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**Mestrado em Estatística e Gestão de Informação**

Master Program in Statistics and Information Management

**Pragmatic or idealistic reasons: what drives electric vehicles' satisfaction and continuance intention?**

Hugo Daniel Figueira Alves

Dissertation presented as partial requirement for obtaining the Master's degree in Statistics and Information Management

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Instituto Superior de Estatística e Gestão de Informação  
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# **PRAGMATIC OR IDEALISTIC REASONS: WHAT DRIVES ELECTRIC VEHICLES' SATISFACTION AND CONTINUANCE INTENTION?**

by

Hugo Daniel Figueira Alves

Dissertation presented as partial requirement for obtaining the Master's degree in Statistics and Information Management , with a specialization in Marketing Research and CRM

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## **ABSTRACT**

The sales and use of Electric Vehicles (EVs) have been growing continuously over the past years in Europe, with the hopes of mitigating CO<sup>2</sup> emissions and enabling more sustainable transportation. Considering the growth of the Electric Vehicle (EV) market, the main goal of this research is to shed light on what drives electric vehicles' satisfaction and continuance intention. We collected data from 290 EV drivers in Europe. Grounding on the task-technology fit model, expectation-confirmation theory, and green self-identity as moderators, we were able to explain 22% of the variation in EV satisfaction and 40.1% of continuance intention. Several theoretical implications are drawn regarding satisfaction and continuance intention, such that task-technology fit of EVs impacts both of those constructs and that green self-identity is a moderator for task-technology fit and continuance but not for satisfaction. Task-technology fit is also found to be more relevant for individuals that exhibit low green self-identity (and vice-versa). We also present some practical implications, mainly for manufacturers and governments.

## **KEYWORDS**

Electric Vehicles; Satisfaction; Continuance Intention; Green Self-Identity; Task-Technology Fit

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## LIST OF ABBREVIATIONS AND ACRONYMS

<b>AC</b>	Alternating Current
<b>AVE</b>	Average Variance Extracted
<b>BEV</b>	Battery Electric Vehicle
<b>CR</b>	Composite Reliability
<b>DC</b>	Direct Charging
<b>ECM</b>	Expectation-Confirmation Model
<b>EV</b>	Electric Vehicle
<b>FCEV</b>	Fuel Cell Electric Vehicles
<b>FCHEV</b>	Fuel Cell Hybrid Electric Vehicles
<b>GHG</b>	Green House
<b>GSI</b>	Green-Self Identity
<b>HEV</b>	Hybrid Electric Vehicle
<b>PHEV</b>	Plug-In Hybrid Electric Vehicle
<b>PLS</b>	Partial Least Square
<b>SEM</b>	Structural Equation Modelling
<b>TTF</b>	Task-Technology Fit
<b>VAT</b>	Value Added Tax

## 1. INTRODUCTION

The last greenhouse gas (GHG) Bulletin reported that the period from 2016 to 2017 had an increase in the number of molecules of gas per million (ppm) that coincided with the average growth of the last decade but is lower when comparing the 2015-2016 period (World Meteorological Organization & Global Atmosphere Watch, 2018). Also, in the Paris Agreement, that was negotiated as a result of a convention on climate change, the concerns about the GHG emissions are noted (Article 2, United Nations, 2015) since the countries must take measures to reduce the emission levels (Article 6, United Nations, 2015). Although, according to the European Environment Agency, the total GHG emissions measured as CO<sup>2</sup> equivalent (in kt) decreased 27% between 1991 (4,622,236) and 2017 (3,644,378); emissions related to transport “only” decreased 17%. Moreover, in 1991, GHG emissions represented 17% of total emissions (778,676), whereas, in 2017, they represented 26% (934,932). Thus, transport has a substantial and increasing role in GHG emissions. As a result, the establishment of the European Commission target to achieve emission-free transportation by 2050 (Biresselioglu, Demirbag Kaplan, & Yilmaz, 2018).

Out of the replacement of old vehicles and the use of public transport, electric vehicles (EVs) were found to have the higher impact on the reduction of CO<sup>2</sup> emissions (Hofer, Jäger, & Füllsack, 2018), highlighting the positive impact of electric vehicles to achieve the established GHG emissions goals. The growth within Electric Vehicle (EV) sales is constant all over Europe, with a monthly increase of over 20% when comparing to the same month in the previous year (Irle, 2019). Considering Sheldon & Dua's (2018) findings regarding the fact that EVs play a vital role in increasing the fuel efficiency of the overall fleet of vehicles, it is important to highlight the importance of the increased number of EVs to reduce the dependency of fossil fuels.

Although the clear potential growing importance of EVs to reduce GHG emissions, most previous studies on EVs are related to the adoption intention, meaning there is a lack of knowledge on the satisfaction of EV drivers. Rezvani, Jansson, and Bodin (2015), who studied plug-in hybrid electric vehicles (PHEV) adoption intention, claim that in many studies, there is no direct experience of the participants with the vehicles and that it is necessary to understand the gap between the intention and the actual experience. Wang, Fan, Zhao, Yang and Fu (2016) by researching hybrid electric vehicles (HEV) adoption intention and She, Qing Sun, Ma and Xie (2017) in their study regarding the public acceptance of EV, also pointed out the gap between adoption intention and actual adoption behavior as a limitation of their findings. The limitation regarding the focus on adoption intention instead of actual adoption behavior by EV owners was also identified by Wang, Li, and Zhao (2017) and He, Zhan, and Hu (2018), who studied EV adoption and purchasing intention.

This particularity is in fact, a common problem in technology adoption literature - the fact that it is generally assumed that intention leads to behavior when often it does not since, in some cases the link between intention and behavior is weak, with it being necessary to include other variables (Balau, 2018).

Given the potential of EVs to reduce air (through the absence of CO<sup>2</sup> emissions) and noise pollution, understanding the drivers of its users' satisfaction as well as their continuance intention is a matter well worth investigating. Thus, contrarily to (the majority of) other studies, we do not focus on adoption or intention to, but rather on the satisfaction of those who already adopted an EV as well as their intention to continue using these types of automobiles in the future. Since the number of vehicles sold is increasing year after year (Irle, 2019), it is even more relevant to study the actual satisfaction and continuance intention. Thus, this study aims to understand the main drivers behind satisfaction with EVs and continuance intention from those who already have this type of vehicle. In doing so, the remainder of this paper is organized as follows: Section 2 grounds on the task-technology fit (TTF), green self-identity (GSI), and expectation-confirmation model (ECM); Section 3 presents the research model for EV satisfaction and continuance intention; Section 4 the methodology; Section 5 the results; whereas Section 6 concludes with the discussion, implications, and limitations of this study.

## 2. THEORETICAL BACKGROUND

### 2.1. ELECTRIC VEHICLES (EVs)

Electric vehicles (EVs) belong to a broad market which includes hybrid electric vehicles (HEV) – powered by batteries and combustion engine - those vehicles can either have their batteries powered by the engine and are designated as HEV, if there is the capability of being charged connecting a plug into an electric source they are designated as plug-In hybrid vehicles (PHEV). When the vehicles are only powered by batteries, they are classified as battery electric vehicles (BEV). In the EV context, there are also fuel cell electric vehicles (FCEV) – run using hydrogen - and fuel cell hybrid electric vehicle (FCHEV) – run on fuel cells having another energy storage system to support it - (Wilberforce et al., 2017). In this paper, we will focus on EVs, i.e., emphasizing the vehicles that require an infrastructure to charge them.

For some drivers, the main problems of EVs are related to the lack of public infrastructures (She et al., 2017) and also with the driving range which Jensen, Cherchi, and Mabit (2013), found to be a critical factor of EVs, becoming even more crucial when the households can only rely on one car. Even with those barriers, there are plenty of opportunities for drivers to charge their cars since there are three EV main charging modes that can make up for those insecurities: i) EV home charging – those charging points belong to the users for private use; ii) Public street charging – the charging points are located in a public space - and iii) Charging stations on private property with public access. (San Román, Momber, Abbad, & Sánchez Miralles, 2011). Generally, EV drivers are faced with two different charging schemes: fast charging and slow charging. Slow charging is associated with a period of six to eight hours of charging, which is mainly done at home overnight (Botsford & Szczepanek, 2009). Fast charging can enable vehicles to charge for ten minutes and to drive 100 miles (Botsford & Szczepanek, 2009). The difference with the two charging schemes is related to the connectors that each of the schemes use, since fast charging is allowed by level III connectors that enable Direct Charging (DC) while slow charging is associated with level I and II connectors that are Alternating Current (AC) chargers (Botsford & Szczepanek, 2009). With that in mind, If the public street charging and the charging stations on private properties with public access start to adopt more fast-charging units, it will be possible for a large fleet of EV to run in our cities. It is imperative to bear the possibilities of charging that exist and allow the drivers to charge their vehicles in mind since it is reported that near 50% of the individuals from a study conducted in Canada wanted to know more about EVs (Larson, Viáfara, Parsons, & Elias, 2014).

Financial incentives and benefits play an essential role in the EV context, as is noted by some authors. Graham-Rowe et al. (2011) observed in their seven-day experiment that EV drivers were

concerned regarding the fact that the cheaper refueling would not be enough to recover from the high initial investment due to the concerns apropos the battery life and also the depreciation of the cars. In the same year, Caperello and Kurani (2012) also experimented with a four to six week period of some individuals driving a PHEV, and the investigators reported that drivers did not consider the payback period and the fuel costs when doing their calculations to find if PHEV were worth it. Apart from those authors who have experimented with EV, there are also plenty of authors who found the financial incentives and low refueling costs to be positive predictors of EV adoption, for instance, Sierzchula, Bakker, Maat and Van Wee (2014) found financial incentives to have a positive effect on EV market share. Larson et al. (2014) did a pricing analysis regarding EVs and found the purchase price and the operating costs to be among the top three factors that motivate the purchase of EVs.

Nonetheless, the high purchase price and the battery cost also being among the four top barriers to the purchase of EV. Rezvani et al. (2015) did a similar analysis but with PHEV and found the low operational costs and financial incentives to be the most important incentives for adoption. One year later Bjerkan, Nørbech, and Nordtømme (2016) extended those studies to BEV and found that financial incentives are essential for all the income groups and also 80% of the respondents found the exemption from purchase tax and VAT to be decisive to BEV adoption. More recently, Wang et al. (2016), in their study on HEV, reinforce the positive effect of financial benefits towards the intention to purchase the, as defined by the authors, new energy vehicles. The most recent studies that emphasize the importance of financial incentives and savings were conducted by Biresselioglu et al. (2018) who found economic restrictions and battery cost to be the main barriers to EV adoption and the reduction of taxes, financial incentives and the economic savings to be motivators towards EV adoption. Magueta, Madaleno, Ferreira Dias, and Meireles (2017) studying CO<sup>2</sup> emissions highlight that the adoption of EVs has a stronger relationship with the incentives than with environmental issues.

Despite the stronger relationship with monetary incentives rather than environmental concerns, there is plenty of evidence in the literature that EVs are also related to those concerns. Sovacool and Hirsh (2009) conducted an exploratory study regarding plug-in hybrid vehicles that reinforces this idea by associating that the care for the environment was a driver for early adopters to go electric. Environmental concerns are a motivator that does not work alone but is also associated as an excellent addition to the savings households get from driving EVs (Caperello & Kurani, 2012). It is also known that individuals who are concerned with the environment express a higher intention to purchase an EV (Krause, Carley, Lane, & Graham, 2013), even if some of those individuals express that if the EV relied on entirely renewable energy it would increase the likelihood to purchase (Larson et al., 2014). EVs are also seen as symbols that represent the drivers' values, with

those values being related to pro-environmental behavior, beliefs about environmental issues (Rezvani et al., 2015), and green moral obligation (Barbarossa, Beckmann, De Pelsmacker, Moons, & Gwozdz, 2015). The association with green values is transversal to all classes of vehicles in the EV market, and even HEV adoption is positively related to environmental concerns that are related to personal norms (S. Wang et al., 2016). The norms and moral obligation that individuals might feel are associated with green self-identity, which is positively related to the intention to adopt EVs, revealing younger individuals as being more attached to ecological values (Barbarossa, De Pelsmacker, & Moons, 2017). There is a question regarding the norms and moral obligation of the society that make the EV an environmental symbolic element that represents the concern about climate change (White & Sintov, 2017) and the environmental motivation (Biresselioglu et al., 2018). Despite all the evidence regarding the association between EVs and environmental concerns, green self-identity, personal values, and norms, there is room for governments to increase the awareness of those alternative vehicles by communicating and diffusing the benefits (Browne, Mahony, & Caul, 2012).

## **2.2. TASK-TECHNOLOGY FIT**

Task-technology fit (TTF) is based on the TTF model. It posits that there is an alignment between the system (i.e., technology) and the respective task for which it is used, leading to performance impacts (Goodhue & Thompson, 1995).

TTF is an effective instrument for understanding individual performance that has already been successfully applied in different contexts, often proving its high explanatory power. Goodhue (1998) conducted an extensive test of the measurement validity of the instrument, confirming the strong discriminant validity of TTF but pointing out the lack of testing between TTF and performance itself. In subsequent years, there was some interest in the relationship between TTF and performance. McGill & Klobas (2009) developed a model using TTF to measure attitudes towards learning management systems extending the application of TTF and proving that TTF is a powerful model since most of the explanatory power of their model came from TTF. Gebauer, Shaw, and Gribbins (2008) also strengthened the predictive power of TTF by measuring task characteristics and technology characteristics with an experiment which measured TTF right after individuals had completed different tasks with different mobile devices, showing that TTF is a good measure for the fit between the task requirement and the technology used. Parkes (2013), in a more recent study about the interactions between individuals, tasks, and technology, also concluded that technology performance was higher where TTF was good. Another example is given by Tam and Oliveira (2016), who found that the effect of use on individual performance will be stronger among users with high TTF, the reverse also being true (Goodhue & Thompson, 1995).

Despite the wide applications of TTF, which confirm its strength, the model also has some limitations since focusing on fit alone is not enough because systems must be utilized before delivering performance impacts (Goodhue & Thompson, 1995).

### **2.3. EXPECTATION-CONFIRMATION MODEL**

Bahattacherjee's (2001) expectation confirmation model (ECM) is the most influential of IS continuance models. The ECM emerged from an adaptation of the expectation and confirmation theory (ECT) (Oliver, 1980). The ECM is supported by three dimensions to explain the individual's continuous intention of IT usage: satisfaction, confirmation of expectations, and perceived usefulness. The dimension of confirmation and perceived usefulness, determined by the consumer's initial expectations, both influence user satisfaction. The satisfaction and perceived usefulness forecast the individual's continuance intention of IS. The ECM has been studied over different horizons, such as e-government service success (Veeramootoo, Nunkoo, & Dwivedi, 2018), website usability (Pee, Klein, & Jiang, 2018), discrepancy between gratifications obtained and gratifications sought from social networking sites (Bae, 2018), among others, but not in EV context.

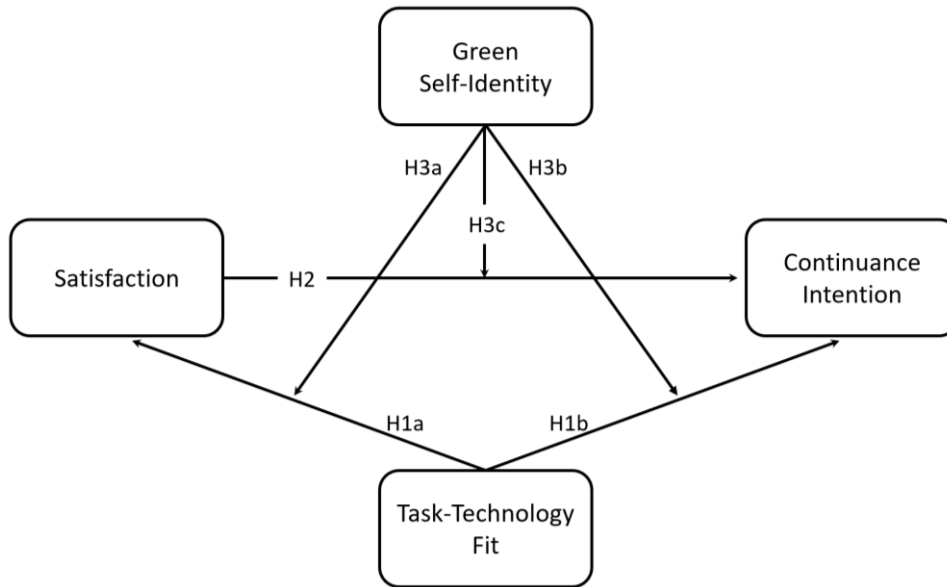
### **2.4. GREEN SELF-IDENTITY**

Green self-identity can be described as the perceived identification of an individual with a typical green consumer (Barbarossa et al., 2017). Binder & Blankenberg (2017) also add the sustainable/green lifestyle to the green consumer equation as the extent of the energy-saving, waste management, water conservation, and other behaviors that are healthy to the environment.

EVs have a positive impact on the reduction of CO<sup>2</sup> emissions, as was previously discussed, which makes these vehicles environmental-friendly. With that in mind and taking into consideration the increased awareness of the population regarding environmental issues, the green self-identity of individuals is found in recent studies to be an internal driver of environmentally friendly behavior. Welsch and Kühling (2018), for example, found that only 10% of the respondents, from a multi-country European social survey, show a low level of greenness. The greater values of greenness reported can show a relationship with the perceived responsibility for environmental damage which refers to the degree in which individuals believe that they are direct or indirectly responsible for causing harm to the environment (Wu & Yang, 2018), such that the individuals are more aware of the harm their everyday actions do to the environment. When individuals take on actual environmentally friendly behaviors, there is a relationship between that and life satisfaction since Welsch and Kühling (2018) and (Binder and Blankenberg (2017) found that environmentally friendly individuals are also more satisfied with their lives.

Green self-identity is a relevant trait of the identity of the individuals since it has been widely applied regarding EV adoption (Barbarossa et al., 2015, 2017), and also in the patterns of consumption and transportation (Kahn, 2007; Wu & Yang, 2018). Some studies applied green self-identity to the behavior (Binder & Blankenberg, 2017) and self-image of individuals who claim to have green behaviors (Welsch & Kühling, 2018). With that said, there is evidence that it is an essential trait of the identity of the individuals to be considered in our present research.

### 3. RESEARCH MODEL



**Figure 1.** Research Model

As discussed previously, TTF is defined by the fit between the characteristics of the task with the technology used. Regarding the vehicle market, the main task that is demanded is the journey from a particular location to another, even if those are for a personal or professional reason. Since there are far fewer EV chargers than gas stations, inevitably, EVs have a more limited driving range compared with internal combustion cars. Thus, the task for which EVs are used can be compromised if the driving distance is longer than the next available charger (Adderly, Manukian, Sullivan, & Son, 2017). We can expect that TTF is related to higher satisfaction and continuance intention. Tam and Oliveira (2016), for example, found TTF to positively influence m-banking satisfaction and use. As we intend to move beyond adoption or intention to, this study replaces intention to use with continuance intention, and individual user performance with satisfaction, there is already proven use of the technology being used replaced with behavioral intention to continue to use EV in the future and we expect TTF not to be a moderator but to have a direct influence on satisfaction. So, we hypothesize:

**H1a:** *TTF of EV positively affects satisfaction.*

**H2b:** *TTF of EV positively affects continuance intention.*

According to ECM, we expect that higher levels of drivers towards EV satisfaction will positively affect its continuance intention. There are several pieces of evidence in the literature that show that satisfaction is an important factor affecting a user's continuance intention (see, e.g., Albashrawi & Motiwalla, 2019; Foroughi, Iranmanesh, & Hyun, 2019; Nascimento, Oliveira, & Tam,

2018). Despite the high cost of EV, the savings of charging EV will be much lower than combustion vehicles. On the other hand, vehicle noise is practically zero. These two aspects, coupled with comfort, will make users much more satisfied, leading to continued intention. These lines of evidence complement ours, based on that, we hypothesize:

**H2:** *Satisfaction of EV positively affects continuance intention.*

Finally, green self-identity is reported to have a positive and direct effect on the environmental consequences of using cars, meaning that there is also a positive effect on the satisfaction and continuance intention of EV (Barbarossa et al., 2015). However, there is some evidence that green self-identity alone is not enough to explain technology adoption and use, since other aspects also play an important role in that process (Barbarossa et al., 2015, 2017). Hence, in our paper, we use green self-identity as a moderator between TTF and ECM in the context of EV.

Hence, we hypothesize that green self-identity, as the perceived identification of an individual with a typical green consumer (Barbarossa et al., 2017) is positively associated with EV satisfaction and continuance intention, since those consumers will see the positive impact of their actions and will continue to perform the behavior. Also, since the drivers are aware of their positive impact regarding the environment, and since they are identified as green consumers, the green self-identity traits will be positively associated with the satisfaction:

**H3a:** *Green self-identity moderates the effect of TTF on satisfaction.*

**H3b:** *Green self-identity moderates the effect of TTF on continuance intention.*

**H3c:** *Green self-identity moderates the effect of satisfaction on continuance intention.*

## **4. METHODS**

### **4.1. MEASUREMENT**

An instrument was developed based on the previous research model and was applied to survey EV owners and aficionados. The instrument was released by email and across social media groups and other online communities related to EVs. Task-technology fit constructs were adapted from Goodhue et al. (1995). The expectation-confirmation model was adapted from (Bahattacherjee, 2001). Green self-identity was adapted from Sparks & Shepherd (1992). Every item was measured from a one to seven-point scale anchored between (1) strongly disagree to (7) strongly agree. Regarding the questions that will be evaluated using the Likert scale, the scale will have seven-points since Krosnik and Presser (2010) found through several studies that there are low gains of reliability by adding more than seven-points to a scale. The use of the seven-point scale is also to maximize the gains on reliability and the refinement since the higher number of points the more considerable the differentiation in the judgements will be (Krosnik & Presser, 2010) and allow to have a more precise definition of the points of the scale since when the scales increase above seven points the definition of each point starts to be less precise (Krosnik & Presser, 2010). Also, those seven-point scales allow having a neutral point, which will not push the respondents towards a positive or negative answer (Krosnik & Presser, 2010).

The original items were in English, and to adapt them to the EV technology, some slight adjustments were made. A professional native English speaker translated the items into Portuguese, and then from Portuguese back to English to ensure its correctness. This measure was also necessary as the instrument was distributed in both Portuguese and English. The questionnaire started with the type of vehicle the respondents have. Only those with EVs were included in the analysis.

### **4.2. DATA**

A pilot test was conducted to evaluate the consistency of the questionnaire. We received 33 responses that were not used in the final estimation. Then, an online survey was carried out over eight weeks. A total of 843 people received the questionnaire. From the answers we gathered, 25 were from individuals who did not have a vehicle making them not suitable to be a part of the study. From the individuals who have a vehicle, 468 did not answer the survey, meaning we had a 43% response rate (considering only answers from individuals with the vehicle). From the valid answers, we had 60 from ICV (Internal Combustion Vehicles) drivers leaving our study with an n=290.

The respondents who drive EVs are aged between 18 and 82, with the mean of ages being 48 years. Regarding education, 83% have completed a university degree or higher, 77% being employed.

It is interesting to note that the weight of EVs is distributed evenly amongst families with children and single-parent/couples without children since only 54% of respondents have three or more elements in their households, meaning that EVs are not only adopted by families but also by single-parents and couples nearly in the same proportion. The sample of EV drivers is mostly representative of men with a weight of 80%.

As a result, from the survey, it is possible to gather some insights regarding the utilization of EVs. On average, the respondent's ownership of an EV is 2-3 years, and those drivers, on average, did around 31.000 km with their vehicles, which means that EV drivers, average, some 1.000 km per month.

## 5. DATA ANALYSIS AND RESULTS

### 5.1. RESULTS

We used partial least squares (PLS) to test the conceptual model. This estimation alternative from “Structural Equation Modelling” (SEM) does not require a normal distribution, focusing on the variance of the dependent variables (Henseler, Ringle, & Sinkovics, 2009). Because all items in our data are not normally distributed ( $p < 0.01$ , based on Kolmogorov-Smirnov test), PLS seems to be adequate for the application. Using smart PLS 3 software (see, e.g., Hair, Sarstedt, Ringle, & Gudergan, 2017), we estimated the dependent variables, testing the measurement model, and the structural model, to obtain support for conclusions about our research model's hypotheses.

### 5.2. MEASUREMENT MODEL

We evaluated the measurement model based on composite reliability, convergent validity, indicator reliability, and discriminant validity. Firstly, to analyze the indicator reliability, we analyzed the loadings. All of them are at least 0.7 (Table 1) and statistically significant. Second, Table 2 shows the composite reliability (CR), and with the square root of the average variance extracted (AVE), these indicators are used to evaluate the developmental reliability and validity. As seen in Table 2, all constructs have CR above 0.7, assuming good levels of reliability, and demonstrate evidence of internal consistency (Henseler et al., 2009). Table 2, also shows a sufficient degree of convergent validity, as the AVE for each construct is greater than 0.5, we can conclude that the latent variable explains more than half of the variance of its indicators (Henseler et al., 2009).

In addition, we also evaluated discriminant validity: i) the square root of AVE is higher than the correlations between the constructs. Thus this criterion is satisfied (Henseler et al., 2009). ii) Table 1 shows the cross-loadings, based on the criterion, which requires that the loading of each indicator should be greater than all cross-loadings (Henseler et al., 2009). As presented in Table 4, this criterion is also satisfied. iii) The Hetrotrait-Monotrait Ratio (HTMT) ratios are below 0.9 (Henseler, Ringle, & Sarstedt, 2015), which suggest discriminant validity (please, see Table 3). Hence, we conclude that all the developmental components demonstrate evidence of discrimination.

**Table 1.** Loadings and cross-loadings

	TTF	green	Satisfaction	ContInt
TTF2	<b>0.89</b>	0.16	0.35	0.44
TTF3	<b>0.88</b>	0.19	0.38	0.38
TTF4	<b>0.87</b>	0.14	0.48	0.36
GREEN1	0.11	<b>0.90</b>	0.07	0.28
GREEN2	0.22	<b>0.86</b>	0.17	0.27
GREEN3	0.18	<b>0.96</b>	0.16	0.33
GREEN4	0.16	<b>0.94</b>	0.21	0.33
SAT1	0.42	0.09	<b>0.86</b>	0.23
SAT2	0.42	0.21	<b>0.84</b>	0.21
SAT3	0.44	0.16	<b>0.92</b>	0.23
SAT4	0.34	0.15	<b>0.90</b>	0.14
CI1	0.34	0.26	0.10	<b>0.87</b>
CI2	0.44	0.31	0.32	<b>0.83</b>
CI3	0.39	0.29	0.17	<b>0.92</b>

**Table 2.** Composite reliability (CP) and average variance extracted (AVE)

Construct	CR	AVE	TTF	green	Satisfaction	Cont. Int.
TTF	0.91	0.77	<b>0.88</b>			
GREEN	0.95	0.84	0.19	<b>0.92</b>		
Satisfaction	0.93	0.78	0.46	0.17	<b>0.88</b>	
Cont. Int.	0.91	0.77	0.45	0.33	0.24	<b>0.88</b>

Notes: Composite reliability (CP), average variance extracted (AVE), the diagonal in bold is the square root of AVE, non-diagonal is correlation.

**Table 3.** Heterotrait-Monotrait Ratio (HTMT)

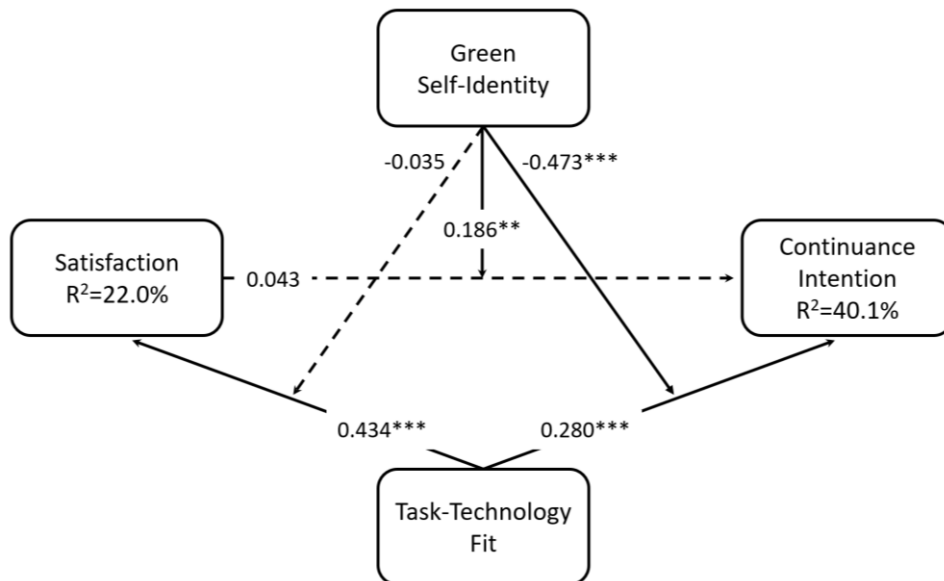
Construct	TTF	green	Satisfaction	Cont. Int.
TTF				
GREEN	0.21			
Satisfaction	0.51	0.18		
Cont. Int.	0.52	0.36	0.25	

### 5.3. STRUCTURAL MODEL

The hypotheses from the research model can be seen in Figure 2. Four of the six hypotheses were supported.

TTF was proven to positively affect satisfaction H1a ( $\beta=0.434$ ,  $p<0.001$ ) and continuance intention H1b ( $\beta=0.280$ ,  $p<0.001$ ). The relationship between satisfaction and continuance intention H2 ( $\beta=0.043$ ,  $p>0.10$ ), contrarily to our expectations, was not supported. Green self-identity revealed to moderate the effect between TTF on continuance intention H3b ( $\beta=-0.473$ ,  $p<0.01$ ), although this effect is the opposite to what we hypothesized and the effect of satisfaction on continuance intention H3c ( $\beta=0.186$ ,  $p<0.05$ ). On the other hand, contrarily to our expectations, green self-identity was not proven to moderate the relationship between TTF on satisfaction H3a ( $\beta=-0.035$ ,

$p > 0.10$ ). Our model explains 22%, and 40.1%, of variation in satisfaction continuance intention, respectively.



**Figure 2.** Supported hypotheses and statistical significance. Note: \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

## 6. DISCUSSION

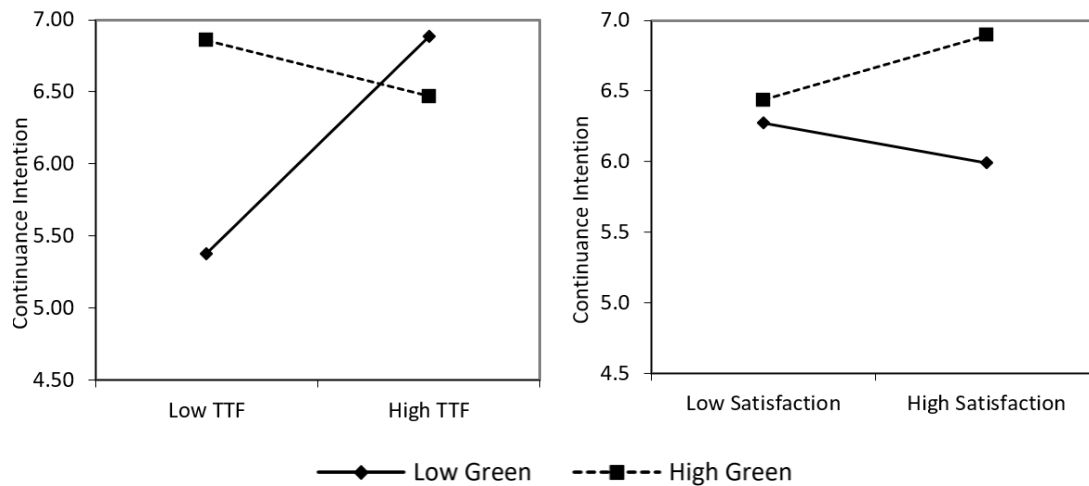
### 6.1. THEORETICAL IMPLICATIONS

Our analysis presents some interesting conclusions. There is substantial evidence that TTF (i.e., EV owners perceived suitability between their vehicles and the trips they use them for) positively influences their satisfaction and continuance intention (H1a and H1b, respectively). This result is not surprising, as EV have a set of specificities that, to some extent, narrow their adequacy to some tasks (trips) in comparison to conventional ones. Thus, one might argue that TTF plays a more important role to EV owners' satisfaction and continuance intention than conventional (internal combustion) vehicles, due to range anxiety, which leads drivers to being extra cautious about the in-car facilities they use in order to save battery power, and the lack of public infrastructures (Graham-Rowe et al., 2011) which are not common problems for conventional vehicles. In fact, it seems reasonable to assume that EV satisfaction and continuance intention have important antecedents that are meaningless in conventional vehicles. EV drivers, for example, need to have specific charging stations available that other drivers. This detail does not mean that EV drivers face some important technical barriers that are non-existent to other drivers (Sovacool & Hirsh, 2009). The distance covered in each trip by an EV is a critical aspect, that emphasizes its importance when individuals drive one of those vehicles (Jensen et al., 2013), as the ranges are still limited, especially in the (still often) absence of charging stations (Larson et al., 2014). This fact may yield some type of "range anxiety" that can vary depending on the context, e.g., urban vs. countryside or driver experience (Rezvani et al., 2015), which ultimately yields to different satisfaction and continuance intention antecedents. In summary, aspects like lack of proper infrastructure, trip characteristics such as long-distance or through rural areas, or even driver experience, can strongly affect EV satisfaction and continuance intention. Thus, the more perceived the fit between task (trips) with technology (EV) is, the more likely EV drivers are to be satisfied and intend to continue using their vehicles in the future.

Surprisingly, at least, at first sight, satisfaction was not proven to influence continuance intention (H2). It seems reasonable to assume that more satisfied EV drivers would also have a higher intention to continue using these vehicles in the future. However, in light of our results, a caveat in our hypothesis arises: this study's respondents are individuals that have already purchased an EV and, due to the relatively young age of these vehicles, along with their acquisition costs, that is considered to be one of the main barriers towards adoption (Sovacool & Hirsh, 2009)(Biresselioglu et al., 2018; Rezvani et al., 2015; She et al., 2017; Sovacool & Hirsh, 2009), are not likely to stop using them as this would imply acquiring a conventional one and since most EV drivers did not reach

breakeven, it is not reasonable that they would stop using their vehicles. Thus, continuance intention is independent of satisfaction, at least for those who have already purchased and regularly use an EV. From a theoretical perspective, it is interesting to note that the ECM hypothesis that satisfaction's effect on continuance intention may not apply to individuals who already bought and use a technology, especially if this is new and with relatively high initial costs. This detail may also be important for policymakers and other EV stakeholders (e.g., manufacturers).

As for green self-identity, the hypothesized moderation effect of the relationship between TTF and satisfaction (H3a) was not supported, whereas the ones between TTF, and satisfaction, on continuance intention were (H3b and H3c, respectively) – see Figures 3a and 3b. For the first (H3a), it thus seems that EV satisfaction is driven exclusively by pragmatic (TTF) and not subjective reasons. There is no influence by how each person sees him or herself as environmentally conscious as far as EV continuance intention is concerned. On the other hand, as mentioned, there is evidence that green self-identity moderates the relationship between TTF and continuance intention (H3b), although with an opposite (negative) effect on what was hypothesized ( $\beta=-0.473$ ,  $p<0.01$ ). If, in EV owners with low green self-identity, TTF is a powerful driver of EV continuance intention, in those with high green self-identity, it is not. This factor is as much interesting as it is surprising as it seems that there is an opposite effect of pragmatism versus idealism. A plausible explanation is that an EV owner's intention to continue using EVs is either because these vehicles fit drivers' needs or fit drivers' values. The more one sees him or herself as environmentally savvy, the less critical TTF is to their intention to continue using EV. In other words, those with lower levels of green self-identity basically only care about TTF to continue using EVs. Finally, even though there is no significant direct effect of satisfaction on continuance intention (H2) when moderated by green self-identity, it is perceptible. For those with low levels of green self-identity, satisfaction is negatively associated with EV continuance intention. Accordingly, for those with higher levels of green self-identity, satisfaction does indeed positively influence EV continuance intention. Thus, for average levels of green self-identity, satisfaction does not indeed influence continuance intention as the effect is close to zero and, therefore, non-significant being contrary to the findings from Rezvani et al. (2015) who noted that drivers feel their pro-environmental values and symbolism when they drive an EV. Note that this critical effect would not be revealed if only a direct effect was tested.



**Figures 3a and 3b.** Moderation effects of green Self Identity in TTF on continuance intention (H3b) and satisfaction on continuance intention (H3c).

Our empirical findings highlight the importance of pragmatism (e.g., utility) and idealism (e.g., environmental values), although at different levels, in EV satisfaction and continuance intention. When comparing our results with the body of the literature, some authors had already noticed that personal utility is placed over environmental concerns (Graham-Rowe et al., 2011) and in some situations, environmentalism was not even considered as a predictor of adoption (Sierzchula et al., 2014). Our results seem to back this to some extent. Some drivers might also be concerned that an EV is not a 100% clean solution depending on the source of EV power being renewable energies (Larson et al., 2014), meaning that some consumers lack trust in the environmental benefits (Biresselioglu et al., 2018). The fact that governments offer some incentives to EV purchases might also influence the population to purchase an EV not because it has low emissions but because of the incentives they obtain (Magueta et al., 2017), it is also noted that environmental concerns are, somehow, the mediators between the financial incentives and incentives to purchase an EV which make them play a limited role in the EV context (S. Wang et al., 2017).

Conversely, Caperello and Kurani (2012) detected that in addition to the economic benefits, EV drivers considered the environment to be important. Even with those conclusions, there was no evaluation of which of those factors were more relevant. Even not knowing the level of importance of environmental concerns, Zhang et al. (2013) placed environmental awareness as part of the four constructs which have a positive impact on the potential purchase of an EV. Environmental concern is also placed as an incentive towards the adoption, being that pro-environmental values awaken when the drivers use their vehicles (Rezvani et al., 2015; S. Wang et al., 2016) meaning that in the literature the environmental concern not only positively impacts the utilization but also the purchase intention (He et al., 2018; Z. Wang, Zhao, Yin, & Zhang, 2017; White & Sintov, 2017). There is also a connection between environmental concerns towards car utilization and the moral obligation of

using an EV (Barbarossa et al., 2015, 2017), but sometimes moral obligation does not mean that the drivers identify themselves as having a green self-identity. We believe our study bridges these two perspectives by including environmental concerns as a moderator of the relationship between utility with satisfaction and continuance intention. This element is, in our opinion, a prominent theoretical implication.

Regarding the EV field of study, there are also contributions to overcome previous studies' limitations. There are implications regarding the fact that we studied the actual use and satisfaction of EVs, while some of the previous studies did not have commercially available vehicles at the time (Sovacool & Hirsh, 2009; Zhang et al., 2013). The present study also contributes to the current state of the art since we are studying the long-term utilization of the vehicles and not only during an experimental period (Graham-Rowe et al., 2011). There are also limitations from samples which did not have any experience with EVs (Rezvani et al., 2015; She et al., 2017) or were in the early stage of adoption (Barbarossa et al., 2015) meaning those studies were focused on intention to adopt instead of adoption behavior (He et al., 2018; She et al., 2017; S. Wang et al., 2016, 2017). We overcame this constraint with our study since our sample, on average, have owned an EV for 2 to 3 years.

## **6.2. PRATICAL IMPLICATIONS**

We believe that our paper may also present some valuable insights for those interested in promoting EVs as effective alternatives to conventional vehicles, such as policymakers and EV manufacturers. Policymakers should focus on providing the necessary infrastructures if they want to reduce GHG emissions and reflect environmental sustainability in their policies, as it seems to increase public concern and even demand. Moreover, policymakers must be aware of future policies on electricity prices (EV drivers are now benefiting from reduced or free costs) since these may affect TTF negatively and thus EV satisfaction and continuance intention.

As TTF is the most critical driver of EV continuance intention, EV manufacturers should focus on new customers (those who do not yet have EVs) as it seems that the marketing dogma that one should keep their customers satisfied does not apply or does not carry the same intensity as usual. Hence, for the automotive industry, this paper will help to understand the main factors of success of the EV being sold and will give them powerful insights for the future since they know what customers already value. With that in mind, manufacturers should work hard on maintaining and improving the levels of quality regarding the range of vehicles in order to improve the TTF for the consumers that are not yet EV drivers. It is also essential to maintain the vehicles updated with the latest technology and design to secure EVs as an exciting option.

### **6.3. LIMITATIONS AND FUTURE RESEARCH**

Future research should consider including more dimensions of personality and not only the traits related to green consumption patterns in order to evaluate if there are some personality characteristics related to the use and valorization of certain aspects regarding EV benefits. Taking into consideration that green self-identity was not considered a driver for satisfaction, future research could consider studying well-being since a person might not consider himself as having a green identity but might feel good by contributing to a better world with no carbon dioxide emissions. Also, some more investigation regarding green-self-identity towards all classes of EV vehicles could explain that green self-identity might be more significant for vehicles that demand a higher adaptation (charging, for instance).

With the increasing number of EVs being sold, it will also be relevant to investigate if the charging infrastructures are increasing at the same rate. Another even more interesting angle to research would also be the status quo in this regard between different countries since there are different investments from governments on charging infrastructures.

## **7. CONCLUSIONS**

With the presented research, there is a contribution to the models that are widely applied in technology adoption contexts and have been extended towards EV utilization. We emphasize the reliability power of TTF, which was able to explain the satisfaction and continuance intention. Satisfaction only explains continuance intention when moderated by green self-identity.

## 8. BIBLIOGRAPHY

- Adderly, S. A., Manukian, D., Sullivan, T. D., & Son, M. (2017). Electric vehicles and natural disaster policy implications. *Energy Policy*, *112*(August 2017), 437–448. <https://doi.org/10.1016/j.enpol.2017.09.030>
- Albashrawi, M., & Motiwalla, L. (2019). Privacy and personalization in continued usage intention of mobile banking: an integrative perspective. *Information Systems Frontiers*, *21*, 1031–1043.
- Bae, M. (2018). Understanding the effect of the discrepancy between sought and obtained gratification on social networking site users' satisfaction and continuance intention. *Computers in Human Behavior*, *79*(November), 137–153. <https://doi.org/10.1016/j.chb.2017.10.026>
- Bahattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly*, *25*(3), 351–370.
- Balau, M. (2018). Exploring the Link between Intention and Behavior in Consumer Research. *European Integration Realities and Perspectives*, (May).
- Barbarossa, C., Beckmann, S. C., De Pelsmacker, P., Moons, I., & Gwozdz, W. (2015). A self-identity based model of electric car adoption intention: Across-cultural comparative study. *Journal of Environmental Psychology*, *42*, 149–160. <https://doi.org/10.1016/j.jenvp.2015.04.001>
- 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>
- Binder, M., & Blankenberg, A. K. (2017). Green lifestyles and subjective well-being: More about self-image than actual behavior? *Journal of Economic Behavior and Organization*, *137*, 304–323. <https://doi.org/10.1016/j.jebo.2017.03.009>
- Biresselioglu, M. E., Demirbag Kaplan, M., & Yilmaz, B. K. (2018). Electric mobility in Europe: A comprehensive review of motivators and barriers in decision making processes. *Transportation Research Part A: Policy and Practice*, *109*(January), 1–13. <https://doi.org/10.1016/j.tra.2018.01.017>
- Bjerkkan, K. Y., Nørbech, T. E., & Nordtømme, M. E. (2016). Incentives for promoting Battery Electric Vehicle (BEV) adoption in Norway. *Transportation Research Part D: Transport and Environment*, *43*, 169–180. <https://doi.org/10.1016/j.trd.2015.12.002>
- Botsford, C., & Szczepanek, A. (2009). Fast Charging vs. Slow Charging : Pros and cons for the New Age of Electric Vehicles. *Evs24*, (May), 1–9. Retrieved from <http://www.cars21.com/assets/link/EVS-24-3960315 Botsford.pdf>
- Browne, D., Mahony, M. O., & Caul, B. (2012). How should barriers to alternative fuels and vehicles be classified and potential policies to promote innovative technologies be evaluated ?, *35*, 140–151. <https://doi.org/10.1016/j.jclepro.2012.05.019>
- Caperello, N. D., & Kurani, K. S. (2012). Households' Stories of Their Encounters With a Plug-In Hybrid Electric Vehicle. *Environment and Behavior*, *44*(4), 493–508. <https://doi.org/10.1177/0013916511402057>
- Foroughi, B., Iranmanesh, M., & Hyun, S. S. (2019). Understanding the determinants of mobile banking continuance usage intention usage intention. *Journal of Enterprise Information*

*Management*, (August). <https://doi.org/10.1108/JEIM-10-2018-0237>

- Gebauer, J., Shaw, M. J., & Gribbins, M. L. (2008). Task-technology fit for mobile locatable information systems. *Journal of Information Technology*, 25(3), 259–272. <https://doi.org/10.1057/jit.2010.10>
- Goodhue, D. L. (1998). Development and Measurement Validity of a Task-Technology Fit Instrument for User Evaluations of Information System. *Decision Sciences*, 29(1), 105–138. <https://doi.org/10.1111/j.1540-5915.1998.tb01346.x>
- Goodhue, D. L., & Thompson, R. L. (1995). Task-Technology Fit and Individual Performance. *Mis Quarterly*, 19(2), 213–236. <https://doi.org/10.2307/249689>
- Graham-Rowe, E., Gardner, B., Abraham, C., Skippon, S., Dittmar, H., Hutchins, R., & Stannard, J. (2011). Mainstream consumers driving plug-in battery-electric and plug-in hybrid electric cars: A qualitative analysis of responses and evaluations. *Transportation Research Part A: Policy and Practice*, 46(1), 140–153. <https://doi.org/10.1016/j.tra.2011.09.008>
- Hair, J., Sarstedt, M., Ringle, C., & Gudergan, S. (2017). *Advanced Issues in Partial Least Squares Structural Equation Modeling*.
- 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>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135. <https://doi.org/10.1007/s11747-014-0403-8>
- Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In *Advances in International Marketing* (pp. 277–319). Emerald. [https://doi.org/10.1108/S1474-7979\(2009\)0000020014](https://doi.org/10.1108/S1474-7979(2009)0000020014)
- Hofer, C., Jäger, G., & Füllsack, M. (2018). Large scale simulation of CO<sub>2</sub> emissions caused by urban car traffic: An agent-based network approach. *Journal of Cleaner Production*, 183, 1–10. <https://doi.org/10.1016/j.jclepro.2018.02.113>
- Irle, R. (2019). Europe Plug-in Sales for 2019 H1. Retrieved from <http://www.ev-volumes.com/country/total-euefta-plug-in-vehicle-volumes-2/>
- Jensen, A. F., Cherchi, E., & Mabit, S. L. (2013). On the stability of preferences and attitudes before and after experiencing an electric vehicle. *Transportation Research Part D: Transport and Environment*, 25, 24–32. <https://doi.org/10.1016/j.trd.2013.07.006>
- Kahn, M. E. (2007). Do greens drive Hummers or hybrids? Environmental ideology as a determinant of consumer choice. *Journal of Environmental Economics and Management*, 54(2), 129–145. <https://doi.org/10.1016/j.jeem.2007.05.001>
- Krause, R. M., Carley, S. R., Lane, B. W., & Graham, J. D. (2013). Perception and reality : Public knowledge of plug-in electric vehicles in 21 U. S. cities. *Energy Policy*, 63(2013), 433–440. <https://doi.org/10.1016/j.enpol.2013.09.018>
- Krosnik, J. A., & Presser, S. (2010). *Question and Questionnaire Design. Handbook of Survey Research* (Vol. 62). <https://doi.org/10.1111/j.1432-1033.1976.tb10115.x>

- Larson, P. D., Viáfara, J., Parsons, R. V., & Elias, A. (2014). Consumer attitudes about electric cars: Pricing analysis and policy implications. *Transportation Research Part A: Policy and Practice*, *69*, 299–314. <https://doi.org/10.1016/j.tra.2014.09.002>
- Magueta, D., Madaleno, M., Ferreira Dias, M., & Meireles, M. (2017). New cars and emissions: Effects of policies, macroeconomic impacts and cities characteristics in Portugal. *Journal of Cleaner Production*, *181*, 178–191. <https://doi.org/10.1016/j.jclepro.2017.11.243>
- McGill, T. J., & Klobas, J. E. (2009). A task-technology fit view of learning management system impact. *Computers and Education*, *52*(2), 496–508. <https://doi.org/10.1016/j.compedu.2008.10.002>
- Nascimento, B., Oliveira, T., & Tam, C. (2018). Wearable technology: What explains continuance intention in smartwatches? *Journal of Retailing and Consumer Services*, *43*, 157–169.
- Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, *17* (4), 351–370.
- Parkes, A. (2013). The effect of task-individual-technology fit on user attitude and performance: An experimental investigation. *Decision Support Systems*, *54*(2), 997–1009. <https://doi.org/10.1016/j.dss.2012.10.025>
- Pee, L., Klein, G., & Jiang, J. (2018). Signaling effect of website usability on repurchase intention. *International Journal of Information Management*, *39*(August), 228–241. <https://doi.org/10.1016/j.ijinfomgt.2017.12.010>
- Rezvani, Z., Jansson, J., & Bodin, J. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda. *Transportation Research Part D: Transport and Environment*, *34*, 122–136. <https://doi.org/10.1016/j.trd.2014.10.010>
- San Román, T. G., Momber, I., Abbad, M. R., & Sánchez Miralles, Á. (2011). Regulatory framework and business models for charging plug-in electric vehicles: Infrastructure, agents, and commercial relationships. *Energy Policy*, *39*(10), 6360–6375. <https://doi.org/10.1016/j.enpol.2011.07.037>
- She, Z. Y., Qing Sun, Ma, J. J., & Xie, B. C. (2017). What are the barriers to widespread adoption of battery electric vehicles? A survey of public perception in Tianjin, China. *Transport Policy*, *56*(February), 29–40. <https://doi.org/10.1016/j.tranpol.2017.03.001>
- Sheldon, T. L., & Dua, R. (2018). Gasoline savings from clean vehicle adoption. *Energy Policy*, *120*(March), 418–424. <https://doi.org/10.1016/j.enpol.2018.05.057>
- Sierzchula, W., Bakker, S., Maat, K., & Van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy*, *68*, 183–194. <https://doi.org/10.1016/j.enpol.2014.01.043>
- Sovacool, B. K., & Hirsh, R. F. (2009). Beyond batteries : An examination of the benefits and barriers to plug-in hybrid electric vehicles ( PHEVs ) and a vehicle-to-grid ( V2G ) transition, *37*, 1095–1103. <https://doi.org/10.1016/j.enpol.2008.10.005>
- Sparks, P., & Shepherd, R. (1992). Self-Identity and the Theory of Planned Behavior : Assessing the Role of Identification with " Green Consumerism " Author ( s ): Paul Sparks and Richard Shepherd Source : *Social Psychology Quarterly*, Vol. 55, No . 4 ( Dec ., 1992 ), pp . 388-399 Publish. *Social Psychology Quarterly*, *55*(4), 388–399.
- Tam, C., & Oliveira, T. (2016). Understanding the impact of m-banking on individual performance:

- DeLone & McLean and TTF perspective. *Computers in Human Behavior*, 61, 233–244.  
<https://doi.org/10.1016/j.chb.2016.03.016>
- United Nations. (2015). Paris Agreement. <https://doi.org/FCCC/CP/2015/L.9/Rev.1>
- Veeramootoo, N., Nunkoo, R., & Dwivedi, Y. K. (2018). What determines success of an e-government service ? Validation of an integrative model of e-filing continuance usage What determines success of an e-government service ? Validation of an integrative model of e-filing continuance usage. *Government Information Quarterly*, 14(March), 161–174.  
<https://doi.org/10.1016/j.giq.2018.03.004>
- 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. <https://doi.org/10.1007/s11116-014-9567-9>
- Wang, S., Li, J., & Zhao, D. (2017). The impact of policy measures on consumer intention to adopt electric vehicles: Evidence from China. *Transportation Research Part A: Policy and Practice*, 105(August), 14–26. <https://doi.org/10.1016/j.tra.2017.08.013>
- Wang, Z., Zhao, C., Yin, J., & Zhang, B. (2017). Purchasing intentions of Chinese citizens on new energy vehicles: How should one respond to current preferential policy? *Journal of Cleaner Production*, 161(June 2009), 1000–1010. <https://doi.org/10.1016/j.jclepro.2017.05.154>
- Welsch, H., & Kühling, J. (2018). How Green Self Image is Related to Subjective Well-Being: Pro-Environmental Values as a Social Norm. *Ecological Economics*, 149(March), 105–119.  
<https://doi.org/10.1016/j.ecolecon.2018.03.002>
- White, L. V., & Sintov, N. D. (2017). You are what you drive: Environmentalist and social innovator symbolism drives electric vehicle adoption intentions. *Transportation Research Part A: Policy and Practice*, 99, 94–113. <https://doi.org/10.1016/j.tra.2017.03.008>
- Wilberforce, T., El-Hassan, Z., Khatib, F. N., Al Makky, A., Baroutaji, A., Carton, J. G., & Olabi, A. G. (2017). Developments of electric cars and fuel cell hydrogen electric cars. *International Journal of Hydrogen Energy*, 42(40), 25695–25734. <https://doi.org/10.1016/j.ijhydene.2017.07.054>
- World Meteorological Organization, & Global Atmosphere Watch. (2018). *The state of Greenhouse Gase in the Atmosphere Based on Global Observations through 2017*. WMO Greenhouse Gas Bulletin.
- Wu, B., & Yang, Z. (2018). The impact of moral identity on consumers' green consumption tendency: The role of perceived responsibility for environmental damage. *Journal of Environmental Psychology*, 59(March), 74–84. <https://doi.org/10.1016/j.jenvp.2018.08.011>
- Zhang, X., Wang, K., Hao, Y., Fan, J., & Wei, Y. (2013). The impact of government policy on preference for NEVs : The evidence from China. *Energy Policy*, 61(2013), 382–393.  
<https://doi.org/10.1016/j.enpol.2013.06.114>

## 9. APPENDIX

### Appendix 1. Summary of EV research.

Reference	Dependent Variable	Theories used	Methods	Main Findings
<b>Wang, S., Li, J., &amp; Zhao, D. (2017)</b>	EV Adoption Intention	Technology Innovation Diffusion Theory; Traditional Marketing Theory	PLS (Partial Least Square)	EV Adoption intention is positively related with Environmental concern and Policy measures.
<b>Larson, P. D., Viáfara, J., Parsons, R. V., &amp; Elias, A. (2015)</b>	EV Adoption Intention	Purchasing Funnel	One-way Anova and LSD (Least Significant Difference)	Price, Vehicle range, Ability to charge at home and Refuelling costs are the most important factors to purchase a EV. High purchase price, Lack of reliability, Limited range and High batter cost are the main barriers to EV adoption.
<b>Rezvani, Z., Jansson, J., &amp; Bodin, J. (2015)</b>	Plug-in EV's Adoption Intention	Theory of planned behaviour, Rational choice theory, Value-belief-norm theory, Self image congruency theory, Cost signaling theory	Literature Review	EV Adoption is positively related with Pro-environmental behaviors and values and also compatibility of EV
<b>Biresselioglu, M. E., Demirbag Kaplan, M., &amp; Yilmaz, B. K. (2018)</b>	Barriers and Motivators of Electric Mobility	Research focused on consumer attitude and perception towards EV	Literature Review	Motivators: Environmental, Economical and Technological benefits. Barriers: Lack of infrastructures, patricality (charging time) and information.

<b>She, Z. Y., Qing Sun, Ma, J. J., &amp; Xie, B. C. (2017)</b>	Public acceptance of BEV	Literature on Vehicle performance and Infrastructures barriers, Personal characteristics and Policy measures	Structural Equation Model (SEM) and Confirmatory Factor Analysis (CFA)	Top barriers: Safety, reliability and range. Main motivator: Public charging infrastructures.
<b>Rudolph, C. (2016)</b>	Impact of incentives on EV Adoption	Choice-Based Conjoint Analysis	Logit Model	EV choice is positively affected by Higher availability of charging infrastructures, rise of CO2 emissions and no parking fees.
<b>Barbarossa, C., Beckmann, S. C., De Pelsmacker, P., Moons, I., &amp; Gwozdz, W. (2015)</b>	EV Adoption Intention	Theory of ethics and Hoffsted Cultural Dimensions	Confirmatory Factor Analysis and Structural Model (SEM)	EV Adoption intention is positively related with Green self-identity and consumer care for environment.
<b>Barbarossa, C., De Pelsmacker, P., &amp; Moons, I. (2017)</b>	EV Adoption Intention	Values-Beliefs-Norms (VBN), Theory of Ethics, Self-determination theory and Theory of planned behaviour	Confirmatory Factor Analysis and Structural Model (SEM)	EV Adoption intention is positively related with Green self-identity and Ecological care
<b>Adderly, S. A., Manukian, D., Sullivan, T. D., &amp; Son, M. (2018)</b>	EV Use Simulation	Investigation (Charging infra-structures)	Ratios (Equations)	Low nº of charging infrastructures in case of huge demand
<b>Lopes, M. M., Moura, F., &amp; Martinez, L. M. (2014)</b>	EV Buying Intention	Census 2011	Decision Tree	High KMs driven and High availability of home-facilities to charge the vehicle are positively related with EV Buying Intention.

<b>Wang, Z., Zhao, C., Yin, J., &amp; Zhang, B. (2017)</b>	EV Purchasing Intention	Theory of planned behaviour and Technology acceptance model	Confirmatory Factor Analysis and Structural Model (SEM)	EV Purchasing intention is positively related with Financial benefit, Infrastructure readiness, Environmental concern and Policy privilege.
<b>Graham-Rowe, E., Gardner, B., Abraham, C., Skippon, S., Dittmar, H., Hutchins, R., &amp; Stannard, J. (2012)</b>	Plug-in EV Perception (after use)	Construal level theory	Qualitative Analysis	Range anxiety and Cheap refuelling was confirmed. Drivers place personal utility over environmental concerns.
<b>Wang, N., Pan, H., &amp; Zheng, W. (2017)</b>	Key factors for EV purchase	China Politics	Linear regression	Lacking of infrastructures is the main barrier to EV adoption.
<b>White, L. V., &amp; Sintov, N. D. (2017)</b>	EV Adoption Intention	Literature Review (symbolic attributes, climate change, instrumental attributes, pro-environmental behavior and social norms)	Factor Analysis and Multiple Regression Analysis	EV Adoption is mostly positively related with Environmentalism symbolism and concern about climate change.
<b>Jensen, A. F., Cherchi, E., &amp; Mabit, S. L. (2013)</b>	Preference of EV over ICEV (after 3 month experiment with a EV)	Joint hybrid choice framework	Linear regression	Driving range is the most critical factor for EV adoption.
<b>Caperello, N. D., &amp; Kurani, K. S. (2012)</b>	Plug-In Hybrid Vehicle Usage (4-6 weeks experiment)	Mixed Method Approach	Qualitative Analysis	Vehicle match the expectation of low refuelling cost. Require a change on driving behaviour (to save battery) and on daily routine (to charge).

<p><b>Wang, S., Fan, J., Zhao, D., Yang, S., &amp; Fu, Y. (2016)</b></p>	<p>Hybrid Vehicle Adoption Intention</p>	<p>Theory of Planned Behaviour</p>	<p>Structural Equation Model (SEM)</p>	<p>Subjective norm, perceived behavioral control, personal norm and environmental concern are positively related with hybrid vehicle adoption intention.</p>
<p><b>He, X., Zhan, W., &amp; Hu, Y. (2018)</b></p>	<p>EV Purchasing Intention</p>	<p>Valence Framework</p>	<p>Confirmatory Factor Analysis and Structural Model (SEM)</p>	<p>Perceived monetary benefit, perceived symbol, personal innovativeness and environmental concern positively influence EV Purchasing Intention. Perceived risk negatively influence EV Purchasing Intention.</p>
<p><b>Sierzchula, W., Bakker, S., Maat, K., &amp; Van Wee, B. (2014)</b></p>	<p>Electric Vehicle Adoption</p>	<p>Literature Review</p>	<p>Multiple Linear Regression</p>	<p>Financial Incentives and Charging Infrastructures have positive impact on EV Adoption.</p>
<p><b>Bjerkan, K. Y., Nørbech, T. E., &amp; Nordtømme, M. E. (2016)</b></p>	<p>Electric Vehicle Adoption</p>	<p>Literature Review (EV Adoption and Incentives for EV Adoption)</p>	<p>Factor Analysis and Logistic Regression</p>	<p>Exemption from purchase tax and VAT are the most decisive for EV adoption.</p>

**Appendix 2.** Constructs and Items used to Measure.

<b>Construct</b>	<b>Author</b>	<b>Item (EN)</b>
<b>Green Self-Identity</b>	Sparks & Shepherd (1992)	I think of myself as someone who is concerned about environmental issues
		I think of myself as a "green" consumer
	Barbarossa, Beckmann, De Pelsmacker, Moons, & Gwozdz (2015) adpted from Jobber (2000)	It is important to me how car usage may affect the environment It is important to me how car usage may cause air pollution
<b>Task Characteristics</b>	Goodhue, Thompson, & Goodhue (1995) - Adapted	I frequently do trips in which there is availability of charging infra-structure.
	Goodhue, Thompson, & Goodhue (1995) - Adapted	The trips i do occasionally have a good availability of electric vehicle charging spots.
	Tam, C., & Oliveira, T. (2016). - Adapted	I always need to have my car ready for use.
	Tam, C., & Oliveira, T. (2016). - Adapted	When i'm on a trip i must do it as fast as possible with no time to spend in the middle of it
<b>Technology characteristics</b>	Graham-Rowe et al., (2012) - Adapted from qualitative analysis	Having a vehicle with low refuelling price is important for me.
		Having a vehicle without CO2 emissions is important for me.
		Having a silent vehicle make me be extra cautious with the pedestrains.
	Tam, C., & Oliveira, T. (2016). - Adapted	Electric vehicles allow me to travel fast. I consider electric vehicles safe.
<b>Task-Technology Fit</b>	Goodhue, Thompson, & Goodhue (1995)	It is easy to incorporate the charging of an electric vehicle in my daily routine.
		An electric vehicle is appropriate for the trips i normally do.
		An electric vehicle allow me to reach my

		destinations on time.
		The range of an electric vehicle is enough for the trips i normally do.
		The charging infra-structures available are adequate for the trips i normally do.
		It is easy to find charging infra-structures in my residential area.
		It is easy to find charging infra-structures in my working area.
		I have access to charging infra-structure.
		On average, how many miles per month you do with your vehicle?
	Yuthas, K., & Young, S. T. (1998).	How many kms have you done in your vehicle/EV?
		For how many years you drive your vehicle?
<b>Use</b>		I use my vehicle daily.
	Venkatesh (2012)	On average, i spend a significant amount of time using my vehicle.
		I use my vehicle intensely.
		It is crucial to use my vehicle on a daily basis.
		I am convinced that my vehicle serves my needs.
		I am convinced that my vehicle efficiency satisfies me.
<b>User Satisfaction</b>	<a href="#">Wu &amp; Wang (2006)</a>	I am convinced that my vehicle effectiveness satisfies me.
		I am convinced that my vehicle satisfies me.
		I intend to use electric vehicles in the future.
<b>Behavioral Intention</b>	Venkatesh (2012)	I will always try to use electric vehicles in my daily life.

Pragmatic or idealistic reasons: what drives electric vehicles' satisfaction and continuance intention?

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I plan to use electric vehicles frequently.

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