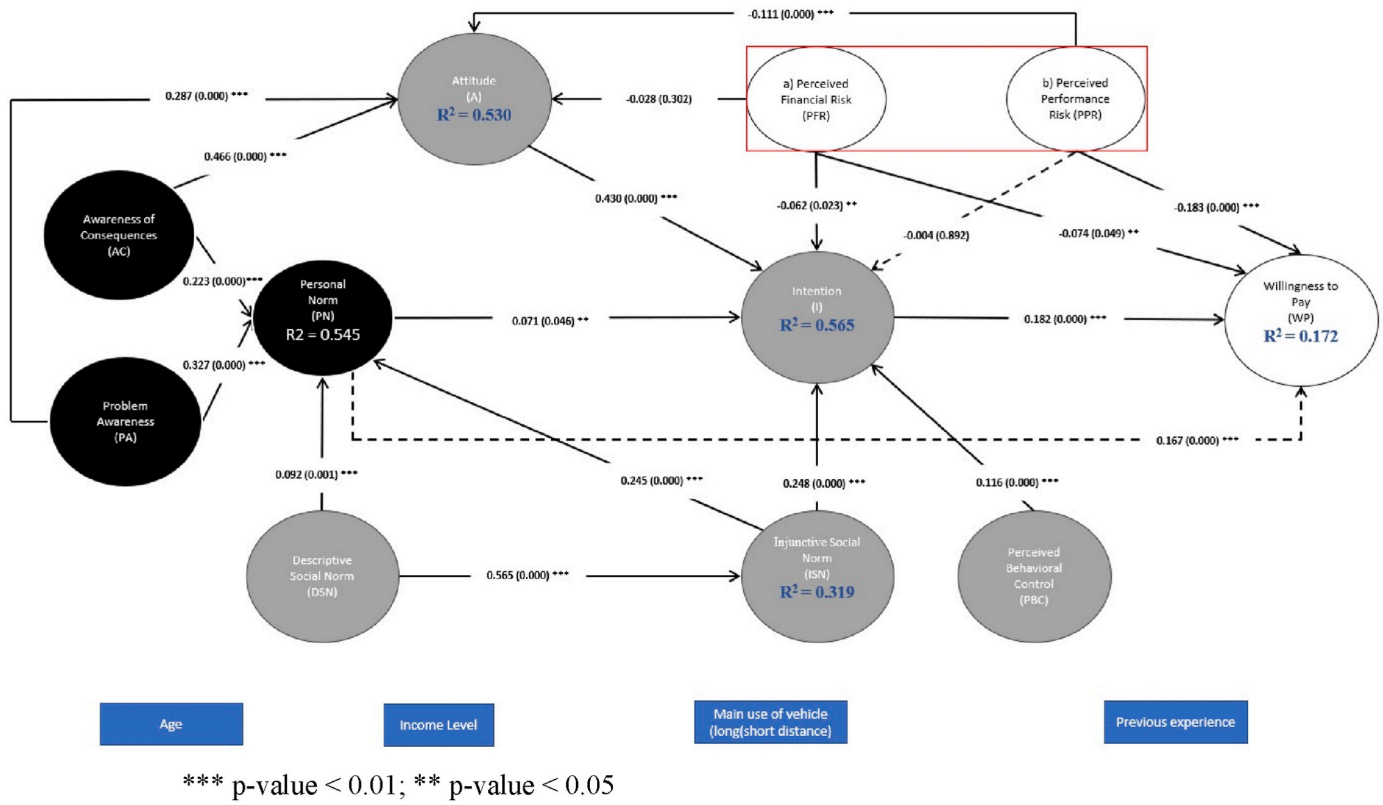

Fig. 2. Path analysis results of partial least squares structural equation modelling.
*** p-value <0.01; ** p-value <0.05.

Table 6
Multi-group analysis.

Age	Path coefficients		Path coefficient difference	Henseler's MGA	Welch-Satterthwaite test	
	≤30 años	>30 años	β_1- β_2	p-value	Student-t	p-value
I → WTP	0.086	0.236	−0.150	0.051	1.983	0.048**
PN → I	0.173	−0.055	0.228***	0.001***	3.323	0.001***
DSN → ISN	0.507	0.642	−0.135***	0.003***	3.022	0.003***
Income	Path coefficients		Path coefficient difference	Henseler's MGA	Welch-Satterthwaite test	
	≤2000 €	>2000 €	β_1- β_2	p-value	Student-t	p-value
ISN → I	0.176	0.343	−0.167**	0.015**	2.473	0.014**
Main use	Path coefficients		Path coefficient difference	Henseler's MGA	Welch-Satterthwaite test	
	>200 km	≤200 km	β_1- β_2	p-value	Student-t	p-value
DSN → ISN	0.615	0.454	0.160***	0.010**	2.418	0.016**
Experience with hybrid and electric	Path coefficients		Path coefficient difference	Henseler's MGA	Welch-Satterthwaite test	
	Sí	No	β_1- β_2	p-value	Student-t	p-value
DSN → ISN	0.759	0.561	0.198**	0.003**	3.758	0.000***

*** p-value <0.01; ** p-value <0.05.

5. Discussion

This study aligns with current research that promotes the integration of psychological models to enhance the understanding of consumer purchase behavior (Adu-Gyamfi, Song, Obuobi, et al., 2022; Asadi et al., 2021; Bösehans et al., 2023; Dong et al., 2020; Gunawan et al., 2022; Hamzah & Tanwir, 2021; Huang et al., 2021; Moon, 2021; Thøgersen & Ebsen, 2019; Tu & Yang, 2019; Vafaei-Zadeh et al., 2022). For instance, Dong et al. (2020) demonstrated that the combined predictive power of TPB and NAM surpasses that of individual approaches, based on previous studies that merged these frameworks (Han & Hyun, 2017; Kim et al., 2018). Similarly, Hamzah and Tanwir (2021). Similarly, Hamzah and Tanwir (2021) illustrated that while TPB leans towards self-interest and social approval, NAM focuses on moral obligation, advocating for the integration of both frameworks to overcome limitations in predicting environmentally moral behaviors. However, these studies overlooked willingness to pay as an outcome variable and did not consider factors associated with risk perception or the possible heterogeneity effects of demographic and situational variables (Adnan et al., 2017; Coffman et al., 2017; Kumar & Alok, 2020; Li et al., 2017; Onat & Kucukvar, 2022). This work integrates these factors to provide a more holistic understanding of consumer behavior in the adoption of electric vehicles.

Our study found significant positive associations between the proposed activators (awareness of consequences (AC), awareness of the problem (PA), descriptive social norm (DSN), **injunctive** social norm

(ISN)), and the personal norm (PN), supporting hypotheses 1 to 4. The outcome was expected, as it is consistent with the findings of Bobeth and Kastner (2020), as well as with previous research that combines the TPB and the NAM to study electric vehicles (Asadi et al., 2021; Dong et al., 2020). At the same time, it is consistent with the claims of Klöckner (2013a) *"personal norms act as an integrating variable for value and* norm *related aspects, they integrate parts of social norms"*. On the other hand, the association between the personal norm and intention was significant, but not as strong as expected, according to the path coefficient (H5). This supports the results of Mohamed et al. (2016) in the context of Canada: environmental awareness can be an important part of a person's interest in buying an electric car, but it is not the decisive construct, since this relationship is mediated by the beliefs linked to the TPB constructs. In the same sense, Liu et al. (2017) explained how, in comparison with the TPB variables, the personal norm can present a weak relationship. This goes to the complementarity of the two models (NAM-TPB) in providing a holistic view of environmental consumption behaviour (Asadi et al., 2021; Dong et al., 2020). Delving into this premise, the model showed how the effects of the NAM elements were channelled, especially from the respondents' beliefs about the awareness of the problem and the beneficial repercussions of purchasing an electric vehicle towards their attitudes (H9 and H10). This finding offers empirical support to the claim made by Bala et al. (2022): promoting environmental sensitivity through knowledge improves attitudes, and ultimately translates into a stronger intention to engage in pro-environmental behaviour. Furthermore, this supports the basic TPB hypotheses (H6, H8 and H11), in line with the meta-analysis of Kumar and Nayak (2022), who found attitude to be the most important antecedent of behavioural intention, followed by subjective norms, and then perceived behavioural control.

The second relevant finding concerns the associations between intention and willingness to pay (H12), and personal norm and willingness to pay (H13). In this respect, our results add to the controversial debate on the proposed relationships between these variables (Bishop & Barber, 2015; Chen-Yu & Yang, 2020). Both variables showed positive and significant links with willingness to pay. However, it is worth noting different experimental studies, including the one by Chen-Yu and Yang (2020), which show how these connections could become insignificant when considering actual willingness to pay. It is thus called into question whether intention is an adequate predictor of willingness to pay; that is, when the time comes to make the actual economic commitment of the purchase. This is known as hypothetical bias, or the inconsistency between what people say they will do and what they actually do (difference between stated and observed actions) (Bishop & Barber, 2014). This effect could even be heightened in the context of behaviours that may be considered socially acceptable (Bishop & Barber, 2015), such as the purchase of an electric vehicle. Nevertheless, in this particular case, both in Spain and in the rest of Europe, a potential adopter must pay an additional amount equivalent to 20%–50% of the cost of a corresponding combustion vehicle (IEA, 2022). Therefore, it seems reasonable to confirm that intention must translate into willingness to pay if the potential adopter really intends to take on the transition to an electric vehicle. In our sample, 37% stated that they planned to purchase a vehicle in the near future, and almost 75% were willing to pay an extra 10% or more for an electric vehicle. And since the average price of electric vehicles in Europe is considerably higher than that of diesel/-gasoline vehicles (IEA, 2022), our work reinforces the exploratory models based on the TPB and NAM (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021). Aligning with studies such as those by Hidrue et al. (2011) and Ferguson et al. (2018), which show strong links between the functional attributes of the vehicle (range, charging time, fuel economy, performance), ecological aspects (pollution reduction), and the variable willingness to pay. Therefore, this finding also aligns with the results of the latest reports on European environmental culture, which indicate that citizens of regions with more resources are more willing to take measures to reduce greenhouse gas emissions. Conversely, inhabitants of regions with fewer resources and less of an environmental culture are more reluctant to do so, due to an increase in costs that they see as hard to afford in the short term (Halman et al., 2022; IEA, 2022; Rodríguez, 2021). This is reflected in the perception of financial and performance risks as significant barriers to the adoption of electric vehicles in these regions, which supports our hypotheses H1, H2, H5, and H13. In regions with more resources, a greater awareness of environmental consequences and problems (H1 and H2) leads to a higher activation of personal norms, thereby increasing the intention to purchase electric vehicles (H5). Moreover, a greater intention to purchase translates into a higher willingness to pay for these vehicles (H13).

The third significant finding of this study pertains to the moderating role of demographic and situational variables. Our study confirmed the effects of up to four variables (age, income level, primary use of the vehicle, and prior experience) out of the seven proposed. Specifically, the age of potential adopters moderated adoption perceptions. This finding aligns with previous literature identifying how age influences the ownership of electric vehicles. An example is found in the logistic regression analyses by Westin et al. (2018), who also observed that, alongside age, the most influential factor in ownership was personal norms. Our research confirmed that personal norms have a stronger influence on the purchase intention of younger individuals. Regarding income level, studies such as those by Javid and Nejat (2017) and Li et al. (2017) have identified that household income, along with other factors such as the highest level of education in the household, the buyer's car-sharing status, the density of charging stations, and the regional gasoline price, can significantly affect the adoption of electric vehicles. Our results showed that injunctive social norms and intention have a greater impact on willingness to pay (WTP) among those with higher incomes. This indicates that individuals with higher incomes are more willing to pay for electric vehicles due to their economic capacity, as well as the influence of their social networks and normative expectations. The primary use of the vehicle also moderated the relationships within the electric vehicle adoption model. Those who primarily use their vehicles for daily commutes and short trips find electric vehicles more attractive due to their energy efficiency and lower operating costs (Li et al., 2017). In our study, it was found that descriptive social norms have a greater effect on injunctive social norms among those who use the vehicle mainly for long trips. This finding highlights the need to consider how vehicle use can influence social norms that affect the intention to adopt electric vehicles, suggesting that messages emphasizing the efficiency and advantages of electric vehicles for long trips can be particularly effective. Finally, prior experience with electric vehicles positively influenced the willingness to adopt this technology. Users who have already had contact or experience with electric vehicles show a greater predisposition to consider purchasing one in the future (Kumar & Alok, 2020; Li et al., 2017; Tunçel, 2022). This finding was supported by our study, where it was found that descriptive social norms (DSN) have a greater effect on injunctive social norms (ISN) among those with prior experience with hybrid or electric vehicles. This suggests that familiarity and comfort with the technology can reduce perceived barriers and increase social acceptance, which in turn reinforces social norms that promote the adoption of electric vehicles.

5.1. Theoretical implications

Several theoretical implications can be drawn from this study. First of all, it applies a dual perspective to electric vehicle adoption: instrumental (self-interest), and pro-environmental or altruistic (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021), acknowledging the dual nature of the electric vehicle as a consumer good (Onat & Kucukvar, 2022; Rosales-Tristancho et al., 2022). The findings yielded by the application of PLS-SEM allowed us, on the one hand, to validate the integration of the two theoretical frameworks (NAM-TPB) (Asadi et al., 2021; Dong et al., 2020; Hamzah & Tanwir, 2021) and, on the other, to shed light on the determinants of the intention to adopt electric vehicles

and the willingness to pay an additional price for an environmentally friendly product (IEA, 2022). Secondly, this study contributes to filling the gap in the knowledge linked to the effects of the social norm on the purchase decision. Consequently, our proposal adheres to the reasoning of Bobeth and Kastner (2020) based on Ajzen (1991), Cialdini et al. (1990) and Minton et al. (2018), who point out that breaking down the social norm into descriptive and **injunctive** elements offers relevant information about the impact of group norms on the purchase decision. For the case of the transition to electric vehicles, we find that both norms are aligned, and that the descriptive social norm exerts a strong influence on the **injunctive** social norm (H7). This finding supports the claims of Smith (2020) and Eriksson et al. (2015), who note the importance of recognizing descriptive (that is, what people do) and prescriptive (that is, the influence of personal referents) elements, given that misaligned or conflicting norms within the group can be particularly detrimental to participation in desired behaviours. Thirdly, our study represents an advance in the assessment of two notable dimensions of risk (financial and performance) and their negative influence on attitudes (H14a, b), intention (H15a, b) and willingness to pay (H16a, b). The results did not allow us to confirm the influence of financial risks on attitudes (H14a), nor of performance risks on intention (H15b), although the effects of performance risk on attitude (H14b) were confirmed, as was the influence of financial risk on intention (H15a), and of both on willingness to pay (H16a, b). Looking at the path coefficients, this could indicate that the population seems to be aware of the transition to electric vehicles, and that the influence of these two risks is not as pronounced as might be expected.

5.2. Practical and management implications

Spain presents promising data, with a sustained increase in electric vehicle sales, but its speed of change leaves it some way behind the European electric mobility benchmarks (Norway, Iceland, Sweden, the Netherlands, Germany) (ANFAC, 2022; IEA, 2022). From a rational-normative point of view, the application of the model to the study sample reflects the idea that both rational and altruistic motives play a relevant role in investment decision-making (Bobeth & Kastner, 2020). This could be indicative of a favourable inclination towards the transition. However, in the Spanish context, unlike in Germany (Bobeth & Kastner, 2020), the effects of social pressure exert a marked influence (H7), as do attitudes towards electric vehicles generated by the NAM activators (H11). The actions of the Spanish government have mainly focused on offering purchase subsidies, and gradually implementing traffic restrictions in population centres of more than 50,000 inhabitants (ANFAC, 2022; MTERD, 2021; European Parliament, 2022). According to the results, manufacturers and institutions should segment their marketing and communication actions by the age of the potential buyer. The multigroup analysis shows that in the over-30s, intention has a larger influence on willingness to pay, but the environmental moral norm negatively influences intention. Awareness-raising campaigns should therefore be targeted at the older population. Simultaneously, the multigroup analysis also revealed that the influence of one's surroundings (what people do) enhances the effects of the subjective norm (personal referents). This points to the need for communication about the status of electric vehicle infrastructure deployment, for example, by running information campaigns on the availability of charging points, or by extending subsidies for the installation of new charging points. Specifically, this enhances the influence of the subjective norm on the purchase decision, particularly for those drivers who use the vehicle for long journeys and those who have some kind of previous experience with electric or hybrid vehicles.

5.3. Limitations and future lines of research

There are certain limitations to this study that present opportunities for further research. First, the data collection technique, convenience sampling in social networks and car forums, could cast doubt on how generalizable the results are. However, as Bobeth and Kastner (2020) pointed out, although the interpretation is limited due to socio-demographic characteristics, the approach used captures valuable information about potential adopters. Therefore, the sample is pertinent to the creation of support strategies and the gradual adoption of sustainable mobility practices. Moreover, it opens the door to verifying the directions of causality through probability sampling and by implementing an experimental design. Secondly, we assessed the influence of just two risks (financial and performance); future studies should consider the different variants of perceived risk (Featherman et al., 2021; Jain et al., 2022; Wang et al., 2018). Thirdly, when decomposing the social norm into descriptive and **injunctive** elements, it is assumed that the second is part of the subjective norm of the standard TPB model. The two roles of the social norm have rarely been used in the field of electric mobility, which creates an opportunity to provide empirical support to the effects found here. Finally, the study has a markedly cross-sectional nature, meaning it captures the influence of rational and altruistic factors in a given context and time. Therefore, future research should implement longitudinal studies that allow an assessment of the evolution of the moral norm, and descriptive and **injunctive** social norms, as well as offering a view of the progress of the rational elements of the purchase decision as the electric vehicle becomes more widespread.

6. Conclusion

This study presented an extended model of the integrated theoretical framework of the Theory of Planned Behavior (TPB) and the Norm Activation Model (NAM). This model incorporated perceived risk variables and used willingness to pay as a dependent variable. Additionally, it examined how demographic and situational variables influence rational and altruistic elements. The study revealed the connection between purchase intention and willingness to pay. The results confirmed that the intention to purchase an electric vehicle is significantly connected to the willingness to pay more for such a vehicle. Specifically, it was found that purchase intention positively influences willingness to pay, verifying that consumers with a higher purchase intention are willing to make a greater economic sacrifice. Regarding the impact of perceived economic and performance risks, it was found that both negatively affect both intention and willingness to pay. However, it was observed that the impact of performance risk on purchase intention is not statistically significant, while financial and performance risks have a significant negative effect on willingness to pay. Finally, regarding the moderation of demographic and situational variables, it was confirmed that these variables moderate the relationships between the psychological constructs of NAM and TPB with purchase intention and willingness to pay. Personal norms have a greater influence on purchase intention among younger individuals, while descriptive social norms and intention have a greater impact on willingness to pay among older groups and those with higher incomes. It was also observed that the influence of descriptive social norms (i.e., what people perceive others are doing) on injunctive social norms (i.e., what people perceive others consider correct to do) is stronger in specific groups. This effect is more pronounced in people who primarily use their vehicle for long trips and in those with prior experience with hybrid or electric vehicles. This indicates that these groups are more influenced by the perceptions of others' actions and behaviors when forming their own norms and decisions regarding the use of electric vehicles.

CRediT authorship contribution statement

L. Javier Cabeza-Ramírez: Conceptualization, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft. **Abel Rosales-Tristancho:** Conceptualization, Data curation, Formal analysis, Software,

Visualization, Writing – original draft. **Sandra M. Sánchez-Cañizares:** Conceptualization, Data curation, Formal analysis, Methodology, Resources, Software, Validation, Visualization, Writing – original draft. **Beatriz Palacios-Florencio:** Conceptualization, Investigation, Resources, Supervision, Validation, Writing – review & editing.

Acknowledgements

This project has been partially funded by research group SEJ-063: Direccion de Empresas y Economia Aplicada (University of Cordoba).

Data availability

Data will be made available on request.

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