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Analysis of Consumers' Electric Vehicle Purchase Intentions: An Expansion of the Theory of Planned Behavior

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Abstract: For the purpose of paving the way for reducing environmental pollution globally, adapting green energy to people's lives in more areas is seen as a good solution. The strategic plan implemented to prevent possible energy and water shortages in the future includes cleaning the environment and air from carbon emissions as soon as possible. Countries are taking mandatory sectoral and individual measures to remove the use of CO_2-based fuels. As a part of the sustainable development process for Turkey, which is trying to convince its individuals to use more green energy, it is important for society to adopt more electric vehicles. However, there are few internationally accepted studies on the adoption of EVs in Turkey, and a limited number of studies include individuals' environmental concerns (EC) and green trust (GT) structures. In this research, which we started on the basis of filling this literature gap by taking behavioral factors into account, we expand the TPB framework (subjective norm (SN), attitude (AT), and perceived behavioral control (PBC)) with the "EC" and "GT" constructs. So, with this research, we examine the behavioral factors that affect the intention to purchase electric vehicles (EVPI) of consumers residing in Turkey, based on the theory of planned behavior. Thus, we aim to reveal the barriers to the adoption of EVs in Turkey with an empirical application and SEM analysis. The first phase includes a review of the literature, adaptation of the survey, and development of the hypotheses. The second phase involves conducting a survey with 626 consumers whose information was obtained from four dealers in Turkey. We used Cronbach's alpha and CFA analyses on the data obtained from the survey. In the final phase, we performed an SEM analysis for our extended theory of planned behavior (ETPB) and hypotheses. The CFA results revealed that the survey showed compatibility with EV purchase intentions. The SEM results indicated that the behavioral constructs of AT, PBC, EC, and GT were positively correlated with EV purchase intentions, and our new ETPB model, extended with EC and GT, was suitable for predicting consumers' EVPI, suggesting that EVPI are a result of behavioral constructs. This study is unique for being the first in Turkey to focus on whether the factors of EC or GT can predict consumers' EVPI. On the other hand, it was found that SN had a negative effect on consumers' EVPI, and this result was in agreement with some studies in the literature and contradicted by others. In addition, we make suggestions based on the findings of the research to the country and related sector managers in order for the country to progress at a level that will set an example for other developing countries in its sustainable development plan. This study contributes to the EVs industry by revealing the consumers' responses and increasing their marketing efforts. Our findings constitute a comprehensive example for further research on sustainable consumption, EVs, EVPI, and ETPB.

Keywords: consumer behavior; behavioral intention; electric vehicles (EVs); electric vehicles purchase; intention environmental concern; green trust; green energy; extended theory of planned behavior; sustainable development; SEM

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1. Introduction

For sustainable development, it is very important for all countries to encourage individuals to use green energy, especially in terms of protecting human health and the environment. Ensuring that by 2030 the world gains the necessary awareness about sustainable development, green energy use, green production, and zero waste products and takes responsibility for keeping nature alive will facilitate the goal of reducing global carbon emissions by 48% [1,2]. This will help realize the target of 0% CO_2 by 2050 [1,3–5].

As one of the gears of the global economy, the automotive industry has undergone a major transformation to protect the world's future, to ensure sustainable consumption, and to increase renewable and green energy use. At the end of this year, the total oil consumption worldwide is expected to reach an average of 100 million 600 thousand barrels per day, increasing by nearly 3.1 million barrels, compared to 2021, and 102 million 600 thousand barrels in 2023 [6]. The automotive industry is trying to do its part to prevent the environmental damage caused by excessive oil consumption (air pollution, increased carbon footprint, increased greenhouse gas emissions, etc.) [7]. The industry is not only rapidly increasing investments in EVs production but also trying to evoke a consumer response in this regard.

With climate change, Turkey has begun to take significant measures to reduce environmental pollution and diseases that are caused by air and water pollution. With the increasing income rates and development in the country, the greenhouse gas emission rate has reached 1% (within the global total greenhouse gas rate), and the government has resorted to implementing some solutions [8]. Although Turkey's carbon intensity was lower than many European countries in 2004, there has been a 3% increase in CO_2 intensity from 2004 to 2021 [8]. Experts associate this sharp increase in CO_2 intensity with the coal used to generate electricity.

Another type of fuel use that causes high CO_2 intensity is oil. The total oil consumption in Turkey as of 2021–January 2022 is approximately 2,059,147.157 [9]. Researchers report that if electric vehicles do not become widespread enough, Turkey will experience a 25% increase in CO_2 emissions from conventional fuel vehicles from 2020 to 2030 [10]. This increase in carbon emissions would cause a 20% decrease in the country's growth rate [10]. The research argues that reducing the environmental problems in Turkey is, to a large extent, related to highway mobility [11–16]. One of the steps to significantly reduce CO_2 emissions is the use of electric vehicles instead of conventional vehicles [17]. Adopting vehicles that use environmentally friendly fuels (cars, motorcycles, trucks, buses, etc.) would not only realize most growth targets but also reduce some increasingly common health problems, such as lung cancer, COPD, etc. Turkish politicians aim to increase the number of electric vehicles in Turkey to 2 million by 2030 [10].

Within the framework of this target, the country provides incentives to the automotive, energy, and technology sectors to purchase electric vehicles instead of vehicles whose raw materials are based on carbon-based fuels. Country managers, marketers, academics, and environmental experts hold numerous sessions, conferences, and meetings on the adoption of EVs and publish about them in their social media and visual and print media. For example, they provide loans for businesses to install electric vehicle charging stations. Along with the Ministry of Industry and Technology, they are presenting a development strategy to make million dollar investments and spread the network of charging stations throughout the country. Turkey is also producing its own domestic electric vehicle (TOGG-Turkey's Automobile Enterprise Group, [18]). The infrastructure for this vehicle was established in 2019 and it will be introduced to the market by December 2022 [18]. Under these sustainable development goals, Turkey implements solar energy systems all over the country for clean energy production and encourages both the public and private sectors to ensure that the produced energy is used in more areas.

In Turkey, which is a developing country, the number of EVs on the road is below what it should be despite all the incentives offered for the use and expansion of electric vehicles [19]. Therefore, analyzing which behavioral patterns affect consumers' EVPI in

Turkey can give the automotive industry and government officials the opportunity to conduct studies on perception in light of realistic information.

Moreover, there are fewer studies in Turkey listed in international indexes (SSCI, SCI, SCIE, SCOPUS, etc.) than in other developing countries on the correlations between consumers' EVPI and extended behavioral factors [19,20]. Research on the adoption of EVs is mostly carried out for China, India, and US countries [21,22]. We observed that research on adopting EVs is rather more in countries with large populations and high per capita income [23]. In order to fill the literature gap with this study, according to the data of April 2022, 13 million 882 thousand 587 automobiles among 25 million 594 thousand 663 vehicles and the number of environmentally friendly vehicles within the total number of automobiles is very small (9.2%). By examining the behavioral factors that affect consumers' intention to purchase EVs, we aim to obtain solutions that facilitate EVs adoption in Turkey.

Therefore, in the current study, we investigate the behavioral reasons why consumers have low intentions towards purchasing electric vehicles. We explore the behavioral factors that facilitate the adoption of EVs in the country. In this study, we seek an answer to the following question: "Which behavioral patterns are affected by the EVs purchase intentions of consumers residing in Turkey?". Similar research problems have previously been investigated in other countries using TPB and ETPB [24–28]. Most researchers have used TPB to predict consumers' EVPI via behavioral patterns [29–32]). The TPB is a social-psychological theory that specifies the factors impacting individuals as they make decisions to direct their behaviors [33]. The theory argues that people hold control over their behaviors, that is, before individuals perform an action, they calculate the benefits and harms that it will bring to them [34]. According to the TPB, consumer behaviors for adopting and purchasing EVs can be interpreted by measuring consumers' direct intentions, thus drawing certain conclusions. The TPB argues that the constructs of attitude (AT), subjective norm (SN), and perceived behavioral control (PBC) are effective in individuals' behavioral decisions, so consumers' EVPI can be predicted using TPB [34]. The traditional TPB can be extended with factors, such as green trust and environmental concern, differentiating consumers' EVPI [24,35,36].

In this context, the current study presents a new framework of an extended theory of planned behavior (ETPB) by incorporating the constructs of EC and GT into the original behavioral constructs in TPB (subjective norm, attitude, perceived behavioral control) to predict the intentions of individuals residing in Turkey regarding adopting EVs. We used a two-part survey to collect consumer data. The first part contains questions about the participants' demographic information. The second part is a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) with 24 items that inquire about consumers' behavioral constructs about purchasing EVs under the ETPB. We received help from an intermediary statistics company to conduct the survey. For this study, which we built on AT, SN, PBC, EC, and GT to determine the behavioral factors in EVs adoption in Turkey, the items of the scale and its compatibility with this research were first examined by three experts (marketing professors) in order to validate our scale, which we adapted from previous research to our study. As a result of the examination, spelling errors and meaning corrections were made in the scale items that could be misunderstood. Then, the scale was piloted to a group of 22 people. We made revisions in our scale to present the purpose of the research more clearly with the answers given by the participants to the scale items (Appendix A).

Later, the company collected consumer data from four car dealers and administered the survey to 684 consumers online. We excluded the forms with inconsistent answers. We first performed a confirmatory factor analysis (CFA) and a reliability analysis (Cronbach's alpha) for the scale using the forms of 626 participants. We then used the SPSS 25 software to obtain the participants' demographic data. Afterward, we tested the fitness of our ETPB model and tested the hypotheses with structural equation modeling (SEM) analysis using LISREL (V. 8.7).

With the results of our study, we aim to make it easier to adopt EVs, which we see as a way to prevent air pollution in Turkey, reduce carbon footprints, protect the environment, and leave a more livable world to future generations, as well as reducing the dependency on diesel, which is getting more expensive at the global level. Using the extended theory of planned behavior, we present the model of this study to the literature by demonstrating that AT, SN, PBC, EC, and GT are antecedents of EVPI. It also makes a theoretical contribution to the literature gap as it is the first study on EVs adoption to assume that GT is directly related to EVs adoption based on past green product adoption studies and confirm it with SEM analysis findings. At the same time, we are paving the way for future research by expanding the limited studies that have obtained the direct impact of EC on consumers' EVPI in the Turkish context.

With this study, we make practical contributions based on empirical findings to reduce the responsibilities of country individuals, politicians, responsible managers, and energy and automotive sector managers; to access information more quickly; and to incorporate the behavioral structures of consumers into all incentive and awareness strategies for the adoption of EVs.

The article is structured as follows: Section 2: Literature Review; Section 3: Research Hypotheses and Model; Section 4: Methodology; Section 5: Results; Section 6: Discussion; Section 7: Conclusions

2. Literature Review

2.1. Theory of Planned Behavior (TPB)

Sustainable development goals give great importance to producing green energy and using it in more areas [3–5,30]. Moreover, alternative markets are being created for consuming this energy [3–5,37–39]. For the last decade, one of these sustainable markets has been the electric vehicle (EVs) market [40], including giant automotive companies (BMW, Mercedes, Volvo, Tesla, Volkswagen, etc.). Still, the market for automobiles and other vehicles that operate with environmentally friendly fuel has not grown enough to reduce CO_2 emissions [41]. Whereas consumers continue to demand conventional fuel vehicles, the automotive industry and governments are investing heavily in EVs [3–5,39,42–46].

EVs yield numerous positive outcomes, including protecting the environment, providing sustainable consumption, and increasing renewable energy use. However, there are some physical (short-term batteries, scarce network of charging stations, finite sustainable fuel, etc.) and psychological (high vehicle prices, lack of technological knowledge, fear, individual habits and perceptions, stress, tension, range perception, etc.) factors that hinder adoption of EVs [47]. Research on EVs analyzes consumer behaviors to remove these barriers. These behavioral analyses involve various theories, one of which is the theory of planned behavior (TPB), a highly demanded model. The TPB was created by incorporating the behavioral construct of perceived behavioral control into the rational choice theory, arguing that individuals only engage in intentions or actions in line with their self-interests. The TPB was developed to investigate the causes behind individuals' behaviors and has since been used in numerous behavioral studies [11,28,48].

The TPB suggests that while performing a behavior, individuals can be affected by uncontrollable factors (money, time, opportunity, etc.). Accordingly, individuals obtain information systematically and then act in a planned manner [34]. The theory considers the constructs of attitude (AT), subjective norm (SN), and perceived behavioral control (PBC) as key factors that determine an individual's behavioral intentions. The TPB can be used to determine consumers' purchase intentions regarding a product or service, as well as the reasons why they prefer one brand over another [34]. Of these constructs, an attitude refers to whether an individual has approved of a certain behavior [34,49]. The second behavioral construct, subjective norm, refers to the social pressure that occurs when an individual performs or does not perform a certain behavior [28,34]. Perceived behavioral control involves asking oneself how easy or difficult it is to perform a certain behavior [11,28,34].

The TPB and its constructs can be arranged according to any field of research. So, the TPB can be adapted and even extended with other behavioral constructs, gaining different meanings based on the intent or topic of research [50,51].

2.2. Extended Theory of Planned Behavior (ETPB)

The TPB is widely used in research involving environmentally friendly behaviors. However, for predicting consumers' intentions about their feelings towards the environment, the theory would benefit from the integration of other behavioral constructs. Previous research on EVPI has associated the TPB with other constructs, such as environmental concern, moral norm, price sensitivity, willingness to pay more, and green trust. Researchers have then applied these extended theories of planned behavior to make broader predictions about the behavioral constructs that could be instrumental in adopting transportation vehicles that use environmentally friendly fuel, such as EVs. Numerous studies have demonstrated that the TPB or the ETPB can be used to measure consumers' EVPI [28,30,49,52–55]. In the current study, we aim to provide a statistical perspective on which behavioral constructs impact the adoption of EVs in Turkey, considering the previous research shown in Table 1. Therefore, we include two behavioral constructs in the TPB that we assume would impact consumers' EVPI: EC and GT.

Table 1. Previous research on EVs and ETPB.

References	ETPB Constructs	Results
[30]	AT, SN, PBC, moral norm (MN), EC	This Indian study found that the constructs of AT, SN, PBC, moral norm, and EC were positively associated with consumers' EVPI.
[24]	AT, SN, PBC	This research from Pakistan reported that SN had a significant negative effect and that AT and PBC had significant positive effects on consumers' EVPI.
[50]	AT, SN, PBC, perceived benefits (PB), knowledge on battery swap (KBST)	This study from China aimed to identify the factors in consumers' behavioral intentions to replace the batteries of EVs. The authors found that ETPB constructs (AT, SN, PB, KBST) had significant positive effects on consumers' intentions to adopt BST but PBC had no impact.
[56]	AT, SN, PBC	This study used TPB constructs to determine the behavioral intentions of 278 Norwegian participants regarding repurchasing EVs. The author also investigated the effect of EVs properties on consumer satisfaction. The study yielded comprehensive results, reporting that TPB constructs had significant positive effects on purchasing EVs.
[51]	AT, SN, PBC, environmental propensity (EP), innovative propensity (IP), green trust (GT)	This Korean study reported that the factors of EP and IP affected AT, SN, and PBC separately, that GT strengthened the correlation between consumers' EVPI, their attitudes towards EVs, and subjective norms. The author observed no impact on the correlation between PBC regarding EVs purchase and consumers' EVPI.
[57]	AT, SN, PBC, AC, AR, perceived green value (PN), environmental knowledge (EK), perceived environmental responsibility (PER)	This research investigated HEV purchase intentions among Malaysian individuals. The authors extended the TPB with PGV, PER, and environmental knowledge. They employed the norm activation model and the TPB to shed light on PGV and green purchase intentions (GPI). The authors concluded that environmental knowledge was a moderator for PGV and GPI, while PGV had a positive impact on PER and GPI.
[58]	AT, SN, PBC, green benefits price, switching intention	This study investigated Indian consumers' intentions to purchase environmentally friendly vehicles. The authors extended the TPB constructs with switching intention (SI) and price sensitivity (PS). They confirmed all their assumptions and proved that the behavioral constructs of AT, SN, PBC, SI, and PS positively affected consumers' intentions to purchase environmentally friendly vehicles.

Table 1. *Cont.*

References	ETPB Constructs	Results
[28]	AT, SN, PBC, personal moral norm, EC	This research analyzed consumers' HEV (hybrid electric vehicle) purchase intentions in China. The authors extended the TPB with personal moral norm (PN) and environmental concern. They highlighted that EC positively affected AT, SN, PBC, and PN, while AT, SN, PBC, and PN positively affected consumers' HEV purchase intentions. Furthermore, HEV purchase intentions had a positive impact on real consumer behaviors.

3. Research Hypotheses and Model

In this section, we perform an empirical analysis to see whether the behavioral structures of AT, SN, PBC, EC, and GT, whose theoretical information is given above, have an effect on the EVPI of consumers. Within the framework of this purpose, we first form the hypotheses of the research by associating them with previous research. Then, we construct the relationship between primary factors (AT, SN, PBC, EC, GT) and EVPI for the hypotheses we created with the ETPB model.

3.1. Research Hypotheses

3.1.1. Attitude (AT)

AT refers to individuals' positive or negative evaluations regarding certain behavior through observation, experience, research, etc., and their tendency to perform that behavior [59,60]. If an individual evaluates the product positively, their probability of purchasing it increases [34,61]. There are already numerous studies from various regions, with various topics and titles that prove this assumption [62–65]. Similarly, the construct of attitude is considered the leading factor for measuring individuals' EVPI [27,28,32,66–69]. Ref. [70] conducted research on BEVs and found that individuals who believe that having a BEV will give them a positive image and increase their status were more likely to purchase BEVs. This finding has been supported by other studies as well [70–73]. Research shows that individuals have an emotionally positive attitude towards purchasing EVs (e.g., they do less harm to the environment, their engines are less noisy, they provide instant acceleration and a smooth driving experience, they run on less costly fuel, purchasing an EVs improves one's status, etc.), though some studies have also found negative attitudes towards the functional properties of EVs [27,70,73]. These negative attitudes stem from the perceived functional barriers of EVs, such as limited distance, long waiting times for charging, scarce charging stations, fear of being stranded, etc., [27,74]. Previous research has compared individuals with positive and negative attitudes towards EVs and found that those with positive attitudes are more likely to purchase EVs and are willing to pay more than they are for conventional vehicles [69,75,76]. Based on previous data, we define attitude as a determinant for measuring consumers' EVPI [32,66,67,77]:

Hypothesis H1 (H_1): *Attitude has a positive and significant effect on Electric Vehicle Purchase Intentions.*

3.1.2. Subjective Norm (SN)

SN means that individuals care about the expectations of the environment before performing their behaviors, which creates a social pressure on them. SN is a significant component of the TPB and has been proven to be extremely necessary in measuring behavioral intentions by international studies scanned over major indexes (SSCI, SCIE, Scopus). Ref. [28] found that SN affects the HEV purchase intentions of individuals in China. In addition, another piece of research reported that SN had a 1% effect on consumers' EVPI in China [24]. Likewise, another important study conducted in India found that SN was a determinant of EVs adoption [30]. However, Ref. [78]'s research, stated that drivers in Germany felt under social pressure regarding their EVPI, but this pressure would not have a

lasting impact. Considering TPB research overall, we observe a positive correlation between feeling social pressure and performing the relevant behavior [30,66,79–81]. Moreover, some other research on the adoption of green products have concluded that SN has no effect on behavioral intention [82–84]. Because of these different results regarding the effect of SN on behavioral intention, the effect of SN on EVs, a green product, remains unclear. We hope that this uncertainty is examined in order to achieve the purpose of this research and to fill this gap in the literature. We are curious about the impact of SN on EVs adoption in Turkey. Taking previous positive effect findings into account, we define SN as one of the determining factors for consumers' EVPI. Therefore, we make the following assumption.

Hypothesis H2 (H_2): *Subjective norm has a positive and significant effect on Electric Vehicle Purchase Intentions.*

3.1.3. Perceived Behavioral Control (PBC)

PBC refers to the influence of pressures and facilitators around individuals as they decide about a certain behavior. Accordingly, PBC is their entire perception of how easy or difficult it is for them to perform that behavior [24,26,50,85]. Ref. [86]'s research observed the impact of PBC in consumers who purchase EVs, and further studies continued to support this finding. In addition, in studies of adoption of EVs, PBC was mostly obtained as a predictor of consumers' pro-environmental behavior [87]. However, with the traditional TPB model, it directly investigates the effect of PBC on behavioral intention. A limited number of EVs adoption studies have explored this direct effect. For example, Ref. [75]'s research reported PBC to be the strongest factor in measuring BEV purchase intentions in Norway. One Indian study highlighted that PBC was significantly correlated with the adoption of EVs [30]. Therefore, we define PBC as a predictor of EVPI. Therefore, we consider the following hypothesis in this study.

Hypothesis H3 (H_3): *Perceived Behavioral Control has a positive and significant effect on Electric Vehicle Purchase Intentions*.

3.1.4. Environmental Concern (EC)

Environmental concern, which has long been accepted as an important predictor of ecological behavioral intentions, includes individuals' emotional responses to ecological issues [84,88–94]. There is research into the adoption of green products, which argues that an individual's feeling is more responsible for the environment and doing their part in protecting the environment is related to the increase in the environmental concern of the individual, and, furthermore, that the individual adopts green products when they feel EC [93]. EC predominantly influences green purchase intentions [48,84,85,95–98]. Individuals with a high EC show a clear intention to protect the environment, making it easier for individuals to adopt green products [12,84,96]. However, this relationship was discussed in the limited article in the adoption of EVs as eco-friendly products [99,100]. Evidence shows that consumers' EC are positively associated with their EVPI [99,100]. For example, a comprehensive study in Germany has found that individuals who act with a sense of responsibility towards the environment are more willing to pay for electric or hybrid vehicles [101]. Especially in the context of Turkey, no research has been done on this relationship. In this research, we think that if environmental concerns of consumers increase, they will abandon traditional vehicles and turn to green energy consuming, environmentally friendly EVs. Based on some other studies in the literature that concluded that EC has a direct impact on the adoption of green products, we think that EC may have a significant impact on the adoption of EVs. To discuss this deficiency in the literature, we construct the following hypothesis.

Hypothesis H4 (H_4): *Environmental Concern has a positive and significant effect on Electric Vehicle Purchase Intentions.*

3.1.5. Green Trust (GT)

Another construct that we added to our ETPB model is GT. The construct refers to individuals' willingness to commit to and believe in products based on their environmental performance [51]. Here, some product features, such as performance and price, are often crucial for consumers. This also involves a search for environmental benefit in these products. To encourage the purchase of a product, it is very important to gain consumers' trust, particularly if they are undecided. Positively influencing consumers' perceptions of a new product can be helpful in measuring their future purchase intentions [102]. Ref. [51] found that GT split consumers between traditional TPB structures and their intention to purchase EVs. However, studies that directly correlate GT with behavioral intention in green product adoption studies are seen in the literature. For example, Ref. [103]'s research, obtained GT as a predictor of green purchase intention. Studies examining the direct relationship of green trust in individuals' behavioral intentions for different green products have obtained results that are in agreement with the findings of this research [104–108]. We think that GT may have a direct impact on the adoption of EVs using green energy-based fuels, and in this context, we question the GT impact on EVs adoption in Turkey. Ref. [42]'s research is not directly examined in this study. We examine the relationship between GT and EVs purchase intention. In addition, in this context, we construct the following hypothesis.

Hypothesis H5 (H_5): *Green Trust has a positive and significant effect on Electric Vehicle Purchase Intentions.*

3.2. Research Model

Based on the literature presented above and the theoretical background, we integrate the constructs of EC and GT into the traditional TPB constructs (AT, SN, PBC) put forth by [34]. We, therefore, propose the following ETPB model to measure consumers' EVPI (Figure 1).

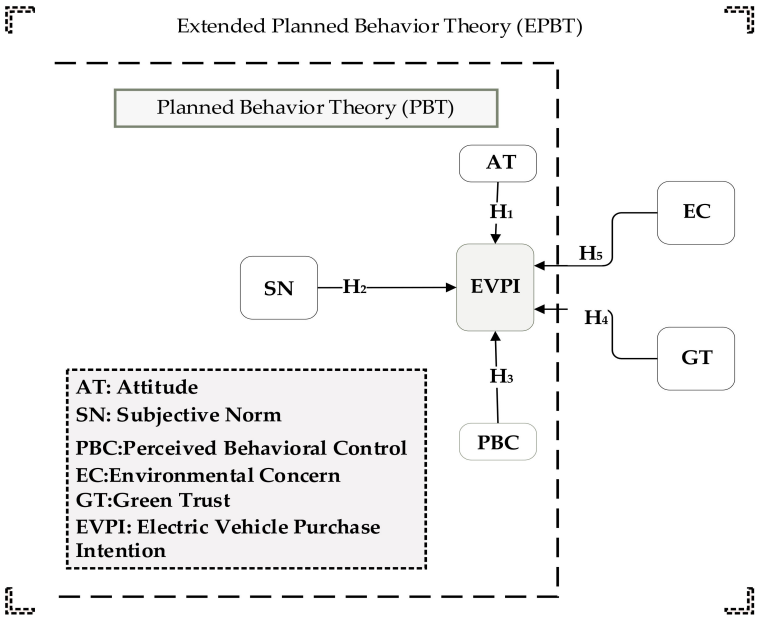

Figure 1. Research model: the theory of planned behavior extended with two additional constructs.

4. Methodology

4.1. Questionnaire Design

We used a two-part survey to collect consumer data. The first part contains questions about the participants' demographic information. The second part of the survey, we referred to [57] (20 items) for the TPB (AT, SN, PBC) and EC scale [57] (5 items), for the GT scale [82], and EVPI scale [30] (3 items). While examining the scale items, we used a 5-point Likert-type scale with answers ranging from "1 = strongly disagree" to "5 = strongly agree". We obtained predictive values from the results. Note that we did not develop any new scales but simply adapted those from 3 widely cited studies (Appendix A).

For this study, which we built on AT, SN, PBC, EC, and GT to determine the behavioral factors in EVs adoption in Turkey, the items of the scale and its compatibility with this research were first examined by 3 experts (marketing professors) in order to validate our scale, which we adapted from previous research to our study. As a result of the examination, spelling errors and meaning corrections were made in the scale items that could be misunderstood. Then, the scale was piloted to a group of 22 people. We made revisions in our scale to present the purpose of the research more clearly with the answers given by the participants to the scale items (Appendix A). The reliability and CFA analysis findings we performed with the participant data included in the pilot study provided above the required values in the literature (Appendix B).

4.2. Data Collection

We conducted the current study in Turkey, a developing country, for two reasons: (i) the number of electric vehicles is below the current target, and (ii) despite politicians' incentives for increasing electric vehicle use, individuals have not yet formed the necessary response. This study covers the two largest cities in Turkey (Istanbul and Ankara) in terms of population and development levels. The population of this study includes all traditional vehicle consumers in Turkey. To determine the sample, we used the random sampling method, which is often recommended with such large populations. We used structural equation modeling (SEM) to analyze the ETPB model and our research hypotheses. The SEM requires a sample size of at least 10 participants per item in the survey. We reached nearly three times as many traditional vehicle consumers (684) as the number of items [109]. Survey data were collected online from the customers of four automotive dealers via a statistics company from February 2022 to April 2022. We then excluded participants under the age of 18, those with no intention to purchase a vehicle, and those who gave inconsistent answers to the two attention check questions (ACQs). Hence, we used the data of the remaining 626 participants in our analysis.

The survey consists of two parts:

- Questions about demographic information;
- Questions about EVPI.

Table 2 describes the data collected with the survey.

Table 2. Survey information.

Study Parameters	Value
Time	February–March–April, 2022
Location	Istanbul–Ankara, Turkey
Sample size	684
Valid responses	626
Response rate	%91.52

4.3. Data Analysis

To discover theoretical results for correlations between variables, the research hypotheses were tested using a two-stage SEM [110]. This technique is more advantageous than others in clearly estimating measurement errors, taking unobservable, latent constructs

into account, and creating and evaluating a construct that conforms with the data. We used SPSS (V. 25) for the reliability analysis of the questionnaire. We used LISREL (V. 8.7) for SEM analysis and CFA.

5. Results

5.1. Demopraphic Results

Table 3 shows the participants' demographic profile. Accordingly, 65% of the participants were male, 76.3% were married, 29.8% were 26–35 years old, 19.6% were academic personnel, and 23.7% had a monthly income of USD 301–400. A total of 92.6% of the respondents owned a carbon fueled vehicle. It was determined that 36.4% of them intend to purchase EVs. Moreover, only a small percentage (3.4%) of respondents owned an electric vehicle, and all of these respondents said they intend to purchase EVs if they ever need them again (Table 3).

Table 3. Demographic findings.

Demographic	Group	%
Gender	Male	65.0
	Female	35.0
Marital Status	Single	23.7
	Married	76.3
Age	19–25	12.1
	26–35	29.8
	36–45	28.3
	46–55	17.8
	56+	11.9
Job	Student	%12.6
	Private Sector Employee	%14.2
	Officer	%14.2
	Academical Personnel	%19.6
	Teacher	%7.2
	Small Business	%8.1
	Engineer	%4.2
	Military Officer	%1.2
	Nurse	%5.9
	Financial Advisor	%1.6
	Doctor	%9.1
	Lawyer	%2.1
Monthly Income	USD −100	14.3
	USD100–300	13.3
	USD 301–400	23.7
	USD 401–500	19.9
	USD 501–600	12.3
	USD 601–700	5.5
	USD 701–800	5.5
	USD 801	5.5
Education Status	College	38.2
	University	53.1
	Master's +	8.6
Type of vehicle owned	I have a carbon fueled vehicle.	%96.6
	I have an electric vehicle.	%3.4
EVPI	I intend to buy an electric vehicle.	%36.4
	I don't intend to buy an electric vehicle.	%60.2
	I intend to buy an electric vehicle again if I need it.	%3.4

5.2. Reliability and Validity Analysis Results

First, we tested the validity and reliability of the scale of the study using data collected from the participants. We used the Cronbach's α analysis, which is widely used to measure the reliability of the scale, to test the reliability of the questionnaire of this study. On the other hand, we applied confirmatory factor analysis to see whether the scale's convergent validity (explains the internal reliability of the items used to measure the same construct) and discriminant validity (explains to what extent different constructs are unrelated and whether constructs can be distinguished from each other) are within the range of values in the literature [111].

To examine the reliability and close validity of the scale, we calculated factor loads, Cronbach's alpha, composite reliability (CR), and subtracted mean variance (AVE) values for all behavioral constructs in this study.

Moreover, we performed a Cronbach's Alpha test to check the internal reliability of the scale items. The reliability of the scale can be ensured by obtaining the Cronbach's Alpha value of the latent factors above 0.7. In our study, Cronbach's alpha values of all factors were above 0.7 (Table 4).

Table 4. Process of validity and reliability construct results.

Construct	Items	AT	SN	PBC	GT	EC	EVPI	Factor Loading	SMC **	Common Variance Loads	CR	AVE	Cronbach's Alpha
AT	AT4	0.646						0.65	0.42	0.86	0.94	0.75	0.96
	AT3	0.658						0.66	0.43	0.87			
	AT5	0.674						0.67	0.45	0.86			
	AT2	0.683						0.68	0.47	0.87			
	AT1	0.720						0.72	0.52	0.85			
SN	SN5		0.565					0.57	0.32	0.86	0.92	0.69	0.95
	SN3		0.597					0.60	0.36	0.84			
	SN2		0.599					0.60	0.36	0.86			
	SN4		0.627					0.63	0.39	0.85			
	SN1		0.777					0.78	0.60	0.80			
PBC	PBC4			0.559				0.56	0.31	0.88	0.94	0.72	0.96
	PBC2			0.566				0.57	0.32	0.88			
	PBC3			0.575				0.58	0.33	0.89			
	PBC6			0.587				0.59	0.34	0.85			
	PBC5			0.606				0.61	0.37	0.87			
	PBC1			0.695				0.70	0.48	0.84			
GT	GT2				0.597			0.60	0.36	0.87	0.92	0.69	0.93
	GT3				0.627			0.63	0.39	0.84			
	GT1				0.672			0.67	0.45	0.81			
	GT4				0.718			0.72	0.52	0.78			
EC	EC1					0.544		0.54	0.30	0.94	0.91	0.72	0.95
	EC2					0.588		0.59	0.35	0.85			
	EC4					0.661		0.66	0.44	0.82			
	EC3					0.671		0.67	0.45	0.83			
EVPI	EVPI3						0.548	0.55	0.30	0.81	0.83	0.62	0.89
	EVPI2						0.608	0.61	0.37	0.82			
	EVPI1						0.655	0.66	0.43	0.80			

Note: CR—composite reliability, ** SMC = square multiple correlations, AVE = average variance extracted. KMO: 0.985 > 0.60; Bartlett's test of sphericity = $X^2(351)$ = 190,777.934; p = 0.000 < 0.01; Cronbach's Alpha for scale = 0.987.

In determining the convergent validity of the scale:

(i) CR value of the constructs should be higher than 0.7, and the (ii) AVE value of all the scale constructs should be higher than 0.5. We considered these values suggested by [112]. The CR values of all constructs of the scale (The CR value of each construct was between 0.729 and 0.828) were over 0.7. Likewise, the AVE values of all constructs of the scale (each construct's AVE value is between 0.729 and 0.828) were above 0.5. As a result, AVE and CR values showed the validity of the study scale (Table 4).

When the reliability levels of the factors were examined, it was determined that the reliability coefficient (α= 0.960) result of the AT was high, and this factor alone explains 17.787% of the scale. When the items under SN were examined, it was determined that the reliability analysis of this sub-dimension (α = 0.948) was at a high level, and this factor alone explains 15.654% of the scale. When the items under the PBC sub-dimension were examined, it was determined that the reliability analysis of this sub-dimension (α = 0.962) was at a very high level, and this factor alone explains 15.151% of the scale. When the items under the GT dimension were examined, it was determined that the reliability analysis of this sub-dimension (α = 0.932) was at a high level, and this factor alone explains 14.261% of the scale. When the items under the EC dimension were examined, it was determined that the reliability analysis of this sub-dimension (α = 0.948) was at a high level, and this factor alone explains 12.245% of the scale. When the items under the EVPI dimension were examined, it was determined that the reliability analysis of this sub-dimension (α = 0.890) was at a high level, and this factor alone explains 9.78% of the scale.

With discriminant validity analysis, we can see the relationship between constructs and whether these relationships are at a high level. So, we used the Fornell–Larcker Criterion (FLC) to calculate the discriminant validity of the scale [113]. Accordingly, the square roots of the average variance extracted (AVE) values for the constructs of our ETPB scale were higher than the correlations between the constructs, so the discriminant validity of our constructs was ensured [113,114]. All the values indicated in dark color in Table 5 were found to be higher than the lower values. In other words, the discriminant validity of the scale was obtained.

Table 5. Correlation matrix and discriminant validity findings.

Variables	AT	EC	EVPI	GT	PBC	SN
AT	**0.929**					
EC	0.905	**0.922**				
EVPI	0.916	0.906	**0.934**			
GT	0.872	0.904	0.907	**0.919**		
PBC	0.910	0.919	0.854	0.905	**0.926**	
SN	0.889	0.919	0.907	0.882	0.889	**0.886**

Notes: The square root of AVE is indicated in bold; EVPI: electric vehicle purchase intentions.

For validity analysis, we performed the first stage of the SEM, which evaluates whether the scale covers the subject. Each item was loaded onto the corresponding construct (Figure 2) and the goodness of fit was found to be at default values. So, the scale displayed excellent validity. This result confirms the model's content validity, given that each item was loaded onto a relevant construct (Table 6). Moreover, using the literature, we confirmed the following values: $X^2/df = 1740 < 3$; GFI= 0.930 > 0.90; AGFI = 0.920 $\geq$ 0.900; NFI = 0.990 > 0.90; RMSEA = 0.039; 0 < CFI = 0.990 < 1 [114–116]).

To clarify the probability of shared systematic error (CMV) among the variables of the scale, we resorted to the multiplex methods of [117]. We examined three situations to avoid the risk of CMV: (i) According to [118], correlation values should be below 0.9. The correlation values of our scale items were significantly low and significant. (ii) Another common latent factor is that it should not explain more than 50% of our variance. For this, we resorted to Harman's single factor test [118]. In our research, our model, in which we applied principal component analysis without the rotation procedure, produced six components that explained 84.87% of the variance, and the principal component captured only 17.78% of the deviation. (iii) We applied CFA with and without adding a common latent factor to our model and obtained differences in loadings below the 0.2 cut-off value. We conclude that this is negligible [119].

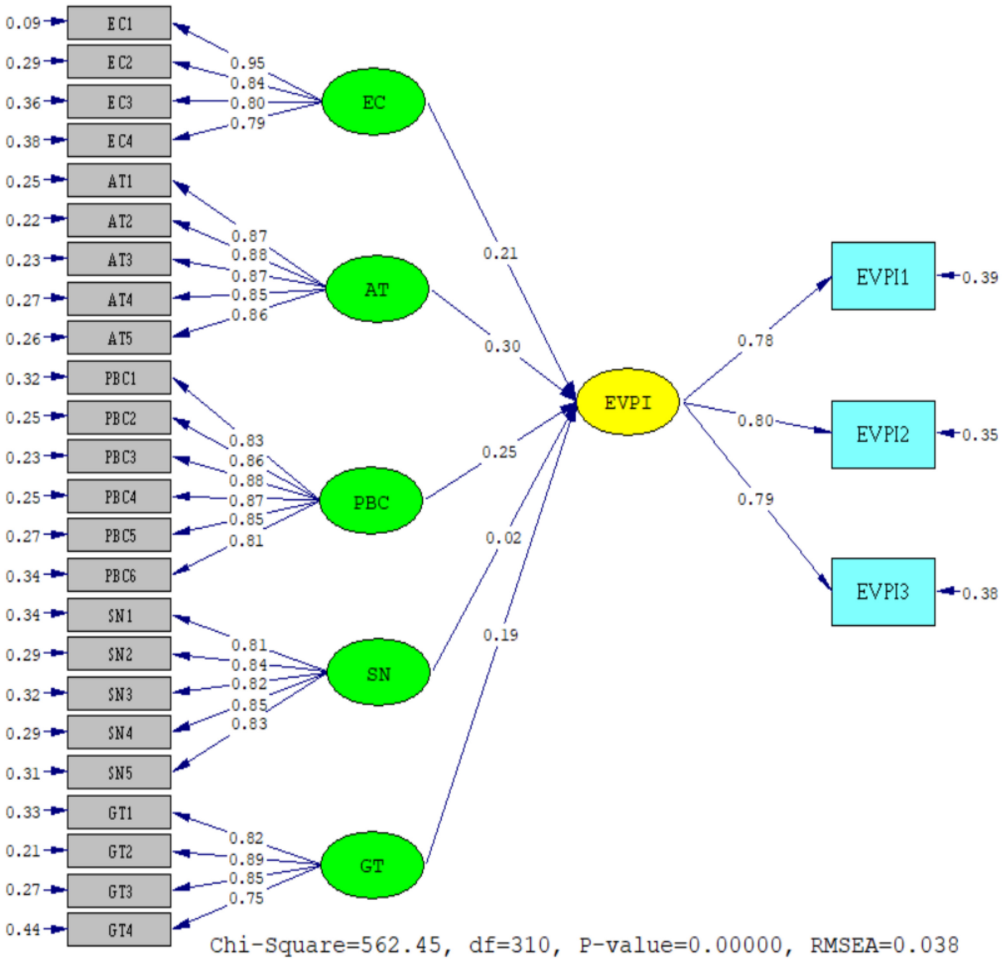

Figure 2. Evaluation of the structural model (path coefficient and t-value).

Table 6. Inter-order relations values.

X^2/df	*p*	RMSEA	CFI	GFI	AGFI	NNFI	NFI	RMR	SRMR
1740	0.000	0.037	0.99	0.93	0.92	0.99	0.99	0.025	0.016

5.3. Structural Equation Model Analysis Results

This section includes the path analysis of the research model (Figures 2 and 3) and hypotheses created to predict consumers' EVPI using ETPB.

We evaluated the multicollinearity of our EPBT model using the variance inflation factor (VIF) value. We found that all factors had VIF values between –1.252 and 4.548. VIF results did not exceed the threshold value (VIF results of AT = 5.861, SN = 6.253, PBC = 7.609; GT = 5.037, EC = 6.44 < 10) [120]. Thus, we determined that there is no multicollinearity problem. We examined the significance of path coefficient, explained variance (R^2) and effect size (t) in the evaluation of structural models and hypotheses.

For our hypotheses on our research model, we used the SEM. The SEM is often preferred in EVs and green energy research allows for the theoretical modeling of complex situations, gives practical results for problems in quantitative research, and includes latent variables that cannot be measured by directly observable ones. The diagram for the SEM included the degrees of relationship between EVPI and each of AT, SN, PBC, EC, and GT, separately (Figure 3). The results reveal that the R^2 values for EVPI (0.449), AT (0.09), SN (0.0004), PBC (0.063), EC (0.041), and GT (0.135) were substantial (Hair et al., 2014). The statistical results showed a standardized β (path coefficient) of 0.30 (AT →EVPI), 0.25 (PBC → EVPI), 0.21 (EC → EVPI), and 0.19 (GT → EVPI). So, H_1, H_3, H_4, and H_5

accepted. We found a result of $p > 0.05$ for H_2, β = 0.02 (SN → EVPI). So, H_2 is rejected (Table 7). For all others, the result was $p < 0.001$.

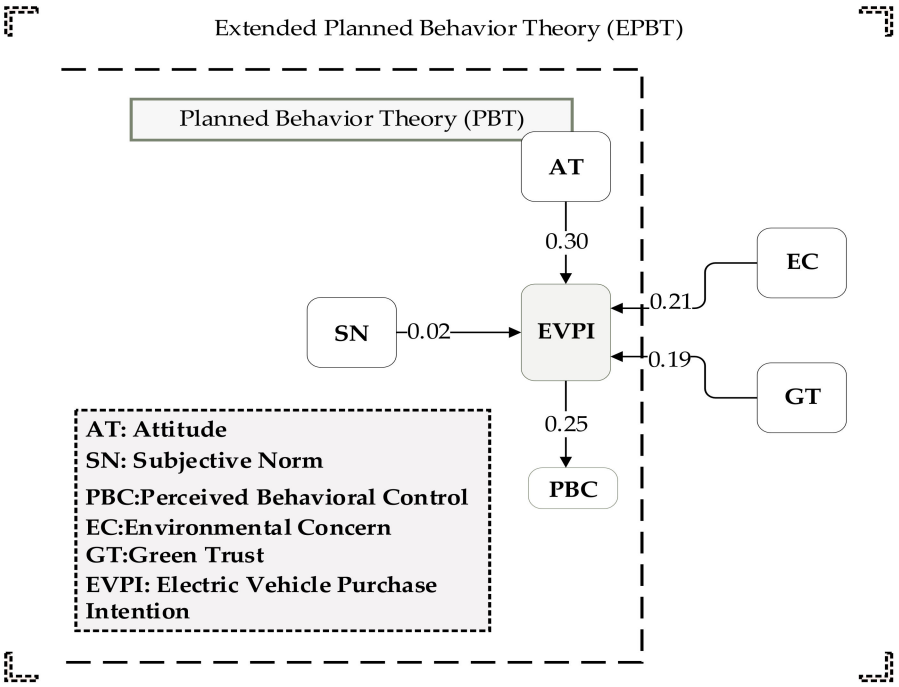

Figure 3. Path analysis results.

Table 7. Findings for the ETPB structural model.

Hypotheses	Roads	β (Path Coefficient)	t	Conclusion
H_4: Environmental Concern has a positive and significant effect on Electric Vehicle Purchase Intentions	EC → EVPI	0.21	2.71 **	Accepted
H_1: Attitude has a positive and significant effect on Electric Vehicle Purchase Intentions	AT → EVPI	0.30	4.24 **	Accepted
H_3: Perceived Behavioral Control has a positive and significant effect on Electric Vehicle Purchase Intentions	PBC → EVPI	0.25	2.81 **	Accepted
H_2: Subjective norm has a positive and significant effect on Electric Vehicle Purchase Intentions	SN →EVPI	0.02	0.25	Rejected
H_5: Green Trust has a positive and significant effect on Electric Vehicle Purchase Intentions	GT → EVPI	0.19	2.61 **	Accepted

** $p < 0.01$.

These values were significant at $p < 0.001$ (Table 7). According to Cohen (1988), R^2 is considered a significant effect size. In addition, our goodness of fit was excellent according to the literature: $X^2/df = 1.814$, RMSEA= 0.038, CFI = 0.99, IFI= 0.99, RMR= 0.025, SRMR = 0.016, GFI = 0.93, AGFI = 0.92, NFI = 0.99, and NNFI = 0.99. Therefore, hypotheses H_1, H_3, H_4, and H_5 were confirmed, indicating that AT, PBC, EC, and GT have a significant, positive effect on consumers' EVPI. However, hypothesis H_2, which argues that the behavioral construct of SN significantly and positively affects consumers' EVPI, was not confirmed ($p > 0.05$).

6. Discussions

The purpose of this article was to investigate, in terms of behavior, the factors affecting individuals' EVPI in Turkey. We adapted the TPB, which is widely used in estimating the behavioral factors that affect individuals in the process of intending this behavior before performing a new behavior, for EVs that have not yet been adopted at the desired level in Turkey.

The traditional TPB framework claims that individuals are influenced by AT, SN, and PBC factors in the process of adopting any behavior [34,96]. In studies conducted with TPB, the individual's AT, SN, and PBC cognitive structures should be considered [11,28,34,48,96]. Due to this requirement presented regarding TPB studies in the literature, in our research, we examine individuals' attitudes towards EVs, subjective norms, and perceived behavioral control structures in the adoption of EVs in Turkey, and we base the research model on these factors [27,28,66–69,96]

To the best of the author's knowledge, the limited number of eVs adoption studies conducted in Turkey did not discuss the impact of consumers' EC and trust in green products on their intention to purchase EVs. However, most studies conducted in different countries have found that individuals adopt green energy-consuming vehicles because of their sensitivity to the environment and their discomfort with the environmental pollution caused by carbon-based vehicles. For example, a comprehensive study in Germany has found that individuals who act with a sense of responsibility towards the environment are more willing to pay for electric or hybrid vehicles [101]. Ref. [100] showed that Chinese citizens accept green energy-consuming vehicles due to environmental concerns. He et al., (2018), in their research in China, found that individuals' environmental concerns reduce their sensitivity to EVs prices and make it easier for them to adopt EVs. Ref. [121] found that EC influences the intention of individuals in China, Russia, and Brazil to purchase EVs. Although the examples are limited, it is stated that EC is also influential in consumers' intentions to purchase green products in studies on the adoption of green products [85,87,95–98,122,123]. In this context, based on the literature findings, we included EC in the TPB model of this study.

Moreover, to the best of the authors' knowledge, previous EVs adoption studies in Turkey did not examine the potential impact of green trust on consumers' intention to purchase EVs. However, providing green trust in consumers is seen as a good green product marketing strategy [124–127], and we only found one study in the literature (of those scanned in SCOPUS) on this effect. Ref. [51] found that GT moderators between the AT, SN, and PBC constructs and the adoption of EVs. We did not include GT in the model of this research, as the assumption that GT may have a direct impact on EVs adoption, rather than the indirect effect obtained here, had an impact on individuals' green product purchase intentions in past green product adoption studies. Thus, we aimed to draw attention to this important but overlooked literature gap and pave the way for future EVs purchase intention research both for Turkey and other countries.

Below we summarize the results of the validity and reliability analysis of the research model. Then, we give the results of the SEM analysis of the hypotheses of the research.

Primarily, Cronbach's alpha and CFA findings suggest that the survey can be used to measure consumers' EVPI. CFA findings confirm that the observable and latent variables were associated with the factors of ETPB. In other words, the validated factors of AT, SN, PBC, EC, and GT provide good reliability for predicting consumers' EVPI.

We extended the theoretical framework of the TPB with EC and GT, and our findings were largely consistent with the literature. The SEM analysis proved our hypotheses.

Firstly, "H_1: Attitude has a positive and significant effect on Electric Vehicle Purchase Intentions" was accepted ($t = 4.24 > 2.58$; $p < 0.01$). We found that 1 unit of increase in participants' attitudes (AT) towards EVPI had a positive effect on their EVPI by 0.30 units. Among all the factors, AT had the highest impact on EVPI. This finding is consistent with other studies in the literature [30,56,80,128,129]. Refs. [36,130] reported that perceived usefulness and perceived ease of use had positive effects on attitude towards EVs [55], in this

regard, highlighting all the features of EVs that will positively affect consumers' attitudes towards purchasing EVs, such as functional efficiency, price, performance, low value of fuel consumption, ease of use and adaptation, and promotions emphasizing all these features by authorized politicians in Turkey. Politicians and industry executives should bring more awareness to the public about EVs. They should conduct more advertisements about the ease of use, functional advantages, and efficiency of EVs. Moreover, the network of electric charging stations should be expanded and consumers' concerns about shorter travel times, compared to conventional vehicles, should be addressed immediately. Production and R&D research on faster charging for EVs should be accelerated. They should ensure better payment facilities and better affordability when purchasing EVs. Policymakers should guarantee less taxes for purchasing EVs than conventional vehicles. With this, it can be ensured that consumers have an intention to purchase EVs. It may also be of interest to consumers who are undecided about their intention to purchase EVs.

Secondly; "H_2: Subjective Norm has a positive and significant effect on Electric Vehicle Purchase Intentions" was rejected ($t = 0.25 < 2.58$; $p > 0.01$). SN had no significant effect on EVPI. Our finding is consistent with some of the research in the literature [24,131]. Hence, this finding supports the previous studies indicating that SN does not affect behavioral intentions [82–84]. Still, some previous studies have found that consumers' subjective norms are a significant factor in terms of their EVPI [24,26,50,75,85,86,132]. SN refers to being affected by one's environment and feeling under external pressure. For our participants, external pressure had a slight negative impact on EVs purchases. Thus, we believe that consumers do not obtain information about EVs from the people around them or they obtain incorrect information about EVs.

Thirdly; "H_3: Perceived Behavior Control has a positive and significant effect on Electric Vehicle Purchase Intentions" was accepted ($t = 2.81 > 2.58$; $p < 0.01$). We found that 1 unit of increase in perceived behavioral control positively affected EVPI by 0.25 units. This finding is consistent with the previous studies in the literature [30,56,66,80,96,128]. Given the correlation between consumers' PBC and EVPI, the difficulties associated with purchasing EVs rather than conventional vehicles (price comparisons, habit changes, innovative actions, psychological and functional challenges, etc.) do not seem to prevent consumers' intentions, thoughts, or evaluations for this behavior. The effect of PBC on EVPI was almost as strong as AT.

Fourthly; "H_4: Environmental Concern has a positive and significant effect on Electric Vehicle Purchase Intentions" was accepted ($t = 2.81 > 2.58$; $p < 0.01$). We found that 1 unit of increase in EC positively affected EVPI by 0.21 units. This finding supports other research using TPB extended with EC, expanding the literature. We performed an extensive literature review. Accordingly, there is an insufficient number of studies on EC in EVPI and behaviors [133–135]. Studies have shown that EC indirectly affects behavioral intention and that EC is a pre-component of TPB constructs (AT, SN, PBC). Ref. [136]'s research revealed that the average correlation coefficient between EC and environmentally friendly behavior is in the range of 0.23–0.35. Results consistent with the findings of this study were provided by different studies. However, Ref. [26] found a positive effect of EC on behavioral intention in their study, which they examined directly from EVs adoption studies. With the findings of our study, we provided [26]'s suggestions for Turkey that the findings should be re-examined in different geographies. Moreover, given the findings of [137] on EC in China, our research stands to confirm their results as appropriate and justified for Turkey. In this regard, politicians should try to raise awareness about consumers' responsibilities towards the environment and raise concerns about the environment. Moreover, educational institutions should carry out projects to raise awareness in students regarding their environmental responsibilities.

Lastly; "H_5: Green Trust has a positive and significant effect on Electric Vehicle Purchase Intentions" was accepted ($t = 2.61 > 2.58$; $p < 0.01$). We found that 1 unit of increase in green trust positively affected EVPI by 0.19 units. This finding is consistent with studies of adoption of other green products containing GT [82,138–141]. While constructing

this hypothesis of the research, we said that only one study [51] investigated the effect of GT on EVs adoption and that GT was examined as a moderator between PBT structures and EVs purchase intention in EVs adoption. With this research, we obtained the direct impact of GT on EVs adoption. In this way, we have demonstrated a very important relationship that can be used to persuade the public to adopt EVs in Turkey, which has many consequences, such as increasing green energy use, reducing environmental pollution, reducing CO_2 emissions. Taking GT into account in implementation and awareness activities about EVPI would clearly be beneficial, even if less than the other factors. Forming the perception of green trust can strengthen EVPI. Ref. [142] obtained green perceived quality and green perceived risk as predictors of GT and found that green satisfaction was a moderator between green perceived quality and GT. In addition, Ref. [143] found in their research that being environmentally friendly will increase individuals' GT. By increasing the perceived quality of EVs in Turkey, individuals may develop a sense of satisfaction towards EVs. In addition, with accurate information about EVs in the society, the risks perceived by individuals against EVs (use, charging, staying on the road, etc.) can be reduced. EVs are environmentally friendly, running on environmentally friendly fuel (green energy), etc. Promotions can boost someone's GT versus EVs, thus improving EVs purchase intention.

6.1. Theoretical Implications

Rising CO_2 emissions and dependence on cars and other vehicles running on carbon-based fuels pose a major, global threat. With this research, we present especially GT and EC behavioral structures that will accelerate the adoption of electric vehicles in Turkey and other countries with similar socio-economic structures. We conducted this research with the aim of facilitating the adoption of EVs, which are thought to provide significant benefits in increasing green energy use and reducing environmental pollution, which is important for Turkey's sustainable development plan.

The research is the first to extend traditional TPB structures with EC and GT on EVs adoption in the Turkish context. To the best of the authors' knowledge, there is no TPB study examining the same behavioral structures and relationships as the ETPB model of this study for EVs adoption. Therefore, we bring this comprehensive model of the study to the literature. With this contribution, we pave the way for future studies on the adoption of electric vehicles, green and clean energy, and sustainable development for Turkey and other developing countries with similar population and development structures. Moreover, this research has different theoretical contributions from some other EVs adoption studies. First, we theoretically explain and support with our findings one of the limited studies that directly establishes the relationship between EC and EVs adoption in a limited number of different geographies (except Turkey), which most studies neglect to examine its direct relationship. Therefore, we provide this finding, which will facilitate the adoption of EVs, to other researchers who will work in the same field. Second, there are many green product adoption studies in the literature that state that GT has a direct effect on behavioral intentions and that directly correlates the impact of GT on individuals' intention to purchase green products. However, the direct impact of GT on the adoption of EVs in the green product category, which consumes green energy and is environmentally friendly, has not been investigated in previous studies. Therefore, our finding reduces the literature gap.

6.2. Practical Implications

With this study, we approached the effects of individuals' intentions to purchase EVs by examining their behavioral patterns, rather than being unresponsive to Turkey's investments for greater adoption of EVs, and thus the spread of green energy. We are making some practical contributions to government officials, automotive industry executives, and marketers with the aim of facilitating the adoption of EVs in Turkey.

Based on the findings, awareness should be raised based on individuals' attitude, PBC, EC, and GT behavioral factors to facilitate EVs adoption. This study presented unique evidence that consumers' environmental concern and green confidence are precursors to

EVs adoption. Therefore, politicians and marketers should launch promotional campaigns that reinforce individuals' environmental concerns and attitudes towards EVs because EVs are environmentally friendly. These could include written and printed advertisements, notifications to be sent to smart phones via GSM operators, public service announcements, etc., containing the fact that this green energy prevents the damage caused by fossil fuels to the environment. Thus, the perceived quality of EVs can be increased and individuals' perceived risk to EVs can be reduced. In this way, individuals' EVs purchase intentions can be changed and improved by increasing EC and GT. We contribute to Turkey's sustainable development plan with these findings and recommendations that will facilitate the adoption of EVs. In other words, with the empirical findings of this research, we present the necessity of developing solutions based on EC and GT behavioral factors in order to ensure the use of green energy to a large extent, reduce environmental pollution, prefer EVs more, and find value in the society for the authorities of the country and the automotive sector.

6.3. Future Research Directions

Rising CO_2 emissions and dependence on cars and other vehicles running on carbon-based fuels pose a major, global threat. Therefore, more research is needed to facilitate the adoption of EVs that will increase green energy use. In order to understand the barriers to the adoption of electric vehicles, which are significantly effective in increasing the use of clean and green energy, we suggest further research on this popular topic and discuss the findings of the study with different methods. This study can be analyzed with other theoretical models that measure intentions. In addition, data can be collected from regions with different dynamic structures, implementing a comparative analysis. We suggest future research specifically investigate the roles of EC and GT in the adoption of EVs and compare them with the findings of this study.

This research investigates the intentions of consumers towards the purchase of electric vehicles in Turkey. We suggest future researchers investigate the behavioral intentions of consumers on vehicles working with other energy sources with different effects and theories.

Our study of consumers' EVPIs does not focus on EVs-related technological features and charging batteries. In this respect, a study that takes into account the technological features that affect the intention to purchase an EV may be useful.

In behavior and intention studies, applying the same model more than once allows one to get more realistic results. In this context, we have some recommendations for future research. This study can be performed in the same regions more than once using the TPB. Researchers can also investigate EVPI in smaller regions of the country, with different demographics, using the new ETPB model and the same behavioral constructs.

Also, the ETPB framework of our research can be further extended with other behavioral constructs and relationships that can affect consumers' EVPI. Our methods can be repeated for other countries with similar social, economic, and demographic characteristics.

Finally, further research can investigate the correlations between the behavioral constructs of our ETPB and consumers' EVs purchase behaviors.

7. Conclusions

In this study, we used the TPB, which is a valid theory in explaining consumer behavioral intentions and has been used in many important behavioral intention prediction studies. In our research, in order to examine and explore the factors that affect the electric vehicle purchase intentions of individuals in Turkey, we have included consumers' environmental concerns and green trust in the theory of planned behavior, which covers AT, SN, and PBC factors. The research has been helpful in increasing the knowledge and understanding of marketers who conduct or want to conduct research on the adoption of green energy consuming vehicles, such as EVs in the Turkish context, by associating consumers' EVPI with behavioral factors.

There is an urgent need to create EC in the society regarding the future of Turkey, which ranks 5th in the world in terms of air pollution. First of all, Turkish state officials have a great responsibility for the reflection of the use of green and sustainable resources to the society in the most general sense. Although the country's sustainable development plan continues at a very global pace, they need to be informed to change their consumption awareness in order for the society to act more voluntarily about CO_2 emissions. It is seen that the use of green energy, which is seen as a way to postpone possible water and energy shortages in the coming centuries, will be consumed in more areas. With the findings of this research we conducted in Turkey, we contribute to the country's increase in green energy use by identifying the behavioral factors that affect the adoption of EVs and with recommendations based on empirical findings.

In particular, Ref. [96] recommended that further research focusing on examining and improving the relationship between attitude and EVPI is needed for future research, and we provided a Turkey extension with our findings, in addition to other EVs research based on this relationship. The findings showed that individuals residing in Turkey coped better with attitude towards EVs, compared to other disabling factors when purchasing EVs, as AT was obtained as the most important predictor of EVPI among other TPB constructs. In line with this result, politicians and industry officials can raise awareness about EVs in society to facilitate the adoption of EVs in Turkey, and a positive image can be created about EVs by raising awareness for EVs in society. Ref. [144] reveal that an individual's attitude towards anything can be changed by creating a positive image in society. In this context, a positive image of EVs can change and increase the attitudes of individuals in Turkey towards EVs. For example, with the transition to the use of EVs, information can be presented to the people of the country that environmental pollution caused by CO_2 emission can be prevented, and thus the energy and water shortages that are foreseen in the future can be delayed in the long term. Moreover, consumers are often reluctant to conduct extensive research [87,145]. Good and direct communication by automotive industry executives and marketers about the benefits of EVs with consumers can prevent consumers from obtaining misinformation from their external environment. Communication is a very important tool for the adoption of environmentally friendly products [66]. Therefore, it is useful to give importance to one-to-one communication with consumers about EVs. This direct communication with consumers will contribute to the awareness of EVs that should be provided as the image that can change the attitude of individuals towards EVs. In this communication, to be established with consumers, it is also important to understand them and inform them about their sensitivities. For example, a price-sensitive consumer might be told that, in the long run, EVs will save on green energy consumption, compared to conventional vehicles that consume carbon-based fuels. Or, information can be provided to reduce functional barriers that cause negative attitudes towards EVs, such as limited distance, long waiting times for charging, limited charging stations, fear of being on the road [27,74,87]. In summary, the attitude of consumers towards EVs, which is seen as an opportunity to pave the way for green energy consumption to a large extent, and which affects the adoption of EVs, which will greatly reduce environmental pollution from CO_2 emissions, can be positively changed by providing the right information flow about EVs in Turkey.

The findings of this research obtained the effect of GT on consumers' EVPI. The GT–EVPI relationship with the lowest path coefficient is still an important factor to consider in the adoption of EVs. This effect was proven in another green behavioral intention study. The lack of GT can cause uncertainty for consumers to buy EVs. This makes EVs difficult to adopt. Therefore, government managers and relevant marketers can provide clear, consistent and effective communication to promote individuals' trust in EVs. If uncertainty arises, it can increase consumers' perceived risks to EVs. Eliminating uncertainties in the adoption of EVs can be a good incentive. In this direction, authorities and marketers can provide individuals with persuasive promotions while promoting EVs. As a method of choosing green products, they can offer effective advertisements where they can establish

the most one-to-one communication with individuals at all levels, because of the eco-friendly characteristics of EVs [146,147]. We know that EVs use green energy, are not a threat to the future, save more money than traditional vehicles, and reduce air pollution, etc. These strategies can promote green trust in EVs and persuade consumers to buy into EVs.

As a result, with this research, in order to facilitate the adoption of EVs by consumers in Turkey, one of the developing countries where the lack of information continues, EVs, which have a large share in increasing the use of sustainable green energy and reducing the use of fossil fuels within the framework of the sustainable development plan, are not yet accepted at the desired level. We aimed to narrow the gap in the literature with our TPB-based model, which we designed specific to this study, which provides a deeper understanding of behavioral intentions towards EVs. With the findings of this research, we have revealed that it will be beneficial for the adoption of EVs in the promotion, marketing and promotion of EVs for developing countries, to raise the concerns of consumers, especially against ecological problems, and to make promotions emphasizing that EVs reduce the damage done by traditional vehicles to the environment. In addition, the findings of this research showed that for developing countries, such as Turkey, increasing consumers' trust in EVs will directly facilitate their adoption. The findings of this paper, which we hypothesized and validated that the EV and GT could be the leading component in the adoption of EVs, expanded the limited research area for EVs in eco-friendly vehicles and specifically narrowed the literature gap.

We hope that the findings of our empirical analysis, which we conducted with this expanded new theory of planned behavior, will be beneficial for the development of the adoption rate of EVs in Turkey, reaching the desired level, and thus accelerating the transition to the use of clean and green energy in Turkey, and spreading sustainable production and consumption.

Despite the expansion and original contributions of this study to the literature, some limitations remain. One limitation is that Turkish individuals are mostly willing to comprehend, accept, and use technology, given Turkey's overall population and the high rate of young individuals, compared to many other countries. Therefore, our findings may only be valid for countries with a similar structure. The other limitation is that this research was conducted in two major geographic regions of Turkey; therefore, with individuals who have high education levels and moderate to high-income levels. Thus, our findings would be more beneficial for this target audience.

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Abbreviations

EVs	Electric Vehicles
AT	Attitude
SN	Subjective Norm
PBC	Perceived Behavior Control
EC	Environmental Concern
GT	Green Trust
EVPI	Electric Vehicles Purchase Intention
TPB	Planned Behavior Theory
ETPB	Extended Planned Behavior Theory
SEM	Structural Equality Model
CFA	Confirmatory Factor Analysis

Appendix A Questionnaire for ETPB

Table A1. Operational definitions of variables and reference scales.

Factors	Items No.	Items	Source
EC	EC1	I am concerned about the environment.	[57]
	EC2	The condition of the environment affects the quality of my health.	
	EC3	I am willing to make sacrifices to protect the environment.	
	EC4	I think individuals have a responsibility to protect the environment.	
AT	AT1	Purchasing electric vehicles is good.	[57]
	AT2	Purchasing electric vehicles is beneficial.	
	AT3	Purchasing electric vehicles is worthwhile.	
	AT4	Purchasing electric vehicles is satisfactory.	
	AT5	Purchasing electric vehicles is valuable.	
PBC	PBC1	I believe I have the ability to purchase a electric vehicle.	[57]
	PBC2	If it were entirely up to me, I am confident that I will purchase a electric vehicle.	
	PBC3	I see myself as capable of purchasing a electric vehicle in the future.	
	PBC4	I have the willingness to purchase a electric vehicle.	
	PBC5	There are likely to be plenty of opportunities for me to purchase a electric vehicle.	
	PBC6	I feel that purchasing a electric vehicle is totally within my control.	
SN	SN1	If I bought a electric vehicle, most people who are important to me would agree with my decision.	[57]
	SN2	If I bought a electric vehicle, most people who are important to me would appreciate my green purchase.	
	SN3	If I bought a electric vehicle, most people who are important to me would find it as a desirable purchase.	
	SN4	If I bought a electric vehicle, most people who are important to me would support my purchase decision.	
	SN5	If I bought a electric vehicle, it would be consistent with the trend of social development.	
GT	GT1	I feel that the environmental commitments of electric vehicles are generally credible.	[82]
	GT2	I feel that the environmental performance of electric vehicles is generally reliable.	
	GT3	I feel that the environmental arguments for electric vehicles are credible.	
	GT4	I feel that electric vehicles deliver on their environmental promises and commitments.	
EVPI	EVPI1	When buying a vehicle in the future, I am willing to prefer an electric vehicle.	[30]
	EVPI2	When buying a vehicle in the future, I am thinking of choosing an electric vehicle.	
	EVPI3	When buying a vehicle in the future, I plan to choose an electric vehicle.	

Appendix B Pre-Test Results of the Scale

Table A2. The measurement quality evaluation.

Constructs	Cronbach's Alpha	CR	AVE
AT	0.920	0.914	0.835
EC	0.918	0.899	0.802
EVPI	0.910	0.920	0.729
GT	0.892	0.917	0.772
PBC	0.885	0.892	0.857
SN	0.926	0.931	0.805

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