Environment, Development and Sustainability
https://doi.org/10.1007/s10668-023-03865-y

Factors affecting adoption intention of electric vehicle: a cross-cultural study

Elena Higueras-Castillo[1] · Vedant Singh[2] · Virender Singh[3] · Francisco Liébana-Cabanillas[1]

Received: 15 December 2022 / Accepted: 4 September 2023

Abstract
In recent years, the surge in the adoption of electric vehicles has played a vital role in reducing fossil fuel consumption and greenhouse gas emissions. However, limited cross-national research has been conducted on the determinants of electric vehicle adoption in developing and developed countries. This study examines the factors influencing the intention to adopt electric vehicles in India (378 participants) and Spain (265 participants). This study develops an integrated model that combines the unified theory of acceptance and use of technology (UTAUT2) and the value-belief-norm (VBN) model while accounting for the impact of national culture. The model is tested using structural equation modeling. The results indicate the integrated UTAUT2-VBN model is a valuable tool for explaining the differences in adoption intention across cultures. Moreover, the national cultural system plays a significant moderating role in most relationships within the model. This study offers valuable insights into the factors influencing electric vehicle adoption in different cultural contexts, which can inform policies and strategies to promote sustainable transportation.

Keywords Electric vehicles adoption intention · Environmental concern · Unified theory of acceptance and use of technology · Value-belief-norm · National cultural system

✉ Elena Higueras-Castillo
ehigueras@ugr.es

Vedant Singh
er.vedu@gmail.com

Virender Singh
virendersingh0098@gmail.com

Francisco Liébana-Cabanillas
franlieb@ugr.es

[1] University of Granada, Paseo de Cartuja 7, 18011 Granada, Spain

[2] Amrita School of Business, Bengaluru 560035, India

[3] Rajasthan Institute of Engineering & Technology, Jaipur 302026, India

Published online: 25 September 2023

1 Introduction

The transportation sector is responsible for approximately a quarter of the world's carbon dioxide emissions. One million active vehicles worldwide consume about 70% of the total oil production, as highlighted in study by Zhou et al. (2021). Figure 1 shows the countries that emit the most significant amount of CO_2, which is why many studies have developed different methodologies to reduce CO_2 emissions in recent years (Abbasi et al., 2021a, 2021b). Among other options, such as electric scooters (Vallejo-Morales et al., 2021) or electric buses (Abbasi & Hadji Hosseinlou, 2022), the increased use of electric vehicles (EVs) significantly reduces fossil fuel consumption and greenhouse gas (GHG) emissions in the road transportation sector (Hamzah & Tanwir, 2021; He et al., 2018; IEA, 2020). Also, according to the IEA (2020), global transport emissions in 2019 barely increased by 0.5% compared to the annual average growth of 1.9% since 2000 due to the switch to electric engines, improvements in efficiency, and the use of biofuels. In this line, using EVs in road transportation is a solid alternative to traditional combustion engines. However, the uptake of EVs was not up to the mark as initially expected, which may have unfavorable effects concerning the switch to zero-emission vehicles (Asadi et al., 2021; McLeay et al., 2018).

Although some research has been conducted on the factors influencing EV adoption intentions in India and Spain using the UTAUT2 and VBN theories (Jain et al., 2022; Ong et al., 2023; Singh et al., 2023a), more work is still needed in this area. In addition, there has yet to be a cross-national comparative analysis that explores EV adoption intentions in medium- and high-income countries, which has been recommended by other researchers in the adoption of sustainable products (Japutra et al., 2022).

Furthermore, recent data indicate there has been a substantial increase in new vehicle purchases during the first and second quarters (Q1–Q2) of 2021, with India and Spain experiencing growth rates of 32% and 92%, respectively, compared to the same period in 2020 (OICA, 2021). With 82.57 k car sales and 14.27 k charging stations, the Spanish EV market is anticipated to generate US$4.93bn in revenue in 2023 (Statista, 2023b). In India, sales of EVs are anticipated to increase significantly and would likely surpass 900,000 in 2023, accounting for 2–3% of all automobile sales (IEA, 2023). This surge in new vehicle purchases highlights the need to investigate the intention to adopt EVs in these two countries, as it is crucial to understand the factors influencing consumers' decision-making

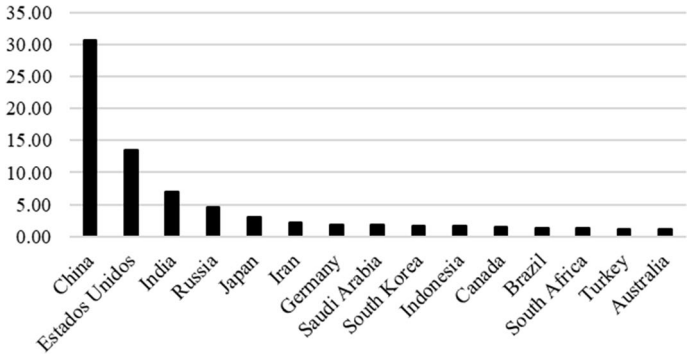

Fig. 1 Distribution of carbon dioxide emission worldwide in 2021. Source: Statista (2023a)

considering this recent growth in the market. Therefore, conducting a cross-national comparative analysis to explore EV adoption intentions in medium- and high-income countries, specifically in India and Spain, using the UTAUT2 and VBN theories would be highly beneficial.

There is a research gap regarding the factors influencing the adoption of EVs in both wealthy nations like Spain and emerging nations like India. By undertaking a thorough cross-cultural comparison between India and Spain, this study seeks to close several information gaps. The study offers insightful information about the elements driving EV adoption by considering the influence of country culture. The research builds a solid theoretical foundation by integrating the UTAUT2 and VBN theories. The study identifies the subtle cultural variations influencing adoption intentions by examining a varied sample from both countries. The study also considers the integrated model's relationships' moderating effects on national culture. These findings have important ramifications for stakeholders and decision-makers involved in creating strategies and policies to enhance sustainable mobility. It would be beneficial to do a cross-cultural study involving Spain and India to gain valuable insights into the ways in which cultural and other factors affect EV adoption in various contexts.

2 Literature review and research gaps

The COVID-19 pandemic has significantly impacted the global economy, including the EV industry and supply chain (Abbasi et al., 2021a; Sun et al., 2022). The pandemic has caused disruptions in the supply chain due to factory closures, travel restrictions, and decreased demand for goods and services (Abbasi et al., 2022a, 2022b). These disruptions have affected the production and delivery of EV components, such as batteries, motors, and electronics, leading to delays in EV production (Sun et al., 2022). On the demand side, the pandemic has had mixed effects on EV adoption. On the one hand, the economic slowdown caused by the pandemic has led to decreased demand for vehicles, including EVs. On the other hand, some countries have used the pandemic as an opportunity to promote EV adoption as part of their economic recovery plans (Razmjoo et al., 2022). For example, several European countries have offered incentives for purchasing EVs, such as tax breaks and subsidies, as part of their COVID-19 recovery plans.

Furthermore, the pandemic has highlighted the importance of localizing the supply chain for EVs to reduce dependence on foreign suppliers and ensure greater resilience in future crises (Abbasi et al., 2022d; Razmjoo et al., 2022). COVID-19 has led to increased investments in the local production of EV components, particularly in countries such as China and the USA (Zhang et al., 2022). The COVID-19 pandemic has presented challenges and opportunities for the EV industry and its supply chain. While the disruptions caused by the pandemic have harmed the production and delivery of EV components, some countries have used the pandemic to promote EV adoption and localize the supply chain, which could have positive long-term effects on the industry.

The literature review on factors affecting the usage intention of EVs includes several studies that have identified various factors, such as environmental concerns, financial incentives, range anxiety, charging infrastructure, and sociodemographic factors (Singh et al., 2020a, 2023b), as significant determinants of EV usage intention. These factors were expressed in terms of several theories and models, such as attribution theory, IDT (innovation diffusion

theory), NAM (norm activation model), RBM (risk–benefit model), SDT (self-determination theory), SICT (self-image congruence theory), TAM (technology acceptance model), TPB (theory of planned behavior), TRA (theory of reasoned action), UGT (uses and gratifications theory), UTAUT (unified theory of acceptance and use of technology), and VBN (values–beliefs–norms) as shown in Table 1. Table 1 also shows the countries of study, significant findings, and research gaps in the context of this study.

Integrating the UTAUT2 and VBN models is a new approach that aims to comprehensively understand the factors influencing the intention to adopt EVs in different cultural contexts. The UTAUT2 model has been widely used to understand technology adoption in various contexts, including EVs in India and Spain (Bhat et al., 2022; Gunawan et al., 2022; Singh et al., 2023a). However, this model must consider the impact of cultural values, beliefs, and norms on individuals' intentions to adopt new technologies. On the other hand, the VBN model provides a framework for understanding the underlying values, beliefs, and norms that shape individuals' behavior, including pro-environmental behavior (Barbarossa et al., 2017).

By integrating these models, this study aims to provide valuable insights into the factors influencing the intention to adopt EVs in India and Spain. The study investigates the role of individual factors, such as performance expectancy, effort expectancy, social influence, facilitating conditions, and cultural factors, such as values, beliefs, and norms, in shaping individuals' intentions to adopt EVs in these two countries. This approach offers a more comprehensive understanding of the complex interactions that influence EV adoption, which can inform policies and strategies to promote sustainable transportation in these two countries.

The work makes an important contribution by exploring the factors influencing the intention to use EVs in contexts with different cultural perspectives, which fills a research vacuum. The writers emphasize the cultural distinctions between India, which is still developing in this area, and Spain, a technologically advanced nation. These results have practical ramifications for stakeholders and policymakers, offering insights into successful promotion tactics for EV adoption in both developed and developing nations. The study provides a thorough understanding of the variables influencing EV adoption, enabling the creation of focused initiatives to advance environmentally friendly transportation. Overall, the report offers significant insights into the variables affecting EV adoption in various cultural contexts and advises stakeholders and policymakers on encouraging EV adoption.

The study's primary aim is to investigate the factors influencing the intention to adopt EVs, focusing on individual and cultural factors. The authors chose Spain and India as research settings since both countries are emerging markets for electric vehicles (Singh et al., 2023a). The findings from this research present valuable insights into the complex interactions that affect adoption in different cultural contexts, highlighting the importance of conducting research in developing countries such as India, where EV adoption is still in its early stages (Bhat et al., 2022; Gunawan et al., 2022). This information can inform policymakers and stakeholders of effective strategies to promote sustainable transportation. Therefore, this paper contributes significantly to the literature on adopting EVs.

The rest of the study is structured as follows: (3) theoretical background, which presents the proposed integrated model and the hypotheses, (4) methods, (5) analysis, and results, (6) discussion, and (7) conclusion.

Table 1 Review of EV adoption literature and research gaps

Study	Theory/Model	Country	Finding	Research gap
Singh et al. (2023a)	UTAUT2, NAM	India	The study's findings suggest that several factors such as performance expectancy, facilitating conditions, hedonic motivation, price value, and personal norms have a significant positive impact on consumers' intention to adopt EVs	A limitation of this study was that it was conducted solely in the Himalayan region, and a cross-cultural comparison was not included in the research
Bhat et al. (2022)	UTAUT	India	The study found that environmental enthusiasm, technological enthusiasm, social image, social influence, perceived benefits, and performance expectancy have a positive influence on Indian consumers' intention to adopt EVs	The main research gap of this study is that it only focuses on students as the target population and does not analyze the impacts of other variables such as brand preferences and vehicle ownership, nor does it evaluate the effects of demographic variables such as age, gender, and income
Gunawan et al. (2022)	UTAUT2, TPB	Indonesia	The study found that attitude towards use, subjective norm, and perceived behavior control positively affect interest in using EVs in Indonesia. Attitude towards use was the most influential factor, which was influenced by performance and effort expectancies, hedonic motivation, price value, as well as functional, financial, and social risks	This study only focuses on the determinants of customer intentions to use EVs in Indonesia, and the results might not be applicable to other countries, especially those with different cultural backgrounds
Higueras-Castillo et al. (2022)	TRA	Spain	The study found that urban consumer intention to adopt an electric car is reinforced by word-of-mouth communication, care of environmental consequences, and personal innovativeness, and that the impact of switching cost is lower in smaller households	The study focuses only on urban residents in Spain, thus limiting the generalizability of the findings to other countries, especially developing ones
Jain et al. (2022)	UTAUT	India	One major finding of this study is that government support moderates the relationship between perceived risk and adoption intention of EVs in India	This study does not consider the role of cultural factors such as values and beliefs in shaping adoption intentions towards EVs in India, which could be considered a major research gap

Table 1 (continued)

Study	Theory/Model	Country	Finding	Research gap
Loengbudnark et al. (2022)	TAM	Australia	The major finding of this study is that safety concerns have a stronger impact on adoption intention of EV than the purchase cost and perceived benefits	One major research gap of this study is that it only focused on consumer perceptions and preferences in Australia, without considering cultural, economic, and infrastructural factors
Manutworakit and Choocharukul (2022)	UTAUT	Thailand	The main finding of this study is that the adoption of EVs by Thai car owners is positively influenced by factors such as performance expectancy, effort expectancy, social influence, hedonic motivation, and environmental concern, but not significantly influenced by price value and policy measures	The study is limited to a specific region (Bangkok and vicinity) in Thailand, and hence, the generalizability of the findings to other regions and countries is limited
Abbasi et al., (2021a, 2021b)	UTAUT	Malaysia	The study found that factors identified in the motivational context significantly influence consumer intentions to purchase EVs, and a significant relationship between effort expectancy, social influence, technophilia, perceived environmental knowledge, and purchase intention towards EVs has been observed	The study did not examine the impact of cultural differences on consumer motivation and adoption of EVs
Asadi et al. (2021)	TPB, NAM	Malaysia	The main finding of the study is that perceived value, attitude, ascription of responsibility, subjective norms, personal norms, perceived consumer effectiveness, and awareness of consequences significantly and positively affect consumers' intention to purchase EVs in Malaysia	The study's limitations include not examining real adoption behavior, using only TPB and NAM to illustrate EV adoption, and the absence of confirmation of findings in contexts outside Malaysia
Featherman et al. (2021)	TRA, RBM	USA	The study found that beliefs about perceived benefits and risks, as well as social influences, play a significant role in consumers' decisions to adopt EVs	The study focused on the beliefs and attitudes of consumers towards the adoption of EVs, but it did not examine the influence of cultural and societal factors on consumer behavior

Table 1 (continued)

Study	Theory/Model	Country	Finding	Research gap
Huang et al. (2021)	Extended TAM	China	The study found that consumer technological knowledge positively affects their intention to adopt EVs, and imparting knowledge and usefulness of EVs may enhance consumers' willingness to use them	The main research gap of this study is the lack of a technological knowledge-based view and limited discussion on the effects of consumer technological knowledge about EVs on their adoption intention
Khazaei and Tareq (2021)	UTAUT	Malaysia	One major finding of this study is that social influence, facilitating conditions, environmental concern, and perceived enjoyment positively influence the adoption of EVs in Kuala Lumpur, Malaysia	The study's major research gap is the lack of exploration into the impact of demographic factors on the adoption of BEVs in Malaysia. Another gap is its limited scope to a specific cultural setting, neglecting potential cross-cultural variations in factors affecting EV adoption
Zhou et al. (2021)	UTAUT2	China	One major finding of this study is that satisfaction with government incentive policies is a significant factor influencing Chinese taxi drivers' adoption of EVs for their livelihoods	One research gap of this study is that it focuses only on the specific context of China and does not examine potential cross-cultural differences in factors influencing taxi drivers' adoption of EVs for their livelihoods
Wahl et al. (2020)	UTAUT, NAM	Germany	One major finding of this study is that consumer expectancy, social influence, facilitating conditions, and ecological norm orientation are all significant predictors of the intention to adopt battery EVs in Germany	A potential research gap of this study is that it focuses solely on Germany and may not consider the potential differences in factors influencing the adoption of EVs across different cultures and countries
Higueras-Castillo et al. (2019a)	SICT, UGT	Spain	The main finding of this study is that trust and extrinsic incentives are the primary motivators driving the purchase of electric or hybrid vehicles, with green self-identity playing a less significant role	One research gap of this study is that it only considers a single country (Spain) and may not generalize to other cultural contexts

Table 1 (continued)

Study	Theory/Model	Country	Finding	Research gap
Haustein and Jensen (2018)	TPB	Denmark, Sweden	One major finding from this study is that perceived functional barriers, particularly driving range, are the most relevant factor of intention for EV users	One research gap from this study is that it focuses only on Denmark and Sweden, and thus, the findings may not be generalizable to other regions or countries
He and Zhan (2018)	NAM	China	One major finding of this study is that personal norms have a positive influence on consumers' intention to adopt EVs, which suggests that altruistic values play an important role in promoting pro-environmental behavior	The study has a research gap in that it only examines the role of personal norms as a factor influencing consumers' intention to adopt EVs, while other psychological and social factors may also play a role
Barbarossa et al. (2017)	VBN theory, TPB, SDT, Theory of Ethics	Belgium, Denmark, and Italy	This study highlights the importance of personal values and green self-identity in predicting electric car adoption intention and provides insights into how personal values moderate the relationship between green self-identity, ecological care, moral obligation, and electric car adoption intention	The main research gap in the study is the lack of cross-cultural validation of the proposed conceptual model in developing countries, which limits the generalizability of the findings
Schmalfuß et al. (2017)	Extended TPB	Germany	One major finding of this study is that direct experience with EVs has a positive effect on the evaluation of EV attributes, attitudes, and purchase intention	The research gap of this study is the lack of examination of the long-term sustainability of BEV adoption and the limited sample that may restrict the generalizability of the findings

EV electric vehicle, *IDT* innovation diffusion theory, *NAM* norm activation model, *RBM* risk–benefit model, *SDT* self-determination theory, *SICT* self-image congruence theory, *SGT* social cognitive theory, *SOR* stimulus–organism–response, *TAM* technology acceptance model, *TPB* theory of planned behavior, *TRA* theory of reasoned action, *UGT* uses and gratifications theory, *UTAUT* unified theory of acceptance and use of technology, *VAB* value–attitude–behavior, *VBN* values–beliefs-norms

3 Theoretical background

3.1 UTAUT2 and VBN consolidated theory

The unified theory of acceptance and use of technology (UTAUT) model, proposed by Venkatesh et al. (2003), has been widely used to assess the intention to use new technology. It considers factors such as performance expectancy, effort expectancy, social influence, and the mediating effect of behavioral intention. The UTAUT model evolved into UTAUT2 (Venkatesh et al., 2012), which incorporates additional antecedents such as pricing, consumption habits, and hedonic motivations, along with the moderating effects of age, gender, and experience. Various studies have employed the UTAUT2 model in different fields, including mobile banking (Merhi et al., 2019), mobile commerce (Shaw & Sergueeva, 2019), and artificial intelligence (Gansser & Reich, 2021). However, only a limited number of studies have utilized this model to explore EV adoption, such as Singh et al. (2023a), Bhat et al. (2022), and Gunawan et al. (2022).

On the other hand, the value–belief–norm (VBN) theory, introduced by Stern (2000), combines the New Environmental Paradigm (NEP) by Dunlap and Van Liere (1978) and Dunlap et al. (2000), the Personal Values Theory by Schwartz (1992), and the norm activation model (NAM) by Schwartz (1970, 1975). The VBN theory emphasizes the impact of norms on individual behaviors and posits that personal norms are influenced by awareness of consequences (AC) and ascription of responsibility (AR, Steg et al. 2005). It suggests that personal norms enable pro-environmental behaviors and attitudes, while general beliefs and stable value orientations shape personal beliefs. The four value orientations considered in this study are egoistic, altruistic, biospheric, and openness to change (Stern et al. 1993). Research in this field indicates that individuals prioritizing collective values over personal orientations are likelier to engage in pro-environmental behaviors. Personal norms mediate the relationship between values and behaviors (Poortinga et al. 2004). The VBN theory has successfully explained pro-environmental behaviors such as reduced car use (Unal et al., 2019) and plastic carry bag use (Yakut, 2021), and it has also been applied to explore EV adoption (Saleem et al., 2021; Simsekoglu, 2018).

This study integrates the UTAUT2 model and the VBN theory to examine EV adoption. While previous studies have separately examined the intention to adopt EVs using these models, our research combines both theories to provide a comprehensive and integrated perspective. By combining the UTAUT2 model's focus on technology acceptance and the VBN theory's emphasis on personal norms and values, we aim to understand better the factors influencing EV adoption intentions.

The main advantage of the UTAUT2 theory is that it provides a comprehensive framework that considers various factors influencing technology acceptance, allowing for a thorough analysis of EV adoption intentions. While the VBN theory highlights the role of personal norms and values, providing insights into the pro-environmental behaviors and attitudes associated with EV adoption. The main disadvantage of the UTAUT2 and VBN consolidated theory is that the UTAUT2 model may only capture some contextual factors specific to EV adoption, as it was originally developed for general technology acceptance. In contrast, the VBN theory's emphasis on personal norms and values may only partially account for other influential factors in EV adoption, such as infrastructure availability or government policies.

Utilizing the UTAUT2 and VBN consolidated theory, we aim to address this study's research questions: What factors influence EV adoption intentions in India and Spain? How

do variables from the UTAUT2 model and the VBN theory impact EV adoption intentions? We hypothesize that the factors identified in the UTAUT2 theory, and the personal norms derived from the VBN theory will significantly influence individuals' intention to adopt EV. The integration of these theories allows us to capture both technological and psychological determinants of EV adoption intentions, providing a comprehensive understanding of the factors influencing consumer behavior in this context.

3.2 Research hypotheses

3.2.1 Performance expectancy

Performance expectancy indicates the degree to which an individual believes technology can help them perform their daily tasks. It also reveals to what extent users believe a specific technology will be able to yield increased performance (Venkatesh et al., 2012). This construct emerged from the perceived usefulness construct developed by TRA and TAM. Regarding the automobile industry, "performance expectancy" refers to prospective buyers' beliefs that EVs will help them make road trips and journeys more effectively and efficiently (Osswald et al., 2012). In this regard, previous research found that performance expectancy is instrumental in positively influencing the intention to purchase EVs (Jain et al., 2022; Khazaei, 2019). In this light, the following research hypothesis is put forward:

Hypothesis 1: Performance expectancy positively impacts the intention to adopt EVs.

3.2.2 Effort expectancy

Effort expectancy can be considered as the difficulty expected from using new technology (Venkatesh et al., 2012). Effort expectancy is also closely related to other antecedents, such as the construct of perceived ease of use proposed by TAM, the construct of complexity proposed by the Theory of Human Behavior, and the construct of ease of use from the IDT. The positive relationship between the constructs above has been confirmed in the context of the theory of general technology acceptance, for example, in the case of online banking adoption (Rahi et al., 2019) or even in a far-removed field of study such as politics (Sair & Danish, 2018). In this line, the study by Abbasi et al., (2021a, 2021b) reports a strong relationship between effort expectancy and intention to purchase EVs. Furthermore, Lee et al. (2021) corroborated the positive impact of effort expectancy on the intention to use EVs. Considering that the higher the perceived ease of use of EVs, the higher the intention to adopt them, the following research hypothesis is proposed:

Hypothesis 2: Effort expectancy positively impacts the intention to adopt EVs.

3.2.3 Social influence

Social influence can be regarded as the extent to which individuals believe that their ideas are meaningful to others or that they think alike concerning new technology. In this sense, individuals' behaviors are modeled by the degree to which they believe society will value technologies (Venkatesh et al., 2012). In the context of EVs, social influence measures the extent to which users consider the opinions of others when deciding to purchase and use an EV. In this regard, with EVs pioneering technological advances in the automotive industry,

they become part of their users' identities and are usually considered symbols of social status (Axsen et al., 2013; Osswald et al., 2012). Extant research studies indicate a significant impact of social influence on the intention to adopt (Bhat et al., 2022; Cui et al., 2021) while promoting EV purchase and use (Yang & Chen, 2021). Also, Curtale et al. (2021) posit that social influence is instrumental to behavioral intentions. In light of all of the above, the following research hypothesis is put forward:

Hypothesis 3: Social influence positively impacts the intention to adopt EVs.

3.2.4 Facilitating conditions

Facilitating conditions refer to individuals' perceptions of the technical and organizational infrastructures and technical support available for users of new technology (Venkatesh et al., 2012). In the case of EVs, the most significant concern is the availability of stations for battery charging (Verma et al., 2020) and vehicle maintenance. In this sense, the construct mentioned above is moderated by other variables such as perceived behavioral control (TPB), facilitating conditions (Theory of Human Behavior), and compatibility (IDT). In this sense, recent studies have reported the crucial role of facilitating conditions in predicting the intention to adopt (Wahl et al., 2020). Also, Zhou et al. (2021) explored drivers' intentions to use EVs and obtained similar results. In this light, the following research hypothesis is put forward:

Hypothesis 4: Facilitating conditions positively impact the intention to adopt EVs.

3.2.5 Hedonic motivations

Hedonic motivations are usually described as feelings of joy and pleasure derived from using a system or technology (Venkatesh et al., 2012). In this regard, the literature posits that hedonic motivations strongly impact the intention to adopt new technology (Childers et al., 2001). In the field approached by the present study, hedonic motivations were remarkable drivers of the intention to adopt EVs (Khan & Hammed, 2019). In addition, the impact of hedonic motivations on behavioral intention is more robust in the case of consumers adhering to sustainable consumption behaviors (Rezvani et al., 2018). According to Schuitema et al. (2013), users' hedonic motivations, such as driving enjoyment, help improve their intention to adopt EVs. Therefore, EV driving experience must be considered (Higueras-Castillo et al. 2019b). In light of the above, the following research hypothesis is put forward:

Hypothesis 5: Hedonic motivations positively impact the intention to adopt EVs.

3.2.6 Environmental concern

Environmental concern can be defined as the degree to which individuals value and react to environmental problems (Weigel & Weigel, 1978). Studies in the extant literature have revealed a significant impact of environmental concern on attitudes toward EVs (Adnan et al., 2018; Wang et al., 2016). In this sense, consumers' pro-environmental behaviors also positively impact the intention to adopt EVs (Liu et al., 2021). In addition to playing a pivotal role in EV adoption intention (Bhalla et al., 2018; Wu et al., 2019), environmental concern is also regarded as the most significant construct in studies such as Cui et al.

(2021). Degirmenci and Breitner, (2017) prioritize environmental concerns above driving range and price. In this way, it also impacts the amount prospective buyers would be willing to pay to own an EV (Thananusak et al., 2017). Soon in the automotive industry, EVs will play a key role in reducing emissions that harm the environment. Therefore, individuals with pro-environmental attitudes are more likely to adopt EVs (Higueras-Castillo et al., 2020a). In this light, the following research hypothesis is put forward:

Hypothesis 6: Environmental concern positively impacts the intention to adopt EVs.

3.2.7 Personal norms

PN can be described as individuals' internal beliefs and motivations helping them perceive morally right attitudes and behave following their value system (Schwartz, 1977). This construct is crucial in the VBN theory (Stern, 2000). In addition, the literature reveals that PN can be approached to explain the intention to adopt conventional and alternative vehicles (Nordlund et al., 2016). More precisely, the fact that some individuals feel morally obliged to choose pro-environmental vehicles leads to an increased intention to adopt EVs. Also, as Westin et al. (2018) revealed, PN would be the most significant driver of EV adoption and are heavily influenced by pro-environmental behaviors (Liao et al., 2017). In this light, the following research hypothesis is put forward:

Hypothesis 7: Personal norms positively impact the intention to adopt EVs.

3.2.8 Awareness of consequences and ascription of responsibility

AC assesses individuals' awareness of the negative consequences of their environmentally unfriendly behavior (Schwartz, 1977). In the case of the present study, AC is approached concerning consumer awareness of the negative impacts of traditional, fossil fuel combustion engines on the environment. To help mitigate emissions, consumers should engage in pro-environmental attitudes and purchasing behaviors (Van Liere & Dunlap, 1989). When this happens, a sense of moral obligation toward the environment is formed, and they develop personal norms to behave in an environmentally friendly manner (López-Mosquera & Sánchez, 2012). In other words, if consumers know this, they will feel a moral obligation to adopt EVs. Therefore, AC is a crucial factor in activating PN.

On the other hand, the study of AR also reveals that consumers are deeply concerned by the negative impact of their behaviors. They would feel responsible for damaging the environment should they buy fossil fuel-powered vehicles. In this way, AC is instrumental to the development of AR, so customers feel morally obliged to engage in green behaviors that positively impact the environment and society in general, according to their personal norms (López-Mosquera & Sánchez, 2012). In this light, AC can be reliably approached to predict AR as a mediator of personal norms.

The extant literature reveals different research papers testing AC, AR, and personal norms in varied fields of study. In this regard, research from He and Zhan (2018) and Ashraf et al. (2021) revealed the strong reliability of AC and AR when predicting the role of personal norms in the intention to adopt EVs. Moreover, they found that customers under the influence of AC and AR tend to develop a moral obligation to engage in

pro-environmental behaviors. Therefore, they are more likely to adopt EVs. Considering these findings, the following research hypotheses are put forward.

Hypothesis 8: Ascription of responsibility positively impacts personal norms.

Hypothesis 9: Awareness of consequences positively impacts personal norms.

Hypothesis 10: Ascription of responsibility positively impacts awareness of consequences.

3.2.9 Altruistic and egoistic behaviors: biospheric values and openness to change

First, altruistic behaviors usually emerge from an honest concern for the well-being of others. On the other hand, egoistic attitudes are engaged by customers who care about what affects them personally. In the case of EVs, egotistical behaviors harm the environment when the perceived price is high and customers decide to purchase fossil fuel-powered vehicles instead. Therefore, there is a direct relationship between perceived costs and pro-environmental behaviors. Second, biospheric values have prospective EV buyers reflect on their future purchases by analyzing biospheric impact and perceived personal benefits. In this sense, there is a positive relationship between biospheric values and AC. Finally, in the case of openness to change, most customers will engage in behaviors that satisfy their intellectual and emotional needs (Karp, 1996). Prospective buyers can also be influenced and pressured by the decisions made by other people switching from traditional vehicles to EVs. When pro-environmental behaviors are engaged after reflecting on the well-being of others, they can be considered to have altruistic-oriented motivations.

On the other hand, when such behaviors are engaged to avoid damage to oneself, they can be regarded as egoistic attitudes. In addition, when behaviors are engaged aiming to mitigate the degradation of the environment, they can be regarded as changes motivated from biospheric values. When behaviors are engaged regardless of intellectual or emotional reasons, they are considered as attitudes related to general openness to change.

The relatively scarce literature in this field of study overly agrees with the lack of a direct relationship between personal values and pro-environmental behaviors. According to the VBN theory (Stern, 2000), personal values and orientations in causal contexts can influence awareness of consequences. In this sense, personal values predispose individuals to pick the pieces of information that agree with their values and beliefs. The present study posits that altruistic values, egoistic values, biospheric values, and openness to change are directly related to AC. In this light, the following research hypotheses are put forward:

Hypothesis 11: Altruistic values positively impact awareness of consequences.

Hypothesis 12: Egoistic values negatively impact awareness of consequences.

Hypothesis 13: Biospheric values positively impact awareness of consequences.

Hypothesis 14: Openness to change positively impact awareness of consequences.

3.3 The moderating effect of culture from the perspective of UTAUT2 and VBN

According to Alcántara-Pilar et al. (2017), the role of cultural dimensions in modeling consumer behavior is well established. Hofstede (2001) identified six cultural dimensions: power distance, collectivism versus individualism, femininity versus masculinity, uncertainty avoidance, long-term orientation, and indulgence. Power distance refers to the degree to which individuals at the base of power believe it is distributed unequally. Collectivism versus individualism refers to the degree to which individuals form groups. Femininity versus masculinity refers to the attributes usually related to women, such as quality of life and humility, and those associated with men, such as financial success and confidence. "Avoidance of uncertainty" refers to the degree to which society tolerates varying degrees of uncertainty and undesirable deeds. Long-term orientation refers to the inclination of individuals towards attitudes, actions, or conditions for the future. Indulgence refers to the degree to which society fulfills human nature, desires, and needs despite established social norms.

Figure 2 compares India and Spain through the above-mentioned cultural dimensions. This comparison highlights the differences in the cultural values of the two countries and how they may influence consumer behavior.

Even if the present study excludes Hofstede dimensions from the sample, the literature in this field of knowledge validates their use for cross-cultural research (Migliore et al., 2021; Zhang et al., 2018). In this sense, several studies have already reported that culture is instrumental in the intention to adopt EVs (Ashmore et al., 2018; Kuhn et al., 2017; Novotny et al., 2022; Sharif et al., 2021). In this light, marked differences can be observed in some of the abovementioned factors.

3.3.1 Power distance

Individuals are more likely to accept the power differences among the members of society if they have a strong understanding of power distance. On the other hand, individuals with a low score on said dimension strive for equal power distribution (Alcántara-Pilar et al., 2017). For example, suppose a person who possesses power-distance cultural values

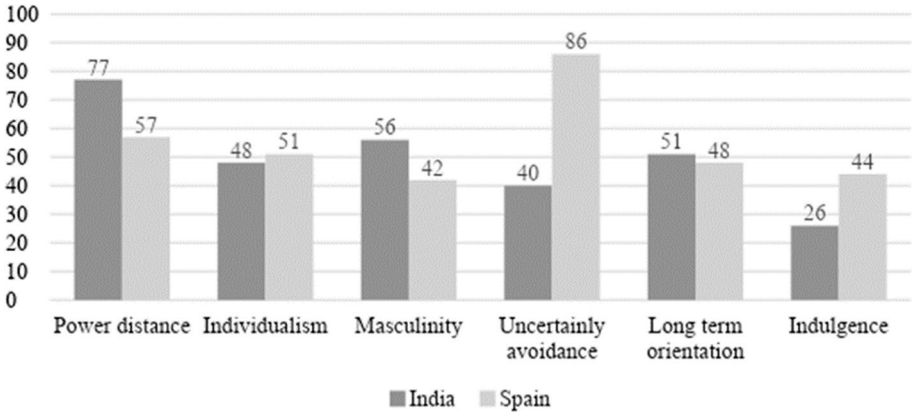

Fig. 2 Cultural dimensions in India and Spain. Source: https://www.hofstede-insights.com

notices their hierarchical superiors driving an EV. In that case, that person will most likely believe that using this vehicle is positive since they trust their managers to do what can be considered correct. Therefore, the relationships between performance expectancy, effort expectancy, facilitation condition, and adoption intention are expected to be stronger in societies with high levels of power distance. Considering the above, the following hypotheses are put forward:

Hypothesis 15: The relationship between performance expectancy (15a), effort expectancy (15b), and facilitation condition (15c) on the intention to adopt is higher in national cultures with a high level of power distance.

3.3.2 Individualism and collectivism

Second, collectivism also plays a crucial role in consumers' adoption of pro-environmental behaviors (Nguyen et al., 2017). Individuals living in societies with a marked level of collectivism are more likely to share resources with others while engaging in cooperative behaviors focusing on public benefits (Escandón-Barbosa et al., 2021). Therefore, they are inclined to feel deeply concerned about environmental problems (Liu et al., 2021). Considering this approach, consumers in such societies are more likely to purchase pro-environmental goods and services than those in organizations with a high level of individualism. Therefore, the intention to acquire is positively impacted (McLeay et al., 2018; Sreen et al., 2018). In this light, based on the above theoretical background and the different levels of collectivism found in India and Spain, the following hypotheses are put forward:

Hypothesis 16: The relationship between the ascription of responsibility (16a), awareness of consequences (16b), and personal norms is higher in national cultures with a high level of collectivism compared to those where individualism takes precedence.

3.3.3 Masculinity and femininity

Masculinity in modern societies is usually regarded as a dimension related to confidence, power control, ambition, and high-performance attitudes (Hofstede, 1980). In contrast, femininity is associated chiefly with quality of life, emotional and physical nourishment, and concern for the well-being of others (Gupta et al., 2019). Societies with a high level of masculinity tend to have a competitive orientation, whereas feminine societies are more geared toward consensus (Barbarossa et al., 2015). In this sense, traditional vehicles have usually been associated with societies with a high level of masculinity (Anfinsen et al., 2019). Moreover, some research studies associate the purchase of electric vehicles with feminine individuals, groups, and societies (Novotny et al., 2022). In this sense, Ziefle et al. (2014) posit that the gender dimension is instrumental in EV adoption. Women are more likely to purchase EVs due to their environmental concerns (Higueras-Castillo et al., 2020b). Consequently, the following hypothesis is put forward:

Hypothesis 18: The relationship between social influence and the intention to adopt is stronger in cultures with a high level of femininity than in cultures where masculinity takes precedence.

3.3.4 Uncertainty avoidance

Uncertainty avoidance can be considered the degree to which the different members of a society are uncomfortable with uncertainty and ambiguity (Hofstede & McCrae, 2004). Societies with high uncertainty avoidance tend to avoid risks and are usually threatened by new situations and challenges arising from exposure to other cultural perspectives (Cleveland et al., 2011). While uncertainty avoidance serves to identify variations in the intention to adopt new technologies, the marked level of uncertainty acts as a barrier to the adoption of innovations (Mooij & Hofstede, 2010). In the case of the present study, marketing campaigns aimed at societies with high uncertainty avoidance should focus on the positive environmental consequences of purchasing and using an EV (Barbarossa et al., 2015). In this sense, the following hypotheses are put forward:

Hypothesis 19: The relationship between performance expectancy (19a), effort expectancy (19b), social influence (19c), and the intention to adopt is higher in societies with a high level of uncertainty avoidance.

3.3.5 Long-term orientation

Long-term orientation describes encouraging values and behaviors geared toward achieving greater future rewards. In this regard, perseverance and thriftiness are primarily regarded as long-term orientation attributes. On the other hand, short-term orientation targets are associated with the recent past and the present, such as respect for traditions and social responsibilities (Hofstede, 1980). In this sense, individuals with a high level of long-term orientation are inclined to engage in pro-environmental behaviors since they are crucial for their future (Leonidou et al., 2010). In this sense, they will follow a sustainable lifestyle focusing on saving resources for the well-being of future generations (Perret et al., 2022). Based on these different approaches, the following hypothesis is put forward:

Hypothesis 20: The relationship between facilitating conditions and the intention to adopt is higher in societies with a higher long-term orientation than in short-term-oriented cultures.

3.3.6 Indulgence

Finally, indulgence can be described as the degree to which individuals try to gain control over their desires and impulses (Hofstede, 1980). In this sense, Wang et al. (2021) posit that indulgence is usually associated with the level to which people who firmly believe in carpe diem tend to engage in hedonistic behaviors. Therefore, the intention to adopt increases as innovations provide a tangible benefit concerning the enjoyment of life (Yun et al., 2021). Consequently, individuals with higher levels of indulgence and concern for others feel more comfortable adopting and using new technologies such as EVs (Escandon-Barbosa et al., 2021). In this sense, the previous research for the present study is put forward:

Hypothesis 21: The relationship between hedonic motivations and the intention to adopt is higher in societies with higher levels of indulgence.

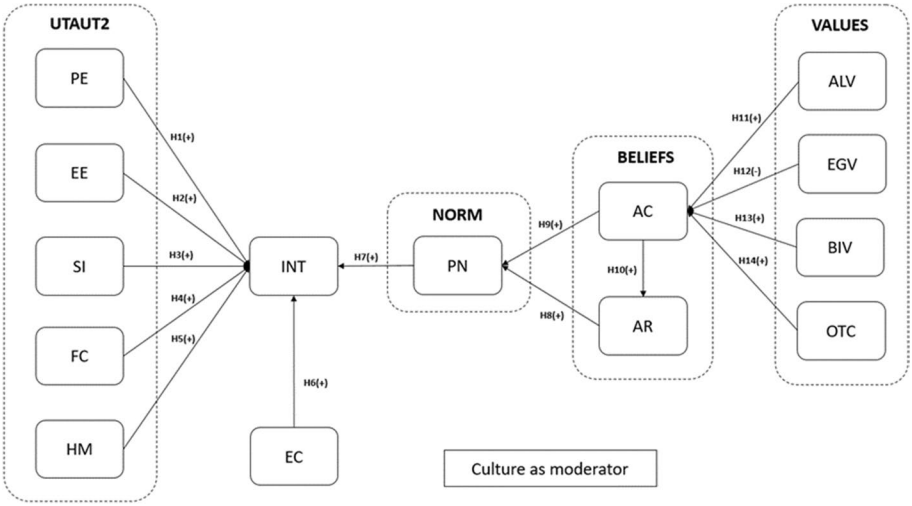

Fig. 3 The integrated UTATUT2-VBN model. *Note PE* performance expectancy, *EE* effort expectancy, *SI* social influence, *FC* facilitating conditions, *HM* hedonic motivation, *EC* environmental concern, *INT* intentions to adopt, *PN* personal norm, *AC* awareness of consequences, *AR* ascription of responsibility, *ALV* altruistic values, *EGV* egoistic values, *BIV* biospheric values, *OTC* openness to change

The behavioral model proposed in the present study is graphically summarized below (see Fig. 3).

4 Methods

4.1 Questionnaire design

A structured questionnaire-based survey was conducted to test the proposed model. The questionnaire consists of two parts, with the first part of the survey aimed at collecting the respondents' demographic information. The questionnaire presents eleven questions on gender, age, level of education, annual net income, driving experience, average daily distance driven, EV knowledge, driving experience with EVs, and actual EV ownership, including plans to purchase an EV. The second part explored the electric vehicles adoption intention of the participants. As shown in Appendix A, all measurement items in the questionnaire were adopted from previous studies in the extant literature and revised in the context of electric vehicles adoption intention. Survey items were scored on a 7-point Likert scale. In this sense, a pilot survey was conducted among the participants before the final study. Reliability for all dimensions involved scored above 0.7, which shows a solid internal consistency of the constructs. Feedback from the pilot survey helped the present study make minor amendments to the questionnaire.

4.2 Data collection

Data for both nations were gathered through a convenient sampling technique. More specifically, Indian and Spanish respondents received emails containing a link to a questionnaire on Google Forms. On the other hand, in India, the data were collected in person.

In the case of India, 378 valid responses were gathered as opposed to 265 in Spain after discarding invalid responses. The survey was administered from January 2021 to December 2021 in both countries. All participants were informed beforehand that participation was voluntary, and the confidentiality of their responses was ensured.

Appendix B reveals demographic data for the two different groups of participants. In India, most participants (83%) were male, with just 17% of female respondents. On the other hand, 55% of Spanish respondents were male, and 45% of them were female. Concerning age groups, most Indian participants (53.7%) were in the age range of 26–40, while most Spanish participants were 18–25 (55.3%). Also, most Indian participants (64.3%) possessed at least a bachelor's degree compared to Spanish participants (55%). Regarding annual net income, most Indian participants (58.7%) had an annual net income below 8,000 USD compared to Spanish participants. (64.7% of them had a monthly net income ranging from 0 to 1,500 €.) In addition, nearly 80 percent of the Indian participants had a driving license, compared to 75 percent of the Spanish participants. Also, most Indian participants (36.6%) had driving experience in the 1–5-year range compared to Spanish participants (26%). In Spain, nearly 55% of participants did not use any vehicle daily compared to Indian participants (32.3%). Moreover, 97% of Spanish participants had prior information about EVs, compared to 84% of Indian participants. In India, 14.3% of participants had already driven an EV, compared to Spanish participants (10.2%). The representation of EV ownership was relatively equal, at 1.9% and 1.1% in India and Spain, respectively. Also, the percentage of participants planning to purchase an EV in the future was similar for both countries: 69.6 percent and 66 percent in India and Spain, respectively.

5 Analysis and results

Data were assessed through statistical software such as IBM SPSS version 20 and IBM Amos version 26. Structural equation modeling (SEM), a widely used technique to analyze models with latent variables (Hair et al., 2009), was used to test the proposed model. Firstly, the reliability and validity of the measurement model were tested, and secondly, the structural model was examined to test the research hypotheses.

5.1 Measurement model analysis

Confirmatory factor analysis (CFA) with maximum likelihood estimation was conducted to test the reliability and validity of the integrated measurement model. Appendix A shows results concerning the reliability and validity of the measurement model. All standardized factor loadings were more significant than 0.60. The items SI5 and EGV4 were discarded due to their low factor loadings. Also, all t-values exceeded the minimum limit of ± 1.96 at the 0.000 level of significance, as per Hair et al. (2009). Cronbach's alpha (α) and composite reliability were employed to check the internal reliability of the different dimensions (Hair et al., 2009). In this study, Cronbach's alpha values for the integrated model range from 0.865 to 0.942, while values for composite reliability (CR) range from 0.866

to 0.943, revealing that the examined dimensions had strong internal reliability (Fornell & Larcker, 1981). The average variance extracted (AVE) values were more significant than 0.5, showing that the convergent validity of the measurement model was acceptable (Singh et al., 2020b). The maximum shared variances (MSVs) were relatively lower than AVEs, which showed evidence of discriminant validity. Also, discriminant validity was estimated by the square root of AVE and the correlation coefficient matrix, as shown in Table 2. In this regard, the square root of AVE for each construct, the values in the diagonal, were more significant than those from all the correlation coefficients. Therefore, the discriminant validity of the integrated model was regarded as satisfactory following prior studies by Anderson and Gerbing (1988) and Fornell and Larcker (1981). Finally, Table 3 shows that all fit indices (CMIN/DF, p-value, GFI, AGFI, IFI, CFI, TLI, RMSEA, and PCLOSE) are within the recommended thresholds suggested by Hair et al. (2009), Byrne (2010), and Singh et al. (2018). Therefore, this confirms that the overall fit of the model is acceptable.

5.2 Integrated structural model and hypothesis testing

The integrated model ($N=643$) was also tested after confirming the factor structure in the CFA model. In the case of the present study, the goodness of fit of the integrated structural model was found to be generally good given the observed values: CMIN/DF = 1.935, GFI = 0.865, AGFI = 0.851, IFI = 0.952, TLI = 0.949, CFI = 0.952, PCLOSE = 1, and RMSEA = 0.038. All the standardized item loadings were above 0.60, as shown in Table 4. In addition, Fig. 4 shows the obtained results from the structural model. All the hypotheses were supported except for H12. The most significant relationships were observed between AC → PN ($\beta=0.436$) followed by PE → INT ($\beta=0.292$).

5.3 Multigroup moderation

The fit of the unconstrained measurement model for the Indian and Spanish groups was confirmed to be adequate (χ^2/DF = 1.428; CFI = 0.953), meaning that the model is configurable invariant. On the other hand, constraining both models to be considered equal led to the Chi-square difference test being significant at $p=0.000$. Therefore, groups were different at the model level. Further testing revealed that the criteria of metric invariance across the different country types were met.

Multigroup moderation analysis (MGA) was conducted to assess the integrated model (India, $N=378$; Spain, $N=265$). The impact of the different characteristics of the Indian and Spanish respondents was compared. The critical ratio difference (CRD) test was used to compare the Indian and Spanish samples. Table 5 shows the moderating role of national cultural dimensions.

The MGA results (Table 5) demonstrate national culture moderates intentions to adopt EVs. Specifically, in terms of performance expectancy (PE), the significant CRD value of 2.91 for H15a indicates a substantial difference in the strength of the relationship between PE and intentions to adopt EVs in India and Spain. The higher path estimate for H15a in the Spain sample implies that the relationship between PE and intentions to adopt EVs is stronger in Spain than in India. Nevertheless, both path estimates are optimistic, indicating that PE significantly predicts intentions to adopt EVs in both countries. This finding highlights the role of a high level of power distance in certain national cultures in adopting EVs. In such cultures, individuals may be more likely to rely on the opinions and decisions of authority figures, such as government officials or industry leaders, to adopt EVs. The

Table 2 Correlations and square root of AVE for the different dimensions in the integrated model

	BIV	EE	AC	ALV	SI	PE	EC	INT	PN	FC	AR	EGV	OTC	HM
BIV	0.870													
EE	0.162	0.881												
AC	0.330	0.235	0.861											
ALV	0.176	0.105	0.346	0.831										
SI	0.108	0.099	0.164	0.028	0.896									
PE	0.179	−0.171	0.329	0.127	0.115	0.862								
EC	0.311	0.318	0.631	0.255	0.170	0.300	0.856							
INT	0.149	0.139	0.421	0.176	0.198	0.484	0.489	0.842						
PN	0.186	0.122	0.480	0.374	0.069	0.241	0.346	0.402	0.832					
FC	−0.026	−0.159	−0.070	0.172	0.055	0.080	−0.152	0.147	0.298	0.805				
AR	0.060	−0.067	0.199	0.255	0.037	0.111	0.077	0.185	0.364	0.338	0.781			
EGV	0.015	0.108	0.137	0.109	0.052	0.066	0.211	0.108	0.054	−0.095	−0.066	0.810		
OTC	0.227	0.121	0.219	0.248	0.079	0.106	0.333	0.218	0.252	0.121	0.199	0.123	0.877	
HM	0.020	−0.071	0.311	0.164	0.131	0.433	0.308	0.498	0.296	0.190	0.208	0.132	0.131	0.826

Results in the diagonal are taken from the square root of average variance extracted (AVE). These values should exceed the inter-construct correlations for adequate discriminant validity

PE performance expectancy, *EE* effort expectancy, *SI* social influence, *FC* facilitating conditions, *HM* hedonic motivation, *EC* environmental concern, *INT* intentions to adopt, *PN* personal norms, *AC* awareness of consequences, *AR* ascription of responsibility, *ALV* altruistic values, *EGV* egoistic values, *BIV* biospheric values, *OTC* openness to change

findings can lead to a greater emphasis on EVs' perceived legitimacy and credibility and the importance of social norms and expectations in shaping attitudes and behaviors related to EV adoption.

The MGA also found a positive relationship between the intention to adopt EVs and hedonic motivations (HM) in India and Spain. The path estimate for H21 in India was 0.159 with a p value of 0.000, while for Spain, it was 0.335 with a p value of 0.000, indicating a stronger relationship between INT and HM in Spain. The result supports Hypothesis 21, which suggests that societies with higher levels of indulgence have a stronger connection between HM and intentions to adopt EVs. The findings imply that societies with higher levels of indulgence may prioritize the pleasure and enjoyment of owning and using EVs, leading to a stronger relationship between HM and their intentions to adopt EVs. Therefore, understanding cultural and social factors is essential in designing effective policies to promote EV adoption in different countries and societies.

Moreover, Hypothesis 19c suggests that the relationship between SI and the intention to adopt EVs is higher in societies with a high level of uncertainty avoidance. The results from the India sample indicate a positive but insignificant relationship between INT and SI, while the Spain sample shows a stronger positive association. The significant CRD for H21 between the two samples suggests that the relationship between SI and the intention to adopt EVs is stronger in Spain than in India, possibly due to the higher level of uncertainty avoidance in Spain. Overall, these findings support Hypothesis 19c and indicate that cultural factors such as uncertainty avoidance influence the relationship between SI and the intention to adopt EVs.

Furthermore, the study results support Hypothesis 16a, which proposes that the relationship between AR and PN is higher in national cultures with a high level of collectivism compared to those where individualism is prioritized. Although Spain has a slightly higher level of individualism than India, according to Fig. 2, the path estimates for H16a indicate a positive and significant relationship between AR and PN in India and Spain, with a stronger relationship observed in the Spain sample. This finding suggests that individuals in more collectivistic cultures may be more likely to view AR as an essential factor in shaping their personal norms. The significant CRD for H16a between the two samples (2.136) suggests that the relationship between AR and PN significantly differs between the two cultural contexts. A higher level of relationship is observed in Spain, despite having a slightly higher level of individualism than in India. This suggests that cultural factors such as collectivism and individualism influence the relationship between AR and PN and could have important implications for understanding the factors that shape individuals' intentions to adopt EVs in different cultural contexts. The study suggests cultural factors should be considered when developing strategies to promote EV adoption. The relationship between AR and PN may vary depending on the cultural context.

Finally, the results from MGA support Hypothesis 20, which proposes that the relationship between facilitating conditions (FCs) and the intention to adopt (INT) is higher in societies with a higher long-term orientation than in short-term-oriented cultures. The path estimate for H20 in the India sample indicates a positive and significant relationship between INT and FCs. This suggests that individuals in India with a higher long-term orientation may be more likely to view FCs as essential in shaping their intentions to adopt electric vehicles. In contrast, the weaker and non-significant relationship between INT and FCs observed in the Spain sample suggests that individuals in Spain with a lower long-term orientation may place less emphasis on FCs in their intentions to adopt electric vehicles. The significant CRD for H20 between the two samples (-1.660) indicates that

Table 3 Goodness-of-fit indices for the integrated model

Goodness-of-fit indices	Observed value	Recommended criteria	References
Normalized Chi-square (CMIN/DF)	1.823	< 3 good < 5 permissible	Abbasi et al. (2023), Aboutorabi Kashani et al. (2023), Hair et al. (2009), Singh et al. (2018), Byrne (2010)
p-value	< 0.001	< 0.05	
Goodness-of-Fit Index (GFI)	0.877	> 0.90	
Adjusted GFI	0.856	> 0.80	
Incremental Fit Index (IFI)	0.963	> 0.90	
Comparative Fit Index (CFI)	0.962	0.90 < CFI < 1	
Tucker-Lewis's Index (TLI)	0.958	0.90 < TLI < 1	
Root Mean Square Error of Approximation (RMSEA)	0.036	< 0.05 good fit < 0.08 acceptable fit	
PCLOSE	1	> 0.05	

Table 4 Results of the integrated SEM model

Hypotheses	Path	Standardized factor loadings	t-value	p-value	Support
H1	PE → INT	0.292	6.965	***	Yes
H2	EE → INT	0.113	3.133	0.002**	Yes
H3	SI → INT	0.077	2.188	0.029*	Yes
H4	FC → INT	0.098	2.497	0.013*	Yes
H5	HM → INT	0.265	6.162	***	Yes
H6	EC → INT	0.278	6.923	***	Yes
H7	PN → INT	0.151	3.649	***	Yes
H8	AR → PN	0.275	6.753	***	Yes
H9	AC → PN	0.436	10.509	***	Yes
H10	AC → AR	0.218	5.184	***	Yes
H11	ALV → AC	0.202	5.391	***	Yes
H12	EGV → AC	0.018	0.477	0.633	No
H13	BIV → AC	0.285	6.604	***	Yes
H14	OTC → AC	0.106	2.461	0.014*	Yes

PE performance expectancy, *EE* effort expectancy, *SI* social influence, *FC* facilitating conditions, *HM* hedonic motivation, *EC* environmental concern, *INT* intentions to adopt, *PN* personal norm, *AC* awareness of consequences, *AR* ascription of responsibility, *ALV* altruistic values, *EGV* egoistic values, *BIV* biospheric values, *OTC* openness to change

*$p < .05$; **$p < .01$; ***$p < .001$

the relationship between FCs and INT is significantly different between the two cultural contexts, with a higher relationship observed in the India sample. This suggests that cultural factors such as long-term orientation are essential in determining the relationship between FCs and INT and could have implications for strategies to promote electric vehicle

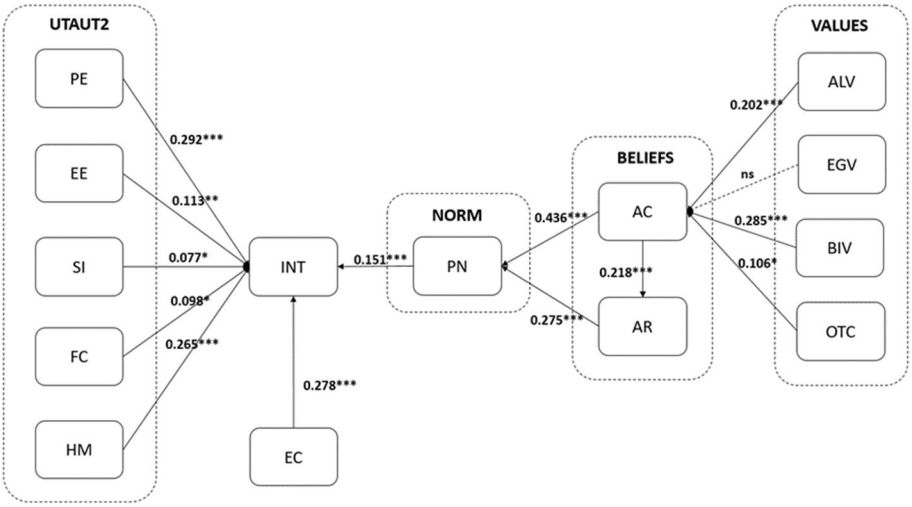

Fig. 4 Integrated model ($N = 643$). *Note* $*p < .05$, $**p < .01$, $***p < .001$; *ns* non-significant. *PE* performance expectancy, *EE* effort expectancy, *SI* social influence, *FC* facilitating conditions, *HM* hedonic motivation, *EC* environmental concern, *INT* intentions to adopt, *PN* personal norm, *AC* awareness of consequences, *AR* Ascription of responsibility, *ALV* altruistic values, *EGV* egoistic values, *BIV* biospheric values, *OTC* openness to change

Table 5 Multigroup analysis of intentions to adopt EVs in India and Spain

Hypotheses	Path	India (N = 378)		Spain (N = 265)		Critical ratio difference (CRD)
		Estimate	*p* value	Estimate	*p* value	
H11	ALG → AC	0.368	0.000	0.522	0.000	1.048
H12	EGV → AC	− 0.038	0.505	0.004	0.956	0.465
H13	BIV → AC	0.120	0.046	0.168	0.007	0.558
H14	OTC → AC	− 0.009	0.880	0.048	0.411	0.674
H10	AC → AR	0.262	0.000	0.347	0.000	1.072
H16b	AC → PN	0.302	0.000	0.392	0.000	0.945
H16a	AR → PN	0.216	0.000	0.441	0.000	2.136**
H18, H19c	SI → INT	0.017	0.519	0.163	0.007	2.197**
H15c	EC → INT	0.194	0.000	0.139	0.029	− 0.699
H20	FC → INT	0.185	0.007	0.021	0.764	− 1.66*
H21	HM → INT	0.159	0.000	0.335	0.000	2.291**
H7	PN → INT	0.177	0.000	0.113	0.026	− 0.896
H15b, H19b	EE → INT	0.028	0.486	− 0.005	0.953	− 0.363
H15a, H19A	PE → INT	0.163	0.000	0.422	0.000	2.91***

PE performance expectancy, *EE* effort expectancy, *SI* social influence, *FC* facilitating conditions, *HM* hedonic motivation, *EC* environmental concern, *INT* intentions to adopt, *PN* personal norm, *AC* awareness of consequences, *AR* ascription of responsibility, *ALV* altruistic values, *EGV* egoistic values, *BIV* Biospheric values, *OTC* openness to change

$***p$ value < 0.01; $**p$ value < 0.05; $*p$ value < 0.10

adoption in different cultural contexts. The study findings suggest cultural factors should be considered when developing strategies to promote electric vehicle adoption. The relationship between FCs and INT may vary depending on the cultural context.

6 Implications for policy and practice

The study's main objective is to integrate and generally review the UTAUT2 and VBN theories in the context of electric vehicle adoption intention (EVADINT). Also, the second purpose of the present study was to explore the role of culture in EVADINT by comparing two different societies, such as India and Spain. The motivation for this study was that the integrated model could yield a full explanation for EV adoption and validate the integrated model across different cultures.

The proposed theoretical behavioral model, EVADINT, integrates UTAUT2-VBN and confirms its effectiveness. The model's hypotheses are mostly supported, except for one case (H12: EGV → AC). The squared multiple correlation (SMC) is a widely used metric for evaluating the explanatory power of statistical models. It reflects the proportion of variance in the dependent variables explained by the independent variables (Shmueli & Koppius, 2011). In the context of the Indian EV adoption model, the SMC for the dependent variable "Intention" yields a moderate effect size of 0.544. This means that the independent variables in the model can explain approximately 54.4% of the variance in the intention to adopt EVs, providing valuable insights into the relationships between the variables (Moore et al., 2013).

However, caution is advised when comparing the explanatory power of different models. Factors such as sample size, variable selection, data sources, and statistical techniques

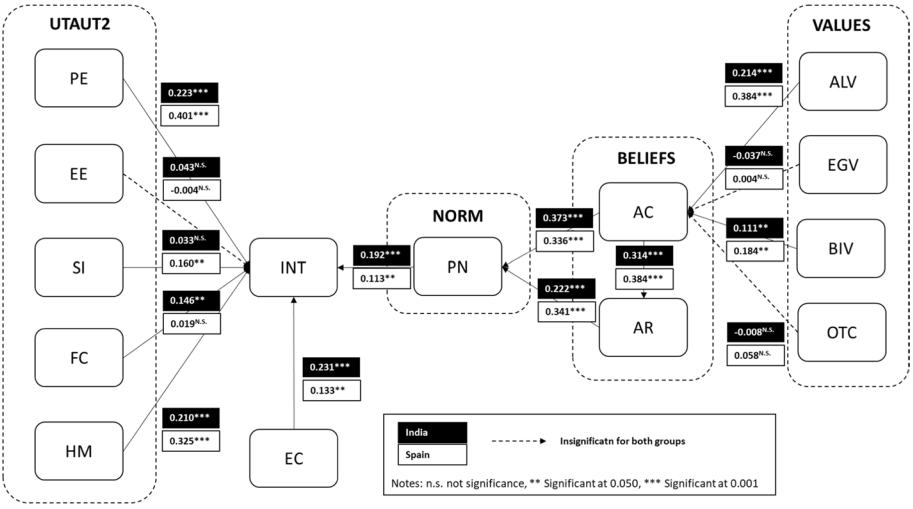

Fig. 5 Results from hypothesis testing in India and Spain. *Note PE* performance expectancy, *EE* effort expectancy, *SI* social influence, *FC* facilitating conditions, *HM* hedonic motivation, *INT* intentions to adopt, *PN* personal norm, *AC* awareness of consequences, *ALV* altruistic values, *EGV* egoistic values, *BIV* biospheric values, *OTC* openness to change

can influence the results (Mital et al., 2018). Therefore, while the Indian model explains a significant proportion of the variance in the intention to adopt electric vehicles, it is essential to consider these factors when interpreting the results and drawing conclusions about the model's effectiveness. On the other hand, the Spanish EV adoption model exhibits a significantly higher SMC, which is 0.983 for the "Intention" variable, indicating a more remarkable ability to account for the variance in the intention to adopt EVs. This shows a much stronger explanatory power compared to the Indian model. However, the caution mentioned earlier still applies, and it is crucial to consider the factors above when comparing the models and interpreting the results.

Most of the hypotheses were supported in both models (see Fig. 5). In this sense, results revealed that PE is significant in the case of EVADINT for both Indian and Spanish respondents (H1). This result is consistent with previous studies in the literature (Jain et al., 2022; Khazaei, 2019), implying that participants considered electric vehicles an excellent alternative to traditional fuel vehicles in terms of utility and efficiency. EE did not have a significant influence in either sample (H2), confirming results from previous studies (Jain et al., 2022) except for some specific research (Abbasi et al., 2021a, 2021b). In this sense, EE may not be considered an appropriate construct to measure EVADINT, implying that respondents' decision-making is unaffected by EV ease of use. In addition, SI significantly influences EVADINT in the case of the Spanish sample but not for the Indian respondents (H3). The opposite occurs in H4: FCs significantly affect EVADINT in the group of Indian respondents as opposed to the Spanish sample. Finally, as for UTAUT2, HM is significant for EVADINT for Indian and Spanish respondents (H5). These results support previous findings in the literature (Khan & Hammed, 2019). In general, participants perceived EVs as a joy to drive. In addition, EC significantly influences EVADINT in both samples (H6), whereby both countries' participants consider environmental issues to be essential and EVs to be a less polluting option. In line with other studies (Cui et al., 2021; Liu et al., 2021), these motivations help improve EVADINT.

As for the VBN theory, all hypotheses are supported in both samples except H12, where EGV ➔ AC and H14, with OTC ➔ AC. PN is also a key predictor of EVADINT in both countries (H7), as other studies have already corroborated (Liao et al., 2017; Westin et al., 2018). In this regard, the central variable in the VBN theory, i.e., PN, was confirmed. Respondents are guided by their moral standards to opt for a more environmentally friendly offering in the automotive market. Also, both AR and AC significantly influence PN (H8 and H9) in both samples, in line with previous research in the literature (Ashra et al., 2021; He & Zhan, 2018). This finding implies that the more individuals are aware of the negative consequences of fossil fuel-powered vehicles on the environment and take responsibility for using polluting products, the more likely they are to adopt EVs. Likewise, AR is related to AC (H10). Finally, concerning the obtained results, the present study confirmed that ALV and BIV are vital predictors of AC (H11 and H13) for both respondents. At the same time, EGV and OTC do not significantly influence AC (H12 and H14). As Simsekoglu (2018) demonstrated, behaviors can be motivated by the consequences on the well-being of other people, i.e., ALV, avoiding implications on the environment, and BIV are significant predictors of EVADINT. However, EGV in the case of self-centered individuals (Kim & Seock, 2019) and OTC (Nordlund et al., 2016) for intellectual and emotional self-fulfillment do not significantly influence the two assessed groups.

Results show differences between the two countries' samples when analyzing the moderating effect of culture. In this regard, there were significant differences in Hofstede's six cultural dimensions (power distance, individualism, masculinity, uncertainty avoidance,

long-term orientation, and indulgence). It is confirmed that due to the greater power distance observed in India compared to Spain, the impact of PE on INT and FC on INT is more significant in the Indian sample. Furthermore, in the case of India as a country with a higher level of collectivism, the impact of EC on INT is significantly more significant than the group of Spanish respondents. Similar results were obtained for the relationship between AR and AC on PN. Individuals in collectivist cultures tend to engage in more environmentally friendly behaviors.

On the other hand, Spain presents a higher occurrence of feminine values in its society than India. In this regard, it is confirmed that the impact of SI on INT is significantly higher in the case of Spain. Feminine societies value the quality of life and care, being concerned about general well-being. Therefore, these cultures are more influenced by SI. Societies with high uncertainty avoidance, such as Spain's, would be more concerned with the performance of innovations. In addition, the level of SI in such societies is more significant since the perceived risk is also greater. Usually, people with a high level of long-term orientation tend to have a positive attitude toward eco-friendly products. They are focused on the future and well-being of society. Therefore, it is confirmed that in the case of the Indian group of respondents, FC on INT is significantly higher compared to the Spanish group. Finally, concerning the indulgence dimension, Spanish respondents obtained higher values, indicating that they prioritize the enjoyment of life and living in the present moment to a greater extent. In this sense, it is confirmed that HM had a significantly more significant impact than the group from India.

6.1 Managerial contributions

Results from the present study show some practical implications. First, awareness of consequences plays a central role in the proposed behavioral model. Major market players encouraging the use of EVs should focus on promoting the negative impacts of using combustion vehicles. It is recommended to use many available online and offline media to publicize the pollution problems caused by traditional fossil fuel-powered vehicles. This finding will create a general awareness in the population that they should develop a moral obligation to respect the environment by consuming green products such as electric vehicles.

Secondly, performance expectancy constitutes another essential element regarding the intention to buy EVs. PE is related to attributes such as reliability, performance, speed, (Jain et al., 2022) and driving range of electric vehicles (Kasper & Abdelrahman, 2020). Therefore, it is recommended that manufacturers focus on improving the above-mentioned vehicle characteristics (Higueras-Castillo et al., 2021), showcasing safety among their qualities, and incentivizing battery charging infrastructure. Similarly, product performance should be adequately communicated to potential users. This task could be accomplished by highlighting the advantages of EVs over traditional vehicles, for example, in vehicle maintenance.

Finally, it is advisable to consider the cultural differences observed in marketing strategies. For example, India values performance expectancy and facilitating conditions more than Spain. Although, as noted above, it is essential for both, with a greater emphasis on the case of India. Therefore, it would be exciting to focus on these product attributes related to the characteristics of the population. On the other hand, India is a more collectivist society with a greater regard for the group's well-being, which would give greater importance to environmental values while developing a moral obligation to respect the well-being of

others. Therefore, promoting the values above should be encouraged to a greater extent in marketing campaigns.

On the other hand, the Spanish group of respondents exhibited a more significant degree of uncertainty avoidance. In this sense, social influence helps mitigate the perceived risk of driving an electric vehicle. Therefore, it is advisable to encourage word of mouth since recommendations from friends and relatives are critical when purchasing goods and services. Another difference worth highlighting would be that of hedonic motivations in the case of the Spanish group, i.e., the emotions, sensations, enjoyment, and pleasure of driving an electric vehicle are considered more relevant than in the case of the Indian group. Therefore, this is a valuable attribute when it comes to communication campaigns.

6.2 Limitations and avenues for future research

The present study's limitations should be considered for future research. First, it focused only on the constructs positively associated with usage intention and did not consider the constructs negatively associated with usage intention. In future research, it is recommended to study other variables such as perceived risk, privacy concern, and range. Another significant limitation would be the sample. On the one hand, the choice of two different countries to establish two groups of respondents should be expanded to test the adequacy of the UTATU2-VBN integration. Differences in the distribution of the two samples regarding gender and age should also be considered. In addition, the data collection method employed also has several limitations.

The present study adopts a cross-sectional approach. In this regard, a longitudinal perspective is recommended to reveal changes in adopting new technology over time. This avenue is beneficial in societies such as those of India and Spain, as they are at an early stage of product adoption. Regarding the adopted cross-cultural approach, it was based on Hofstede's theory and the cultural dimensions published on his website. Measuring the cultural dimensions through the questionnaire would be interesting for future research.

7 Conclusion

In conclusion, this cross-cultural study offers insightful information on the variables affecting EV adoption intentions in Spain and India. The integrated model, which combines the UTAUT2 and VBN theories while considering national culture, finds considerable disparities between the two countries at the model level, indicating that cultural considerations are important in determining EV adoption aspirations. The results show the value of power distance in societies where reliance on the judgments and views of authority figures greatly impacts EV adoption. The study further emphasizes the role of pleasure and enjoyment in promoting EV adoption by highlighting the larger association between hedonic motives and EV adoption intentions in countries with higher levels of indulgence. The connections between characteristics and EV adoption intentions were also influenced by cultural factors such as uncertainty avoidance, collectivism, and long-term orientation, highlighting the need to consider cultural nuances when developing strategies and interventions to promote sustainable mobility.

These research findings have real-world applications for decision-makers and other interested parties in the transportation industry. Policymakers can create custom policies,

interventions, and communication techniques that resonate with cultural contexts by acknowledging and addressing the cultural elements influencing people's attitudes and behaviors toward EV adoption. Such focused strategies will ease the transition to more environmentally friendly transport systems and support sustainable growth. This study also contributes to the literature on sustainable transportation and cross-cultural research by incorporating various theoretical frameworks and emphasizing the significance of cultural issues. Future research can build on these findings by analyzing more cultural facets, looking at various geographical areas, and gauging the long-term effects of cultural factors on EV adoption. These initiatives will improve our comprehension of the intricate connection between culture, individual attitudes, and adopting environmentally friendly transportation, ultimately leading to a more environmentally friendly and sustainable future.

Appendix A: Results from the integrated measurement model

Constructs and items measured	Standardized factor loadings	Standard error
Performance expectancy (adapted from Khan et al., 2021; Udo et al., 2016; Venkatesh et al., 2012; Wahl et al., 2020). (Cronbach's $\alpha = 0.920$; CR = 0.920; AVE = 0.743; MSV = 0.234)		
Using an electric vehicle will help me get to my destination on time	0.865***	
Using an electric vehicle would be more cost effective	0.875***	0.034
Using an electric vehicle will serve as a good alternative to conventional vehicles	0.868***	0.035
Using electric vehicles would be useful for me	0.840***	0.038
Effort expectancy (adapted from Wahl et al., 2020; Shaw & Sergueeva, 2019; Udo et al., 2016; Cronbach's α = 0.932; CR = 0.933; AVE = 0.777; MSV = 0.101)		
My interaction with the EV would be clear and understandable	0.857***	
Learning to use an EV would be easy for me	0.912***	0.037
I would find EV easy to use	0.890***	0.036
It would be easy for me to become skillful at using Electric Vehicles	0.865***	0.039
Social influence (adapted from Asadi et al., 2021; Khazaei et al., 2021; Hamzah & Tanwir, 2021; He et al., 2018; Udo et al., 2016; Cronbach's $\alpha = 0.942$; CR = 0.943; AVE = 0.803; MSV = 0.039)		
Using an electric vehicle would be positive for society	0.889***	
People who are important to me would think that I should use an electric vehicle	0.906***	0.027
I would use an electric vehicle if a number of other people use it	0.904***	0.029
My family and friends would be upset if I did not adopt an electric vehicle	0.886***	0.029
I would receive recognition from others if I adopted an electric vehicle	0.889***	
Facilitating conditions (adapted from Asadi et al., 2021; Khazaei et al., 2021; Khan et al., 2021; Udo et al., 2016; Venkatesh et al., 2012; Cronbach's $\alpha = 0.877$; CR = 0.881; AVE = 0.649; MSV = 0.114)		
I would have the necessary resources to purchase an electric vehicle	0.793***	
Using an electric vehicle would be compatible with other technologies I use	0.827***	0.038
I would have knowledge, resources, services, and facilities to use an electric vehicle	0.796***	0.042
I would be constrained by the lack of infrastructure and other facilities to use an electric vehicle	0.805***	0.040

Constructs and items measured	Standardized factor loadings	Standard error
Hedonic motivation (adapted from Asadi et al., 2021; Khazaei et al., 2021; Al-Azawei & Alowayr, 2020; Cronbach's $\alpha = 0.865$; CR = 0.866; AVE = 0.682; MSV = 0.248)		
Driving an electric vehicle would be a pleasant experience compared to conventional cars	0.819***	
An electric vehicle would be a very exciting new technology	0.851***	0.048
I would prefer to drive an electric vehicle instead of a conventional car	0.807***	0.049
Environmental concern (adapted from Khazaei et al., 2021; Hamzah & Tanwir, 2021; Chen et al., 2021; Adnan et al., 2018; Cronbach's $\alpha = 0.916$; CR = 0.916; AVE = 0.732; MSV = 0.398)		
I think environmental problems are becoming more and more serious in recent years	0.858***	
I think EVs contribute to saving the environment for the next generation	0.852***	0.035
I think EVs cause less pollution	0.878***	0.035
I think individuals have the responsibility to protect the environment	0.834***	0.036
Personal norm (adapted from Asadi et al., 2021; Hamzah & Tanwir, 2021; Wahl et al., 2020; He & Zhan, 2018; Udo et al., 2016; Cronbach's $\alpha = 0.899$; CR = 0.900; AVE = 0.692; MSV = 0.230)		
I feel a strong personal obligation to use energy wisely	0.801***	
I feel a moral obligation to protect the environment	0.895***	0.044
I feel that it is important to travel as little as possible by fossil fuel powered cars	0.862***	0.044
I feel it is important that people in general protect the environment	0.808***	0.045
Awareness of consequences (adapted from Asadi et al., 2021; Wahl et al., 2020; He & Zhan, 2018; Udo et al., 2016; Cronbach's $\alpha = 0.929$; CR = 0.919; AVE = 0.740; MSV = 0.398)		
Conventional vehicles contribute to environmental damage	0.868***	
Depletion of fossil fuel constitutes a major problem	0.861***	0.028
Driving conventional vehicles has an effect on global warming	0.861***	0.043
Global warming is a problem for society	0.852***	0.045
Ascription of responsibility (adapted from Asadi et al., 2021; Wahl et al., 2020; He & Zhan, 2018; Udo et al., 2016; Cronbach's $\alpha = 0.874$; CR = 0.861; AVE = 0.610; MSV = 0.132)		
I have the responsibility to preserve resources and to ensure quality of life for future generations	0.873***	
I have the responsibility to influence the vehicle industry toward more environmentally friendly solutions	0.848***	0.042
I feel personally responsible for the environmental problems resulting from the type of vehicle I own	0.688***	0.044
I feel joint responsibility for the negative consequences of conventional vehicles	0.697***	0.046
Altruistic values (adapted from Chen et al., 2021; Ghazali et al., 2019; Barbarossa et al., 2017; Nayum et al., 2016; Cronbach's $\alpha = 0.898$; CR = 0.899; AVE = 0.690; MSV = 0.140)		
Equality (equal opportunity for all)	0.822***	
Helpfulness (work for the welfare of the others)	0.853***	0.041
Social justice (correcting injustice, care for the weak)	0.881***	0.041
Preserving nature (protecting the environment)	0.762***	0.043
Egoistic values (adapted from Chen et al., 2021; Ghazali et al., 2019; Barbarossa et al., 2017; Nayum et al., 2016; Cronbach's $\alpha = 0.850$; CR = 0.851; AVE = 0.656; MSV = 0.045)		
Authority (the right to lead or to command)	0.796***	
Social power (the right to control or dominate the others)	0.803***	0.052
Wealth (the possession of good materials and money)	0.830***	0.056

Constructs and items measured	Standardized factor loadings	Standard error
Biospheric values (adapted from Chen et al., 2021; Ghazali et al., 2019; Barbarossa et al., 2017; Nayum et al., 2016; Cronbach's $\alpha = 0.920$; CR = 0.903; AVE = 0.756; MSV = 0.109)		
Preventing pollution (preserving natural resources)	0.861***	
Respecting the planet (harmony with other species)	0.884***	0.035
Unity with nature (fitting into nature)	0.864***	0.037
Openness to change (adapted from Mehta et al., 2019; Barbarossa et al., 2017; Nayum et al., 2016; Cronbach's $\alpha = 0.908$; CR = 0.909; AVE = 0.769; MSV = 0.111)		
Freedom (freedom of action and thought)	0.872***	
Creativity (uniqueness, Imagination)	0.890***	0.038
A varied life (filled with challenge, novelty and change)	0.868***	0.036
Purchase intention (adapted from He & Zhan, 2018; Asadi et al., 2021; Wahl et al., 2020; Cronbach's $\alpha = 0.906$; CR = 0.907; AVE = 0.710; MSV = 0.248)		
Next time I buy a vehicle, I will consider buying an electric vehicle	0.801***	
I expect to drive an electric vehicle in the near future	0.895***	0.044
I have the intention to drive an electric vehicle in the near future	0.862***	0.044
I intend to adopt electric vehicle because it is environmentally friendly	0.808***	0.045

***$p < 0.001$; For composite reliability (CR > 0.70); convergent validity (CR > AVE > 0.50); discriminant validity (MSV < AVE); MSV maximum shared variance

Appendix B

Measure	India % (N = 378)	Spain % (N = 265)		India % (N = 378)	Spain % (N = 265)
Gender of respondent			*Daily distance driven (Km)*		
Male	83.1	55.1	Less than 25 km	32.5	24.2
Female	16.9	44.9	26–50 km	21.2	13.6
Age of respondent (in years)			More than 50 km	14.0	6.8
18 -25	34.9	55.3	I do not use the vehicle daily	32.3	55.5
26 -40	53.7	29.8	*Did you know about Electric Vehicles?*		
41 -55	10.8	14	Yes	84.4	97
Above 55	0.5	4.9	No	15.6	3
Education level			*Have you ever driven an electric vehicle?*		
Basic Schooling	0.5	0.4	Yes	14.3	10.2
Diploma and equivalent	0.8	23.4	No	85.7	89.8
Degree and equivalent	64.3	54	*Do you own an Electric vehicle?*		
Post-graduation and above	34.4	22.3	Yes	1.9	1.1
Driving experience expressed in years			No	98.1	98.9
1—5	36.8	26			
6- 10	16.4	14.3			

Measure	India % (N = 378)	Spain % (N = 265)	India % (N = 378)	Spain % (N = 265)
11—15	13.8	11.7		
Above 15	13.2	23		

Funding Funding for open access publishing: Universidad de Granada/CBUA.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Data availability Data are available by request to corresponding author.

Ethical approval Not applicable.

References

Abbasi, H. A., Johl, S. K., Shaari, Z. B. H., Moughal, W., Mazhar, M., Musarat, M. A., et al. (2021a). Consumer motivation by using unified theory of acceptance and use of technology towards electric vehicles. *Sustainability, 13*(21), 12177.

Abbasi, M., & Hadji Hosseinlou, M. (2022). Assessing Feasibility of overnight-charging electric bus in a real-world BRT system in the context of a developing country. *Scientia Iranica, 29*(6), 2968–2978.

Abbasi, M., Mamdoohi, A. R., Sierpiński, G., & Ciari, F. (2023). Usage intention of shared autonomous vehicles with dynamic ride sharing on long-distance trips. *Sustainability, 15*(2), 1649.

Abbasi, S., Daneshmand-Mehr, M., & Kanafi, A. G. (2021b). The sustainable supply chain of CO2 emissions during the coronavirus disease (COVID-19) pandemic. *Journal of Industrial Engineering International, 17*(4), 83–108.

Abbasi, S., Daneshmand-Mehr, M., & Ghane Kanafi, A. (2022a). Green closed-loop supply chain network design during the coronavirus (COVID-19) Pandemic: A case study in the Iranian Automotive industry. *Environmental Modeling and Assessment, 28*, 1–35.

Abbasi, S., Khalili, H. A., Daneshmand-Mehr, M., & Hajiaghaei-Keshteli, M. (2022b). Performance measurement of the sustainable supply chain during the COVID-19 Pandemic: A real-life case study. *Foundations of Computing and Decision Sciences, 47*(4), 327–358.

Aboutorabi Kashani, M., Abbasi, M., Mamdoohi, A. R., & Sierpiński, G. (2023). The role of attitude, travel-related, and socioeconomic characteristics in modal shift to shared autonomous vehicles with ride sharing. *World Electric Vehicle Journal, 14*(1), 23.

Adnan, N., Md Nordin, S., Hadi Amini, M., & Langove, N. (2018). What make consumer sign up to PHEVs? Predicting Malaysian consumer behavior in adoption of PHEVs. *Transportation Research Part a: Policy and Practice, 113*, 259–278. https://doi.org/10.1016/j.tra.2018.04.007

Al-Azawei, A., & Alowayr, A. (2020). Predicting the intention to use and hedonic motivation for mobile learning: A comparative study in two Middle Eastern countries. *Technology in Society, 62*, 101325. https://doi.org/10.1016/j.techsoc.2020.101325

Alcántara-Pilar, J. M., del Barrio-García, S., Crespo-Almendros, E., & Porcu, L. (2017). Toward an understanding of online information processing in e-tourism: Does national culture matter? *Journal of Travel and Tourism Marketing, 34*(8), 1128–1142.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*. https://doi.org/10.1037/0033-2909.103.3.411

Anfinsen, M., Lagesen, V. A., & Ryghaug, M. (2019). Green and gendered? Cultural perspectives on the road towards electric vehicles in Norway. *Transportation Research Part D: Transport and Environment, 71*, 37–46.

Asadi, S., Nilashi, M., Samad, S., Abdullah, R., Mahmoud, M., Alkinani, M. H., & Yadegaridehkordi, E. (2021). Factors impacting consumers' intention toward adoption of electric vehicles in Malaysia. *Journal of Cleaner Production, 282*, 124474. https://doi.org/10.1016/j.jclepro.2020.124474

Ashmore, D. P., Pojani, D., Thoreau, R., Christie, N., & Tyler, N. A. (2018). The symbolism of 'eco cars' across national cultures: Potential implications for policy formulation and transfer. *Transportation Research Part D: Transport and Environment, 63*, 560–575.

Ashraf Javid, M., Ali, N., Abdullah, M., Campisi, T., & Shah, S. A. H. (2021). Travelers' adoption behavior towards electric vehicles in lahore, Pakistan: An extension of Norm activation model (NAM) theory. *Journal of Advanced Transportation, 2021*.

Axsen, J., Orlebar, C., & Skippon, S. (2013). Social influence and consumer preference formation for pro-environmental technology: The case of a UK workplace electric-vehicle study. *Ecological Economics, 95*, 96–107.

Barbarossa, C., Beckmann, S. C., De Pelsmacker, P., Moons, I., & Gwozdz, W. (2015). A self-identity based model of electric car adoption intention: A cross-cultural comparative study. *Journal of Environmental Psychology, 42*, 149–160.

Barbarossa, C., De Pelsmacker, P., & Moons, I. (2017). Personal values, green self-identity and electric car adoption. *Ecological Economics, 140*, 190–200. https://doi.org/10.1016/j.ecolecon.2017.05.015

Bhalla, P., Ali, I. S., & Nazneen, A. (2018). A study of consumer perception and purchase intention of electric vehicles. *European Journal of Scientific Research, 149*(4), 362–368.

Bhat, F. A., Verma, M., & Verma, A. (2022). Measuring and modelling electric vehicle adoption of Indian consumers. *Transportation in Developing Economies, 8*(1), 1–13.

Byrne, B. M. (2010). Structural equation modeling with AMOS: Basic concepts, applications, and programming, structural equation modeling.

Chen, C. F., Eccarius, T., & Su, P. C. (2021). The role of environmental concern in forming intentions for switching to electric scooters. *Transportation Research Part a: Policy and Practice, 154*, 129–144. https://doi.org/10.1016/j.tra.2021.10.010

Childers, T. L., Carr, C. L., Peck, J., & Carson, S. (2001). Hedonic and utilitarian motivations for online retail shopping behavior. *Journal of Retailing, 77*(4), 511–535.

Cleveland, M., Erdoğan, S., Arıkan, G., & Poyraz, T. (2011). Cosmopolitanism, individual-level values and cultural-level values: A cross-cultural study. *Journal of Business Research, 64*(9), 934–943.

Cui, L., Wang, Y., Chen, W., Wen, W., & Han, M. S. (2021). Predicting determinants of consumers' purchase motivation for electric vehicles: An application of Maslow's hierarchy of needs model. *Energy Policy, 151*, 112167.

Curtale, R., Liao, F., & van der Waerden, P. (2021). User acceptance of electric car-sharing services: The case of the Netherlands. *Transportation Research Part a: Policy and Practice, 149*, 266–282.

De Mooij, M., & Hofstede, G. (2010). The Hofstede model: Applications to global branding and advertising strategy and research. *International Journal of Advertising, 29*(1), 85–110.

Degirmenci, K., & Breitner, M. H. (2017). Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transportation Research Part d: Transport and Environment, 51*, 250–260.

Dunlap, R. E., & Van Liere, K. D. (1978). The "new environmental paradigm." *The Journal of Environmental Education, 9*(4), 10–19.

Dunlap, R., Liere, K. V., Mertig, A., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues, 56*(3), 425–442.

Escandon-Barbosa, D., Salas-Paramo, J., Meneses-Franco, A. I., & Giraldo-Gonzalez, C. (2021). Adoption of new technologies in developing countries: The case of autonomous car between Vietnam and Colombia. *Technology in Society, 66*, 101674.

Featherman, M., Jia, S. J., Califf, C. B., & Hajli, N. (2021). The impact of new technologies on consumers beliefs: Reducing the perceived risks of electric vehicle adoption. *Technological Forecasting and Social Change, 169*, 120847.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res. This, 18*, 39–50.

Gansser, O. A., & Reich, C. S. (2021). A new acceptance model for artificial intelligence with extensions to UTAUT2: An empirical study in three segments of application. *Technology in Society, 65*, 101535.

Ghazali, E. M., Nguyen, B., Mutum, D. S., & Yap, S.-F. (2019). Pro-Environmental Behaviours and Value-Belief-Norm Theory: Assessing Unobserved Heterogeneity of Two Ethnic Groups. *Sustainability, 11*, 3237. https://doi.org/10.3390/su11123237

Gunawan, I., Redi, A. A. N. P., Santosa, A. A., Maghfiroh, M. F. N., Pandyaswargo, A. H., & Kurniawan, A. C. (2022). Determinants of customer intentions to use electric vehicle in Indonesia: An integrated model analysis. *Sustainability, 14*(4), 1972.

Gupta, M., Esmaeilzadeh, P., Uz, I., & Tennant, V. M. (2019). The effects of national cultural values on individuals' intention to participate in peer-to-peer sharing economy. *Journal of Business Research, 97*, 20–29.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate data analysis: A global perspective* (7th ed.). Prentice Hall.

Hamzah, M. I., & Tanwir, N. S. (2021). Do pro-environmental factors lead to purchase intention of hybrid vehicles? The moderating effects of environmental knowledge. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2020.123643

Haustein, S., & Jensen, A. F. (2018). Factors of electric vehicle adoption: A comparison of conventional and electric car users based on an extended theory of planned behavior. *International Journal of Sustainable Transportation, 12*(7), 484–496.

He, X., & Zhan, W. (2018). How to activate moral norm to adopt electric vehicles in China? An empirical study based on extended norm activation theory. *Journal of Cleaner Production, 172*, 3546–3556.

He, X., Zhan, W., & Hu, Y. (2018). Consumer purchase intention of electric vehicles in China: The roles of perception and personality. *Journal of Cleaner Production, 204*, 1060–1069. https://doi.org/10.1016/j.jclepro.2018.08.260

Higueras-Castillo, E., García-Maroto, I., Muñoz-Leiva, F., & Liébana-Cabanillas, F. (2022). Modelling sustainable mobility adoption from the urban population view (SMAUP model): The moderating effect of household size. *Research in Transportation Business and Management, 45*, 100878.

Higueras-Castillo, E., Guillén, A., Herrera, L. J., & Liébana-Cabanillas, F. (2021). Adoption of electric vehicles: Which factors are really important? *International Journal of Sustainable Transportation, 15*(10), 799–813.

Higueras-Castillo, E., Liébana-Cabanillas, F. J., Muñoz-Leiva, F., & García-Maroto, I. (2019a). Evaluating consumer attitudes toward electromobility and the moderating effect of perceived consumer effectiveness. *Journal of Retailing and Consumer Services, 51*, 387–398.

Higueras-Castillo, E., Molinillo, S., Coca-Stefaniak, J. A., & Liebana-Cabanillas, F. (2020b). Potential early adopters of hybrid and electric vehicles in Spain—Towards a customer profile. *Sustainability, 12*(11), 4345.

Higueras-Castillo, E., Molinillo, S., Coca-Stefaniak, J. A., & Liébana-Cabanillas, F. (2019b). Perceived value and customer adoption of electric and hybrid vehicles. *Sustainability, 11*(18), 4956.

Higueras-Castillo, E., Kalinic, Z., Marinkovic, V., & Liébana-Cabanillas, F. J. (2020a). A mixed analysis of perceptions of electric and hybrid vehicles. *Energy Policy*. https://doi.org/10.1016/j.enpol.2019.111076

Hofstede, G. (1980). *Cultures consequences: International differences in work-related values*. Sage.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Sage.

Hofstede, G., & McCrae, R. R. (2004). Personality and culture revisited: Linking traits and dimensions of culture. *Cross-Cultural Research, 38*(1), 52–88.

Huang, X., Lin, Y., Lim, M. K., Tseng, M. L., & Zhou, F. (2021). The influence of knowledge management on adoption intention of electric vehicles: Perspective on technological knowledge. *Industrial Management and Data Systems, 121*(7), 1481–1495.

IEA (2020). Tracking Transport 2020. https://policycommons.net/artifacts/1343391/tracking-transport-2020/1955535/

IEA (2023). Global EV Outlook 2023. Catching up with climate ambitions. https://www.iea.org/reports/global-ev-outlook-2023

Jain, N. K., Bhaskar, K., & Jain, S. (2022). What drives adoption intention of electric vehicles in India? An integrated UTAUT model with environmental concerns, perceived risk and government support. *Research in Transportation Business and Management, 42*, 100730.

Japutra, A., Vidal-Branco, M., Higueras-Castillo, E., & Molinillo, S. (2022). Unraveling the mechanism to develop health consciousness from organic food: A cross-comparison of Brazilian and Spanish millennials. *British Food Journal, 124*(1), 197–220.

Kapser, S., & Abdelrahman, M. (2020). Acceptance of autonomous delivery vehicles for last-mile delivery in Germany-Extending UTAUT2 with risk perceptions. *Transportation Research Part C: Emerging Technologies, 111*, 210–225.

Karp, D. G. (1996). Values and their effect on pro-environmental behavior. *Environment and Behavior, 28*(1), 111–133.

Khan, I. U., Hameed, Z., Khan, S. N., Khan, S. U., & Khan, M. T. (2021). Exploring the effects of culture on acceptance of online banking: A comparative study of Pakistan and Turkey by using the extended UTAUT model. *Journal of Internet Commerce*. https://doi.org/10.1080/15332861.2021.1882749

Khan, K., & Hameed, I. (2019). Determinants of sustainable consumption in high and low involvement Thananusak, T., Rakthin, S., Tavewatanaphan, T., & Punnakitikashem, P. (2017). Factors affecting the intention to buy electric vehicles: empirical evidence from Thailand. *International Journal of Electric and Hybrid Vehicles, 9*(4), 361–381.product categories. *Amazonia Investiga, 8*(20), 503–515.

Khazaei, H. (2019). The influence of personal innovativeness and price value on intention to use of electric vehicles in Malaysia. *European Online Journal of Natural and Social Sciences, 8*(3), 483.

Khazaei, H., & Tareq, M. A. (2021). Moderating effects of personal innovativeness and driving experience on factors influencing adoption of BEVs in Malaysia: An integrated SEM–BSEM approach. *Heliyon, 7*(9), e08072.

Kim, S. H., & Seock, Y. K. (2019). The roles of values and social norm on personal norms and pro-environmentally friendly apparel product purchasing behavior: The mediating role of personal norms. *Journal of Retailing and Consumer Services, 51*, 83–90.

Kuhn, M., & Jong, N. D. (2017). Does one really fit all? Cultural differences experiencing E-mobility. In *Marketing at the confluence between entertainment and analytics* (pp. 1565–1578). Springer, Cham.

Lee, J., Baig, F., Talpur, M. A. H., & Shaikh, S. (2021). Public intentions to purchase electric vehicles in Pakistan. *Sustainability, 13*(10), 5523.

Leonidou, L. C., Leonidou, C. N., & Kvasova, O. (2010). Antecedents and outcomes of consumer environmentally friendly attitudes and behaviour. *Journal of Marketing Management, 26*(13–14), 1319–1344.

Liao, F., Molin, E., & van Wee, B. (2017). Consumer preferences for electric vehicles: A literature review. *Transport Reviews, 37*(3), 252–275.

Liu, R., Ding, Z., Wang, Y., Jiang, X., Jiang, X., Sun, W., et al. (2021). The relationship between symbolic meanings and adoption intention of electric vehicles in China: The moderating effects of consumer self-identity and face consciousness. *Journal of Cleaner Production, 288*, 125116.

Loengbudnark, W., Khalilpour, K., Bharathy, G., Taghikhah, F., & Voinov, A. (2022). Battery and hydrogen-based electric vehicle adoption: A survey of Australian consumers perspective. *Case Studies on Transport Policy, 10*(4), 2451–2463.

López-Mosquera, N., & Sánchez, M. (2012). Theory of planned behavior and the value-belief-norm theory explaining willingness to pay for a suburban park. *Journal of Environmental Management, 113*, 251–262.

Manutworakit, P., & Choocharukul, K. (2022). Factors influencing battery electric vehicle adoption in Thailand—expanding the unified theory of acceptance and use of technology's variables. *Sustainability, 14*(14), 8482.

McLeay, F., Yoganathan, V., Osburg, V. S., & Pandit, A. (2018). Risks and drivers of hybrid car adoption: A cross-cultural segmentation analysis. *Journal of Cleaner Production, 189*, 519–528.

Mehta, A., Morris, N. P., Swinnerton, B., & Homer, M. (2019). The influence of values on E-learning adoption. *Computer Education, 141*, 103617. https://doi.org/10.1016/J.COMPEDU.2019.103617

Merhi, M., Hone, K., & Tarhini, A. (2019). A cross-cultural study of the intention to use mobile banking between Lebanese and British consumers: Extending UTAUT2 with security, privacy and trust. *Technology in Society, 59*, 101151.

Migliore, G., Wagner, R., Cechella, F. S., & Liébana-Cabanillas, F. (2022). Antecedents to the adoption of mobile payment in China and Italy: An integration of UTAUT2 and innovation resistance theory. *Information Systems Frontiers*, 1–24.

Mital, M., Chang, V., Choudhary, P., Papa, A., & Pani, A. K. (2018). Adoption of Internet of Things in India: A test of competing models using a structured equation modeling approach. *Technological Forecasting and Social Change, 136*, 339–346.

Moore, D. S., Notz, W. I., & Flinger, M. A. (2013). *The basic practice of statistics* (6th ed., p. 138). Freeman and Company.

Nayum, A., Klöckner, C. A., & Mehmetoglu, M. (2016). Comparison of socio-psychological characteristics of conventional and battery electric car buyers. *Travel Behaviour and Society, 3*, 8–20. https://doi.org/10.1016/j.tbs.2015.03.005

Nguyen, T. N., Lobo, A., & Greenland, S. (2017). The influence of cultural values on green purchase behaviour. *Marketing Intelligence and Planning, 35*(3), 377–396.

Nordlund, A., Jansson, J., & Westin, K. (2016). New transportation technology: Norm activation processes and the intention to switch to an electric/hybrid vehicle. *Transportation Research Procedia, 14*, 2527–2536.

Novotny, A., Szeberin, I., Kovács, S., & Máté, D. (2022). National culture and the market development of battery electric vehicles in 21 countries. *Energies, 15*(4), 1539.

OICA (2021). Registrations or sales of new vehicles—all types regions/countries [WWW Document]. http://www.oica.net/wp-content/uploads/total_sales_2019.pdf

Ong, A. K. S., German, J. D., Redi, A. A. N. P., Cordova, L. N. Z., Longanilla, F. A. B., Caprecho, N. L., & Javier, R. A. V. (2023). Antecedents of behavioral intentions for purchasing hybrid cars using sustainability theory of planned behavior integrated with UTAUT2. *Sustainability, 15*(9), 7657.

Osswald, S., Wurhofer, D., Trösterer, S., Beck, E., & Tscheligi, M. (2012). Predicting information technology usage in the car: towards a car technology acceptance model. In *Proceedings of the 4th international conference on automotive user interfaces and interactive vehicular applications* (pp. 51–58).

Perret, J. K., Udalov, V., & Fabisch, N. (2022). Motivations behind individuals' energy efficiency investments and daily energy-saving behavior: The case of China. *International Economics and Economic Policy, 19*(1), 129–155.

Poortinga, W., Steg, L., & Vlek, C. (2004). Values, environmental concern, and environmental behavior: A study into household energy use. *Environment and Behavior, 36*(1), 70–93.

Rahi, S., Mansour, M. M. O., Alghizzawi, M., & Alnaser, F. M. (2019). Integration of UTAUT model in internet banking adoption context: The mediating role of performance expectancy and effort expectancy. *Journal of Research in Interactive Marketing, 13*(3), 2040–7122.

Razmjoo, A., Ghazanfari, A., Jahangiri, M., Franklin, E., Denai, M., Marzband, M., et al. (2022). A comprehensive study on the expansion of electric vehicles in Europe. *Applied Sciences, 12*(22), 11656.

Rezvani, Z., Jansson, J., & Bengtsson, M. (2018). Consumer motivations for sustainable consumption: The interaction of gain, normative and hedonic motivations on electric vehicle adoption. *Business Strategy and the Environment, 27*(8), 1272–1283.

Sair, S. A., & Danish, R. Q. (2018). Effect of performance expectancy and effort expectancy on the mobile commerce adoption intention through personal innovativeness among Pakistani consumers. *Pakistan Journal of Commerce and Social Sciences (PJCSS), 12*(2), 501–520.

Saleem, M. A., Eagle, L., & Low, D. (2021). Determinants of eco-socially conscious consumer behavior toward alternative fuel vehicles. *Journal of Consumer Marketing*.

Schmalfuß, F., Mühl, K., & Krems, J. F. (2017). Direct experience with battery electric vehicles (BEVs) matters when evaluating vehicle attributes, attitude and purchase intention. *Transportation Research Part F: Traffic Psychology and Behaviour, 46*, 47–69.

Schuitema, G., Anable, J., Skippon, S., & Kinnear, N. (2013). The role of instrumental, hedonic and symbolic attributes in the intention to adopt electric vehicles. *Transportation Research Part a: Policy and Practice, 48*, 39–49.

Schwartz, S. (1975). The justice of need and the activation of humanitarian norms. *Journal of Social Issues, 31*(3), 111–136.

Schwartz, S. H. (1970). Moral decision making and behavior. *Altruism and Helping Behavior*, 127–141.

Schwartz, S. H. (1977). Normative influences on altruism. In *Advances in experimental social psychology* (Vol. 10, pp. 221–279). Academic Press.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In *Advances in experimental social psychology* (Vol. 25, pp. 1–65). Academic Press.

Sharif, M. S., Yaqub, R. M. S., Saleem, H. M. N., Iqbal, J., & Rasool, F. (2021). The consumers'intention to adopt hybrid electric vehicles in Pakistan; the role of cultural values. *International Journal of Management* (IJM), 12(4).

Shaw, N., & Sergueeva, K. (2019). The non-monetary benefits of mobile commerce: Extending UTAUT2 with perceived value. *International Journal of Information Management, 45*, 44–55.

Shmueli, G., & Koppius, O. R. (2011). Predictive analytics in information systems research. *MIS Quarterly*, 553–572.

Simsekoglu, Ö. (2018). Socio-demographic characteristics, psychological factors and knowledge related to electric car use: A comparison between electric and conventional car drivers. *Transport Policy, 72*, 180–186.

Singh, H., Singh, V., Singh, T., & Higueras-Castillo, E. (2023a). Electric vehicle adoption intention in the Himalayan region using UTAUT2–NAM model. *Case Studies on Transport Policy, 11*, 100946.

Singh, V., Kumar, A., & Singh, T. (2018). Impact of TQM on organisational performance: The case of Indian manufacturing and service industry. *Operations Research Perspectives, 5*, 199–217. https://doi.org/10.1016/j.orp.2018.07.004

Singh, V., Singh, T., Higueras-Castillo, E., & Cabanillas, F. J. L. (2023b). Sustainable road transportation adoption research: A meta and weight analysis, and moderation analysis. *Journal of Cleaner Production, 392*, 136276.

Singh, V., Singh, V., & Vaibhav, S. (2020a). A review and simple meta-analysis of factors influencing adoption of electric vehicles. *Transportation Research Part D: Transport and Environment, 86*, 102436.

Singh, V., Vaibhav, S., & Singh, V. (2020b). Fuel consumption optimisation using structural equation modelling and genetic algorithm approach: The case of commercial aviation. *European Transport Research*

Sreen, N., Purbey, S., & Sadarangani, P. (2018). Impact of culture, behavior and gender on green purchase intention. *Journal of Retailing and Consumer Services, 41*, 177–189.

Statista (2023a). Distribution of carbon dioxide emissions worldwide in 2021, by select country. https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/

Statista (2023b). Market insights, electric vehicles—worldwide. https://www.statista.com/outlook/mmo/electric-vehicles/worldwide

Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology, 25*(4), 415–425.

Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407–424.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior, 25*(5), 322–348.

Sun, X., Liu, G., Hao, H., Liu, Z., & Zhao, F. (2022). Modeling potential impact of COVID-19 pandemic on global electric vehicle supply chain. *Iscience, 25*(3), 103903.

Thananusak, T., Rakthin, S., Tavewatanaphan, T., & Punnakitikashem, P. (2017). Factors affecting the intention to buy electric vehicles: Empirical evidence from Thailand. *International Journal of Electric and Hybrid Vehicles, 9*(4), 361–381.

Udo, G., Bagchi, K., & Maity, M. (2016). Exploring factors affecting digital piracy using the norm activation and UTAUT models: The role of national culture. *Journal of Business Ethics, 135*, 517–541. https://doi.org/10.1007/s10551-014-2484-1

Ünal, A. B., Steg, L., & Granskaya, J. (2019). "To support or not to support, that is the question". Testing the VBN theory in predicting support for car use reduction policies in Russia. *Transportation Research Part a: Policy and Practice, 119*, 73–81.

Vallejo-Morales, D., Higueras-Castillo, E., & Liébana-Cabanillas, F. (2021). Exploring the key buying factors for electric scooters. *International Journal of Electric and Hybrid Vehicles, 13*(2), 173–193.

Van Liere, K. D., & Dunlap, R. E. (1978). Moral norms and environmental behavior: An application of Schwartz's norm-activation model to yard burning 1. *Journal of Applied Social Psychology, 8*(2), 174–188.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 157–178.

Verma, M., Verma, A., & Khan, M. (2020). Factors influencing the adoption of electric vehicles in Bengaluru. *Transportation in Developing Economies, 6*(2), 1–10.

Wahl, L. S., Hsiang, W. H., & Hauer, G. (2020). The intention to adopt battery electric vehicles in Germany: Driven by consumer expectancy, social influence, facilitating conditions and ecological norm orientation. In *Innovations for metropolitan areas* (pp. 79–92). Springer.

Wang, P., Kuah, A. T., Lu, Q., Wong, C., Thirumaran, K., Adegbite, E., & Kendall, W. (2021). The impact of value perceptions on purchase intention of sustainable luxury brands in China and the UK. *Journal of Brand Management, 28*(3), 325–346.

Wang, S., Fan, J., Zhao, D., Yang, S., & Fu, Y. (2016). Predicting consumers' intention to adopt hybrid electric vehicles: Using an extended version of the theory of planned behavior model. *Transportation, 43*(1), 123–143.

Weigel, R., & Weigel, J. (1978). Environmental concern: The development of a measure. *Environment and Behavior, 10*(1), 3–15.

Westin, K., Jansson, J., & Nordlund, A. (2018). The importance of socio-demographic characteristics, geographic setting, and attitudes for adoption of electric vehicles in Sweden. *Travel Behaviour and Society, 13*, 118–127.

Wu, J., Liao, H., Wang, J. W., & Chen, T. (2019). The role of environmental concern in the public acceptance of autonomous electric vehicles: A survey from China. *Transportation Research Part F: Traffic Psychology and Behaviour, 60*, 37–46.

Yakut, E. (2021). A VBN theory view on pro-environmental behavior and life satisfaction: Turkey's recent legislation on plastic carry bags. *Current Psychology, 40*(4), 1567–1579.

Yang, J., & Chen, F. (2021). How are social-psychological factors related to consumer preferences for plug-in electric vehicles? Case studies from two cities in China. *Renewable and Sustainable Energy Reviews, 149*, 111325.

Yun, Y., Oh, H., & Myung, R. (2021). Statistical modeling of cultural differences in adopting autonomous vehicles. *Applied Sciences, 11*(19), 9030.

Zhang, X., Hu, X., & Qi, L. (2022). Terminated local subsidy on electric vehicle adoption during the COVID-19 pandemic: The case of Chongqing City. *Energy, 259*, 124891.

Zhang, Y., Sun, J., Yang, Z., & Wang, Y. (2018). What makes people actually embrace or shun mobile payment: A cross-culture study. *Mobile Information Systems, 2018*.

Zhou, M., Long, P., Kong, N., Zhao, L., Jia, F., & Campy, K. S. (2021). Characterizing the motivational mechanism behind taxi driver's adoption of electric vehicles for living: Insights from China. *Transportation Research Part a: Policy and Practice, 144*, 134–152.

Ziefle, M., Beul-Leusmann, S., Kasugai, K., & Schwalm, M. (2014). Public perception and acceptance of electric vehicles: Exploring users' perceived benefits and drawbacks. *International conference of design, user experience, and usability* (pp. 628–639). Springer.