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Review

Antecedents of Electric Vehicle Purchase Intention from the Consumer's Perspective: A Systematic Literature Review

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Abstract: The growing demand for conventional internal combustion engine vehicles can aggravate the current energy and environmental crisis by presenting a higher dependence on fossil fuels and a higher level of greenhouse gases. The transition to electric mobility is a sustainable solution to mitigate the negative impact on the environment and energy security. In recent years, global sales of electric vehicles (EVs) have grown steadily; however, their worldwide market share is still less than 10%. The present study aims to improve and strengthen the knowledge base on consumer behavior toward EV purchases by investigating the antecedents of EV purchase intention, as well as their impact. This paper is based on a systematic literature review where 63 articles published between 1994 and 2021 were analyzed. The antecedents were classified into three main categories: consumer characteristics, EV characteristics, and EV-related policies. A summary model represents the impact information of each of the main antecedents. The descriptive results of the sample are also discussed. Finally, this study indicates directions for future research and recommendations for developing the most effective strategies and policies that will accelerate the transition to a more sustainable future.

Keywords: purchase intention; electric vehicles; antecedents of purchase intention; systematic literature review; sustainable mobility

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1. Introduction

The growing demand for conventional vehicles with internal combustion engines that use fossil fuels as an energy source has aggravated the current environmental and energy crises. In recent years, the massive use of gasoline and diesel has led to a sharp increase in greenhouse gases (carbon dioxide and nitrogen oxide), and has become a major cause of global warming and climate change [1,2]. Transportation is one of the major sectors of the economy contributing to air pollution [3]. Between 1990 and 2019, annual carbon dioxide (CO2) emissions from the transportation sector increased by about 80% [4]. By 2020, passenger cars were the largest source of CO2 emissions, presenting 41% of the emissions produced by the transportation sector worldwide [5]. Experts predict a doubling of global private car sales by 2050 [6], i.e., the number of private cars on the roads could reach 2–2.5 billion by 2050 [7]. In turn, an increase in the number of vehicles with internal combustion engines will increase dependence on oil, as the transport sector accounts for about 60% of the total oil demand [8]. These factors present major energy security and supply risks at the global level.

The diffusion of electric vehicles (EVs) represents a sustainable solution to mitigate the environmental and energy crises and helps meet the targets for achieving carbon

neutrality under the Paris Agreement and Green Deal. Electric cars use electricity, a secondary energy source that replaces fossil fuels, and do not emit emissions while driving. The negative impact on the environment can be further mitigated, especially if the electricity comes from renewable sources such as wind, sun, biomass, etc. [9,10]. Thus, the transition to electric mobility contributes to the reduction of environmental pollution, which is also beneficial for public health and helps to reduce fossil energy consumption [11–14], representing a new paradigm of sustainable energy [3]. Since 2010, the growth rate of EVs has been much higher than that of conventional vehicles [15]. In recent years, global sales of electric cars have shown a sharp increase. In 2018, the global stock of electric passenger cars reached 5 million, a 63% increase from the previous year. At this time, China dominated with about 45% of electric cars, Europe was second with 24%, and the United States accounted for 22% of the global fleet [16]. By the end of 2021, there were about 16.5 million electric cars on the world's roads, triple the amount in 2018 [17]. Thus, as can be seen in Figure 1, electric vehicles sales bucked the trend, increasing to 3 million and accounting for 4.1% of total car sales in 2020 [18]. For the first time, Europe overtook China to become the largest electric vehicle market in the world [19]. In 2021, electric vehicles sales more than doubled compared to the 2020 figures, representing 6.6 million new registrations. However, their market share represented only about 9% of the global car market in 2021. As far as major markets are concerned, China and Europe are leading electric vehicle sales worldwide [18].

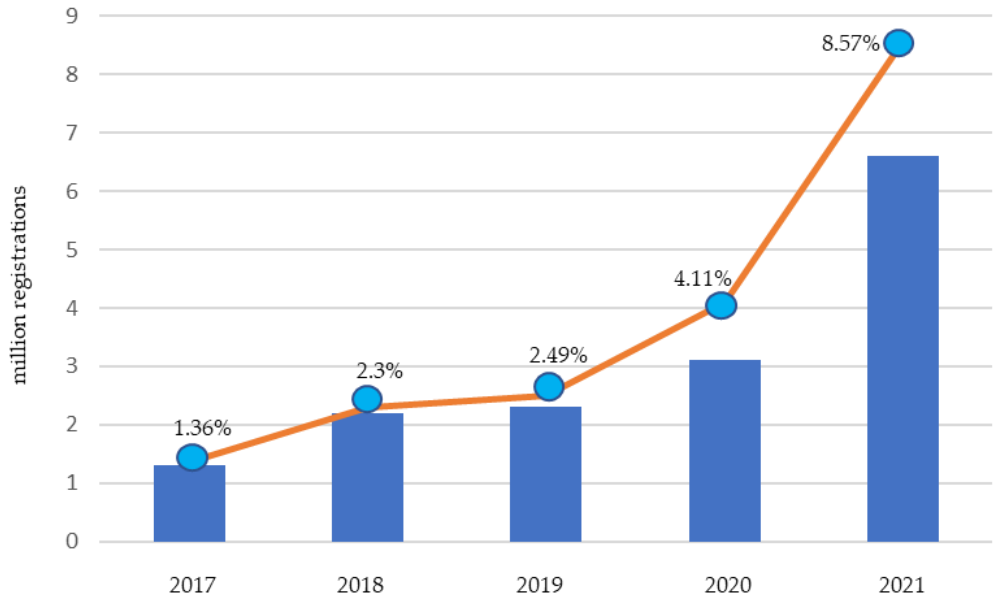

Figure 1. Global sales and the sales market share of electric cars, 2017–2021 [18].

For faster market penetration of EVs, it is crucial to understand consumer behavior regarding the purchase of this type of vehicle. Consumer behavior is directly predicted by intentions [20]. Consumers' purchase intentions largely determine the EV market trend and represents the main aspect of their demand [2]. Understanding the factors associated with EV purchase is a prerequisite for the popularization of sustainable mobility [21].

This paper aims to improve and strengthen the knowledge base on consumer behavior regarding EVs purchase intentions. As such, it is crucial to understand what drives consumers to buy EVs and what affects their purchase intention. Thus, the present study aims to answer the following research question:

- What are the direct antecedents of EVs purchase intention and how do they affect consumers' purchase intention?

For this purpose, this paper uses a systematic literature review, which, in addition to presenting the answer to specific research questions, addresses a series of interrelated questions, providing a summary representation of the topic under analysis [22]. Therefore, this study identifies the following aspects: the author(s) and title of articles; the source and date of publication; geographic location of the studies conducted and the corresponding author; the methodology and theoretical perspective; and the direct antecedents of EV purchase intention and their impact. By answering these questions, this study represents a valuable academic and practical contribution. On an academic level, it provides researchers with a comprehensive overview of existing studies related to this topic and identifies key aspects, providing directions for future research and a new framework. In terms of a practical contribution, this paper generates knowledge and understanding of the relationship between antecedents and purchase intention of EVs that will help governments and companies involved in this area to develop appropriate public policies and marketing strategies, making their implementation more effective. Although there are some literature reviews on factors affecting consumer intentions (e.g., Li et al. [23], Singh et al. [24], Secinaro et al. [25] and Faizal et al. [26]), none have adopted the methodology used in this paper. For example, Secinaro et al. [25], based on a bibliometric analysis, addressed the positive and negative electric car's consumer choices, aggregating them in terms of price, charging modes issues, energy efficiency, on one hand, and new technologies, policy-makers incentives and environmental conscientiousness, on the other hand. Singh et al. [24] used demographic, situational, contextual, and psychological aspects to categorize the main influential factors that lead to the adoption of electric vehicles. Faizal et al. [26] identified the factors that may predict the future trend of EVs in the automotive industry. Finally, Li et al. [23] analyzed the main factors that influence consumer intentions to adopt, specifically, battery electric vehicles. This paper complements previous literature as it analyzes the antecedents of EVs purchase intentions based on three main categories: consumer (socio-demographic, psychological and personal) characteristics; EV (economic, technical and risk-benefits) characteristics; and EV-related (government, pre- and after-sales and infrastructure) policies.

This article is structured in six different sections. After the Introduction, Section 2 presents the method followed to review the literature. Section 3 presents the main findings. Section 4 presents the discussion of the results. Section 5 addresses the main conclusions of the article. Finally, Section 6 presents the main recommendations and the theoretical and business contributions.

2. Method

The systematic literature review (SLR) method was chosen for the design of this study because of its contribution in supporting practice and policy, and in guiding future research efforts. The present paper follows the protocol proposed by Denyer and Tranfield [27] with some adaptations of both the systematic quantitative approach developed by Pickering and Byrne [28] and the preferred reporting items for systematic reviews and meta-analyses **(**PRISMA) protocol, respecting its fundamental principles, such as rigor, transparency and replicability [28,29]. According to Denyer and Tranfield [27], the methodology involves five steps:

1. Formulation of a research question;
2. Localization of manuscripts;
3. Selection and evaluation of the manuscripts;
4. Analysis and synthesis;
5. Reporting and use of results.

The first step in conducting an SLR is formulating the research question, which can be loosely but clearly worded, establishing the focus of the investigation [27]. Taking the information above into consideration, the following research question was developed for the present study:

What are the direct antecedents of EV purchase intention and how do they affect consumers' purchase intention?

The second step involves locating relevant studies to answer the research question. The systematic search for the present study was conducted using the SCOPUS database, a leading bibliometric database [22]. To search for relevant studies, two categories of search words were defined:

1. Words related to EVs: electric vehicles and electric cars. The terms "electric vehicl*" and "electric car*" were introduced with the asterisks to cover all possibilities.
2. Words related to buying: purchase intention; purchase behavior; intention to purchase; willingness to buy; and intention to buy. The asterisk was again used in the following terms to cover all options: "purchas* intention"; "purchas* behavi*"; and "intention to purchas*".

The search was carried out on all possible combinations of the two groups of search words using the "Article title, Abstract, Keywords" field in the SCOPUS database. Thus, 207 documents were found. A series of filters were then applied to help select the most relevant documents for this study (see Table 1).

Table 1. Search strategy deployed.

Filter	Description
Article title Abstract Keywords	"electric vehicl*" OR "electric car*" AND "purchas* intention" OR "purchas* behavi*" OR "intention to purchas*" OR "willingness to buy" OR "intention to buy"
Subject area	Social Sciences; Energy; Environmental Science; Business, Management and Accounting; Economics, Econometrics and Finance
Document Type	Article and Review
Source type	Journal
Language	English

After applying the filters mentioned in Table 1, 70 documents were excluded. The remaining 137 documents most relevant to the research topic were exported to an Excel file with citation information and abstracts/keywords of the articles to be further analyzed. The search included documents up to the year 2021.

The third step consists of the selection and evaluation of the collected studies. After the first stage of the search, the titles and abstracts of the 137 collected documents were analyzed using the following inclusion criteria:

- Do the collected articles consider the relationship between EVs and consumers' purchase intention?

Based on this criterion, the selected articles were treated using the traffic light technique: articles that did not meet the inclusion criterion were considered not relevant and underlined in red; articles that met the inclusion criterion were considered relevant and underlined in green; and articles that needed further analysis were considered more or less relevant and underlined in yellow, since, from their title and abstract, it was not possible to discern their compliance with the inclusion criterion. Based on this logic, the following were identified: 41 articles were not relevant; 24 articles were more or less relevant; and 72 articles were relevant to the present study. Subsequently, the 96 articles (24 more or less relevant articles and 72 relevant articles) were read in full. In this phase of article evaluation, the selection criterion was the answer to the following question:

- Do the articles under review help answer the research question?

Only studies focusing on 100% EVs (electric car, plug-in battery electric vehicle, battery electric vehicles, plug-in electric vehicle, full electric vehicles) were included in the final base for further evaluation. Articles that did not specify the type of EV, mentioning only "electric vehicles" were considered as studies on fully electric vehicles and included

in the database. It should also be underlined that, in this study, the term consumer should be understood as an individual and not as an entity interested in purchasing EVs. After this step, 63 articles were selected for analysis and synthesis. Figure 2 represents the process of study selection and assessment.

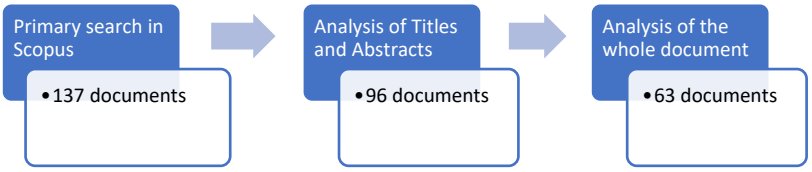

Figure 2. Process of the selection and evaluation of manuscripts.

Following the recommendation of Tranfield et al. [30], the articles were evaluated by the two researchers in order to increase the reliability of their selection. Doubts and disagreements were discussed until a consensus was reached.

The fourth step involves analysis and synthesis of the data collected from the articles relevant to the study. The goal of the analysis is to break down the individual studies into their constituent parts and describe each of these parts. In the analysis phase, each article was analyzed based on the following aspects: source and year of publication; geographic location of the corresponding author and study; methodology and theoretical perspective; the main direct antecedents of EV purchase intention and their impact; and the main findings. The purpose of the synthesis is to establish links between the parts identified in the selected studies, reconstructing information and developing new knowledge that is not evident in an isolated reading of the individual studies [27]. Given the key role of synthesis harmonization with the aim of the review, the data extracted from the articles relevant to the study were explored, cross-referenced and rigorously analyzed in terms of the questions of the present SLR.

The fifth step encompasses the results report and its discussion, thus strengthening the knowledge base on the research topic. This step will be explained in detail in later chapters, such as Sections 3 and 4.

3. Results

This chapter presents the results of the analysis and synthesizes the data extracted from the 63 selected articles. First, general information on the relevant articles is described, namely: the year and source of publication; the geographical location of the corresponding authors and studies; and the methodologies and theoretical perspectives the researchers adopted in their studies. This is followed by a classification and summary model of the direct antecedents of the purchase intention of EVs.

3.1. Year of Publication

The investigation of the purchase intention of EVs from the consumer perspective is a relatively new topic in the literature. The first studies appeared in the 1990s [31,32] in Canada and the United States. Most of the identified articles are quite recent, with 53 articles published in the last five years, representing about 84% of all articles in the sample (see Figure 3). However, there was a spike in publications in 2021 with 20 articles, representing about 32% of the sample.

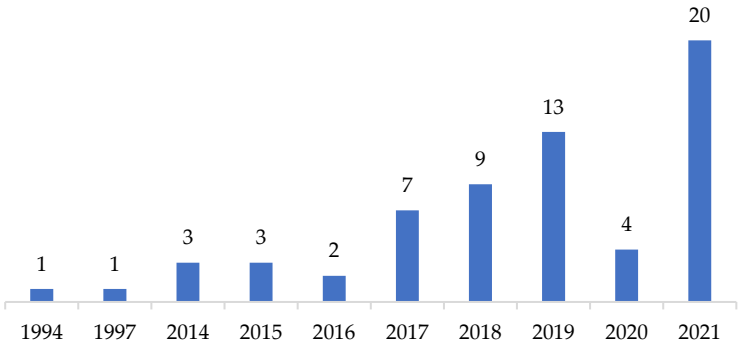

Figure 3. Number of articles per year of publication.

3.2. Source of Publication

The 63 articles selected for the present study were published in 23 different academic journals. Table 2 shows the main publication outlets with more than one published article. These nine academic journals have a total of 49 studies, representing about 78% of all articles in the sample. The journal *Sustainability (Switzerland)* has the largest number of articles—15 studies, which corresponds to 23.81% of the sample. Regarding the ranking of these publications, all journals are in the first quartile (Q1) in their categories according to the SCImago Journal Rank.

Table 2. Main publication outlets.

Journal	No of Articles	%
Sustainability (Switzerland)	15	23.81
Energy Policy	6	9.52
Transportation Research Part A: Policy and Practice	6	9.52
Journal of Cleaner Production	6	9.52
Transportation Research Part D: Transport and Environment	5	7.94
Transportation Research Part F: Traffic Psychology and Behavior	5	7.94
International Journal of Electric and Hybrid Vehicles	2	3.17
Journal of Advanced Transportation	2	3.17
Transport Policy	2	3.17

3.3. Geographic Location of the Corresponding Authors and the Studies

The sample of the present study shows considerable geographical dispersion. Figure 4 shows the countries where more than one study was conducted and information on the number of corresponding authors. China is the outstanding leader with the largest number of articles written by authors from different institutions in this country (~32% of all articles) and the largest number of the studies conducted (~40% of all studies in the sample). Among the countries in Europe, Germany stands out with six researchers (~10% of all articles) and seven studies (~11% of all studies in the sample).

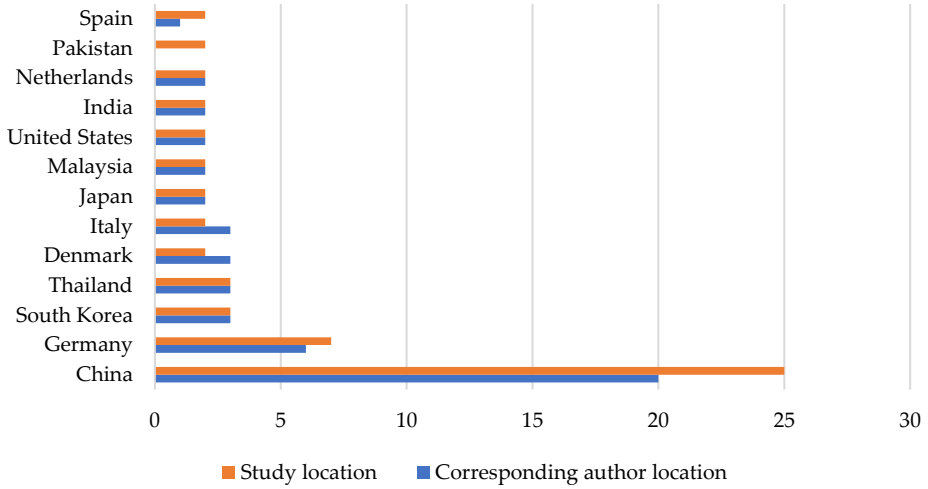

Figure 4. Geographical location of the corresponding authors and studies.

3.4. Methodology and Methods Used in the Analyzed Articles

A wide range of methods and methodologies were used to investigate the antecedents of EVs purchase intention (see Table 3). However, there is a strong predominance for quantitative methodologies—51 articles (~81% of all articles), which were conducted using an online/web-based questionnaire survey (~57% of the studies). A total of 10 studies used mixed methodologies (~16% of all articles), while only two articles (~3% of all articles) used qualitative methodologies based on interviews.

Table 3. Main research methodologies used in the articles analyzed.

Methodology	Data gathering Method	No of Articles	Total
Quantitative	Online questionnaire survey/web-based survey	29	51
	Paper-and-pencil survey/door-to-door survey/ face-to-face survey/paper questionnaire/in-person surveys/paper-based questionnaire survey	9	
	Online survey + paper-and-pencil survey/paper questionnaire	5	
	Survey (N/A specific information)	8	
Qualitative	In-depth interviews	2	2
Mixed approach	In-depth interviews + experience (test-drive) + survey	3	10
	Experience (test-drive) + survey	3	
	In-depth interview + survey	2	
	Archival data + survey	1	
	Focus groups + survey	1	
		Total	63

3.5. Theoretical Perspective

Different theoretical perspectives were adopted to examine the main factors that determine the purchase intention of EVs. Table 4 presents the theories/models that were mentioned in more than one article. The theory of planned behavior is a dominant theory in the studies conducted that was applied in 24 articles (~38% of all studies). In most studies based on the theory of planned behavior [33], the conceptual research model was supplemented with the various additional variables to test its impact on the purchase intention of EVs.

Table 4. Main theories used.

Theoretical Base	Studies
Theory of planned behavior	[34–55]
Theory of reasoned action	[40,53,56,57]
Technology acceptance model	[40,54,58]
Norm activation model theory	[38,46,59]
Diffusion of innovation theory	[45,54]

3.6. Classification of Antecedents of EV Purchase Intention

After a careful reading of each article, a large number of direct antecedents of the purchase intention of EVs were found. For logical organization and easier perception of the obtained results, a classification of antecedents of the purchase intention of EVs was developed, which consists of three main categories: consumer characteristics, EV characteristics and EV-related policies. Each of the three categories has its own subcategories (see Figure 5). The category "Consumer characteristics" was divided into three subcategories: sociodemographic factors; psychological factors; and personal characteristics. The category "EV characteristics" contains the following subcategories: economic factors; technical characteristics; and risk and benefit factors. The category "EV-related policies" consists of three subcategories: government policy factors; pre- and after-sales services; and infrastructure factors.

The main antecedents analyzed were assigned to the corresponding subcategory according to their nature and relationship to the subcategory. The antecedents mentioned more than once in the selected studies (with the exception of some variables in the subcategory "Pre- and after-sales services") were considered as main antecedents and included in the synthesis.

Figure 6 presents a summary of the main direct antecedents and their impact on the purchase intention of EVs. The "+" sign means a positive impact; the "-" sign shows a negative impact; and the "Ø" sign reveals that the antecedent did not impact the EV purchase intention in a statistically significant way; whereas, the "●" sign indicates that the data on the antecedent impact is contradictory. Thus, the analysis of the articles selected for the present SLR highlighted a total of 41 main antecedents, of which 19 (~46%) are from the "Consumer characteristics" category; 14 (~34%) represent the "EV characteristics" category; and 8 (~20%) correspond to the "EV-related policies" category. As can be seen in Figure 6, more than half (27 variables, corresponding to ~66%) of the highlighted antecedents show the contradictory data, i.e., the researchers did not reach a consensus regarding the impact of the antecedent under analysis.

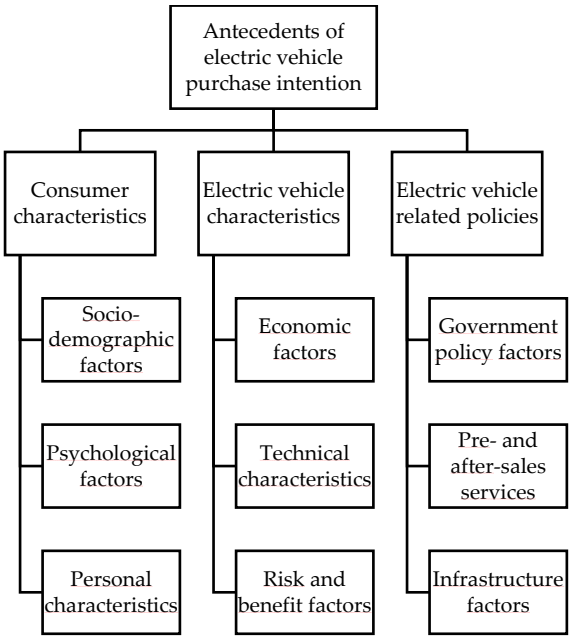

Figure 5. Classification of the antecedents of the purchase intention of EVs.

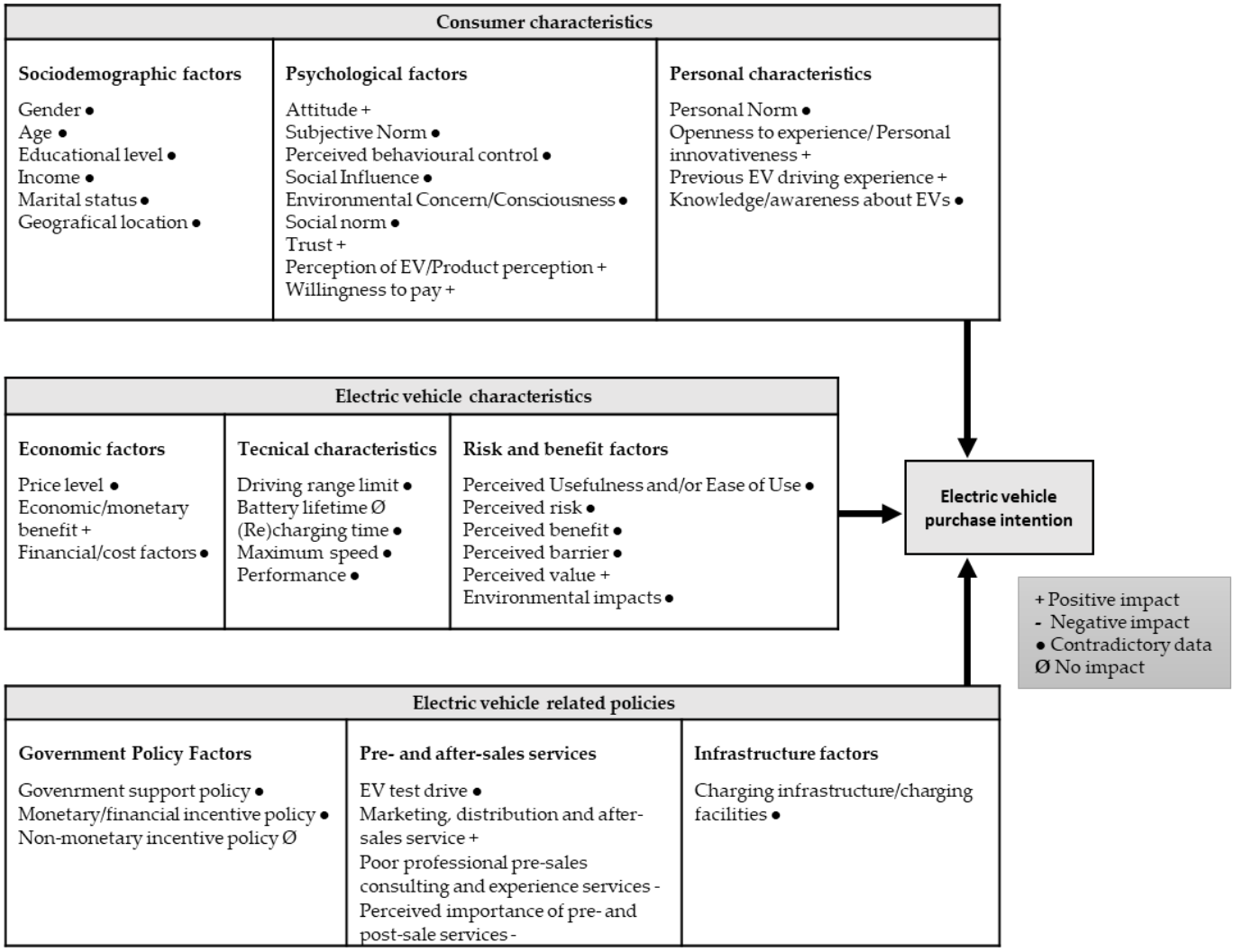

Figure 6. Summary of the antecedents of the purchase intention of EVs and their impact.

3.6.1. Consumer Characteristics

The category "Consumer characteristics" has been the most investigated in the literature under review, presenting the largest number of direct antecedents of the purchase intention of EVs. Table 5 provides information on the impact of various consumer characteristics on their purchase intention, presenting subcategories with the investigated antecedents and the main findings of the corresponding studies. The following antecedents showed a positive relation with the purchase intention of EVs in all relevant studies: attitude; perceived behavioral control; trust, perception of EV/product perception; willingness to pay; openness to experience/personal innovativeness; and previous EV driving experience. However, most of the highlighted antecedents showed discordant results, among them: gender; age; educational level; income; marital status; geographic location; subjective norm; social influence; environmental concern/consciousness; social norm; personal norm; and knowledge/awareness about EV.

Table 5. Impact of the characteristics of the consumers' purchasing intention of EVs.

Consumer Characteristics	Antecedents	Main Conclusions
Socio-demographic factors	Gender	In Russia, women are more likely to buy EVs than men [60].
		In South Korea, women are more likely to buy EVs than men [61].
		In China, female respondents have a higher EV buying intention [20].
		In Norway, women are more interested in buying an EV than men [52].
		In the Netherlands, men have higher preferences for purchasing EVs than women [62].
		In South Korea, male respondents are more likely to buy EVs [63].
		In China, men are associated with a higher intention to buy EVs [64].
		In Germany, men are the most likely group of buyers of EVs [65].
		In China, gender had no statistically significant effect on EV purchase intention [66,67].
	Age	Age had a positive and significant effect on the purchase intention of EVs. The group with the highest purchase intention was between 35 and 49 years old [66].
		People between 25 and 65 years old are more willing to buy an EV [68].
		Age has a positive effect on EV purchase intention [61].
		Age has a negative significant effect on the purchase intention of EVs. This implies that the older the consumer, the weaker the EV purchase intention [20].
		The most likely group of private EV buyers is between the ages of 41 and 50 [65].
		Young people, specifically people in their 20s, have a significantly negative association with the purchase of EVs [63].
		Age has no statistically significant effect on EV purchase intention in Russia and Brazil, and only a weak effect in China [60].
		The purchase intention of EVs is not significantly influenced by consumer age [62,67].
	Educational level	The level of education has a significant effect on the purchase intention of EVs. People with a higher level of education (highly educated) are more willing to buy an EV [37,60–62,66].
		The level of education does not have a significant effect on EV purchase intention [20,60].
	Income	Income has a significant effect on the purchase intention of EVs. High-income individuals are associated with high EV purchase intention [37,60,64,67,69].
		Low-income individuals are more likely to buy EVs [63,70].
		Income had no statistically significant effect on EV purchase intention [20,62,66].

	Marital status	Marital status (married individuals) has a significant and positive effect on EV purchase intention [20].
		Married people without children tend to have negative opinions about the purchase of EVs [62].
	Geographical location	Daily travel distance had a significant impact on the purchase intention of EVs. A consumer with a higher daily trip distance will be more likely to buy an EV [67].
		Respondents from the capital and large cities had a significantly positive intention to buy EVs [63].
		People living in rural or suburban areas and travelling a significant number of kilometers per year were more likely to buy EVs than urban dwellers [65].
		There is no statistically significant effect of the respondents' location on EV purchase intention [44,60].
		Living in urban areas has no statistically significant effect on EV purchase intention [66].
Psychological factors	Attitude	Consumers' attitude has a significantly positive impact on EV purchase intention [34,35,37,39–42,44,48,50,51,53–55,57,62,63,71,72].
	Subjective Norm	Consumers' subjective norms have a positive impact on EV purchase intention [34,37–39,41,42,48,51,52,54,57,72].
		Consumers' subjective norms do not influence EV purchase intention [44,50].
	Perceived behavioral control	Perceived behavior control has a significantly positive effect on EV purchase intention [34,37–39,41,42,44,48,50–52,72].
	Social Influence	Social influence has a significantly positive impact on EV purchase intention [58,62,63,70,73,74].
		Social influence does not influence EV purchase intention [63,75].
	Social norm	Social norms have a significant effect on EV purchase intention [43].
		Social norms do not influence EV purchase intention [55].
	Environmental Concern/ Consciousness	Consumers' environmental concerns have a significantly positive impact on EV purchase intention [12,20,37,42,43,55,58,60,63,66,73,75–80].
		Consumers' environmental concerns do not predict EV purchase intention [34,46,49,80].
	Trust	Trust in EVs has a significantly positive impact on EV purchase intention [46,49].
	Perception of EVs	Perception of EVs has a significantly positive impact on EV purchase intention [44,80].
	Willingness to pay	Willingness to pay has a significantly positive impact on EV purchase intention [46,49].
Personal characteristics	Personal Norm	Personal norms have a significantly positive impact on EV purchase intention [38,53,59].
		Personal norms do not significantly affect EV purchase intention [46,49].
	Openness to experience/Personal innovativeness	Consumers' innovativeness has a significantly positive effect on their intention to purchase EVs [12,45,63,73].
	Previous EV driving experience	Prior EV driving experience has a significantly positive impact on EV purchase intention [21,51,61,64,81,82].
	Knowledge/awareness about EVs	Consumers' knowledge/awareness of EVs has a significantly positive impact on EV purchase intention [21,61,67,69].
		Consumers' knowledge/awareness of EVs does not influence EV purchase intention [34,52,82].

3.6.2. EV Characteristics

The variables in this category have been extensively investigated in the literature. Table 6 provides information on the effect of the factors associated with the characteristics on the purchase intention of EVs, presenting subcategories with the analyzed antecedents and the main findings of the related studies. Once again, most of the highlighted antecedents show contradictory results, among them: price level; financial/cost factor; driving rang limit; (re)charging time; maximum speed; performance; perceived usefulness and/or ease of use; perceived risk; perceived benefit; perceived barrier; and environmental impacts. Only two antecedents of this category showed a positive relation with EV purchase intention: economic/monetary benefit and perceived value. Battery lifetime had no statistically significant effect on EV purchase intention.

Table 6. Impact of the EV characteristics on the purchase intention of EVs.

EV Characteristics	Antecedents	Main Conclusions
Economic factors	Price level	The price level of EVs significantly affects the purchase intention of EVs. Lowering the initial purchase price of EVs increases consumers' purchase intention [20,60,68,70,73,74,77,78,83–85].
		The price of EVs does not have a significant influence on EV purchase intention [37,66].
	Economic/monetary benefit	Economic/monetary benefits have a significantly positive effect on the purchase intention of EVs [12,63,80].
	Financial/cost factors	Cost/financial factors significantly affect EV purchase intention [82,86].
		Cost factors do not influence EV purchase intention [38,78].
Technical characteristics	Driving range limit	The limited range of EVs has a significant impact on the purchase intention of EVs. A greater reach increases consumers' intention to purchase EVs [31,68,70,83,85,87].
		The limited range of EVs is not a significant predictor of purchase intention of EVs [32,60,69].
	Battery lifetime	EV battery life does not have a significant influence on EV purchase intention [60,68].
	(Re)charging time	EV charging time has a significant influence on the purchase intention of EVs. Reducing EV charging time increases consumers' EV purchase intention [31,32,68,88].
		(Re)charging time of EVs does not impact EV purchase intention [67,83,85].
	Maximum speed	Maximum speed has a significant statistical influence on EV purchase intention [31].
		Maximum speed is not a significant predictor of EV purchase intention [85].
	Performance	The performance of EVs has a significantly positive impact on EV purchase intention [20,67,74,75,78,86].
		The performance of EVs does not affect their purchase intention [58,82].
Risk and benefit factors	Perceived Usefulness and/or Ease of Use	The perceived usefulness and/or ease of use has/have a significantly positive impact on EV purchase intention [53,58,75,81].
		The perceived usefulness and/or ease of use is/are not a significant predictor(s) of EV purchase intention [74].
	Perceived risk	The perceived risk has a significantly negative effect on EV purchase intention [12,31,81].
		The perceived risk has no impact on EV purchase intention [40,52].
	Perceived benefit	The perceived benefit has a positive impact on EV purchase intention [40,74,81].

		The perceived benefit has no statistical influence on EV purchase intention [57].
	Perceived barrier	The perceived barriers affect negatively EV purchase intention [43,74].
		The perceived barriers do not have a significant effect on EV purchase intention [57].
	Perceived value	The perceived value has a significantly positive impact on EV purchase intention [46,49].
	Environmental impacts	The environmental impact of EVs has a positive effect on EV purchase intention [86,88].
		The environmental impact of EVs does not affect EV purchase intention [12].

3.6.3. EV-Related Policies

The category "EV-related policies" presents the smallest number of the antecedents, but the overwhelming majority of the articles are recent (published between 2017 and 2021). Table 7 provides information about the impact of the antecedents associated with EV-related policies on EV purchase intention, presenting subcategories with the analyzed antecedents and the main findings of the related studies. The negative impact was identified in relation to two antecedents: poor professional pre-sales consulting and experience services; and perceived importance of pre- and post-sale services. In turn, the antecedent marketing, distribution and after-sales service affected EV purchase intention positively, while a non-monetary incentive policy had no statistically significant effect. However, the following antecedents show contradictory results: government support policy; monetary/financial incentive policy; EV test drive; and charging infrastructure/charging facilities.

Table 7. Impact of EV-related policies.

EV-Related Policies	Antecedents	Main Conclusions
Government-based policy factors	Government support	A government support policy has a significantly positive impact on EV purchase intention [21,43,47,61,67,70,82,86].
		A government support policy has no effect on EV purchase intention [34,60,74].
	Monetary/financial incentive	Monetary/financial incentives have a significantly positive effect on EV purchase intention [20,37,44,55].
		Monetary/financial incentive-based policies do not have an impact on EV purchase intention [63,77].
	Non-monetary incentive	Non-monetary incentives do not have an impact on EV purchase intention [37,44].
Pre- and after-sales services	EV test drive	EV test-driving experience has a positive effect on EV purchase intention [89].
		EV test-driving experience does not effect on EV purchase intention [51,90].
	Marketing, distribution and after-sales service	Marketing, distribution and after-sales service positively influence EV purchase intention [74].
	Poor professional pre-sales consulting and experience services	A low level of professional pre-sales consulting and experience services has a negative impact on EV purchase intention [21].
	Perceived importance of pre- and post-sale services	The perceived importance of pre- and after-sales services is negatively related EV purchase intention [57].
Infrastructural factors	Charging infrastructure/charging facilities	Infrastructural factors have a significant effect on the purchase intention of EVs. The lack of charging facilities hindered consumers' EV purchase intention. The possibility of charging at home is a very important influencing factor [21,60,85,87].

	Charging infrastructure/charging facility does not affect EV purchase intention [60,66,77,78,82].

4. Discussion

The dynamics of publications in the area of consumer behavior towards EV purchasing (see Figure 3) coincide with the dynamics of global electric car sales, i.e., the trend is positive with a peak in 2021. There was a drop in academic publications in 2020, which can be explained as a result of the onset of the COVID-19 pandemic and restrictions applied by governments. This coincidence indicates that the academic community is closely following the evolution of the EV market, as well as the concern of governments with sustainability and climate change. Regarding the publication sources, the articles were published in 23 different journals. This reveals the importance and relevance of the topic, as well as its engaging nature.

The analysis of the geographical location of the corresponding authors and studies identified that China is the country that stands out the most, followed by Germany. These results are fully in line with the EV market analysis [91], which shows China's leadership and highlights Germany, in absolute terms, in the European market. China's leading position can also be explained by its government's climate strategy. China is the second largest emitter of carbon dioxide from transportation worldwide [92], which has to comply with the Paris Agreement on combating climate change. In turn, the significant progress of countries in Europe [91] and the interest of their academic community on the topic (see Figure 4) may be due to the Green Deal agreement, which aims to place Europe on the path to a green transition by reducing transport-related greenhouse gas emissions by 90% by 2050. The results reveal that researchers study consumer behavior towards EV purchasing in the countries with the most successful EV sales, trying to understand the key influencing factors and best practices for a faster penetration of the EV market globally.

Different theoretical perspectives were used by the authors in their research on the topic. However, the theory of planned behavior is the dominant theory in this SLR. This result is in agreement with Lin and Wu [20], who state the popularity of TPB in the academic community for predicting consumers' intentions. Its use helps to understand why people choose an EV, what factors are relevant and how they impact their intention. The results also contribute to market segmentation and target identification [48].

With regard to the research methodology, the analysis found a strong predominance for quantitative methodologies. This result is perfectly understandable, since this type of methodology is often used in marketing research. The online/web-based questionnaire survey was the most popular collection method, followed by the paper/face-to-face questionnaire survey. The predominance of the online/web-based survey in the sample can be explained by its low cost and simplicity of administration.

Analysis of the 63 articles relevant to the present SLR identified several antecedents of the purchase intention of EVs. Singh et al. [24] divided them into four types: demographic, situational, contextual and psychological. In turn, Sierzchula et al. [93] distinguished between three sets: technological aspects; consumer characteristics; and contextual factors. In this paper, the identified antecedents were classified into three categories, namely consumer characteristics, EV characteristics and EV-related policies; and nine subcategories: socio-demographic factors psychological factors; personal characteristics; economic factors; technical characteristics; risk and benefit factors; government policy factors; pre- and after-sales services; and infrastructure factors (see Figure 5). From the authors' perspective, the proposed classification has a more logical organization of the antecedents, which facilitates mapping and synthesizing the literature reviewed.

The category "Consumer characteristics" is the most researched. Despite this fact, there is a clear need for further research in this area, since the results of the studies are contradictory, especially regarding sociodemographic factors. Regarding gender issues, researchers have not reached a consensus. For example, in Russia [60] and Norway [52],

women show more interest in buying an EV than men, while in the Netherlands [62] and Germany [65], male respondents are more likely to buy EVs. However, Habich-Sobiegalla et al. [66] and Zhang et al. [67] did not find a statistically significant relationship between gender and the purchase intention of EVs. These conflicting findings can be explained by the sociocultural differences between the countries, the sample characteristics, the data collection method or the year and place of study.

Regarding the age group of consumers, middle-aged individuals are more likely to buy an EV [65,66,68], while young individuals show a significantly negative association with EVs purchase intention [63]. Given the high price of electric cars and the low incomes of young consumers at the beginning of their working careers, these results are understandable. Several studies indicate that highly-educated individuals are more willing to buy an EV [37,60–62,66]. As a rule, workers with higher education earn more money, which means that their higher incomes allow them to pay the premium price of an EV. This view is indirectly supported by Habich-Sobiegalla et al. [60], Ling et al. [64], Shareeda et al. [69], Zhang et al. [67] and Xu et al. [37], who found that consumers with the highest incomes are associated with higher EV purchase intention. However, based on a study of 1500 potential consumers in South Korea [63] and a study of 360 Chinese respondents [70], it was concluded that individuals with lower incomes are more likely to buy EVs. This can be explained by the lower total cost of ownership (TCO) of an EV (less maintenance and repair, low cost per mile) compared to a conventional vehicle, which is something that individuals with low incomes may take into consideration. However, when analyzing the TCO of all-electric cars in Italy, Scorrano et al. [94] argued that high annual mileage (the annual distance travelled) is a decisive factor in achieving TCO savings.

The results of the factor impact of the consumers' geographical location show that people living in rural or suburban areas travelling a large number of kilometers per year [65] or with a higher daily travel distance [67] are more likely to buy an EV. This can be explained by the economic benefits, namely by low cost per kilometer, which Heyvaert et al. [71] considered the biggest advantage of EVs. Clearly, this only makes sense if electricity is much cheaper than gasoline or diesel. As far as psychological factors are concerned, the relationship between consumer attitude towards EVs and their purchase intention is one of the most studied in this SLR. All the researchers conclude that attitude has a significantly positive impact on the purchase intention of EVs. According to Yetano Roche et al. [95], attitudinal research is one of the conceptual frameworks and methodological approaches, which can be used in studies of preferences and demand for new technologies.

The results also point to a strong positive impact of subjective norm [34,37–39,41,42,48,51,52,54,57,72] and social influence [58,62,63,70,73,74] as antecedents on EVs consumers' purchase behavior. Comments from individuals close to the potential buyer (e.g., friends, family members and parents) create social pressure and influence the potential buyer's behavior towards purchasing an EV. Therefore, the higher the social pressure, the higher the intention to buy an EV. This knowledge can be used most successfully in crafting strategies for countries with a strong tendency towards collectivism, where people place the highest value on the opinions of others. The third variable of TPB, perceived behavior control, was found to be a significant positive predictor of EVs purchase intention [34,37–39,41,42,44,48,50–52,72], implying its strong influence on consumer behavior. Perceived behavioral control refers to an individual's perception of their ability to engage in a particular behavior [33]. Therefore, EV-related policies need to be geared towards increasing the consumer's willingness to purchase an EV.

With regard to environmental concern, many researchers from different countries studied its relationship with the purchase intention of EVs. This is not surprising, as EVs are seen as a means of sustainable mobility that can mitigate the environmental crisis. The analysis shows that consumers' environmental concerns have a strong positive effect on their willingness to buy EVs [12,20,37,42,55,58,60,63,66,73,75–80]. Government awareness and public education programs on the need to protect the environment can directly contribute to the market penetration of EVs. Regarding consumers' personal characteristics,

the results indicate that there is a consensus among researchers regarding the positive influence of the openness to experience/personal innovativeness variables [12,45,63,73]. Openness to experience is related to the degree of curiosity, creativity and preference for variety and novelty [73]. Personal innovativeness is a widely examined factor in innovation adoption research. Consumers with a high level of innovation are more willing to try new things and adopt new ideas [12]. Thus, electric cars, which are seen by many people as a new transportation technology, can easily attract the attention of innovative individuals who are open to experimentation.

The analysis shows that previous experience in driving EVs influences the most willingness to buy EVs [21,51,61,64,81,82]. This result is in agreement with Schulte et al. [96], who noted that a positive experience with high-tech products makes them attractive to consumers, creating a positive perception, which in turn increases the likelihood of purchase. Most studies confirm a positive influence of consumers' knowledge/awareness of EVs on their intention to buy EVs [21,61,67,69], although few studies found no relationship between the two variables [34,52,82]. Following Simsekoglu and Nayum [52], due to the relative newness of EVs, consumers know little about their history and features compared to their knowledge of internal combustion engine vehicles. In turn, Ghadikolaei et al. [7] conclude that knowledge about alternative fuel vehicles is a critical point to increase the number of this type of car in the global transportation sector. Therefore, the authors believe that educating the population about the characteristics of alternative fuel vehicles and their use is a permanent solution for a sustainable demand in the future. Shareeda et al. [69] stated that the success of EV adoption depends on consumers' high awareness and understanding of why they should switch to this type of vehicle. Several studies have shown that the antecedent personal norm relative to EV purchase is a positive influencing factor [38,53,59]. Thus, a high level of moral responsibility on the part of consumers leads to a higher intention to purchase EVs. This is mainly valid for developed countries and China, as studies in developing countries [46,49] found no statistically significant relationship between these two variables. Thus, activating personal norms may promote EV ownership.

The results reveal that the variables in the category "EV characteristics" have been extensively investigated in the literature on the topic. However, the data on the impact of the antecedents are contradictory. Only the economic/monetary benefit variable from the subcategory "Economic factors" showed a significantly positive association with the purchase intention of EVs in all studies in the sample [12,63,79]. Following Lai et al. [80], product acceptance is often affected by a personal perception of economic benefit. Regarding EVs, the economic/monetary benefits refer to consumers' perceptions of saving money through governmental subsidies and incentives [97], low cost per mile [71] and lower maintenance [7] and repair costs [89]. The fact that respondents in all studies on this question considered the economic/monetary benefit variable as a positive influence on their EV purchasing behavior indicates that governments should start/continue to subsidize EV purchase and use, and that the price of electricity should remain below the price of petrol/diesel to make EVs attractive.

Regarding the impact of "financial/cost factors" as an antecedent, the results are contradictory: some studies on this issue found a significant effect on EV purchase intention [82,86], while other studies found no statistically significant relationship between the two variables [38,78]. There are a set of indicators, such as acquisition cost, fuel cost, maintenance cost, EV depreciation and resale price, among others, that are important. Following Sovacool et al. [82], the adoption of new technologies is associated with tradeoffs between high initial capital costs versus long-term efficiency. The authors conclude that cost considerations are important in Chinese consumers' willingness to purchase EVs. In turn, Montian and Suthikarnnarunai [86] reached the same conclusion in their research in Bangkok. A positive effect of cost factors on consumers' purchase intentions may be related to the symbolic significance of the electric car itself, i.e., its role in defining consumer status. The higher the costs associated with an EV, the higher the status that should be expressed. However, Thananusak et al. [78] did not find a positive relationship between the financial

factors and EV purchase intention, which may be due to a lack of information about operating costs, maintenance costs and the resale market in Thailand. In turn, Dong et al. [38] stated that, in the context of subsidies that the Chinese government has implemented in its EV-related policies, the cost factors do not significantly influence EVs purchase intentions. This can be explained by an individual's greater concern for EV autonomy and ease of charging in China. Given the lack of consensus, further studies are needed to better understand the impact of financial/cost factors on EVs purchase intention.

The effect of the price of an EV on consumers' willingness to buy was of great interest to academics. Most studies state that the purchase price level of EVs is a determining factor and has a significant impact on consumer behavior regarding EV purchase intention. Consumers consider the price of an EV to be higher than the price of an internal combustion engine car [68,74,78]. A decrease in the initial purchase price is positively associated with EV purchase intention, i.e., the willingness to buy an EV increases when the EV price is lower [60,68,77]. According to Cui et al. [73], Chinese consumers are unwilling to purchase EVs if the price of the products is high. This is also confirmed by Zhuge and Shao [84], who showed that Chinese consumers care more about the price of EVs than the other factors. The results in several European countries show that EV price reduction is the most important "triggering factor" for EV diffusion, which determines consumers' transition from non-intention to "intention to buy an EV" more than other factors [85]. According to these results, it is clear that lowering the purchase price of EVs can play a crucial role in EV market diffusion. OEMs should try to lower production costs, while governments should introduce monetary support measures for EV purchase.

Regarding the technical characteristics of EVs, the results of the influence of the antecedents of this subcategory on the purchase intention of EVs vary from one study to another, presenting contradictory results. However, most studies state a statistically significant influence of the antecedents performance [20,67,74,75,78,86], (re)charging time [31,32,68,98] and driving range [31,68,70,83,85,87] on the purchase intention of EVs. According to Ghadikolaei et al. [7] and Heyvaert et al. [71], one of the major disadvantages of EVs is their limited driving range i.e., the distance a vehicle can travel without recharging. This can be explained by the fact that cars powered exclusively by electricity cannot currently provide an equal range as fuel-powered cars. Therefore, to achieve a greater diffusion of EVs, consumer concerns about limited range need to be alleviated. OEMs need to develop technology to achieve the same range as conventional vehicles, while governments and other stakeholders need to install more charging stations. It is important to note that around 43% of the studies focused on driving range did not consider this variable as a significant predictor of EV purchase intention. This may be due to the fact that consumers attach more importance to other factors, such as individual factors, EV purchase price, charging infrastructure factors [32,69], or, as in the case of Shareeda et al. [69], the reason for the lack of significant influence may be the small size of the Kingdom of Bahrain. Another disadvantage of EVs is the (re)charging time, which is considerably longer than in conventional vehicles [7].

The studies of the 1990s state that consumers consider EV battery charge duration as an important influence factor [32], which may hinder market acceptance of the electric car [31]. The most recent results show that consumers have a negative opinion about electric car charging time influencing the purchase intention of EVs [88]. Therefore, a reduction in charging time could increase the willingness to purchase EVs [68]. The insignificance of the variable time in some sample studies [67,83,85] may be related to the possibility of (re)charging EVs at home or at the workplace.

The significantly positive impact of the antecedent performance on the purchase intention of EVs was confirmed in the vast majority of studies [20,67,74,75,78,86]. In the EV context, EV performance refers to acceleration, safety, reliability, driving comfort, range, etc. Thus, it is important to develop advertising and marketing plans with emphasis on these characteristics of EVs, presenting them as strengths in order to stimulate the demand for EVs. This will also educate consumers, increasing their knowledge about EVs. As

mentioned above, consumers' knowledge/awareness of EVs can contribute to a sustainable demand for EVs in the future.

With regard to the risk and benefit factors, the antecedents perceived usefulness and/or ease of use, perceived risk and perceived benefit were highly cited, although the results of their influence are contradictory. The significantly positive relationship between the perceived benefit and intention to purchase EVs showed greater agreement among the researchers. Perceived benefit is the perceived possibility of the positive outcome of a purchase. Following Yang et al. [40], the perceived benefits towards EVs consist of financial (e.g., low cost of electricity, maintenance and repair, government subsidies) and non-financial (possibility of charging at home, being environmentally friendly, use of a high-tech product, enjoyment of non-monetary government policies) benefits. Krishnan and Koshy [74] found that the perceived benefit has the greatest direct effect on Indian consumers' intention to purchase EVs. Other studies in the sample also state that this variable is a key factor for the diffusion of electric cars [40,81]. One more positive relation was noticed between the antecedent perceived usefulness and/or ease of use and intention to purchase EV [53,58,75,81]. This variable is widely used in research related to new technologies. Perceived usefulness indicates the extent to which an individual believes that using EVs will increase their performance [74], while perceived ease of use represents the degree to which an individual feels that they will not have complications and additional effort to learn to use the EV [58,74]. The statistically significant influence of these variables indicates that consumers are concerned about the issue of the ease of use of EVs and their usefulness. Thus, marketing strategies should be developed to spread public awareness that EV use is easy and requires no additional effort.

Given the positive impact of the perceived benefit on purchase intention, it is important to underline the financial and non-financial advantages in EV advertising for a faster diffusion of this type of car. In turn, the insignificance of the perceived benefit [57] and perceived usefulness and/or ease of use [74] in some sample studies can be explained by other factors (e.g., price, range, lack of infrastructure, etc.) or by the fact that individuals do not have a clear awareness of EV ease of use or usefulness. Regarding the antecedent perceived risk, as expected, most studies state its significantly negative influence on the willingness to buy EVs, i.e., the more risk a person perceives regarding EVs, the lower their intention to buy them. Perceived risk was originally a research topic in the field of psychology, and referred to the negative effects predicted by the consumer regarding the purchase of a specific product [40]. Since an EV is considered a technological innovation, it is often associated with safety, operational, functional and temporal risks [81,99]. In a study conducted in China, He et al. [12] found that perceived risk is significant for women but not for men, indicating that risk perception has a stronger negative effect on EV purchase intention for women than for men. This can be used in marketing campaigns to reduce women's fears of EVs. Yang et al. [40] did not find the direct effect of perceived risk on EV purchase intention, but instead stated its influence on EV purchase intention through attitude. The authors assume that the perceived risk (low safety, short battery life and long charging time) will be constantly reduced with the development of the EV industry and technological advances.

The analysis shows that the influence of the antecedents of the category "EV-related policies" on consumer behavior towards EV purchase was studied heavily in the last five years (2017–2021). The recent interest of academics on this issue may be due to the development of the various policies supporting EV diffusion by governments of different countries to comply with the international agreements on the environment, such as the UN Climate Convention, the Kyoto Protocol, the Paris Agreement, the Green Deal, etc. In addition, many automakers have announced aggressive EV investment plans with an electrification target for 2030 [18]. The results show that almost all of the variables highlighted in this category play a significant role in consumer willingness to purchase an EV, although with some surprising exceptions.

Regarding government-based policy factors, the relationship between the antecedent government support policy and the purchase intention of EVs was the most studied in this subcategory, showing a significantly positive correlation in three-quarters of the studies on this issue [21,43,47,61,67,70,82,86]. EVs government support policies consist of financial (e.g., purchase subsidies for EVs, purchase tax/some toll exemption, etc.) and non-financial (e.g., charging and free parking in public areas, provision of the electronic platforms, etc.) incentives [6,71,97,100]. Given the importance of government support policies for consumers, governments should start/continue to implement a range of incentives for faster EV market penetration. Lin and Wu [20], Xu et al. [37], Huang and Ge [44] and Wang et al. [55] studied the impact of the more specific variable, monetary/financial incentive policy, and found its positive effect on the purchase intention of EVs. However, Brinkmann and Bhatiasevi [77] and Lashari et al. [63] claimed that a monetary/financial incentive policy does not affect EV purchase intention. In the case of Brinkmann and Bhatiasevi [77], the insignificance of financial subsidies was explained by the non-transparent communication about how the Thai government supports EVs. Participants were aware of the tax reduction, but did not know exactly how much the Thai state would compensate them if they purchased an EV. According to Lashari et al. [63], the respondents gave more importance to the economic benefits of EVs, recognizing the advantages of EVs in terms of economic efficiency. Subsidies play an important role in promoting EVs, however monetary incentives are expensive for governments [101,102]. Several studies show that the effectiveness of this type of government policy could be improved by targeting incentives by income [101–104], i.e., instead of allocating uniform subsidies to each EV buyer, governments should consider household incomes, increasing the value of monetary incentives for low-income consumers and eliminating them for high-income consumers.

The influence of pre- and after-sales service factors on EV purchase intention is still little studied when compared to other factors. It was possible to highlight the following antecedents: test drive, marketing, distribution and after-sales service, poor professional pre-sales consulting and experience services and the perceived importance of pre- and post-sale services. Regarding the test drive, the researchers used the concept of a sensory marketing approach. According to Krishna [105], sensory marketing engages consumers' senses and affects their perception, judgment and behavior by creating subconscious triggers that characterize consumers' perceptions of abstract notions of the product. Moreira et al. [106] advocated the use of sensory stimuli to influence customers' intentions to purchase a product. Analysis of the studies reveals the insignificance of the test-drive in relation to EV purchase intention [51,90]. Still, the data show an increase in the mean value of various factors (price perception, knowledge about EVs, general attitude towards EVs, etc.) after an electric car test drive. Having said this, it can be concluded that the EV test drive has the potential to change consumers' perception of EV attributes and psychological factors, thus promoting this type of car. Marketing departments should take this promising strategy into consideration, especially in view of the fact that Krishnan and Koshy [74] found a significantly positive influence of the marketing, distribution and after-sales service variables on EV purchase intention. In turn, Li et al. [21] concluded that the low level of professional pre-sales consulting and EV experience services (trial ride/drive experience) strongly impaired consumers' willingness to purchase an EV. This result is in agreement with Zarazua de Rubens et al. [107], who conducted 126 buying experiences at 82 car dealerships in Denmark, Finland, Iceland, Norway and Sweden, and concluded that salespeople were dismissive of EVs, misinformed buyers about vehicle specifications, neglected EVs from the sales conversation, and even strongly steered customers toward gasoline and diesel vehicle options. As a result, only in 8.8% of cases did customers prefer to buy an EV over gasoline/diesel cars. The authors state that the dealers' technological orientation, willingness to sell and demonstrated knowledge about EVs were the main contributors to explain the likelihood of purchase intentions. Ghadikolaei et al. [7] also agreed with this conclusion, arguing that increased demand for alternative fuel vehicles in the future will be possible if car sellers are encouraged and motivated to sell them.

Therefore, governments, policy makers and industries should develop the political and marketing strategies aimed at increasing the diffusion of electric cars, taking into consideration the barriers at EV sales points, test drive potential and the importance of professional pre-sales consultancy and after-sales services.

How infrastructural factors impact EV purchase intention is still poorly understood in the academic literature. The analysis highlighted the antecedents charging facilities and charging infrastructure, representing efficiency and accessibility of available charging stations, the possibility to charge the battery at home, at the workplace, in public parking lots or on freeways. Currently, charging stations for EVs are very limited when compared to charging stations for cars powered by gasoline or diesel [7,108]. Thus, insufficient infrastructure is one of the disadvantages of EVs. The results present contradictory and surprising data: several studies state the important positive effect [21,60,85,86], while the majority concluded that infrastructural factors do not predict EV purchase intention [60,66,77,78,82]. In their investigation of Bangkok residents, Montian and Suthikarnnarunai [86] concluded that infrastructure is a very important influencing factor. In turn, Cecere et al. [85] found that in Poland and France, the highest priority was given to the possibility to recharge the vehicle at home. In the case of consumers in China [21] and Brazil [60], the lack of charging facilities hindered their intention to purchase EVs. However, most studies regarding infrastructural factors did not find a significant impact on EV purchase intention. This non-significance might be due to regional differences among the countries. Another possible explanation refers to the fact that other critical factors are more important (e.g., EV price, perceived risk, consumers' environmental concerns) for consumer behavior towards EV purchase. One more reason could be the possibility to charge EVs at home to meet consumers' daily commuting needs. Considering the low cost of charging at home compared to public charging points, many respondents could consider this possibility as a preferred option, without worrying about insufficient public infrastructure.

5. Conclusions and limitations

The present study provided a systematic and detailed review of the literature on the direct antecedents of EV purchase intention. A total of 63 articles published between 1994 and 2021 were analyzed, highlighting their key information and findings. The analysis of the articles in the sample verified an increasing trend in the academic literature on the topic, especially in the last five years. The diverse geography of the studies conducted is an interesting sign of global interest in the subject. It should be noted that China was the country that contributed the most to the understanding of the factors that influence consumer behavior towards EV purchase, presenting the largest number of the studies conducted and articles published by researchers from different Chinese institutions. Regarding the methodology, there was a strong predominance of quantitative methodology, which was conducted through a questionnaire survey. The researchers adopted different theoretical perspectives; however, the theory of planned behavior is a dominant theory in the studies conducted.

This literature review revealed that the studies focused on the various antecedents of EV purchase intention. In order to provide a logical and clear organization of the identified variables, a classification was developed in which the main antecedents were categorized into three groups: consumer characteristics, EV characteristics and EV-related policies. A summary model of the 41 main direct antecedents highlighted in this SLR was created, with an indication of their impact on EV purchase intention (see Figure 6). The analysis of the variables has shown that the results of their influence are often contradictory. The researchers did not reach a consensus on the impact of 27 variables: gender; age; educational level; income; marital status; geographical location; subjective norm; social influence; environmental concern/consciousness; social norm; personal norm; knowledge/awareness about EVs; price level; financial/cost factor; driving rang limit; (re)charging time; maximum speed; performance; perceived usefulness and/or ease of

use; perceived risk; perceived benefit; perceived barrier; environmental impacts; government support policy; EV test drive; and charging infrastructure/charging facilities. Still, 10 antecedents have shown a positive correlation with EV purchase intention, among them: attitude; perceived behavioral control; trust; perception of EV/product perception; willingness to pay; openness to experience/personal innovativeness; previous EV driving experience; economic/monetary benefit; perceived value; marketing; and distribution and after-sales service. The negative impact was identified in relation to the two antecedents: poor professional pre-sales consulting and experience services; and perceived importance of pre- and post-sale services. Two variables had no statistically significant effect on EV purchase intention: battery lifetime; and non-monetary incentive policy. This indicates that understanding consumer behavior towards EV purchase remains a challenging and complex issue with a strong need for further research.

One limitation of this study is that the systematic search was conducted using a single database: SCOPUS. Other electronic databases, such as Web of Science, were not included in the search. Another limitation concerns the choice of search words that, in this study, were presented by two categories: words related to EVs and words related to purchasing. Other search words could be included, such as drivers, barriers, enablers and disablers that may influence consumers' EV purchase intention.

6. Future Research and Theoretical and Business/Managerial Contribution

This paper makes an important contribution to the current body of literature by extending the knowledge about consumer behavior towards EV purchase. Analyzing the main theories and research methods used is also a contribution to the research in this field. A classification of the direct antecedents of EV purchase intention was developed that can be used by researchers in their future research. In turn, the summary model, which represents a synthesis of the literature reviewed with information on the impact of each of the antecedents highlighted in this study on EV purchase intention, allows academics and all stakeholders to better and more clearly understand what makes or prevents consumers from wanting to purchase an EV. Future research needs to address some contradictory results regarding the antecedents found, e.g., gender, age, educational level, income, marital status, geographical location, subjective norm, social influence, environmental concern/consciousness, social norm, personal norm, knowledge/awareness about EVs, price level, financial/cost factor, driving rang limit, (re)charging time, maximum speed, performance, perceived usefulness and/or ease of use, perceived risk, perceived benefit, perceived barrier, environmental impacts, government support policy, EV test drive and charging infrastructure/charging facilities.

It would also be important to address the mixed effect of age, gender and educational level, as it would be beneficial to pinpoint if the results obtained are part of a context-based perspective or are part of a new green-based trend that was not disclosed (e.g., [20,60,65]). Another important aspect that deserves closer scrutiny is the relationship between income and geographical locations, as those individuals with higher income are more likely to purchase EVs and more prone to look for solutions for the cost of travelling a significant number of kilometers, but those individuals that live in urban areas are more likely to have higher incomes (e.g., [63,65,67]). It would also be important to analyze how greater incentives to low-income households would impact the perceived value of EVs and would influence the economic perceived benefit of EVs [104].

It would be interesting to investigate how some technical characteristics, such as driving range limit and (re)charging time, could be mitigated by economic incentives, especially for individuals living in rural or suburban areas, which are likely to be more affected by those technical characteristics. Moreover, future studies could also address the importance of green purchase behavior toward EV purchase intention in infrastructure green-friendly government contexts *vis-à-vis* monetary incentive government policies. It is clear that social norms and social influence play an important role in changing [20] EV purchase intention; however, it would be important to address, for example, how the

different generations are affected by the social norms and social influence, as millennials and generations X and Y are expected to react very differently regarding environmental changes and have different levels of green activism, which is important for understanding the purchase intentions of EVs of the different generations.

Finally, the results reveal that some variables are poorly explored, showing a small percentage in the sample. For instance, the antecedents of the subcategory "Pre- and after-sales services" are only mentioned in six studies, thus representing a gap in the literature on the topic. From the authors' perspective, the issue of professional consulting (pre-sales), availability of test-drive and maintenance and repair services represent a potential influence and can play a crucial role in the diffusion of EVs. Further studies are needed to provide more valuable insights regarding the controversial results found.

Regarding the business/practical contribution, the knowledge presented in this study will help all stakeholders (policy makers, governments, OEMs, car vendors, non-profit associations, etc.) in this area to develop appropriate marketing programs and strategies, making their implementation more effective. The results contribute to the identification of the target, which, in this case, is presented by middle-aged individuals with a high level of education and environmental concerns, influenced by the comments of close or important people. Taking into account these characteristics of the potential buyer, appropriate EV promotion strategies should be developed. The use of social media can be very effective in generating individuals' awareness and knowledge about EVs. In promoting EVs, their environmentally friendly role targeting zero emissions while driving and their impact on public health should be emphasized. This in turn will create a positive word-of-mouth, increasing social pressure, which will lead to a greater intention to buy EVs. This method may be more successful in collectivist countries, where people attach the greatest importance to the opinions of others. In order to avoid negatively affecting the eco-image of EVs, automakers should make the production of the batteries and electronic components more sustainable, since manufacturing an electric car results in 60% more CO_2 emissions compared to manufacturing fuel-powered cars. Given the positive impact openness to experience/personal innovativeness, it can be beneficial to present EVs at technology events, thus attracting the right people at the right time. Private sector companies and public entities could buy/use electric cars to set an example to their employees. This will also give employees the opportunity to gain experience in driving this type of vehicle. As the results reveal, there is a strong positive relation between previous EV driving experience and the willingness to buy an EV. This SLR shows the importance of EV features in explaining consumer behavior, such as purchase price, range, charging time and economic factors. Car manufacturers should try to lower the production cost (e.g., by using economies of scale or new production technologies), increase the range of EVs and reduce the charging time. Moreover, governments should encourage EV purchase and use by developing policies geared towards increasing consumer capacity by reducing their difficulties and obstacles in wanting to buy an EV.

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References

1. Ju, N.; Lee, K.-H.; Kim, S.H. Factors Affecting Consumer Awareness and the Purchase of Eco-Friendly Vehicles: Textual Analysis of Korean Market. *Sustainability* **2021**, *13*, 5566. https://doi.org/10.3390/su13105566.
2. Zhao, X.; Ma, Y.; Shao, S.; Ma, T. What Determines Consumers' Acceptance of Electric Vehicles: A Survey in Shanghai, China. *Energy Econ.* **2022**, *108*, 105805. https://doi.org/10.1016/j.eneco.2021.105805.
3. Higueras-Castillo, E.; Molinillo, S.; Coca-Stefaniak, J.A.; Liébana-Cabanillas, F. Perceived Value and Customer Adoption of Electric and Hybrid Vehicles. *Sustainability* **2019**, *11*, 4956. https://doi.org/10.3390/su11184956.
4. Statista Research Department Transportation Emissions Worldwide—Statistics & Facts. 2022. Available online: https://www.statista.com/topics/7476/transportation-emissions-worldwide/#topicHeader__wrapper (accessed on 5 April 2022).
5. Tiseo, I. Breakdown of CO_2 Emissions in the Transportation Sector Worldwide 2020, by Subsector. Available online: https://www.statista.com/statistics/1185535/transport-carbon-dioxide-emissions-breakdown/ (accessed on 2 April 2022).
6. Bauer, G. The Impact of Battery Electric Vehicles on Vehicle Purchase and Driving Behavior in Norway. *Transp. Res. Part D Transp. Environ.* **2018**, *58*, 239–258. https://doi.org/10.1016/j.trd.2017.12.011.
7. Ghadikolaei, M.A.; Wong, P.K.; Cheung, C.S.; Zhao, J.; Ning, Z.; Yung, K.-F.; Wong, H.C.; Gali, N.K. Why Is the World Not yet Ready to Use Alternative Fuel Vehicles? *Heliyon* **2021**, *7*, e07527. https://doi.org/10.1016/j.heliyon.2021.e07527.
8. International Energy Agency. Global Energy Review 2021. 2021. Available online: https://iea.blob.core.windows.net/assets/d0031107-401d-4a2f-a48b-9eed19457335/GlobalEnergyReview2021.pdf (accessed on 15 April 2022).
9. European Environment Agency, Electric Vehicles from Life Cycle and Circular Economy Perspectives. 2018. Available online: https://www.eea.europa.eu//publications/electric-vehicles-from-life-cycle (accessed on 16 April 2022).
10. Lucian, J.; Can, R.; Stolten, D.; Peters, R. How to Reduce the Greenhouse Gas Emissions and Air Pollution Caused by Light and Heavy Duty Vehicles with Battery-Electric , Fuel Cell-Electric and Catenary Trucks. *Environ. Int.* **2021**, *152*, 106474. https://doi.org/10.1016/j.envint.2021.106474.
11. Almeida Neves, S.; Cardoso Marques, A.; Alberto Fuinhas, J. Technological Progress and Other Factors behind the Adoption of Electric Vehicles: Empirical Evidence for EU Countries. *Res. Transp. Econ.* **2019**, *74*, 28–39. https://doi.org/10.1016/j.retrec.2018.12.001.
12. He, X.; Zhan, W.; Hu, Y. Consumer Purchase Intention of Electric Vehicles in China: The Roles of Perception and Personality. *J. Clean. Prod.* **2018**, *204*, 1060–1069. https://doi.org/10.1016/j.jclepro.2018.08.260.
13. Wu, Y.; Zhang, L. Can the Development of Electric Vehicles Reduce the Emission of Air Pollutants and Greenhouse Gases in Developing Countries? *Transp. Res. Part D Transp. Environ.* **2017**, *51*, 129–145. https://doi.org/10.1016/j.trd.2016.12.007.
14. Yuan, X.; Li, L.; Gou, H.; Dong, T. Energy and Environmental Impact of Battery Electric Vehicle Range in China. *Appl. Energy* **2015**, *157*, 75–84. https://doi.org/10.1016/j.apenergy.2015.08.001.
15. Song, M.R.; Chu, W.; Im, M. The Effect of Cultural and Psychological Characteristics on the Purchase Behavior and Satisfaction of Electric Vehicles: A Comparative Study of US and China. *Int. J. Consum. Stud.* **2022**, *46*, 345–364. https://doi.org/10.1111/ijcs.12684.
16. International Energy Agency 2019, Global EV Outlook 2019: Scaling Up the Transition to Electric Mobility. Available online: www.iea.org/publications/reports/globalevoutlook2019/ (accessed on 20 April 2022).
17. International Energy Agency Global EV Outlook 2022 Securing Supplies for an Electric Future. 2022. Available online: https://iea.blob.core.windows.net/assets/ad8fb04c-4f75-42fc-973a-6e54c8a4449a/GlobalElectricVehicleOutlook2022.pdf (accessed on 16 December 2022).
18. Paoli, L.; Gül, T. Electric cars fend off supply challenges to more than double global sales. International Energy Agency. 2022. Available online: https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales (accessed on 25 April 2022).
19. International Energy Agency Global EV Outlook 2021. 2021. Available online: https://iea.blob.core.windows.net/assets/ed5f4484-f556-4110-8c5c-4ede8bcba637/GlobalEVOutlook2021.pdf (accessed on 26 April 2022).
20. Lin, B.; Wu, W. Why People Want to Buy Electric Vehicle: An Empirical Study in First-Tier Cities of China. *Energy Policy* **2018**, *112*, 233–241. https://doi.org/10.1016/j.enpol.2017.10.026.
21. Li, Q.; Long, R.; Chen, H.; Geng, J. Low Purchase Willingness for Battery Electric Vehicles: Analysis and Simulation Based on the Fault Tree Model. *Sustainability* **2017**, *9*, 809. https://doi.org/10.3390/su9050809.
22. Paul, J.; Criado, A.R. The Art of Writing Literature Review: What Do We Know and What Do We Need to Know? *Int. Bus. Rev.* **2020**, *29*, 101717. https://doi.org/10.1016/j.ibusrev.2020.101717.
23. Li, W.; Long, R.; Chen, H.; Geng, J. A Review of Factors Influencing Consumer Intentions to Adopt Battery Electric Vehicles. *Renew. Sustain. Energy Rev.* **2017**, *78*, 318–328. https://doi.org/10.1016/j.rser.2017.04.076.
24. Singh, V.; Singh, V.; Vaibhav, S. A Review and Simple Meta-Analysis of Factors Influencing Adoption of Electric Vehicles. *Transp. Res. Part D Transp. Environ.* **2020**, *86*, 102436. https://doi.org/10.1016/j.trd.2020.102436.
25. Secinaro, S.; Calandra, D.; Lanzalonga, F.; Ferraris, A. Electric Vehicles' Consumer Behaviours: Mapping the Field and Providing a Research Agenda. *J. Bus. Res.* **2022**, *150*, 399–416. https://doi.org/10.1016/j.jbusres.2022.06.011.

26. Faizal, M.; Feng, S.Y.; Zureel, M.F.; Sinidol, B.E.; Wong, D.; Jian, G.K. A review on challenges and opportunities of electric vehicles (evs). *J. Mech. Eng. Res. Dev.* **2019**, *42*, 130–137. https://doi.org/10.26480/jmerd.04.2019.130.137.
27. Denyer, D.; Tranfield, D. Producing a Systematic Review. In *The Sage Handbook of Organizational Research Methods*; Buchanan, D.A., Bryman, A., Eds.; SAGE Publications Ltd.: Thousand Oaks, CA, USA, 2009; pp. 671–689. ISBN 9781412931182.
28. Pickering, C.; Byrne, J. The Benefits of Publishing Systematic Quantitative Literature Reviews for PhD Candidates and Other Early-Career Researchers. *High. Educ. Res. Dev.* **2014**, *33*, 534–548. https://doi.org/10.1080/07294360.2013.841651.
29. Mallett, R.; Hagen-Zanker, J.; Slater, R.; Duvendack, M. The Benefits and Challenges of Using Systematic Reviews in International Development Research. *J. Dev. Eff.* **2012**, *4*, 445–455. https://doi.org/10.1080/19439342.2012.711342.
30. Tranfield, D.; Denyer, D.; Smart, P. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *Br. J. Manag.* **2003**, *14*, 207–222. https://doi.org/10.1111/1467-8551.00375.
31. Chéron, E.; Zins, M. Electric Vehicle Purchasing Intentions: The Concern over Battery Charge Duration. *Transp. Res. Part A Policy Pract.* **1997**, *31*, 235–243. https://doi.org/10.1016/S0965-8564(96)00018-3.
32. Kurani, K.S.; Turrentine, T.; Sperling, D. Demand for Electric Vehicles in Hybrid Households: An Exploratory Analysis. *Transp. Policy* **1994**, *1*, 244–256. https://doi.org/10.1016/0967-070X(94)90005-1.
33. Ajzen, I. The Theory of Planned Behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T.
34. Ackaah, W.; Kanton, A.T.; Osei, K.K. Factors Influencing Consumers' Intentions to Purchase Electric Vehicles in Ghana. *Transp. Lett.* **2021**, 1–12. https://doi.org/10.1080/19427867.2021.1990828.
35. Degirmenci, K.; Breitner, M.H. Consumer Purchase Intentions for Electric Vehicles: Is Green More Important than Price and Range? *Transp. Res. Part D Transp. Environ.* **2017**, *51*, 250–260. https://doi.org/10.1016/j.trd.2017.01.001.
36. Wu, D.; Yu, L.; Zhang, Q.; Jiao, Y.; Wu, Y. Materialism, Ecological Consciousness and Purchasing Intention of Electric Vehicles: An Empirical Analysis among Chinese Consumers. *Sustainability* **2021**, *13*, 2964. https://doi.org/10.3390/su13052964.
37. Xu, Y.; Zhang, W.; Bao, H.; Zhang, S.; Xiang, Y. A SEM–Neural Network Approach to Predict Customers' Intention to Purchase Battery Electric Vehicles in China's Zhejiang Province. *Sustainability* **2019**, *11*, 3164. https://doi.org/10.3390/su11113164.
38. Dong, X.; Zhang, B.; Wang, B.; Wang, Z. Urban Households' Purchase Intentions for Pure Electric Vehicles under Subsidy Contexts in China: Do Cost Factors Matter? *Transp. Res. Part A Policy Pract.* **2020**, *135*, 183–197. https://doi.org/10.1016/j.tra.2020.03.012.
39. Yan, Q.; Qin, G.; Zhang, M.; Xiao, B. Research on Real Purchasing Behavior Analysis of Electric Cars in Beijing Based on Structural Equation Modeling and Multinomial Logit Model. *Sustainability* **2019**, *11*, 5870. https://doi.org/10.3390/su11205870.
40. Yang, C.; Tu, J.-C.; Jiang, Q. The Influential Factors of Consumers' Sustainable Consumption: A Case on Electric Vehicles in China. *Sustainability* **2020**, *12*, 3496. https://doi.org/10.3390/su12083496.
41. Zhang, X.; Bai, X.; Shang, J. Is Subsidized Electric Vehicles Adoption Sustainable: Consumers' Perceptions and Motivation toward Incentive Policies, Environmental Benefits, and Risks. *J. Clean. Prod.* **2018**, *192*, 71–79. https://doi.org/10.1016/j.jclepro.2018.04.252.
42. Dutta, B.; Hwang, H.-G. Consumers Purchase Intentions of Green Electric Vehicles: The Influence of Consumers Technological and Environmental Considerations. *Sustainability* **2021**, *13*, 12025. https://doi.org/10.3390/su132112025.
43. Haustein, S.; Jensen, A.F.; Cherchi, E. Battery Electric Vehicle Adoption in Denmark and Sweden: Recent Changes, Related Factors and Policy Implications. *Energy Policy* **2021**, *149*, 112096. https://doi.org/10.1016/j.enpol.2020.112096.
44. Huang, X.; Ge, J. Electric Vehicle Development in Beijing: An Analysis of Consumer Purchase Intention. *J. Clean. Prod.* **2019**, *216*, 361–372. https://doi.org/10.1016/j.jclepro.2019.01.231.
45. Li, L.; Wang, Z.; Li, Y.; Liao, A. Impacts of Consumer Innovativeness on the Intention to Purchase Sustainable Products. *Sustain. Prod. Consum.* **2021**, *27*, 774–786. https://doi.org/10.1016/j.spc.2021.02.002.
46. Ng, M.; Law, M.; Zhang, S. Predicting Purchase Intention of Electric Vehicles in Hong Kong. *Australas. Mark. J.* **2018**, *26*, 272–280. https://doi.org/10.1016/j.ausmj.2018.05.015.
47. Li, L.; Wang, Z.; Wang, Q. Do Policy Mix Characteristics Matter for Electric Vehicle Adoption? A Survey-Based Exploration. *Transp. Res. Part D Transp. Environ.* **2020**, *87*, 102488. https://doi.org/10.1016/j.trd.2020.102488.
48. Moon, S.-J. Effect of Consumer Environmental Propensity and Innovative Propensity on Intention to Purchase Electric Vehicles: Applying an Extended Theory of Planned Behavior. *Int. J. Sustain. Transp.* **2021**, *16*, 1032–1046. https://doi.org/10.1080/15568318.2021.1961950.
49. Ninh, N.G. Resistance to Change and Purchase Intention of Electric Vehicles: Empirical Evidence from Vietnam. *Asian J. Bus. Res.* **2021**, *11*, 83–101. https://doi.org/10.14707/ajbr.210108.
50. Pradeep, V.H.; Amshala, V.T.; Raghuram Kadali, B. Does Perceived Technology and Knowledge of Maintenance Influence Purchase Intention of BEVs. *Transp. Res. Part D Transp. Environ.* **2021**, *93*, 102759. https://doi.org/10.1016/j.trd.2021.102759.
51. Schmalfuß, F.; Mühl, K.; Krems, J.F. Direct Experience with Battery Electric Vehicles (BEVs) Matters When Evaluating Vehicle Attributes, Attitude and Purchase Intention. *Transp. Res. Part F Traffic Psychol. Behav.* **2017**, *46*, 47–69. https://doi.org/10.1016/j.trf.2017.01.004.

52. Simsekoglu, Ö.; Nayum, A. Predictors of Intention to Buy a Battery Electric Vehicle among Conventional Car Drivers. *Transp. Res. Part F Traffic Psychol. Behav.* **2019**, *60*, 1–10. https://doi.org/10.1016/j.trf.2018.10.001.
53. Thøgersen, J.; Ebsen, J.V. Perceptual and Motivational Reasons for the Low Adoption of Electric Cars in Denmark. *Transp. Res. Part F Traffic Psychol. Behav.* **2019**, *65*, 89–106. https://doi.org/10.1016/j.trf.2019.07.017.
54. Tu, J.-C.; Yang, C. Key Factors Influencing Consumers' Purchase of Electric Vehicles. *Sustainability* **2019**, *11*, 3863. https://doi.org/10.3390/su11143863.
55. Wang, X.-W.; Cao, Y.-M.; Zhang, N. The Influences of Incentive Policy Perceptions and Consumer Social Attributes on Battery Electric Vehicle Purchase Intentions. *Energy Policy* **2021**, *151*, 112163. https://doi.org/10.1016/j.enpol.2021.112163.
56. Afroz, R.; Rahman, A.; Masud, M.M.; Akhtar, R.; Duasa, J.B. How Individual Values and Attitude Influence Consumers' Purchase Intention of Electric Vehicles—Some Insights from Kuala Lumpur, Malaysia. *Environ. Urban. ASIA* **2015**, *6*, 193–211. https://doi.org/10.1177/0975425315589160.
57. Nosi, C.; Pucci, T.; Silvestri, C.; Aquilani, B. Does Value Co-Creation Really Matter? An Investigation of Italian Millennials Intention to Buy Electric Cars. *Sustainability* **2017**, *9*, 2159. https://doi.org/10.3390/su9122159.
58. Abbasi, H.; Johl, S.; Shaari, Z.; Moughal, W.; Mazhar, M.; Musarat, M.; Rafiq, W.; Farooqi, A.; Borovkov, A. Consumer Motivation by Using Unified Theory of Acceptance and Use of Technology towards Electric Vehicles. *Sustainability* **2021**, *13*, 12177. https://doi.org/10.3390/su132112177.
59. Ashraf Javid, M.; Ali, N.; Abdullah, M.; Campisi, T.; Shah, S.A.H. Travelers' Adoption Behavior towards Electric Vehicles in Lahore, Pakistan: An Extension of Norm Activation Model (NAM) Theory. *J. Adv. Transp.* **2021**, *2021*, 7189411. https://doi.org/10.1155/2021/7189411.
60. Habich-Sobiegalla, S.; Kostka, G.; Anzinger, N. Electric Vehicle Purchase Intentions of Chinese, Russian and Brazilian Citizens: An International Comparative Study. *J. Clean. Prod.* **2018**, *205*, 188–200. https://doi.org/10.1016/j.jclepro.2018.08.318.
61. Kim, J.H.; Lee, G.; Park, J.Y.; Hong, J.; Park, J. Consumer Intentions to Purchase Battery Electric Vehicles in Korea. *Energy Policy* **2019**, *132*, 736–743. https://doi.org/10.1016/j.enpol.2019.06.028.
62. Kim, J.; Rasouli, S.; Timmermans, H. Expanding Scope of Hybrid Choice Models Allowing for Mixture of Social Influences and Latent Attitudes: Application to Intended Purchase of Electric Cars. *Transp. Res. Part A Policy Pract.* **2014**, *69*, 71–85. https://doi.org/10.1016/j.tra.2014.08.016.
63. Lashari, Z.A.; Ko, J.; Jang, J. Consumers' Intention to Purchase Electric Vehicles: Influences of User Attitude and Perception. *Sustainability* **2021**, *13*, 6778. https://doi.org/10.3390/su13126778.
64. Ling, Z.; Cherry, C.R.; Wen, Y. Determining the Factors That Influence Electric Vehicle Adoption: A Stated Preference Survey Study in Beijing, China. *Sustainability* **2021**, *13*, 11719. https://doi.org/10.3390/su132111719.
65. Plötz, P.; Schneider, U.; Globisch, J.; Dütschke, E. Who Will Buy Electric Vehicles? Identifying Early Adopters in Germany. *Transp. Res. Part A Policy Pract.* **2014**, *67*, 96–109. https://doi.org/10.1016/j.tra.2014.06.006.
66. Habich-Sobiegalla, S.; Kostka, G.; Anzinger, N. Citizens' Electric Vehicle Purchase Intentions in China: An Analysis of Micro-Level and Macro-Level Factors. *Transp. Policy* **2019**, *79*, 223–233. https://doi.org/10.1016/j.tranpol.2019.05.008.
67. Zhang, X.; Bai, X.; Zhong, H. Electric Vehicle Adoption in License Plate-Controlled Big Cities: Evidence from Beijing. *J. Clean. Prod.* **2018**, *202*, 191–196. https://doi.org/10.1016/j.jclepro.2018.07.265.
68. Junquera, B.; Moreno, B.; Álvarez, R. Analyzing Consumer Attitudes towards Electric Vehicle Purchasing Intentions in Spain: Technological Limitations and Vehicle Confidence. *Technol. Forecast. Soc. Change* **2016**, *109*, 6–14. https://doi.org/10.1016/j.techfore.2016.05.006.
69. Shareeda, A.; Al-Hashimi, M.; Hamdan, A. Smart Cities and Electric Vehicles Adoption in Bahrain. *J. Decis. Syst.* **2021**, *30*, 321–343. https://doi.org/10.1080/12460125.2021.1911024.
70. Yang, Y.; Tan, Z. Investigating the Influence of Consumer Behavior and Governmental Policy on the Diffusion of Electric Vehicles in Beijing, China. *Sustainability* **2019**, *11*, 6967. https://doi.org/10.3390/su11246967.
71. Heyvaert, S.; Coosemans, T.; Van Mierlo, J.; Macharis, C. Electric Vehicle Attitudes and Purchase Intention: A Flemish Case Study. *Int. J. Electr. Hybrid Veh.* **2015**, *7*, 83. https://doi.org/10.1504/IJEHV.2015.068946.
72. Ye, F.; Kang, W.; Li, L.; Wang, Z. Why Do Consumers Choose to Buy Electric Vehicles? A Paired Data Analysis of Purchase Intention Configurations. *Transp. Res. Part A Policy Pract.* **2021**, *147*, 14–27. https://doi.org/10.1016/J.TRA.2021.02.014.
73. Cui, L.; Wang, Y.; Chen, W.; Wen, W.; Han, M.S. Predicting Determinants of Consumers' Purchase Motivation for Electric Vehicles: An Application of Maslow's Hierarchy of Needs Model. *Energy Policy* **2021**, *151*, 112167. https://doi.org/10.1016/j.enpol.2021.112167.
74. Krishnan, V.V.; Koshy, B.I. Evaluating the Factors Influencing Purchase Intention of Electric Vehicles in Households Owning Conventional Vehicles. *Case Stud. Transp. Policy* **2021**, *9*, 1122–1129. https://doi.org/10.1016/j.cstp.2021.05.013.
75. Lee, J.; Baig, F.; Talpur, M.A.H.; Shaikh, S. Public Intentions to Purchase Electric Vehicles in Pakistan. *Sustainability* **2021**, *13*, 5523. https://doi.org/10.3390/su13105523.
76. Klabi, F.; Binzafrah, F. Exploring the Relationships between Islam, Some Personal Values, Environmental Concern, and Electric Vehicle Purchase Intention: The Case of Saudi Arabia. *J. Islam. Mark.* **2023**, *14*, 366–393. https://doi.org/10.1108/JIMA-06-2020-0170.

77. Brinkmann, D.; Bhatiasevi, V. Purchase Intention for Electric Vehicles among Young Adults in Thailand. *Vis. J. Bus. Perspect.* **2021**, *27*, 097226292110019. https://doi.org/10.1177/09722629211001981.
78. Thananusak, T.; Rakthin, S.; Tavewatanaphan, T.; Punnakitikashem, P. Factors Affecting the Intention to Buy Electric Vehicles: Empirical Evidence from Thailand. *Int. J. Electr. Hybrid Veh.* **2017**, *9*, 361. https://doi.org/10.1504/IJEHV.2017.089875.
79. Okada, T.; Tamaki, T.; Managi, S. Effect of Environmental Awareness on Purchase Intention and Satisfaction Pertaining to Electric Vehicles in Japan. *Transp. Res. Part D Transp. Environ.* **2019**, *67*, 503–513. https://doi.org/10.1016/j.trd.2019.01.012.
80. Lai, I.; Liu, Y.; Sun, X.; Zhang, H.; Xu, W. Factors Influencing the Behavioural Intention towards Full Electric Vehicles: An Empirical Study in Macau. *Sustainability* **2015**, *7*, 12564–12585. https://doi.org/10.3390/su70912564.
81. Xu, G.; Wang, S.; Li, J.; Zhao, D. Moving towards Sustainable Purchase Behavior: Examining the Determinants of Consumers' Intentions to Adopt Electric Vehicles. *Environ. Sci. Pollut. Res.* **2020**, *27*, 22535–22546. https://doi.org/10.1007/s11356-020-08835-9.
82. Sovacool, B.K.; Abrahamse, W.; Zhang, L.; Ren, J. Pleasure or Profit? Surveying the Purchasing Intentions of Potential Electric Vehicle Adopters in China. *Transp. Res. Part A Policy Pract.* **2019**, *124*, 69–81. https://doi.org/10.1016/j.tra.2019.03.002.
83. Miwa, T.; Sato, H.; Morikawa, T. Range and Battery Depletion Concerns with Electric Vehicles. *J. Adv. Transp.* **2017**, *2017*, 7491234. https://doi.org/10.1155/2017/7491234.
84. Zhuge, C.; Shao, C. Investigating the Factors Influencing the Uptake of Electric Vehicles in Beijing, China: Statistical and Spatial Perspectives. *J. Clean. Prod.* **2019**, *213*, 199–216. https://doi.org/10.1016/j.jclepro.2018.12.099.
85. Cecere, G.; Corrocher, N.; Guerzoni, M. Price or Performance? A Probabilistic Choice Analysis of the Intention to Buy Electric Vehicles in European Countries. *Energy Policy* **2018**, *118*, 19–32. https://doi.org/10.1016/j.enpol.2018.03.034.
86. Montian, K.; Suthikarnnarunai, N. Factors Influencing Purchase Intention towards Electric Vehicles in Bangkok Metropolis. *Int. J. Recent Technol. Eng.* **2018**, *7*, 123–128.
87. Franke, T.; Günther, M.; Trantow, M.; Krems, J.F. Does This Range Suit Me? Range Satisfaction of Battery Electric Vehicle Users. *Appl. Ergon.* **2017**, *65*, 191–199. https://doi.org/10.1016/j.apergo.2017.06.013.
88. Hardman, S.; Shiu, E.; Steinberger-Wilckens, R. Comparing High-End and Low-End Early Adopters of Battery Electric Vehicles. *Transp. Res. Part A Policy Pract.* **2016**, *88*, 40–57. https://doi.org/10.1016/j.tra.2016.03.010.
89. Hinnüber, F.; Szarucki, M.; Szopik-Depczyńska, K. The Effects of a First-Time Experience on the Evaluation of Battery Electric Vehicles by Potential Consumers. *Sustainability* **2019**, *11*, 7034. https://doi.org/10.3390/su11247034.
90. Bühler, F.; Cocron, P.; Neumann, I.; Franke, T.; Krems, J.F. Is EV Experience Related to EV Acceptance? Results from a German Field Study. *Transp. Res. Part F Traffic Psychol. Behav.* **2014**, *25*, 34–49. https://doi.org/10.1016/j.trf.2014.05.002.
91. International Energy Agency. *Tracking Report*; International Energy Agency: Paris, France, 2021.
92. Tiseo, I. Statista. 2022. Transportation Sector CO_2 Emissions Worldwide 2020, by Major Country. Statista. 2022. Available online: https://www.statista.com/statistics/1291501/transportation-emissions-worldwide-by-country/ (accessed on 22 April 2022).
93. Sierzchula, W.; Bakker, S.; Maat, K.; van Wee, B. The Influence of Financial Incentives and Other Socio-Economic Factors on Electric Vehicle Adoption. *Energy Policy* **2014**, *68*, 183–194. https://doi.org/10.1016/j.enpol.2014.01.043.
94. Scorrano, M.; Danielis, R.; Giansoldati, M. Dissecting the Total Cost of Ownership of Fully Electric Cars in Italy: The Impact of Annual Distance Travelled, Home Charging and Urban Driving. *Res. Transp. Econ.* **2020**, *80*, 100799. https://doi.org/10.1016/j.retrec.2019.100799.
95. Yetano Roche, M.; Mourato, S.; Fischedick, M.; Pietzner, K.; Viebahn, P. Public Attitudes towards and Demand for Hydrogen and Fuel Cell Vehicles: A Review of the Evidence and Methodological Implications. *Energy Policy* **2010**, *38*, 5301–5310. https://doi.org/10.1016/j.enpol.2009.03.029.
96. Schulte, I.; Hart, D.; Vorst, R. Van Der Issues a Ecting the Acceptance of Hydrogen Fuel. *Int. J. Hydrog. Energy* **2004**, *29*, 677–685. https://doi.org/10.1016/j.ijhydene.2003.09.006.
97. Breetz, H.L.; Salon, D. Do Electric Vehicles Need Subsidies ? Ownership Costs for Conventional , Hybrid , and Electric Vehicles in 14 U . S . Cities. *Energy Policy* **2018**, *120*, 238–249. https://doi.org/10.1016/j.enpol.2018.05.038.
98. Jenn, A.; Lee, J.H.; Hardman, S.; Tal, G. An In-Depth Examination of Electric Vehicle Incentives: Consumer Heterogeneity and Changing Response over Time. *Transp. Res. Part A Policy Pract.* **2020**, *132*, 97–109. https://doi.org/10.1016/j.tra.2019.11.004.
99. Vafaei-Zadeh, A.; Wong, T.-K.; Hanifah, H.; Teoh, A.P.; Nawaser, K. Modelling Electric Vehicle Purchase Intention among Generation Y Consumers in Malaysia. *Res. Transp. Bus. Manag.* **2022**, *43*, 100784. https://doi.org/10.1016/j.rtbm.2022.100784.
100. Fevang, E.; Figenbaum, E.; Fridstrøm, L.; Halse, A.H.; Hauge, K.E.; Johansen, B.G.; Raaum, O. Who Goes Electric? The Anatomy of Electric Car Ownership in Norway. *Transp. Res. Part D Transp. Environ.* **2021**, *92*, 102727. https://doi.org/10.1016/j.trd.2021.102727.
101. Sheldon, T.L.; Dua, R. Measuring the Cost-Effectiveness of Electric Vehicle Subsidies. *Energy Econ.* **2019**, *84*, 104545. https://doi.org/10.1016/j.eneco.2019.104545.
102. Linn, J. Is There a Trade-Off Between Equity and Effectiveness for Electric Vehicle Subsidies? 2022. Available online: https://media.rff.org/documents/WP_22-7.pdf (accessed on 10 January 2023).
103. Sheldon, T.L.; Dua, R. Effectiveness of China's Plug-in Electric Vehicle Subsidy. *Energy Econ.* **2020**, *88*, 104773. https://doi.org/10.1016/j.eneco.2020.104773.

104. Xing, J.; Leard, B.; Li, S. What Does an Electric Vehicle Replace? *J. Environ. Econ. Manage.* **2021**, *107*, 102432. https://doi.org/10.1016/j.jeem.2021.102432.
105. Krishna, A. An Integrative Review of Sensory Marketing: Engaging the Senses to Affect Perception, Judgment and Behavior. *J. Consum. Psychol.* **2012**, *22*, 332–351. https://doi.org/10.1016/j.jcps.2011.08.003.
106. Moreira, A.C.; Fortes, N.; Santiago, R. Influence of Sensory Stimuli on Brand Experience, Brand Equity and Purchase Intention. *J. Bus. Econ. Manag.* **2017**, *18*, 68–83. https://doi.org/10.3846/16111699.2016.1252793.
107. Zarazua de Rubens, G.; Noel, L.; Sovacool, B.K. Dismissive and Deceptive Car Dealerships Create Barriers to Electric Vehicle Adoption at the Point of Sale. *Nat. Energy* **2018**, *3*, 501–507. https://doi.org/10.1038/s41560-018-0152-x.
108. European Environment Agency. Electric Vehicles in Europe. 2016. Available online: https://www.eea.europa.eu/publications/electric-vehicles-in-europe (accessed on 10 May 2022).