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Psychosocial Traits Characterizing EV Adopters' Profiles: The Case of Tenerife (Canary Islands)

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Abstract: The aim of this paper is to analyze Rogers-system categories of electric vehicle adopters in Tenerife (Canary Islands) to highlight the psychological factors defining each category. The paper runs a model to calculate willingness to change and willingness to pay for an electric vehicle following the contingent valuation methodology. A survey performed in Tenerife Island collected data from 444 private cars drivers. The survey contained a set of questions on psychological and car-features issues, as well as other items querying the socioeconomic factors and mobility characteristics of the drivers. This paper brings key contributions to the literature. First, it uses two theoretical frameworks to define the categories of innovators from a psychosocial standpoint. Second, the results will usefully inform both policymakers and automaker marketing departments on specific actions to accelerate the uptake of electric vehicles. Our results confirm that electric vehicle adopter categories are similar in proportion and characteristics to those of Rogers' diffusion of innovation theory, and can be collapsed into two macro-groups of adopters distributed in a 50%–50% split in our sample, i.e., the earlier adopters and the later adopters.

Keywords: psychosocial traits; electric vehicles; early adopters; island regions; contingent valuation; willingness to pay

1. Introduction

The EU population is demanding green energy technologies to address environment, climate change and sustainability concerns. These green technologies include using renewables and improved energy efficiency measures. Electric Vehicles (EVs) are an innovative transportation technology capable of providing sustainable mobility. Using EVs can significantly reduce global and local emissions while solving traffic congestion problems. The transport sector is responsible for 17.8% of global greenhouse gas emissions and accounts for 21.0% of total final energy consumption according to International Energy Agency (IEA) figures for 2015 [1]. Despite these advantages, there are important social and technical bottlenecks to widespread adoption of EV technology, which currently represents a small share of the vehicle market.

Environmental concerns are especially sharp on islands, as they tend to be extremely dependent on fossil fuels for socio-economic development [2,3]. Similar to other isolated regions of the EU, the Canary Islands are almost totally dependent on fossil fuels as primary energy source, mainly for electricity generation and road transportation. EVs could provide the local-island electricity systems with extra benefits by functioning as distributed energy storage, increasing renewables capacity and decreasing energy dependence [4,5]. Furthermore, the small size of the territory, which dictates driver mobility routines, mean that the short average travel distance reduces the effects of range anxiety.

Studying early adopters of innovative technologies is a mainstay of the behavioral economics literature. If an innovative technology is supported early on by a large group of consumers, it is far more likely to successfully penetrate the market. Thus, policymakers and automakers are keen to understand the first large EV user group, frequently referred to as "early adopters" [6]. Rogers' diffusion of innovations theory is a frame for investigating the adoption of technology in transportation. Rogers defined diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system" [7]. Rogers proposed a classification of adopter categories in terms of their "innovativeness", which he described as follows: "the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system". Individuals within each adopter category share similar characteristics. For Rogers, innovativeness allows understanding behavior in the innovation-decision process.

Here, we analyze Rogers' classification of adopter categories from the perspective of behavioral economics. The fundamental premise behind behavioral economics is that there are individual cognitive biases that often prevent them making rational decisions. From this perspective, some insights used in psychology are taken to analyze consumer behavior in a globalized economic context, such as the involvement of emotions when buying goods and services. As McDonald pointed out, the connection between psychological variables and purchasing behavior is pivotal to consumer studies [8]. Thus, the decisions taken by a consumer can be influenced by their psychological state, their surrounding environment, and their emotional codes [9].

The aim of this paper is to analyze Rogers-system categories of EV adopters in Tenerife (Canary Islands) to highlight the psychological factors defining each category. The analysis focuses solely on private car users (household level) who are willing to buy a car before a certain year (2021). The paper runs a model to calculate "willingness to change" (WtC) to EVs and "willingness to pay" (WtP) for an EV [10] following the contingent valuation (CV) methodology [11]. A survey performed in Tenerife Island collected data from 444 private cars drivers. The survey contained a set of questions on psychological and car-features issues, as well as other items querying the socioeconomic factors and mobility characteristics of the drivers.

Two useful exercises are carried out from the data collected. First, principal component analysis (PCA) is used to construct a set of socio-psychological components. Second, a cluster analysis is performed to aggregate individuals into groups according to their WtC and WtP for EVs. We then use linkages between these groups of individuals and the components to characterize the adopter categories according to their psychosocial features. Finally, sets of dichotomous regressions (logit and probit) are estimated to get an in-depth analysis of the characteristics defining the different clusters.

This paper brings key contributions to the literature. First, it uses two theoretical frameworks to define the categories of innovators from a psychosocial standpoint. Second, the results will be useful to inform both policymakers and automaker marketing departments on specific actions to accelerate the uptake of EV.

The structure of the paper is organized as follows. Section 2 presents the theoretical framework on innovation diffusion and the psychosocial factors that affect consumer behavior in relation to EVs. Section 3 describes the methodology, the sample, and the survey. Section 4 details and discusses the outcomes of the PCA, the clusters formed, and the logistic regressions. Finally, Section 5 concludes the paper.

2. Theoretical Framework

In the early 1900s, EVs and internal combustion engine vehicles (ICEVs) were part of fleet in most developed countries. However, in the 1930s, as mass production of ICEVs peaked and fuels became cheaper and widely available, EVs fell into decline [12]. However, by the early 2000s, developments in battery technology and growing concern over climate change prompted a revival of interest in EVs [13]. From a technological point of view, EVs stand apart from ICEVs in the fuel they use and their onboard-battery power storage. Moreover, EV propulsion systems are more efficient and more reliable, delivering instant power, without noise, vibration or direct gas emissions. However, they do have limitations, chiefly range and price [14–19]. EVs mean a significant technological change, disrupting the market as an innovative product [20–23].

The literature on EV consumers has analyzed several factors affecting EV adoption. The focus of published studies has been on various aspects of adoption and non-adoption behaviors. Several papers argue that the Rogers' diffusion of innovations theory is a suitable frame for research into EV technology adoption [13,24–26]. Rogers defined the innovation-decision process as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation". Rogers' theory counts several stages that define the innovation acquisition process, but here we focus on the first three: (i) knowledge, which consists of providing information and measuring the change in willingness to adopt the technology; (ii) persuasion, in which the consumer compares and evaluates the advantages and disadvantages; and (iii) the decision, i.e., whether the consumer adopts or rejects the innovation. At the decision stage, there are certain characteristics of innovations that help reduce uncertainty, which means that consumers' perceptions of these characteristics can serve to predict the rate of innovation adoption.

Rogers considered five categories of consumers based on their innovativeness during the adoption process. The first category is *innovators*, i.e., consumers who are willing to experience new products, and who have a high level of knowledge on technology. The second category is *early adopters*, who are more limited within the boundaries of the social system but have a high degree of opinion leadership for other members of the community. The third category is the *early majority*, who interact strongly with other members of the social system, but are not leaders. The early majority adopts the innovation just before the other half of their peers do. The fourth category is the *late majority* who still need most of the adopters to assume the risk of the innovation, thus reducing the uncertainty of the innovation. Finally, *laggards* are characterized by being tradition-focused and have no opinion leadership.

These five categories can be collapsed into two macro-groups: the earlier adopters (innovators, early adopters, and early majority) and later adopters (late majority and laggards). Rogers proposed a normal distribution where each category is defined using a standardized percentage of respondents. Thus, innovators (2.5%), early adopters (13.5%) and early majority (34%) include half of the consumers as earlier adopters, while the late majority (34%) and laggards (16%) comprise the other half, i.e., later adopters. Rogers also differentiated these groups based on socioeconomic status, personality variables, and communication behaviors, which usually are positively related to innovativeness. Despite an array of studies assessing the determinants of innovativeness for EVs [10,27–29], there has been little research into the role of the psychosocial characteristics of these consumers [30]. Knowledge of these factors could provide key insight to properly understand and classify consumers according to their degree of innovation.

The importance of including psychosocial variables in models to explain the economic behavior of consumers has been sufficiently addressed from the perspective of behavioral economics [9,31–33], which argues that the connection between psychosocial variables and purchasing behavior is pivotal to consumer research [8,34]. In short, psychologically-motivated purchases are based on a need to improve self-concept, self-image, self-esteem, or relations with others. On the other hand, socio-economic context also plays an important role in the formation of knowledge, self-awareness and perception of the world.

Moving forward, there are certain psychological characteristics that are very much related to the degree of innovation adoption and can also explain the profile of potential EV consumers. Incorporating these variables into consumer behavior models can therefore increase the explanatory capacity of buyer decisions and serve to characterize and segment consumers according to Roger's theory [7]. Based on the behavioral economics literature, the following aspects should be modeled:

- Subjective well-being, whose influence on economic decisions has been established in several studies [35,36]. Subjective well-being can be understood as satisfaction with life as a whole and with specific areas of life (work, money, family, and social) and approached, following Diener and Lucas [37], through satisfaction, which we can assess in three dimensions: psychological, social, and physical [38–40].
- Compulsive buying, understood in terms of non-planned buying [41], emotional buying [42] or chronic and repetitive buying behavior [43]. Other authors have analyzed the weight of social determinants in compulsive buying, highlighting the symbolic meaning of purchased products in order to conform a positive social identity [44,45].
- Risk attitude, understood as the personality feature that determines a consumer's tendency and willingness to take risks. Following Das and Teng [46] and Rohrmann [47], risk-averse consumers will avoid the alternatives that may have results that vary far from their expectations. Other authors argue that tendency to take risk, together with proactivity and innovation, are three psychological features that characterize decision-makers [48–50].
- Future time perspective, which, according to Zimbardo and Boyd [51], is the process through which consumers arrange their personal and social experiences in time intervals. Authors highlighted the fact that the time valuation made by consumers is a factor that significantly shapes behavior: future-oriented consumers think about the effects of their future acts, their objectives are clear, and they are ready to tolerate the tensions that achieving their goals may entail [52,53].

Lastly, we include two factors—use of ICT and Environmental awareness—that are considered highly influential in EV buying decisions by the empirical literature on this innovative product.

- According to Rogers, tendency to buy and use information and communication technologies (ICT) affects the adoption of any kind of innovations entering the market. Rosen et al. [54] produced empirical work showing that the incorporation of variables such as use of social media improves traditional scales measuring technology usage. New technological paradigms and the impact of the adoption of new ICT devices on consumer life habits mean that the scales have to be constantly updated [55,56].
- Increasing environmental awareness has driven growing demand for environmentally-friendly products such as EVs. Ham et al. [57], analyzed and discussed the main results of the measurement of consumers' environmental awareness and commitment. Likewise, Culiberg and Rojšek [58] stressed the importance of studying the connection that exists between environmental awareness and degree of adoption of new technologies.

3. Methodology

This paper aims to find the factors determining the decision to adopt or reject technological innovations such as EVs. The work focuses on the role that traditional economic determinants and psychosocial factors have on the behavior of each group of consumers according to their degree of innovativeness following Roger's model. To this end, we led an empirical exercise consisting of conducting a survey on the Island of Tenerife using the CV method. Using the survey results, we obtained the WtC to an EV and the WtP for an EV, enabling us to group the consumers into categories according to their readiness to adopt the new technology.

Carson [59] stated that CV is a widely-used technique for the measurement of WtP and the valuation of public goods and services. The method consists in using interviews to create a realistic (although hypothetical) market scenario that starts by describing the good or service and ends by getting respondents to directly state their WtP (and also WtC here) for it. This CV methodology has been used for market valuation of non-market or new-to-market products and/or services [59]. Focusing on EV studies, Larson et al. [60] used a CV method to estimate WtP for electric cars in Manitoba (Canada), and highlighted strong consumer interest but a need for stronger knowledge on EVs. Hidrue and Parsons [16] recently used a CV design to estimate consumer WtP for vehicle-to-grid (V2G) services. The results show that WtP is lower than the projected cost, because of range anxiety, the V2G contract, and the high cost of the battery. Thiel et al. [10] used a CV design to determine WtC to an EV in six European countries. The main findings were that the potential EV consumer lends importance to price reduction, range extension, and charging infrastructure. Liao et al. [61] gave a roll-up summary of the main results of this type of study.

The survey gathered information into five blocks: (I) mobility routines, which give information on vehicle use requirements (driven distances and required range) within the context of Tenerife's territorial limitations; (II) WtC and WtP for EV, which provide information for determining preferences and grouping consumers; (III) psychosocial traits; (IV) characteristics and attributes of vehicle purchases; and (V) socio-economic data on the respondents. The methodology used for the purpose of this work follows the three-stage process below:

First, a PCA was carried out to group the psychosocial traits questions (Block III). This exercise served to explain the greater amount of information contained on the psychosocial question in a smaller number of components [62]. The advantage of this method is that it guarantees independence of the components generated, which means they can be used, for instance, in further econometric modeling, hence avoiding collinearity problems. In addition, it is essential to pretest for correlations between variables and measure sampling adequacy to check it is suitable for use in the PCA [63,64]. PCA techniques enabled us to characterize the different of adopters in terms of the psychosocial components obtained.

Second, hierarchical cluster analysis was carried to classify observations (consumers) into different categories according to their attitude on the adoption of EVs. This classification criterion was obtained from the questions on WtC and WtP (Block II) [65]. The hierarchical grouping method used was Ward's linkage approach [66]. Subsequent graphical analysis then helped us decide the cluster number according to its size and differential characteristics. Finally, the clusters obtained served to classify consumers by groups according to their innovativeness and attitude to EV.

Third, logit and probit regressions were used to analyze the impacts of a set of explanatory variables on the different clusters obtained in the previous step [67]. The explanatory variables were divided into four main groups (mobility routines, psychosocial components, car features, and socio-economic variables). To improve the estimations of the models, we used a backward stepwise approach considering only the most significant explanatory variables [62]. Applying both models (logit and probit) further served to check the robustness of the results. Lastly, we were able to classify the clusters into groups linked to the Rogers-system adopter categories (i.e., early adopters, early majority, late majority, and laggards) [7]. Figure 1 summarizes the methodology design and the theoretical framework of this study.

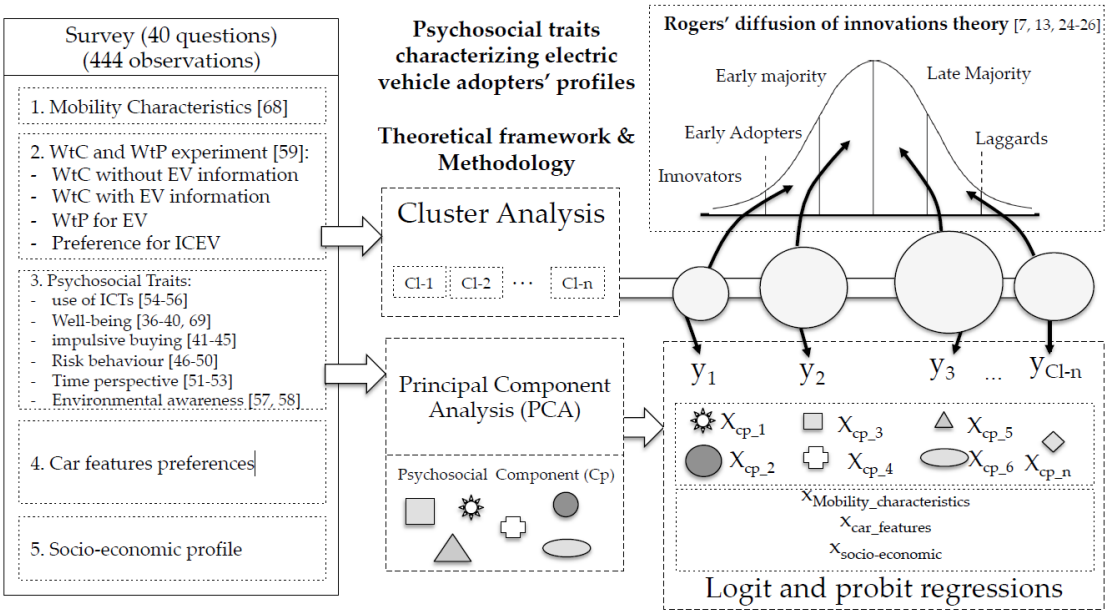

Figure 1. Theoretical framework and methodology design.

3.1. Survey

The survey was purpose-designed to collect the information necessary to meet the objectives of this study, based on the experience gained with a previous questionnaire of similar characteristics carried out in 2014 [29]. However, it has been extended to include the psychosocial traits relating to the EV purchase decision. The survey was designed with the collaboration of a focal group of professionals from the transport sector. A group of users completed a pre-test to verify the difficulty involved with some of the initial questions of reformulate them accordingly.

First, to be eligible for the questionnaire, respondents had to meet three conditions: (i) possess their own vehicle, or have a vehicle at their disposal and use it assiduously; (ii) possess a driver's license; and (iii) have the intention of acquiring a new vehicle before 2021. Before completing the questionnaire, respondents had to consider two assumptions: (a) that there is an adequate EV charging infrastructure; and (b) that there is a basic charge point at their usual home. Here, we describe the most relevant survey questions—see Appendix A for the complete survey. The full survey contained 40 questions split into five blocks:

1. Mobility Characteristics (Q1–Q3)
2. Willingness to change and willingness pay for the EV (Q4–Q9)
3. Psychosocial traits (Q10–Q27)
4. Car feature preferences (Q28–Q35)
5. Socio-economic profile (Q35–Q40)

The first block included three questions dealing with mobility routines and geographical place of residence. The first question referred to the municipality of habitual residence (Q1). The second question asked about the daily kilometers travelled (ranked question format), distinguishing between a weekday and a weekend day (Q2). The third question asked for the minimum range that a vehicle needs to offer (open response format) (Q3), as also done in other studies [68].

The second block of questions was focused on WtC and WtP for EVs. The first question asked how much the individual is willing to pay for the new vehicle that he/she plans to acquire (Q4). For this question on WtP, an open response was used, given that the product is widely known and there is a rough estimate of what to pay for it. Next, the respondent was asked if he/she is willing to pay more

for an EV than his/her preferred conventional equivalent (Q5). At this step, certain information about EVs was detailed, including the following elements:

- EVs pollute 95% less locally
- EVs cost 85% less in fuel
- EVs do not produce noise
- EVs have 25% higher acceleration
- EVS cost approximately 60% less in maintenance
- EVs have between 150–200 km autonomy under the island's orographic and climate conditions.
- Charging time is 3–6 h for a basic charge (usual residence) and 30–60 min for a quick charge.

This information is important to reinforce the knowledge stage in the consumer adoption process, and could be important as an element of the persuasion stage [7]. Therefore, at this time, we repeated Q5 on whether he/she is willing to switch and pay more for an EV than his/her conventional equivalent vehicle (Q6), with the dichotomous answer (YES, NO). If the answer was NO, the respondent had to cite the reasons for refusing to switch, which include several options such as: lack of confidence in the technology, long journeys, or preference for conventional technology (Q7). Moreover, the respondent was also asked if he/she would be willing to pay for an EV if the price is lower than that indicated in Q4: 10%, 20% 30%, 40% or 50% lower, or if they would never buy an EV (Q8). If the answer to Q6 was YES, the respondent was asked to state how much more he/she would pay for an EV over a conventional vehicle (Q9). As mentioned earlier, these variables allowed us to classify the individuals (clustering methods) according to their attitude and innovativeness toward EV. In addition, these Block-II questions provided relevant information on the first three stages of the innovation-decisions process (knowledge, persuasion, and decision).

Block III featured questions on the individual's psychosocial characteristics (see Section 2): (i) predisposition to acquire and use ICT; (ii) degree of well-being; (iii) impulsiveness; (iv) risk attitude; (v) future time preference; and (vi) environmental awareness. These items were scored on a Likert scale ranging from 1 to 7, where 1 indicates total agreement and 7 indicates total disagreement. The questions in this block encompass the following:

- Three questions addressed the use and purchase of ICTs according to Rosen and coworkers' [54] Media and Technology Usage and Attitudes Scale (MTUAS). The questions were on assiduity with acquiring technological novelties (Q10); possession and use of accounts in social networks (Q11); and possession of home electronics devices with Internet access (Q12).
- The cognitive aspects of well-being were evaluated through an adapted version of LISAT-8 (Fulg–Meyer's Life Satisfaction survey) [69]. This scale measures three essential aspects of life (family, social, work and money). Three questions were included to evaluate work and money situation (Q13); family and social life (Q14); and achievement of goals in life (Q15).
- Following the scale proposed by Valence et al. [45], three questions were included to evaluate impulsive buying: degree of impulsiveness when replacing the vehicle (Q16); buyer's remorse (Q17); and analysis of market alternatives (Q18).
- The consumer's propensity and willingness to take risks was approached via three questions adapted from a short version of Rohrmann's Risk Orientation Questionnaire [47]: tendency to imagine unfavorable situations from their actions (Q19); self-perception of the degree of risk from their actions (Q20); and evaluation of the consequences from their actions (Q21).
- An adaptation of the Time Perspective Inventory by Zimbardo and Boyd [51] was used to consider the consumer's attitude towards future time preferences. Three questions were included polling inability to change the future with present actions (Q22); work hard to achieve goals in life (Q23); and sacrifice present well-being for future well-being (Q24).

- Finally, to complete the block of psychosocial questions, and following Ham et al. [57], three questions were included on environmental awareness: knowledge on the effects of greenhouse gas emissions from energy consumption (Q25); willingness to buy low-energy-consumption devices (Q26); and commitment to rational use of energy (Q27).

Block IV of the questionnaire evaluated vehicle attributes and features. First, Q28 assessed the level of loyalty to a specific vehicle make on a 7-point Likert scale. Next, open response format Q29 asked whether the individuals preferred a specific automaker, allowing up to two responses (Q29). Finally, Q30 gauged the order of preference of 7 vehicle attributes:

1. Design and aesthetics both interior and exterior
2. Low emissions level and low fuel consumption
3. Functional, versatile, and adaptable to daily use needs
4. Connectivity with devices and advanced technological equipment
5. Excellent quality-to-price ratio
6. High reliability and low maintenance
7. A unique driving experience offered by a renowned automaker.

Block IV then included another four questions on: (i) age of habitual vehicle (Q31); (ii) number of vehicles at their disposal in the household (Q32); (iii) vehicle currently owned or driven (Q33); and (iv) vehicle that he/she wants to buy in the near future (Q34).

Finally, Block V of questions addressed the individuals' socio-economic features: age (Q35); gender (Q36); educational attainment (Q37); number of children (Q38);, main occupation (Q39); and approximate annual income (Q40).

3.2. Data Collection

The empirical work was based on a survey conducted between March and August 2017 on the island of Tenerife (Spain). The modality of the survey was a face-to-face administration by topic-trained professional interviewers. In total, 444 valid surveys were carried out across the island. This sample size has a statistical confidence level of 95%, with a sampling error of 4.648%.

Our population represents individuals who hold a driving license, own a car and are willing to acquire a vehicle before 2021. The population was thus approached as holders of driving licenses from Tenerife segmented by zone of residence [70]. The sample was stratified by geographical area and population as follows: capital zone (urban area) and the northern and southern zones of the island (semi-urban/rural zones). Area of residence was contrasted through a Chi-squared test for goodness of fit to test the sample's adequacy for the population segmentation. Results showed that there is enough evidence to reject the null hypothesis ($p = 0.5025$) at a 5% significance level. Our sample segmentation thus fits with our population in terms of residence area.

4. Results

4.1. Psycho-Sociological Components

The PCA methodology grouped the Block-III questions (i.e., psychosocial traits) to reduce the items to a set of components. Starting from 18 psychosocial questions, a series of tests were out to measure the correlation and the sample adequacy. First, Bartlett's test of sphericity ($p = 0.000$) and the determinant of the correlation matrix ($det. = 0.058$) showed that there is correlation between variables, which is necessary to perform a PCA. Second, a Kaiser–Meyer–Olkin test ($KMO = 0.698$) confirmed that sample adequacy was of an acceptable level. It is a measure of the proportion of variance among variables that might be equal variance, showing that the sample was adequate for PCA [64]. Additionally, Guttman lambda is calculated, approaching the internal consistency and reliability of the items included (lambda2 = 0.692 and lambda4 = 0.806). Proceeding with the PCA,

it reduced the 18 initial psychosocial questions to 9 components gathering 70.89% of the information contained in the items. An *equamax* rotation conducted on the component matrix of the PCA then redistributed the variance of the original variables over the obtained components, and thus get a better interpretation of the results.

Table 1 shows the correlations of the questions (Q10–Q27, represented in rows) with respect to the component to which it belongs (Cp-1 to Cp-9, in columns), after removing weights below 0.390. For instance, Cp-1 is composed of questions Q10, Q11 and Q12, where items Q11 and Q12 have greater weight in the index.

Table 1. Results of principal component analysis [1].

	Cp-1	Cp-2	Cp-3	Cp-4	Cp-5	Cp-6	Cp-7	Cp-8	Cp-9	Unexplained Variance
Q10	0.395									0.373
Q11	0.575									0.321
Q12	0.580									0.256
Q13			0.718							0.264
Q14								0.788		0.226
Q15			0.543							0.387
Q16				0.633						0.325
Q17							0.733			0.289
Q18									0.797	0.166
Q19						0.406				0.429
Q20									−0.452	0.362
Q21						0.790				0.228
Q22					-0.683					0.301
Q23				0.448			-0.392			0.253
Q24					0.609					0.287
Q25				0.543						0.306
Q26		0.670								0.210
Q27		0.635								0.257

[1] Shaded cells indicate level of correlation of the variable in the component, where dark shading indicates hard correlation (>0.700), medium shading indicates intermediate correlation (>0.500 and <0.700), light shading indicates low correlation (>0.390 and <0.500), and no shading indicates very low correlation (<0.390).

Each component has a specific meaning that is determined by its defining questions. According to PCA results (Table 1), there are nine psychosocial components:

Cp-1. **Predisposition to new technologies**. Ownership of a higher number of ICT devices (Q12), active use of social media (Q11), and regular acquisition of the latest technologies (Q10).

Cp-2. **Environmental awareness**. Commitment to buy energy-efficient products (Q26) and use energy rationally (Q27).

Cp-3. **Subjective well-being**. Well-being through satisfaction with work and money (Q13) and achievement of goals set by the individuals (Q15).

Cp-4. **Predisposition to change vehicles**. The need to urgently replace the vehicle when financing is available (Q16), individual priority to purchase the desired vehicle (Q23), and awareness of the impact of emissions on the environment (Q25).

Cp-5. **Future hedonistic**. The individuals plan actions that allow them to experience future pleasure, showing a positive attitude towards it (Q22), and a willingness to sacrifice current well-being for future well-being (Q24).

Cp-6. **Aversion to risk**. The individual cognitively evaluates the consequences of his/her decisions (Q21) and imagines unfavorable situations from them (Q19).

Cp-7. **Propensity to impulsiveness**. Shows a tendency to make purchases without rational analysis on the future consequences of the actions (Q23), and activation of emotional conflict producing a feeling of guilt (Q17).

Cp-8. **Satisfaction with family and social life**. Expresses the degree of satisfaction with affective relations, both with family and other social relations (Q14).

Cp-9. **Reflexive behavior.** A reflexive behavior is where the individual cautiously learns and evaluates the features of the product in the market (Q18), thus reducing the uncertainty in the purchasing process (Q20).

4.2. Cluster Analysis

In this section, a hierarchical cluster analysis applying Ward's method is used to group individuals. This method is used to group individuals in which the observations are joined, maximizing the sum of squares objective function [66]. The five selected criteria are the questions of Block II of the survey (WtC and WtP for EV): (i) WtC to EV (Q5); (ii) WtC to EV after being given information on EV (Q6); (iii) WtP for standardized EV (Q9); (iv) WtP for an EV above €28,000 (average EV market price references; and (v) preference over ICEVs (Q10, option d).

Using the common diagram technique to illustrate the grouping of clusters (*dendrogram*), six groups of individuals emerged [65,66]. *Dendrograms* graphically chart which observations group together at various levels of (dis)similarity. Table 2 shows a summary of the main characteristics of the individuals by clusters (Cl) according to questions from Block II. Appendix B gives more detailed descriptive results of the clusters compiling the rest of variables studied in this work. All tests and the *dendrogram* can also be found in the Supplementary Materials. The clusters obtained with this method were then compared against the adopter categories proposed by Rogers' innovation diffusion theory (see Section 4.4).

Table 2. Descriptive statistics of categorical variables by clusters.

Categorical Var.	Question	Sample	Cl-1	Cl-2	Cl-3	Cl-4	Cl-5	Cl-6
Number of individuals		444	23	121	8	66	161	60
Cluster share (%)		100	5.18	27.25	1.80	14.86	37.39	13.51
WtC for an EV (%)	(Q8)							
Yes, I would pay more		33.56	100	100	0	0	3.01	0
No, I would pay less/not pay		66.44	0	0	100	100	96.99	100
WtC to EV (EV info) (%)	(Q9)							
Yes, I would pay more		49.10	100	100	100	100	0	0
No, I would pay less		13.51	0	0	0	0	29.81	20.00
No, I would not pay for EV	(Q10)	26.35	0	0	0	0	70.19	80.00
ICEV preferences (%)	(Q11)	31.53	0	0	0	0	56.02	78.33
WtP for a new car (€)	(Q6)	17,438	30,826	14,508	32,750	14,598	17,403	19,391
WtP for a an EV (€)	(Q12)	17,821	34,739	16,815	39,125	16,588	11,588	11,562
Difference in WtP (%)	-	+2.15	+11.26	+13.72	+16.29	+12.00	−33.41	−40.37

From Table 2, we can summarize the main characteristics of the individuals that make up each group as follows:

- The individuals of Cl-1 and Cl-2, who represent 32.4% of the sample, are willing to switch to an EV without receiving specific information on EV characteristics (Q8). In addition, individuals of Cl-1 would be willing to pay €34,739 on average for an EV (Q12).
- The individuals of Cl-3 and Cl-4, who represent 16.7% of the sample, would only adopt this type of technology after receiving basic information about EVs (Q9). Moreover, Cl-3 individuals would be willing to pay €39,125 on average for an EV.
- Most individuals of Cl-5 and Cl-6, who represent 50.9% of the sample, would not buy an EV as they prefer a conventional vehicle (56% in Cl-5 and 78% in Cl-6). Some of them would actually be willing to pay less for an EV (33.41% in Cl-5 and 40.37% in Cl-6), whereas others would acquire an EV if its price was lower than the ICEV (Q11).

We can draw two conclusions from this analysis: Clusters 1 and 2 have prior knowledge of EV characteristics and show a clear predisposition to adopt EV technology while Clusters 3 and 4 need more information before deciding. Clusters 5 and 6 show a significant rejection of EVs, citing, as their main reason, "preference for ICEVs as a matter of taste".

4.3. The Determinants of the Clusters

To determine the characteristics of each cluster, two different dichotomous regressions models (logit and probit) were estimated. In both models, the dependent variable represented the belonging to each cluster (0, no and 1, yes) from Cl-1 to Cl-6. The independent variables included in the models were grouped into the following categories: (i) mobility characteristics; (ii) psychosocial components; (iii) car features; and (iv) socio-economic variables. This assessment served to identify the most relevant variables characterizing each cluster.

To improve the adjustment of the model, we followed a backward stepwise regression method consisting in removing, step by step, its less significant variables until the model is defined by the most relevant ones [62,67]. We also ran a series of tests to verify the reliability of the results of the models: first, we studied whether the model that includes all the independent variables was globally significant (global significance test, Nagelkerke R^2 and Hosmer–Lemeshow test), and then we studied the overall significance of the explanatory variables of the model using the Wald tests. [62]. The results of these tests can be found at the end of Table 3 (Wald test and Nagelkerke R^2) and in the Supplementary Materials (global significance test and Hosmer–Lemeshow test).

Table 3 shows the results of the estimated models. Columns show the different clusters (Cl-1 to Cl-6) stratified by the logit and probit models. Rows show the explanatory variables included in the four blocks (in panels) presented earlier. The regression coefficients (in cells) measure the probabilities of each variable of belonging to a cluster. Empty cells show that the variable has no significant impact on the cluster.

First, Table 3 shows that the results of both logit and probit in terms of sign and coefficient are robust and feasible. Furthermore, we could highlight that almost all one-psychosocial-trait components are significant in all clusters, in contrast with the rest of the blocks. However, all models discard the future hedonistic and satisfaction with family and social life components due to non-significant relevance. In addition, car features and socio-economic variables are non-significant in several clusters, while mobility routines are not significant in Cl-1 and Cl-6.

Table 3. Determinants of the Clusters.

	Dichotomous Model [3]	**CL-1**		**CL-2**		**CL-3**		**CL-4**		**CL-5**		**CL-6**	
		Logit	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**
Mob. rout	Minimum range req.			0.436 *	0.254 *	3.084 *	1.650 ***	1.010 ***	0.532 ***	−1.190 ***	−0.701 ***		
	Km covered per week					0.0116 ***	0.0101 ***	−0.00253 **	−0.00125 **				
	Capital					−5.711 ***	−4.740 ***			−0.402 *	−0.239 *		
Psychosocial components	Predisp. new technologies	0.535 ***	0.253 ***			1.839 ***	1.669 ***			−0.184 ***	−0.111 ***		
	Environmental awareness	0.596 ***	0.304 ***			1.598 **	0.700 **						
	Subjective well-being								−0.103 *				
	Predisp. change vehicle					−1.258 **	−0.862 **						
	Aversion to risk					−2.498 ***	−1.965 ***	−0.273 **	−0.149 **	0.278 ***	0.163 ***		
	Tendency to impulsiveness	0.580 ***	0.297 ***	0.274 ***	0.160 ***	−1.353 **	−1.052 ***					−0.386 ***	−0.212 ***
	Reflexive behavior	−0.359 **	−0.197 **			2.506 ***	2.138 ***						
Car features variables	Loyalty to a brand								0.0707 *	−0.163 ***	−0.0971 ***	0.146 *	0.0811 **
	Car design											0.160 *	0.0853 *
	Versatility and adaptability					1.784 ***	1.363 ***	−0.203 ***	−0.0948 **			0.227 **	0.125 **
	Technological equipment						0.458 **						
	Price-performance					0.796 **	0.720 ***						
	Low maintenance					0.940 **	0.781 ***						
	Prestige and unique experience											0.126 *	0.0736 **
	Small car						2.702 ***						
	Large car					3.620 *	4.510 ***						
	All-terrain car											0.696 **	0.405 **
	Number of cars in household					1.508 ***	1.242 ***						
	Age of current car					0.313 ***	0.273 ***						

Table 3. *Cont.*

	Dichotomous Model [3]	**CL-1**		**CL-2**		**CL-3**		**CL-4**		**CL-5**		**CL-6**	
Socio-economic variables	Millennial (under 38 years old)					−12.62 ***	−10.41 ***						
	Gen_X (from 39 to 58 years old)					−11.21 ***	−8.375 ***						
	Gender (women)					−4.305 ***	−3.960 ***						
	High income			0.731 ***	0.439 ***	−3.650 **	−2.613 ***						
	Education					4.256 ***	2.864 ***					−0.887 ***	−0.479 ***
	Paid-employed					3.926 ***	2.008 ***						
	Self-employed							1.166 ***	0.661 **				
	Children							−0.523 *	−0.302 *				
	_cons	−3.702 ***	−1.996 ***	−1.336 ***	−0.808 ***	−30.88 ***	−25.30 ***	−0.513	−0.721 **	0.559 **	0.328 **	−4.473 ***	−2.541 ***
	Nagelkerke R^2	0.180	0.1857	0.043	0.043	0.546	0.595	0.103	0.113	0.094	0.093	0.090	0.092
	Wald Chi^2	28.280	26.750	20.290	20.600	40.760	57.380	28.450	30.550	41.630	45.120	32.480	34.040

[3] Significance level * ($p < 0.10$); ** ($p < 0.05$); *** ($p < 0.01$).

Detailed analysis of each cluster, considering the sign, magnitude and statistical significance of the parameters, highlights the main characteristics of the members of each group:

Cl-1. Show a high degree of impulsiveness and low reflexive behavior. Moreover, they are inclined to acquire technological innovations and show strong environment consciousness. In contrast, mobility routines, car features and socio-economic variables appear non-significant impacts.

Cl-2. Show a lower degree of impulsiveness than members of Cl-1. They require less kilometers of range given their mobility routines, and have a high economic status, whereas car features are still non-significant in this cluster.

Cl-3. Show a good predisposition to new technologies, as well as environmental consciousness. They are individuals who take risks, but under a reflexive behavior. They are not very impulsive, and so do not have any imperative need to change vehicles. They live outside the urban areas, drive many kilometers daily, but do not require a huge range. They show a preference for top-end vehicles—medium, large, and luxury segment—and look for versatility, reliability and a good quality-to-price ratio. Overall, they are men of advanced age and education.

Cl-4. Members are not risk-averse, have a high subjective well-being, and do not drive many kilometers, but they do need versatility and adaptability in a vehicle. In terms of socio-economic features, they are usually self-employed and do not have children.

Cl-5. Show a high aversion to risk and no predisposition to new technological innovations. In terms of mobility routines, these are individuals who live in rural areas and require a higher range in their vehicle. In terms of car features, they are not loyal to any one automaker. No relevant socio-economic factors emerge.

Cl-6. The individuals in this cluster are not impulsive. They seek versatility, interior and exterior design, and a unique driving experience in a vehicle. For that reason, they show a certain loyalty to prestigious makes. They also target vehicles within the all-terrain vehicles segment, i.e., SUV, crossover, pick-up, and van. In terms of educational attainment, non-university-educated individuals predominate.

4.4. The EV Innovation Adopters

In this section, the clusters are grouped and compared against the Rogers-system adopter categories (i.e., early adopter, early majority, late majority, and laggards). Our six clusters (Cl-1 to Cl-6) can this be arranged into four groups according to the Rogers-system categories. The correspondence between the clusters and Rogers' adopter categories is reported in Table 4, where the first column represents Rogers' adopter categories, the second column plots the clusters obtained in this work, the third column lists the most relevant characteristics of these clusters, and the fourth column shows whether the characteristics of the third column are typical of a single cluster or of all of them.

Individuals from Cl-1 and Cl-3 are willing to change to EVs, and have a very high WtP for them. These two clusters account 6.98% of the sample. The features of these clusters are similar to those given by Rogers for innovators and early adopters (16% of his sample). They have a high social status, take risks, are impulsive and are predisposed to new technologies.

Members of Cl-2 and Cl-4 account for up to 42.11% of the sample and share similar characteristics to the early majority (34% according to Rogers). They have a certain degree of impulsiveness and are prone to risk. Although they have a high social and economic status, their WtP for an EV is still low with respect to the current market price. The four clusters analyzed (Cl-1, Cl-2, Cl-3, and Cl-4) together match with the early adopters defined by Rogers, who represent 50% of his sample, being 49.09% in our study.

Members of Cl-5 (37.39% of our sample) match with Rogers' late majority (34% of the sample) and are characterized by low predisposition to technologies and high-risk aversion. Finally, Cl-6 (13.51%) matches with Rogers' laggards category (16% of the individuals). According to our results, these individuals are not impulsive and have a low education level, consistently with Rogers. In conclusion,

these two clusters (Cl-5 and Cl-6), which comprise a little over 50% of the sample used in this study, mirror the behavior of the later adopters described by Rogers.

Table 4. Main characteristics according to Rogers' adopter profiles.

Rogers' Adopters	Clusters (Sample)	Main Characteristics	By Cluster
Innovators and early adopters (16%)	1, 3 (6.98%)	—High WtP for an EV	Cl-1 and Cl-3
		—Frequently car usage but low minimum range required	Cl-1 and Cl-3
		—Predisposition to new technologies	Cl-1 and Cl-3
		—Risk behavior	Cl-3
		—Impulsive behavior	Cl-1 vs. but no Cl-3
		—Reflexive behavior	Cl-3
		—Environmental awareness	Cl-1 and Cl-3
		—High educational attainment	Cl-1 and Cl-3
		—Gen X or better	Cl-3
Early Majority (34%)	2, 4 (42.11%)	—Moderate WtP for an EV	Cl-2 and Cl-4
		—Few kilometers covered	Cl-4
		—Low minimum range required	Cl-2 and Cl-4
		—Risk behavior	Cl-4
		—Impulsive behavior	Cl-2
		—High socio-economic status	Cl-2
		—No children	Cl-4
		—Self-employed	Cl-4
Late Majority (34%)	5 (37.39%)	—Low WtP for an EV	Cl-5
		—Live in rural areas	Cl-5
		—Cover large distances	Cl-5
		—Reject new technologies	Cl-5
		—Highly risk-averse behavior	Cl-5
Laggards (16%)	6 (13.51%)	—No WtC to an EV due to preference for a conventional vehicle as a matter of taste	Cl-6
		—Not impulsive behavior	Cl-6
		—Design, versatility and driving experience are important	Cl-6
		—Large vehicles (SUV, crossover, . . .)	Cl-6
		—Loyalty to a prestigious make	Cl-6
		—Low educational level	Cl-6

5. Conclusions

The aim of this study was to analyze Rogers-system categories of EV adopters in Tenerife (Canary Islands) to highlight the psychological factors defining each category. Although this research was carried out in an insular context, the results in general can be extrapolated to mainland contexts. The majority of consumer characteristics are the same in both regions, such as psychosocial traits or car feature preferences. Hence, policy implications and marketing strategies drawn from our results could be generalized for any regions. As an exception to the previous statement, the only notable difference is that island drivers travel shorter distances than mainland drivers. Hence, they have a much lower perception of "range anxiety" placing the EV as an interesting option of mobility in islands.

This paper brings key contributions to the literature. First, it uses two theoretical frameworks to define the categories of innovators from a psychosocial standpoint. The study focused on the role that traditional economic determinants and psychosocial factors have on the behavior of each group of consumers according to their degree of innovativeness following Roger's model. Second, the results will be usefully inform both policymakers and automaker marketing departments on specific actions to accelerate the uptake of EV.

The work runs a model to calculate WtC to EVs and WtP for an EV following the CV methodology. Two useful exercises are carried out from the data collected. First, PCA is used to construct a set of socio-psychological components. Second, a cluster analysis is performed to aggregate individuals into groups according to their WtC and WtP for EVs. We then use linkages between these groups of individuals and the components to characterize the adopter categories according to their psychosocial features. Finally, sets of dichotomous regressions (logit and probit) are estimated to get an in-depth analysis of the characteristics defining the different clusters.

According to our results, and in line with other authors, the following factors were found to predispose to willingness to purchase an EV: (i) predisposition to use new technologies [27,71,72]; (ii) environmental awareness [27,72–74]; and (iii) older males with high income and high educational attainment [27,75,76]. Moreover, the psychosocial variables were relevant in each of the profiles obtained, providing new insights with which to develop marketing strategies focused on certain consumers.

Another important finding is that giving users basic information on EVs can increase their WtC to an EV. A large share (almost 17% of the sample) of the people surveyed would be willing to switch to an EV after receiving basic information about it. As stated by Rogers and Erdem et al. [7,25], access to information is key so that potential adopters can compare the relative advantages of the innovation and its compatibility with their life habits, and thus overcome the barriers attributed to the complexity of the system. Given the importance of targeted information, companies need to tailor their marketing strategies based on the psychosocial and socio-economic characteristics of potential consumers, while governments need to implement policies to boost EV uptake based on awareness campaigns that highlight the environmental benefits of using EVs, incentivization schemes that reduce EV cost-to-buy, and instruments that promote the development of an adequate infrastructure for recharging and using EVs.

The EV adopter categories obtained in this work are similar in proportion and characteristics to those of Rogers' diffusion of innovation theory, and can be collapsed into two macro-groups of adopters distributed in a 50%–50% split in our sample, i.e., the earlier adopters and the later adopters. In addition, within each of the groups, the main characteristics of four categories of Rogers adopters can be differentiated (i.e., innovators-early adopters, early majority, late majority and laggards).

The proposed actions to increase the acquisition of EVs in the market are the following:

- Early adopters (6.98%) show two clear psychosocial profiles. Both groups stand out for their high WtP for EVs, and may be the first candidates for buying an EV. The first (5.18%) stands out as having a tendency to a behavior that is impulsive, not reflective, and guided by emotions and feelings, whereas the second group (1.8%) has a more reflective behavior but with a certain predisposition to risk. Due to their willingness to pay, both types of individuals could buy premium-class vehicles.
- The first group of early adopters must be the target of marketing campaigns that provoke satisfaction in the purchase through specific promotions that highlight the innovative aspect of the EV technology. To attract the individuals of the second group, it is very important to let them know the characteristics of the vehicle so that they can take the purchase decision. In this case, the information should be provided by both companies and public administrations.
- However, the early majority group is the one that should be paid more attention because it supposes 42.11% of the market; at the same time, it is possible to attract them to buy an EV: these individuals are predisposed to buy an EV and have an intermediate WtP, but not enough to acquire an EV in the current market. For this reason, price discounts and the existence of medium-class EVs would allow that these consumers could acquire the product.

- There are also two profiles in this group that differ from each other, similar to the case of the early adopters: the first one (27.25%) is more impulsive while the second one (14.85%) takes the decision to buy when receiving the information. For this reason, the marketing campaigns that encourage impulse buying for the first case, and the disclosure of the characteristics of the EV highlighting its environmental benefits are fundamental for the sale of the product in this segment of the market.
- Individuals in the late majority group (37.39%) stand out as having a certain aversion to risk, a lower degree of impulsivity, and reject the adoption of innovations. These individuals would not acquire an EV until the earlier adopters have penetrated the market.
- Laggards (13.51% of the sample) show a preference towards conventional vehicles for reasons qualified as "taste", and categorically refuse to change for an EV. They stand out as lending high importance to vehicle attributes (design, versatility, driving experience and prestige), which differentiates them from all the other groups.

Finally, we emphasize the importance of the adoption of the EV to provide flexibility to the isolated electric systems. These systems are more vulnerable to intermittencies of renewable energies and require more restrictive operation conditions. Thus, consumers should be informed about the managing of the EV charge and the possibility of using their EV battery as distributed energy storage. These uses could provide some benefits to the electrical systems, such as frequency and voltage regulation, through V2G applications. According to Diaz et al. [4], the introduction of 50,000 EVs in Tenerife using V2G systems could increase up to 30% the renewable share in Tenerife, not only eliminating direct pollutants in urban areas but also reducing the emissions in the electricity production by 27%. Hence, in future research, we will address the willingness to provide services to the network by island EV users' through different compensation methods. Another interesting proposal to address in further research is the study of the tourist rent-a-car fleet, which represents almost a 5% of the total vehicles on the islands. The evaluation of the willingness to pay for the rental of low-carbon emission vehicles and the particular mobility routines of the visitors is key to perform an exhaustive analysis.

Supplementary Materials: The following are available online at http://www.mdpi.com/2071-1050/10/6/2053/s1, Database D1: Data collection from survey, Instructions I1: Instructions for execute the analysis.

Author Contributions: The authors declare equity in the process of developing the article. M.G.R.-B. constructed the theoretical framework and the psychosocial components. A.J.R.-D. developed the econometrics. F.J.R.-R. organized the manuscript and helped interpret the results. Y.P. provided the theoretical framework on electric cars and helped to design the experiment. All authors helped design the survey, develop the study, and discuss the results.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Survey

Title: Individual characteristics and car purchase features

Questionnaire code: ☐

Initial Conditions (mark the boxes with an X if you meet the follow conditions):

1. Own a vehicle, or have a vehicle available and use it assiduously ☐
2. Hold a valid car driver's license ☐
3. Intend to acquire a new vehicle before 2021 ☐

This survey aims to collect information on respondents' perceptions of alternative vehicles, on current mobility characteristics, and on socioeconomic and psychosocial aspects related to car purchasing. This survey is totally anonymous, and the University of La Laguna will only use the data collected for scientific purposes, and not for any commercial use. If you have any questions during

the course of the survey, the interview agent is there to help. We thank you for participating. The questionnaire is split into five blocks. It is important to complete the questions in the order given.

BLOCK I: Mobility characteristics

Q1. Municipality of residence

☐ Adeje	☐ Granadilla de Abona	☐ Puerto de la Cruz
☐ Arafo	☐ Guía de Isora	☐ San Cristóbal La Laguna
☐ Arico	☐ Güimar	☐ San Miguel de Abona
☐ Arona	☐ Icod de los Vinos	☐ San Juan de la Rambla
☐ Buenavista del Norte	☐ La Guancha	☐ Santa Cruz de Tenerife
☐ Candelaria	☐ La Matanza	☐ Santa Úrsula
☐ El Rosario	☐ La Orotava	☐ Santiago del Teide
☐ El Sauzal	☐ La Victoria	☐ Tacoronte
☐ El tanque	☐ Los Realejos	☐ Tegueste
☐ Fasnia	☐ Los Silos	☐ Vilaflor
☐ Garachico		

Q2. How many kilometres do you cover on average?

A.	**Weekday**	**B.**	**Weekend**
☐	Less than 10 km	☐	Less than 10 km
☐	Between 11 and 20 km	☐	Between 11 and 20 km
☐	Between 21 and 40 km	☐	Between 21 and 40 km
☐	Between 41 and 60 km	☐	Between 41 and 60 km
☐	Between 61 and 80 km	☐	Between 61 and 80 km
☐	Between 81 and 100 km	☐	Between 81 and 100 km
☐	More than 100 km	☐	More than 100 km

Q3. What should be the minimum acceptable range that a vehicle must offer?

☐ Kilometers

BLOCK II: Willingness to change and willing to pay for an EV

Q4. How much would you be willing to pay for your preferred car?

☐ Euros

Q5. If you were to acquire a new vehicle, would you be willing to pay more for an EV to replace your preferred conventional vehicle?

☐ Yes, I would pay more or the same for an electric vehicle to replace my conventional car.
☐ No, I prefer a conventional vehicle.

NOW ASSUME THAT:
"The purchasing conditions of an electric vehicle include charging station and battery ownership (not leasing)" and "When you are willing to pay for an EV, it should be assumed that the infrastructure is developed and a charging station is available at home".
NOW CONSIDER THAT:
"Compared to a conventional car, an electric vehicle pollutes 95% less locally, costs 85% less in fuel (recharge), has 25% more acceleration, and requires 60% less maintenance, and is noiseless. However, the electric car has a range of about 150–200 kilometres, depending on route, and requires a fairly large amount of time to charge (more than 30 min)"

Q6. If you were to acquire a new vehicle, would you be willing to pay more for an EV to replace your preferred conventional vehicle?

- ☐ Yes, I would pay more or the same for an equivalent electric vehicle to replace my conventional car.
- ☐ No, I would prefer a conventional vehicle.

Only for the respondents who say **NO, I would prefer a conventional vehicle (Q6)**

Q7. What are the main reasons for refusing to switch to an electric vehicle (choose up to two).

- ☐ Complex charging system
- ☐ Serious doubts over the maturity of the electric vehicle technology
- ☐ Does not have sufficient range to cover my mobility routines
- ☐ Matter of individual preferences
- ☐ Other:

Q8. *Would you purchase an electric vehicle for a lower price than your preferred conventional vehicle?*

- ☐ *I'd never buy an electric vehicle*
- ☐ *I would buy for 10% less*
- ☐ *I would buy for 20% less*
- ☐ *I would buy for 30% less*
- ☐ *I would buy for 40% less*
- ☐ *I would buy for 50% less*

Only for the respondents who say **YES, I would pay more or the same for an equivalent electric vehicle to replace my conventional car (Q6)**
Q9. Considering the attributes and the assumptions described above, what is the most you would be willing to pay for an electric vehicle compared with the price of your preferred conventional vehicle? ☐ Euros

BLOCK III: Psychosocial traits

The questions in this block use what is called a 'Likert scale' ranging from 1 to 7, where 1 means you totally agree and 7 measn you totally disagree with the assertiosn presented.

	1	2	3	4	5	6	7
A. Predisposition to technological innovations							
Q10. You would say that you assiduously acquire technological novelties as soon as they go on the market.							
Q11. You would say that you have numerous accounts on social networks and actively use them.							
Q12. You have a large number of electronic communication and information devices with access to internet (Smartphone, Smart TV, computer, gaming console, Smartwach, etc.)							
B. Degree of well-being							
Q13. Your work and money situation is satisfactory							
Q14. Your family and social relationships are satisfactory							
Q15. You achieve the goals and dreams that you set in your life							
C. Impulsive behaviour							
Q16. When you have enough money saved up to buy a new vehicle, do you feel an urgent need to renew the old one?							
Q17. After acquiring a vehicle, you wonder whether you made the right decision.							
Q18. When you decide to buy a vehicle, you take your time to learn and evaluate the technical characteristics of each one on option and you compare a series of models or technologies.							

D. Tendency to take risk	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Q19. You tend to imagine your actions have unfavourable results.							
Q20. You would say that you are a person who likes to take risks in the acts, investments or expenses that you make.							
Q21. You would say that your behaviour is influenced by the immediate consequences of your actions.							

E. Time preference	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Q22. It's not worth worrying about the future, because there's nothing you can do about it.							
Q23. When you want to buy the vehicle I want, I set it as a goal and work hard to acquire it.							
Q24. You would readily sacrifice your current welfare to have a more prosperous future.							

F. Awareness of the environment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Q25. You are fully aware of the greenhouse gas emissions caused when producing the electric energy you usually use.							
Q26. When you acquire electrical and electronic equipment, you look as closely as possible at their energy efficiency (appliances, light bulbs, etc.)							
Q27. You make rational use of electrical energy and you drive in the most efficient way possible.							

BLOCK IV: Car features preferences

Loyalty (from 1 to 7, where 1 means you totally agree and 7 means you totally disagree with the assertions presented).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Q28. You have total confidence in and loyalty to a specific brand of automobiles when you are going to purchase a vehicle.							

Q29. If you having a certain preference, indicate your preferred brand

☐	No brand preferences	☐	Hyundai	☐	Peugeot
☐	Alfa Romeo	☐	Jaguar	☐	Renault
☐	Audi	☐	Kia	☐	Seat
☐	BMW	☐	Land Rover	☐	Skoda
☐	Citroën	☐	Mazda	☐	Smart
☐	Dacia	☐	Mercedes	☐	Toyota
☐	Fiat	☐	Mitsubishi	☐	Volkswagen
☐	Ford	☐	Nissan	☐	Volvo
☐	Honda	☐	Opel	☐	Other automaker not listed here

Q30. Rank, from minor to major, the importance you give to these attributes when purchasing a vehicle (where 1 is the least important and 7 the most important).

☐	Design and aesthetics, both inside and outside.
☐	Low emissions level and low fuel consumption.
☐	Utilitarian, versatile and adaptable to the needs of daily use.
☐	Connectivity with devices and advanced technological equipment.
☐	Excellent price-performance ratio
☐	Reliability and low maintenance.
☐	Unique driving experience and prestige brand.

Q31. Age of your usual vehicle

☐

Q32. Number of cars in your household

☐

Q33. What vehicle do you currently drive? Fill out the model and the type of vehicle (motorcycle, micro-car, small urban, subcompact, compact, medium, large, luxury, SUV, crossover, minivan, multipurpose).

Model		**Segment**	

Q34. What vehicle do you plan to acquire in the near future? Indicate the model and type of vehicle, or if you have not yet decided, give at least the type of vehicle (motorcycle, micro-car, small urban, subcompact, compact, medium, large, luxury, SUV, crossover, minivan, multipurpose)

Model		**Segment**	

BLOCK V: Socioeconomic characteristics

Q35. How old are you?

☐

Q36. What is your gender?

☐ Male
☐ Female

Q37. What is your level of education

☐ Primary education
☐ Secondary education
☐ Sixth form
☐ University

Q38. How many children do you have?

☐

Q39. Please give your employment status

☐ Student
☐ Self-employed
☐ Paid-employed
☐ Retired
☐ Unemployed
☐ Other

Q40. Please give your gross annual salary

☐ Less than €8000 per year
☐ Between €8001 and €16,000 per year
☐ Between €16,001 and €22,000 per year
☐ Between €22,001 and €35,000 per year
☐ More than €35,000 per year

Appendix B. Descriptive Results of Clusters

Table A1 details the descriptive statistics of the categorical variables stratified by variable blocks (rows) and clusters (columns). The first column gives the question number, the second gives the total sample result, and remaining columns illustrate the clusters. The highest values are shaded for each variable.

Table A1. Descriptive statistics of categorical variables by clusters.

Categorical Var.	Question	Sample	Cl-1	Cl-2	Cl-3	Cl-4	Cl-5	Cl-6
Number of individuals		444	23	121	8	66	161	60
Cluster share		**100%**	**5.18%**	**27.25%**	**1.80%**	**14.86%**	**37.39%**	**13.51%**
Mobility routines var.								
Residence zone	(Q1)							
Urban		43.02	47.83	48.76	37.50	48.48	36.14	43.33
Rural		56.98	52.17	51.24	62.5	51.52	63.86	56.67
WtC and WtP var.								
WtP for an EV	(Q8)							
Yes, I would pay more		33.56	100	100	0	0	3.01	0
No, I would pay less/not pay		66.44	0	0	100	100	96.99	100
WtC to an EV (with info)	(Q9)							
Yes, I pay more		49.10	100	100	100	100	0	0
No, I pay less/not pay		50.90	0	0	0	0	100	100
Never buy an EV	(Q11)	31.53	0	0	0	0	56.02	78.33
Car features var.								
Size of the new car	(Q5)							
Small segment		13.74	13.04	15.70	25.00	10.61	13.86	11.67
Compact segment		22.07	13.04	19.01	0.00	30.30	25.90	15.00
SUV segment		31.08	39.13	26.45	37.50	28.79	29.52	43.33
Large segment		10.59	17.39	13.22	12.50	10.61	9.64	5.00
Socio-economic var.								
Age	(Q38)							
Gen Y		42.79	39.13	41.32	37.50	45.45	43.98	41.67
Gen X		52.03	56.52	51.24	37.50	50.00	53.61	51.67
Gender	(Q39)							
Male		51.35	65.22	52.07	62.50	42.42	51.81	51.67
Female		48.65	34.78	47.93	37.50	57.58	48.19	48.33
University education	(Q40)	44.14	47.83	48.76	62.50	39.39	46.99	28.33
Children	(Q41)	57.43	60.87	61.98	50.00	50.00	54.22	65.00
Job	(Q42)							
Self-employed		8.33	4.35	6.61	0.00	15.15	7.83	8.33
Paid-employed		77.03	82.61	76.86	75.00	69.70	80.12	75.00

Table A2 details the descriptive statistics of the continuous variables of the survey stratified by variable blocks (rows) and clusters (columns). Similar to Table A1., the first column gives the question number, the second gives the total sample result, and remaining columns illustrate the clusters. The psychosocial variables and some car features are measured on a 1–7 scale, where 7 is the highest value and 1 is the lowest value.

Table A2. Descriptive statistics of continuous variables by cluster.

Continuous Var. [2]	Question	Sample	Cl-1	Cl-2	Cl-3	Cl-4	Cl-5	Cl-6
Number of individuals		444	23	121	8	66	161	60
Cluster share		100%	5.18%	27.25%	1.80%	14.86%	37.39%	13.51%
Mobility Routines var.								
Kilometers covered per week (KCW).	(Q2)	273.30	318.32	266.76	294.61	221.07	292.53	270.62
Minimum range required (MRR)	(Q3)	419.46	390.87	388.92	412.50	327.12	483.30	417.91
WtC and WtP var.								
WtP for a new car (€)	(Q6)	17,438	30,826	14,508	32,750	14,598	17,403	19,391
WtP for an EV (€)	(Q12)	11,118	34,739	16,815	39,125	16.588	3350	2312

Table A2. *Cont.*

Continuous Var. [2]	Question	Sample	Cl-1	Cl-2	Cl-3	Cl-4	Cl-5	Cl-6
Psychosocial var.								
Pred. new technologies	PCA	3.623	4.856	3.635	3.842	3.577	3.390	3.790
Environmental awareness.	PCA	4.814	5.419	4.812	5.108	4.978	4.699	4.442
Subjective well-being	PCA	4.383	4.809	4.497	4.555	4.135	4.309	3.484
Pred. change vehicle	PCA	3.507	4.200	3.472	3.171	3.492	3.466	3.484
Future hedonistic	PCA	4.131	4.433	4.114	4.029	3.989	4.204	4.012
Aversion to risk	PCA	3.569	3.624	3.495	2.508	3.236	3.813	3.530
Tendency to impulsiveness	PCA	3.492	4.368	3.814	2.799	3.390	3.362	3.069
Satisfaction with family and social life	PCA	4.884	4.904	4.830	4.866	4.806	4.945	4.899
Reflexive behavior	PCA	4.938	4.634	4.924	5.636	4.901	5.026	4.782
Car features var.								
Brand-loyalty	(Q34)	3.856	4.174	3.843	4.625	4.166	3.500	4.300
Car design	(Q37a)	3.782	3.783	3.744	3.125	4.015	3.704	3.900
Emissions/consumption	(Q37b)	4.489	4.391	4.736	4.750	4.515	4.379	4.266
Versatility/adaptability	(Q37c)	4.427	4.000	4.554	5.625	3.969	4.385	4.800
Technologically advanced	(Q37d)	3.074	3.304	3.033	2.500	3.166	3.090	3.000
Price-performance	(Q37e)	4.677	4.391	4.736	5.125	4.772	4.704	4.433
Maintenance/reliability	(Q37f)	4.518	4.478	4.380	4.875	4.590	4.626	4.383
Drive experience/prestige	(Q37f)	3.024	3.652	2.835	2.000	2.984	3.066	3.233
Cars in household	(Q46)	2.21	2.26	2.23	2.37	2.24	2.18	2.18
Age of current car	(Q47)	11.21	11.95	11.11	14.12	11.18	11.04	11.25
Socio-economic var.								
Age	(Q38)	40.69	41.43	41.61	46.50	40.60	39.59	40.95
Income	(Q48)	17,101	19,956	18,933	17,687	15,977	16,403	15,400

[2] The scores within the different cells represent the average of the variable, except for the number of individuals and cluster share.

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