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Original Article

SUSTAINABLE MOBILITY AND ELECTRIC VEHICLE ADOPTION: A STUDY ON THE IMPACT OF PERCEIVED BENEFITS AND RISKS

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Highlights:

- sustainable mobility is essential for mitigating climate change, with EVs providing a practical solution to reduce carbon emissions in transportation;
- PEBs and PPBs significantly increase consumers' intention to adopt EVs, while "perceived performance and financial risks" act as barriers to EV adoption, reducing the likelihood of purchase;
- government policies and incentives are pivotal in reducing financial barriers and enhancing consumer confidence in EV technologies;
- technological advancements in battery life and charging infrastructure are critical for overcoming performance concerns and accelerating the transition to EVs;
- targeted marketing strategies emphasizing environmental and performance benefits can enhance EV adoption rates.

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Abstract. The shift towards sustainable transportation is becoming increasingly important as the negative impact of traditional fuel-powered vehicles on the environment becomes more evident. Electric Vehicles (EVs) are considered a viable solution to this problem, and understanding the factors that influence consumer intention to purchase EVs is crucial for their widespread adoption. This study investigates the factors that influence individuals' intention to purchase EVs. 4 independent variables were considered: Perceived Environmental Benefit (PEB), Perceived Performance Benefit (PPB), Perceived Performance Risk (PPR), and Perceived Financial Risk (PFR). A survey was conducted with 398 respondents, and the data collected were analysed using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Structural Equation Modelling (SEM). The results indicate that PEB, PPB, PPR, and PFR have significant effects on Purchase Intention (PI). Specifically, PEB and PPB positively affect PI, while PPR and PFR negatively affect it. These findings suggest that improving the PEBs and PPBs of EVs and reducing perceived performance and financial risks could encourage more individuals to purchase them.

Keywords: electric vehicle, sustainability, sustainable mobility, perceived benefit, perceived risk, adoption, technology acceptance, green transportation.

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Notations

AVE – average variance extracted;
CFA – confirmatory factor analysis;
CFI – comparative fit index;
CMIN – chi square;
CR – composite reliability;
EFA – exploratory factor analysis;
EV – electric vehicle;
GFI – goodness-of-fit index;
GPS – global positioning system;
KMO – Kaiser–Meyer–Olkin;
NFI – normed fit index;
PEB – perceived environmental benefit;
PFR – perceived financial risk;
PI – purchase intention;
PPB – perceived performance benefit;
PPR – perceived performance risk;
RMSEA – root mean square error of approximation;
SE – standard error;
SEM – structural equation modelling;
SRMR – square root mean residual;
SUV – sport utility vehicle;
TLI – Tucker–Lewis index;
TPB – theory of planned behaviour.

1. Introduction

Sustainable development is a critical global challenge, and countries worldwide increasingly recognize the importance of adopting sustainable practices to mitigate the impacts of climate change, promote economic growth, and protect public health. One key area where sustainable practices can make a significant impact is transportation. Transportation is a major contributor to greenhouse gas emissions, and transitioning to more sustainable modes of transportation is crucial for achieving a sustainable future. In recent years, EVs have emerged as a promising solution for reducing transportation-related emissions and promoting sustainable mobility.

The transportation sector significantly contributes to greenhouse gas emissions, with fossil fuel-powered vehicles responsible for a significant proportion of these emissions (Xu *et al.* 2019). People have widely attributed the transportation industry as an essential contributor to climate change. The auto industry invests heavily in creating novel technology to address this issue (D'Adamo, Rosa 2019). EVs have emerged as an alternative to traditional gasoline-powered cars and could solve reducing emissions (Hu *et al.* 2021). The transportation industry significantly contributes to energy insecurity, climate change, and urban air pollution, all high on governments' agendas. Governments take several measures to address these problems, including creating public policy concerning the widespread distribution and use of EVs (Lopez-Arboleda *et al.* 2021).

The transportation sector handles a significant amount of greenhouse gas emissions, which contribute to global climate change. The vast majority of vehicles on the road today are powered by fossil fuels, which emit harmful pollutants into the air. EVs are a promising alternative to traditional gasoline-powered cars, as they emit no tailpipe emissions and have the potential to significantly decrease greenhouse gas emissions (Creutzig *et al.* 2011).

Customers can view EVs as an innovation that improves the ratio of benefits received to customer expenditures. EVs provide economic and environmental benefits due to decreased operating costs and purchasing incentives (Febransyah 2021). In addition, EVs have lower fuel costs than gasoline vehicles. Therefore, household transportation expenditure will decrease if EVs are adopted (Wang *et al.* 2018).

This study explores the determinants that shape customers' buying decisions for EVs. Understanding these factors is essential because it can help policymakers and the automobile industry design policies and strategies that encourage EV adoption. Besides reducing greenhouse gas emissions, adopting EVs can help reduce reliance on foreign oil and improve energy security.

Despite the environmental benefits of EVs, their adoption and uptake by consumers remain relatively low. This is partly due to a need for more awareness and understanding of EVs among consumers and perceived barriers such as high purchase prices, limited driving range, and a lack of charging infrastructure (Lieven *et al.* 2011). Although there have been restrictions in the production of EVs during the COVID-19 pandemic, similar to those in the production of traditional cars, the production, sales, and usage of EVs have significantly increased today. Especially electric cars of European and Chinese origin are rapidly entering the global market. In particular, more than 50% of the population in Norway prefers using electric cars. As stated by Sæle & Petersen (2018), Norway is at the forefront of the European market for EVs, and it is estimated that there will be approximately 1.5 million EVs in use by the year 2030. Anfinsen *et al.* (2019) also emphasize that Norway is one of the successful EV markets in the world. Furthermore, Figenbaum (2022) states that Norway was the global leader with a market share of 54% in 2020. While Tesla was initially the prominent brand, now almost all car manufacturers, such as *Citroen*, *Renault*, *Toyota*, *Togg*, and *MG*, produce EVs. The number of individuals experiencing EVs has also rapidly increased today. In addition, there is a lack of research on the factors influencing customers' PIs for EVs. For example, the lack of knowledge about EVs' capabilities makes drivers more likely to have concerns. Drivers are more likely to have concerns regarding the effectiveness and safety of EVs and a perception that there are more significant dangers associated with EVs (Simsekoglu, Nayum 2019). If customers do not know enough about EVs, prejudice and unfavourable effects will be magnified. Consumers are influenced not just by perceived rewards but also by perceived risks when making choices and taking action. Customers will consider the costs and benefits of various options in depth before settling on one (Zang *et al.* 2022).

EVs are classified into 2 main categories: fully electric and hybrid (D'Adamo, Rosa 2019). Research questions were developed around the relatively low adoption rate of full EVs despite their PEBs. In this context, the research questions are:

- "what is the relationship between PEB and PI?";
- "what is the relationship between PPB and PI?";
- "what is the relationship between PPR and PI?";
- "what is the relationship between PFR and PI?".

The study's objectives are to investigate the factors that influence customers' PIs of EVs and to understand the role of PEB, PPB, PPR, and PFR in shaping these intentions. The significance of the study lies in its potential to inform policy and industry initiatives to encourage the adoption of EVs. By identifying the factors that influence PI, policymakers can design policies that address the barriers to adoption. In contrast, the automobile industry can develop marketing strategies that emphasize the benefits and reduce the perceived risks of EVs.

This article is organized as follows. Current Section 1 – introduction. Section 2 reviews the relevant literature on EVs and sustainable mobility and the factors affecting EV adoption. Section 3 outlines the research method, including the data collection and analytical techniques. The outcomes of the data analysis are presented in Section 4, encompassing descriptive statistics, factor analysis, and SEM. Section 5 discusses the implications of the findings for both theory and practice, as well as the study's limitations. Finally, Section 6 concludes the article by summarizing the essential findings and offering suggestions for future research.

2. Theoretical framework

2.1. Sustainable mobility and EVs

Historically emblematic of social status, cars have become a central aspect of various cultures, yet they have caused environmental and societal challenges such as pollution, noise, and congestion (Müller 2019). Urban transportation initiatives, encompassing shared and smart systems alongside low-carbon alternatives, have emerged as solutions (Hu *et al.* 2021). Notably, electrification is a promising path to urban sustainability, curbing greenhouse gas emissions and promoting eco-friendliness (Kumar, Alok 2020). EVs have gained traction due to their emission control, noise reduction, and potential to foster a greener world (Junquera *et al.* 2016; Huang *et al.* 2021).

Recognizing the inevitability of a shift from carbon-based fuels, the power utility sector has embraced innovative technologies to tackle energy concerns, highlighting the urgency of sustainability (Haddadian *et al.* 2016). EVs represent a long-awaited response to global directives for cleaner transport, promising reduced emissions, improved air quality, and enhanced energy independence (D'Adamo, Rosa 2019; Varghese *et al.* 2021; Degirmenci, Breitner 2017). Various studies underscore their potential to diminish reliance on fossil fuels, reduce carbon footprints, and enhance urban well-being, positioning them as a viable alternative to conventional vehicles (Onat, Kucukvar 2022; Javid *et al.* 2022; Machedon-Pisu, Borza 2020).

Furthermore, adopting EVs can lead to cleaner air, better health, and reduced hazardous emissions, providing significant socio-economic advantages such as decreased trade deficits by cutting gasoline imports (Hinnüber *et al.* 2019; Shakeel 2022). In addressing the challenges posed by depleting resources and climate change, developing low-carbon, energy-efficient, and intelligent EVs remains imperative (Tu, Yang 2019).

2.2. Factors affecting EV adoption

While the benefits of EVs are significant, the adoption rate has been relatively slow because of various barriers and challenges (Lieven *et al.* 2011). Several factors have been identified as essential determinants of EV adoption, including customer attitudes, perceived benefits, perceived risks, and contextual factors. Previous research has shown that perceived benefits, such as environmental and cost savings, and perceived risks, such as range anxiety and infrastructure availability, shape attitudes toward EVs. In addition, contextual factors, such as policy incentives and infrastructure development, have been found to play a critical role in EV adoption (Haustein, Jensen 2018).

Perceived benefits and risks associated with EV technology are crucial to determining PI. As per Ajzen's TPB, if the outcomes of behaviour are desirable and the associated risks are low, individuals will be inclined to engage in it (Ajzen 2011). In EVs, the perceived benefits can be categorized into PEB and PPB, while the perceived risks can be categorized into PPR and PFR (Xu *et al.* 2019).

Several studies have found that PEBs are positively related to the PI of EVs (Ali, Naushad 2022; Lai *et al.* 2015). Therefore, consumers who perceive EVs positively impact the environment are more likely to consider purchasing them. Similarly, PPBs, such as better acceleration and handling than conventional vehicles, have also positively influenced PI (Moeletsi 2021; Wang *et al.* 2018). Therefore, consumers who believe EVs can provide better driving performance are more likely to consider purchasing them.

PPRs – such as limited driving range and lack of charging infrastructure – have been found to negatively influence the PI of EVs (Berkeley *et al.* 2018; Giansoldati *et al.* 2020). Consequently, consumers who perceive EVs as having a higher risk of performance issues are less likely to consider purchasing them. In addition, financial risks, such as high initial costs and uncertain resale value, have also been identified as potential barriers to EV adoption (She *et al.* 2017).

2.3. Development of hypotheses

2.3.1. PEB and EV PI

An individual's understanding of an ecosystem, the environment, and how human activities can impact the environment is called perceived environmental information. Customers and clients who are well-versed in environmental concerns and their solutions are called "environmentally knowledgeable". It also considerably increases eco-friendly goods' patronage (Abbasi *et al.* 2021). Therefore, consumer acceptance of EVs is affected by the consumer's attitude toward protecting the environment (Müller 2019). Consumers' ideas about environmental protection may influence their decisions to use environmentally friendly green products. Consumers who are environmentally conscious or believe they are more likely to purchase an EV (Dutta, Hwang 2021). Climate change worries may affect this behaviour (Hinnüber *et al.* 2019).

Environmental concerns are a significant motivator for EV buying intent. This is understandable, given that EVs are less environmentally hazardous than gasoline or diesel automobiles. In addition, consumers may be concerned about the environment because they are aware of the negative consequences of fossil fuel vehicles on the environment (Bhutto *et al.* 2021).

The consumer's concern about the environment affects the purchasing behaviour of environmentally safe products (Sang, Bekhet 2015). Similarly, Sobiech-Grabka *et al.* (2022) state that customers with pro-environmental attitudes will have positive perceptions about the characteristics of EVs. People's expectations that EVs will lessen environmental dangers will favour EV preference (Lai *et al.* 2015). Therefore, eco-conscious shoppers will probably be interested in purchasing EVs. Since EVs do not release harmful gases into the atmosphere, they are great for the planet (Varghese *et al.* 2021).

Early EV adopters value environmental performance and efficiency more than the vehicle's technological sophistication, aesthetic appeal, or other characteristics (Green *et al.* 2014). Therefore, consumers' buying intentions and behaviour toward low-carbon vehicles will be influenced by their knowledge of current environmental, energy, and low-carbon vehicle policies. Environmental benefits strongly predict positive attitudes toward EVs (Huang, Ge 2019; Lashari *et al.* 2021). In addition, studies indicate that environmental concerns positively affect PI (Kocagöz, İğde 2022; Xu *et al.* 2019).

Earlier studies highlighted that environmental concern is a decisive factor in EV PI, indicating that the PEB could be crucial in forming customers' views towards EVs. In addition, EVs are often marketed as a sustainable and eco-friendly alternative to gasoline-powered vehicles, further highlighting the importance of the PEB in shaping customers' PIs. In this context, the following hypothesis has been formed:

- H1: PEB positively affects the intention to purchase EVs.

2.3.2. PPB and EV PI

The performance heavily influences consumers' decision-making on a product's perceived worth. Consumers' decision-making and behaviour benefit from a cognitive feeling called perceived usefulness, which they define as the perceived probability of favourable outcomes following taking action (Zang *et al.* 2022). One's attitude toward something results from a series of mental processes that lead to a positive or negative evaluation. As a result, people who favour buying EVs are more likely to go out and buy one (Vafaei-Zadeh *et al.* 2022).

Measuring performance is a rather complex task, as it comprises several aspects. Sufficient factors, such as speed, power, range, energy consumption, charging time, energy efficiency, route optimization, acceleration, and braking time, will affect EV perception (Machedon-Pisu, Borza 2020). As a result, the term "performance expectation" pertains to EVs and describes the degree to which consumers believe EVs will aid them in doing particular tasks (Lee *et al.* 2021).

Buyers often prioritize a vehicle's ability to meet their needs for ease of usage. Because of the lack of road noise, EV drivers can have a more relaxing commute. In addition, most electric motors do not need a gearbox; therefore, comfort is not compromised. EVs can accelerate quickly. Most drivers view this positively (Hinnüber *et al.* 2019). The more relaxed a customer is, the more likely they will buy something. This shows that consumers may purchase the EV if they find it easy to use (Bhalla *et al.* 2018).

EVs' performance, safety, and range are essential to consumer reviews, and these factors influence the willingness of potential buyers to adopt EVs. Less noise is also vital in EV adoption (Dutta, Hwang 2021). In addition, EVs are more efficient for fuel consumption in the city (Kumar, Alok 2020). According to Tuan *et al.* (2022), the importance of vehicle performance in buying is emphasized because attributes associated with vehicle performance, such as outstanding ride quality, low noise, and uncomplicated operation, will affect consumers' PI.

Featherman *et al.* (2021) state that, thanks to the innovative technologies in the EV, consumers evaluate the driving quality as comfortable and fashionable. The reliability, recharging time, top speed, driving range, and performance of EVs are all factors that influence their uptake, as emphasized by Asadi *et al.* (2021). In their study, Lai *et al.* (2015) emphasized the importance of a positive perception of EVs regarding preference. The perceived performance of EVs as comfortable driving will be effective in the purchase decision. According to Bhalla *et al.* (2018), the perception that EVs will save fuel has a positive effect in the long run. Therefore, the perception of performance benefits related to EVs will affect the purchasing behaviour of consumers.

Perceived usefulness has been found to affect the intention to use in studies conducted on Chinese (Wang *et al.* 2018) and Korean (Park *et al.* 2018) consumers. Lee *et al.* (2021) determined that people's positive ideas of EVs influenced their probability of buying one. According to Zang *et al.* (2022), perceived usefulness and attitude positively affect PI.

Previous studies have shown that perceived usefulness is crucial to technology adoption. Customers who believe that EVs offer superior performance compared to gasoline-powered vehicles are more likely to have PIs. In addition, EVs have the potential to offer unique performance benefits, such as instant torque and quiet operation, which could appeal to customers who prioritize driving experience. In this context, the following hypothesis has been formed:

- H2: PPBs positively affect the intention to purchase EVs.

2.3.3. PPR and EV PI

Perceived risk is the perceived uncertainty associated with various types of potential loss or product selection (Han *et al.* 2019). In addition, perceived risk is a consumer's negative attitude toward adopting new technology or innovative products (Jaiswal *et al.* 2021). The more customers perceive hazards to new technology, the less positive value they perceive in embracing innovative offers. As a result, perceived risk is tightly linked to consumer behaviour. Consumers' reasons for delaying, changing, or cancelling purchases are primarily connected to the impact of perceived risks. Therefore, the perceived risk might negatively influence consumer attitudes and intentions to purchase innovative products or services. Because EVs are also seen as an innovative technology, people will be hesitant to adopt EVs because of safety concerns (Shu *et al.* 2022). While EVs are a great example of innovation in the automotive industry, they have a few notable drawbacks compared to traditional gasoline-powered vehicles. Among these disadvantages are price, battery life, range, charging time, and the availability of charging stations. Additionally, EVs are produced with intensive technology. Therefore, consumers can also perceive technological fear as a disadvantage (Habich-Sobiegalla *et al.* 2019). These drawbacks may prompt customers' perceptions of risk. Consequently, it is suggested that customers' perception of potential risk may have an adverse impact on their attitude towards EVs and result in a reluctance to adopt EVs (Liao 2022).

Performance risk is related to whether the product performs its function to expectation (Han *et al.* 2019). Therefore, the purchase product's probability of not performing the expected functions is expressed as performance risk. Especially long charging times in EVs may be considered a waste of time by consumers, which may be perceived as a risk (Xie *et al.* 2022).

EVs run on the energy the charged battery supplies, which comes with a guaranteed duration. The high costs associated with battery replacement in EVs will discourage users from considering battery replacement, ultimately having a negative impact on their preference for EVs (Adhikari *et al.* 2020). EVs are required to get all of their power from on-board battery packs. As a result, the driving range of these types of cars is directly proportional to the capacity of their batteries. The battery range in this circumstance depends on variables like the driving scenario and style, the road conditions, the environment, the age of the battery, and the type of battery. Compared to refilling a traditional vehicle, charging the battery once depleted will take considerable time (Varghese *et al.* 2021). Negative associations with risk may also result from the inconvenience of waiting around for an extended period to charge an EV's battery (Jain *et al.* 2022).

Consumers have safety worries regarding EVs because of potential safety and reliability issues, such as spontaneous combustion, which can cause physical damage (Wang *et al.* 2018). While the silent operation of EVs can be seen as a performance benefit, it will create a risk by causing accidents because of the inability of pedestrians to hear noise, especially in urban traffic (Simsekoglu, Nayum 2019). In addition, consumers may perceive a privacy concern when all ride and route information is recorded, and a ride profile is built for each journey. Details regarding each driving mile are recorded because the vehicles are highly computerized and GPS cloud-connected (Featherman *et al.* 2021).

Degirmenci & Breitner (2017) stated that consumers are worried about not having enough charging stations, the range of EVs being too low, and the charging time being too low. The consumer preference for EVs is greatly influenced by the charging infrastructure, charging time, safety, battery life, and cruising range (Huang, Ge 2019). Therefore, some barriers, such as battery technology, charging infrastructure, and fuel sustainability, constrain the widespread adoption of EVs (Javid *et al.* 2022). Han *et al.* (2019) conducted a study in the US on the attitude toward electric aircraft and found that the perceived risk affects the attitude negatively. Zang *et al.* (2022) found that range anxiety significantly negatively affected PI.

Performance risk factors like driving range anxiety, concerns about charging infrastructure, and perceived reliability issues, could lead potential customers to perceive EVs as inferior to gasoline-powered vehicles, decreasing their PIs. Previous research indicated that performance risk is a significant barrier to EV adoption, showing that addressing these concerns is essential for increasing PIs. In this context, the following hypothesis of this research has been formed as below:

- H3: PPR negatively affects the intention to purchase EVs.

2.3.4. PFR and EV PI

When users face newly introduced technologies and systems, the cost concept is important in determining how these technologies and systems are used. Users can examine the expense and benefits of technology at the same time during this process (Park *et al.* 2018). A financial cost customers must pay to buy or use a product is called price perception. With EVs, price perception includes car ownership expenses and operational vehicle costs like charging stations, taxes, and insurance. Price perception negatively impacts consumer intent to purchase EVs (Tuan *et al.* 2022). Therefore, price perception can be evaluated as a financial risk.

Financial risk reflects the possible monetary loss of a purchase; It shows that the product is not worth the price (Han *et al.* 2019). It is the likelihood that a purchase may cause the loss of money or other resources (Wang *et al.* 2018). EVs are considered a green product. Green product prices are higher than non-green product pricing. While some consumers pay more for environmentally friendly products, others do not (Xu *et al.* 2019). According to Junquera *et al.* (2016), most EVs are more expensive than gasoline vehicles. Therefore, the price level of EVs may affect consumers' willingness to adopt them. High price perception is also associated with batteries. The key reason for the greater cost of EVs is the high cost of batteries because of immature battery technology. The power consumption of EVs is directly affected by battery technology, which is a crucial component of the dynamic system of EVs. The combination of high-power usage and battery costs will eventually raise the life cycle cost of EVs (Wang *et al.* 2019). Battery replacement prices impress consumers' adoption attitude and behavioural control when preparing to adopt a new car and are a critical concern for EV adoption. Battery cost significantly impacts customer views (Dutta, Hwang 2021).

Price is an important determinant of EV purchases (Degirmenci, Breitner 2017). Research by Sobiech-Grabka *et al.* (2022) showed that the price of an EV was the most strongly opposed factor to their decision to buy an EV. While consumers prefer products, they seek products that meet the maximum product value and need as much as possible at the lowest cost (Huang, Ge 2019). Consumers will doubt whether EVs can reduce their commute spending and benefit them. As a result, they doubt the effectiveness of EVs and believe that they are less beneficial (Wang *et al.* 2018). (Bhalla *et al.* 2018) found in their research that consumers are worried about using EVs because of the high cost of electricity. Economic uncertainty is one of the key issues creating customer concern because of the high purchase price, long payback period, and ambiguity around maintenance and repair infrastructures in their research on EV adoption in the UK (Berkeley *et al.* 2018). People will also consider economic performance when choosing EVs. Especially the energy cost of EVs will be an important factor in the choice (Lai *et al.* 2015). When people comprehend the financial merits of EVs, their enthusiasm to acquire will increase (Tunçel 2022), while individuals perceive EVs as risky and costly, and their probability of purchasing will decrease (Park *et al.* 2018).

Financial risk factors, such as high purchase price, maintenance and repair costs, and depreciation, could lead potential customers to perceive EVs as less financially viable than gasoline-powered vehicles, decreasing their PIs. Previous research has indicated that financial risk is a significant barrier to EV adoption, showing that addressing these concerns is essential for increasing PIs. Therefore, the following hypothesis has been formed:

- H4: PFR significantly negatively affects the intention to purchase EVs.

3. Methodology

3.1. Research design

This study examined how different factors, including how eco-friendly people thought the vehicle was and how fast it could go, affected their decision to buy an electric car using a cross-sectional survey design. This research design was chosen as it is appropriate for exploring the relationships between variables in a large sample of participants.

The research model of this study is depicted in Figure 1.

3.2. Data collection and sampling

A survey questionnaire was adopted and distributed to respondents from Turkey and Lithuania, where the market share of EVs was beginning to grow. An online platform was used to conduct the survey and sent out through email and social media. The research data was gathered using convenience and snowball sampling methods. However, before selecting participants, they were asked whether they had prior knowledge about EVs and whether they had any experience using them. Participants without prior knowledge of EVs and/or had yet to experience them were omitted. Therefore, although data was collected from 2 countries, the sample size was not extensive. The research data was obtained through an online survey link distributed via online platforms. Furthermore, the primary reason for using snowball sampling in the research was to inquire whether the participants had acquaintances using EVs in their surroundings and, if so, to request the transmission of the survey link to them. This approach aimed to reach individuals who were using/experiencing EVs or were knowledgeable about EVs. In this manner, 436 individuals were reached. However, due to pilot studies testing the average completion time of the survey to be 7...8 min, participants with a completion time below this threshold and/or inadequate responses to certain demographic questions were not included in the analysis. Consequently, 398 surveys were obtained for analysis. Considering a high population, the sample of 398 for statistical analysis is deemed sufficient at a 95% confidence level (Krejcie, Morgan 1970).

398 individuals completed the survey questionnaire, deemed a sufficient sample size for this study. The survey instrument comprised questions related to the independent variables of PEB, PPB, PPR, and PFR, as well as the dependent variable of PI.

No personal information was collected, and all responses were kept strictly confidential to ensure the confidentiality and anonymity of the respondents. Respondents were also informed that participation in the survey was voluntary and that they could withdraw from the study without penalty. Permission for the study was obtained from the Social and Human Sciences Research and Publication Ethics Committee of Kastamonu University (Turkey), with the decision dated 03/10/2022 and numbered 10/9. Research data were collected online in 01/11/2022 and 31/12/2022.

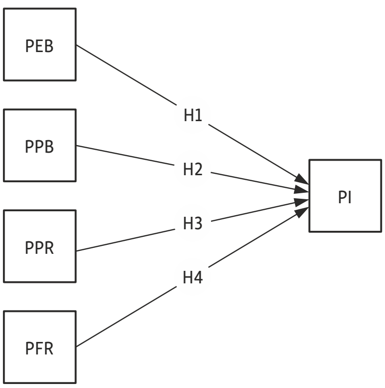

Figure 1. Research model

3.3. Measurement of variables

The questionnaire, which includes demographic questions in the 1st part, comprises 2 parts. The measures used in this study were adapted from previous research are:

- PEB was measured using a 7-question scale adapted from Xu *et al.* (2019), and Ali & Naushad (2022);
- PPB was measured using a 6-question scale adapted from Wang *et al.* (2018), Moeletsi (2021), and Wu *et al.* (2019);
- PPR was measured using a 5-question scale adapted from Giansoldati *et al.* (2020), and Berkeley *et al.* (2018);
- PFR was measured using a 6-question scale adapted from She *et al.* (2017), Wang *et al.* (2018), Berkeley *et al.* (2018), and Giansoldati *et al.* (2020);
- PI was measured using a 10-question scale adapted from Ali & Naushad (2022), Xu *et al.* (2019), Lai *et al.* (2015), and Bunce *et al.* (2014).

All items were scored using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha values for each scale were: PEB (α = 0.944), PPB (α = 0.859), PPR (α = 0.826), PFR (α = 0.877), and PI (α = 0.944). Scale questions are presented in Table A (see Appendix).

3.4. Data analysis

The data collected was analysed using EFA, CFA, and SEM. 1st, EFA was used to assess each scale's construct validity and determine the number of factors to be kept. 2nd, CFA was used to test the goodness-of-fit of the hypothesized model. Finally, SEM was used to test the relationships between variables and the proposed hypotheses.

1st, we conducted EFA to identify the underlying factor structure of the items measuring each construct. The KMO measure of sampling adequacy showed that the data were suitable for factor analysis. Bartlett's test of sphericity was also significant (Sub-chapter 4.2), showing that the correlations between the items were sufficiently large for EFA. Next, we used principal component analysis with varimax rotation to extract factors, keeping factors with eigenvalues greater than 1. Finally, we examined the scree plot and factor loadings to determine the number of factors to keep. After removing items with low loadings or cross-loadings, we kept 4 factors representing PEB, PPB, PPR, and PFR.

Next, we conducted CFA to confirm the factor structure identified in EFA and assess the fit of the measurement model. We used maximum likelihood estimation to estimate the model parameters. The GFIs indicated a good model fit (Sub-chapter 4.3). In addition, all factor loadings were significant ($p < 0.001$) and above the recommended cut-off value of 0.50, indicating that the items loaded well on their respective factors.

Finally, we conducted SEM to examine the relationships between the independent and dependent variables. In CFA, the χ^2 goodness-of-fit value is expected to be between 2 and 3, the RMSEA should not exceed 0.08, the CFI value is expected to be above 0.85 or 0.95, similar to the R2 in multiple regression, and it is recommended that this value does not fall below 0.85. Additionally, it is known that the SRMR value, which is closest to zero for values ranging between 0 and 1, is more suitable for the model. The SRMR value should also not exceed 0.08. We used maximum likelihood estimation to estimate the model parameters. The GFIs showed good model fit (χ^2 = 1159,124, df = 523, $p < 0.001$; GFI = 0.851; CFI = 0.931; RMSEA = 0.057; SRMR = 0.055). While 3 path coefficients were significant and in the expected direction, supporting our hypotheses, one was not. PEB (β = 0.126, p = 0.028) and PPB (β = 0.529, $p < 0.001$) had significant positive effects on purchasing intention. In contrast, PPR (β = –0.262, $p < 0.001$) and PFR (β = –0.144, p = 0.006) had significant negative effects on purchasing intention.

Overall, the EFA, CFA, and SEM results supported the reliability and validity of the measurement instruments and the hypotheses, except for one of them proposed in this study.

4. Results

4.1. Descriptive statistics of the sample

The demographic characteristics of the sample are shown in Table 1.

The sample, primarily consisting of middle-aged men (58.8%) and university graduates (48.7%), can help us understand the perception towards EVs. Comprising a significant portion of public and private sector employees, this group represents a critical segment for understanding attitudes and intentions towards EV technology.

Table 1. Demographic characteristics

Characteristic	Frequency	Percent
Gender		
woman	164	41.2
man	234	58.8
Age		
18...25	34	8.5
26...35	99	24.9
36...45	140	35.2
46...55	85	21.4
56...65	33	8.3
>66	7	1.8
Education		
primary education	5	1.3
secondary education	26	6.5
associate degree	56	14.1
BSc	194	48.7
MSc	66	16.6
PhD	51	12.8
Occupation		
public sector employee	155	38.9
private sector employee	138	34.7
self-employed (lawyer, doctor, accountant, ...)	33	8.3
shopkeepers / company owners	26	6.5
retired	10	2.5
housewife	12	3.0
student	24	6.0

4.2. Exploratory factor analysis results

To analyse the impact of independent variables on dependent variables, we performed EFA, CFA, and SEM. The results of the EFA showed the items loaded on the respective factors as intended. Table 2 demonstrates the results of the EFA conducted on the PEB, PPB, PFR, PPR, and PI variables, respectively.

In the EFA, all items had factor loadings over 0.50, indicating adequacy. KMO values above 0.60 and a significant Bartlett's test of sphericity suggest the sample size is sufficient for factor analysis. We kept a 7-item solution for PEB, a 6-item solution for PPB, a 5-item solution for PPR, a 6-item solution for PFR, and a 10-item solution for PI.

Table 2. EFA results

	Items	Factor loading	Mean	Standard deviation
PEB	PEB1	0.891	4.090	0.943
	PEB2	0.902	4.120	0.979
	PEB3	0.855	4.050	0.989
	PEB4	0.911	4.090	0.954
	PEB5	0.850	4.080	0.960
	PEB6	0.789	3.940	1.013
	PEB7	0.863	3.950	0.960
PPB	PPB1	0.778	3.740	0.975
	PPB2	0.803	3.650	0.995
	PPB3	0.746	3.640	1.039
	PPB4	0.806	3.570	1.050
	PPB5	0.743	3.660	0.997
	PPB6	0.722	3.370	1.091
PPR	PPR1	0.817	3.640	1.072
	PPR2	0.765	3.410	1.084
	PPR3	0.800	3.480	0.998
	PPR4	0.722	3.860	1.005
	PPR5	0.736	3.560	1.098
PFR	PFR1	0.808	2.470	1.204
	PFR2	0.825	2.620	1.129
	PFR3	0.812	2.670	1.113
	PFR4	0.729	2.780	1.100
	PFR5	0.802	2.400	1.146
	PFR6	0.746	2.580	1.116
PI	PI1	0.839	3.540	1.110
	PI2	0.745	3.270	1.149
	PI3	0.842	3.420	1.172
	PI4	0.822	3.540	1.037
	PI5	0.857	3.430	1.048
	PI6	0.886	3.640	0.983
	PI7	0.888	3.620	0.984
	PI8	0.894	3.630	0.987
	PI9	0.684	3.760	0.939
	PI10	0.718	3.340	1.063
PEB: KMO: 0.931 χ^2: 2429.429 *df*: 21 significance: 0.000 total variance explained [%]: 75.102				
PPB: KMO: 0.817 χ^2: 1111.783 *df*: 15 significance: 0.000 total variance explained [%]: 58.836				
PPR: KMO: 0.837 χ^2: 661.139 *df*: 10 significance: 0.000 total variance explained [%]: 59.110				
PFR: KMO: 0.862 χ^2: 1129.549 *df*: 15 significance: 0.000 total variance explained [%]: 62.068				
PI: KMO: 0.950 χ^2: 3244.546 *df*: 45 significance: 0.000 total variance explained [%]: 67.322				

4.3. CFA results

CFA was performed to test the factor structure of the model. Table 3 presents the goodness-of-fit values for the CFA, showing that the measurement models are satisfactory for all constructs.

The GFIs showed an acceptable fit of the model to the data. The standardized factor loadings ranged from 0.70 to 0.90 and were all statistically significant (p < 0.001). For all scales, χ^2/df <5, GFI > 0.85, CFI and TLI > 0.90, and RMSEA and SRMR < 0.08 were obtained. These findings indicate that the scales meet the goodness-of-fit criteria.

Table 4 shows the reliability analysis results, which indicate that all constructs have high levels of reliability.

Factor loadings obtained from the DFA have been used to calculate AVE and CR values. AVE > 0.50 and CR > 0.70 were obtained for all scales except PPR. For PPR, it got 0.49, and this value was considered acceptable. The alpha coefficient was determined as >0.70. These findings show that the scales are reliable.

4.4. Structural equation model results

The SEM examined the relationships between the independent and dependent variables. The results revealed that PEB significantly positively affected PI (β = 0.126, p = 0.028). PPBs also significantly positively affected PI (β = 0.529, p < 0.001). In contrast, PPR significantly negatively affected PI (β = –0.262, p < 0.001). Financial risk also significantly negatively affects PI (β = –0.144, p = 0.006).

Table 5 presents the correlation matrix, which shows that there is a positive and significant relationship between environmental benefit, performance benefit, and PI. There is a negative relationship between environmental benefit, financial risk, and performance risk. It was found that there is a positive and significant relationship between performance utility and PI. There is a positive and significant relationship between financial risk and performance risk. It was found that there is a significant negative relationship between performance risk and PI. The kurtosis and skewness values were determined between –2 and +2. This finding means that the data shows a normal distribution.

The SEM analysis results are presented in Tables 6–7 and Figure 2. Table 6 shows that the model has an acceptable fit. Table 7 and Figure 2 indicate that PEB and PPB have a significant positive effect on PI. Conversely, PPR and PFR have a significant negative effect on PI.

The results of the SEM analysis provided the following values: CMIN/*df*: 2.116 (>3), GFI: 0.851 (>0.85), CFI: 0.931 (>0.90), RMSEA: 0.057 (>0.08), and SRMR: 0.0552 (>0.08). These findings indicate that the model meets the acceptable goodness-of-fit criteria for the SEM analysis.

Table 7 provides the analysis findings for the SEM, including the paths' estimates, SEs, and p-values.

The results of the analysis support H1, H2, H3, and H4, which state that PEB, PPB, PPR, and PFR have significant effects on PI.

Table 3. CFA goodness-of-fit values

Variable	χ^2	*df*	χ^2/df	GFI	CFI	NFI	RMSEA	SRMR
Criterion	–	–	≤5	≥0.85	≥0.90	≥0.90	≤0.08	≤0.08
PEB	35.863	14	2.562	0.975	0.99	0.985	0.075	0.0187
PPB	10.878	9	1.208	0.991	0.996	0.99	0.037	0.0181
PPR	16.317	5	3.263	0.984	0.983	0.975	0.076	0.0269
PFR	19.204	9	2.133	0.985	0.989	0.983	0.066	0.0278
PI	94.425	35	2.697	0.951	0.98	0.971	0.075	0.0293

Table 4. Reliability statistics

Variable	AVE	CR	Cronbach' alpha
PEB	0.71	0.94	0.944
PPB	0.50	0.85	0.859
PPR	0.49	0.82	0.826
PFR	0.54	0.87	0.877
PI	0.63	0.94	0.944

Table 5. Correlation results

	PEB	PPB	PFR	PPR	PI	Skewness	Kurtosis
PEB	1	–	–	–	–	–1.723	1.203
PPB	0.623**	1	–	–	–	–0.633	0.697
PFR	–0.229**	–0.086	1	–	–	0.369	–0.043
PPR	0.108*	–0.075	–0.428**	1	–	–0.684	0.479
PI	0.410**	0.569**	–0.104*	–0.181**	1	–0.466	0.359

Notes: * – $p < 1$; ** – $p < 0.05$.

Table 6. Model fit indices

Variable	χ^2	*df*	χ^2/df	GFI	CFI	NFI	RMSEA	SRMR
Criterion	–	–	≤5	≥0.85	≥0.90	≥0.90	≤0.08	≤0.08
Model	1159.124	523	2.216	0.851	0.931	0.885	0.057	0.0552

Table 7. SEM Results

Analysed path			B	β	SE	CR	p
PI	←	PEB	0.131	0.126	0.059	2.202	0.028
PI	←	PPB	0.655	0.529	0.085	7.699	***
PI	←	PFR	–0.165	–0.144	0.060	–2.767	0.006
PI	←	PPR	–0.318	–0.262	0.067	–4.743	***

Notes: *** – $p < 0.01$.

5. Discussion

This study aimed to investigate the factors affecting the PI of EVs. The study's findings suggest that PEB and PPB positively impact the intention to purchase EVs, while perceived performance and financial risks negatively affect it. These results have several implications for researchers, policymakers, and industry practitioners.

5.1. Theoretical implications of the study

This research contributes to the existing body of literature by presenting an extensive model of the components influencing the intention to purchase EVs. The results indicate that PEBs and PPBs have a positive impact on PI. Conversely, PPR and financial risk have a negative impact on PI. These findings provide new insights into the literature on EV adoption and add to the existing knowledge by examining the relative importance of different factors affecting PI.

The findings of this study have important theoretical implications. 1st, the study contributes to the existing literature on EV adoption by providing empirical evidence of the impact of PEB and PPB, performance, and financial risks on PI. The study supports the argument that the PEB of EVs is an important determinant of PI (Bhutto *et al.* 2021; Sang, Bekhet 2015). Among the reasons, for example,

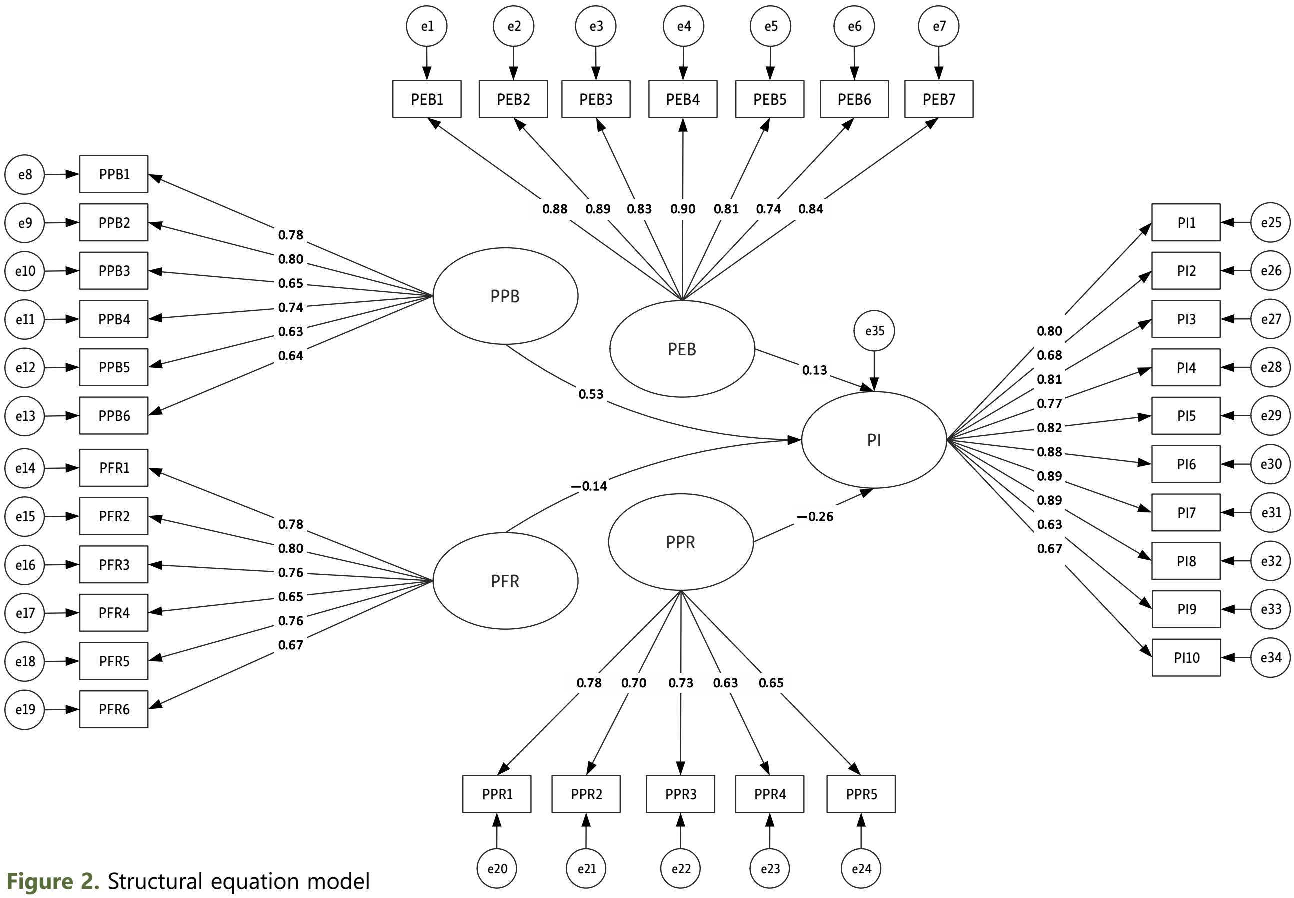

Figure 2. Structural equation model

range anxiety stands out primarily. The range of EVs is a factor that users often express concern about. Users may need help with how far an EV can go on a single charge. Therefore, range anxiety can hinder the adoption of EVs (Ball *et al.* 2021). Additionally, inadequate charging infrastructure and the time it takes for vehicles to charge can complicate the use of EVs. Furthermore, insufficient knowledge about EVs can also be cited among the barriers. The lack of information may lead to performance risk. It also highlights the importance of PPBs, showing that EVs must be perceived as functional and convenient to encourage adoption (Liao 2022; Tunçel 2022; Xu *et al.* 2019). 2nd, the study contributes to understanding PPRs associated with EV adoption. The study's results suggest that PPR is a significant barrier to EV adoption. This finding supports the results of studies (Featherman *et al.* 2021; Jaiswal *et al.* 2021; Liao 2022; Vafaei-Zadeh *et al.* 2022; Wang *et al.* 2018; Xie *et al.* 2022) in the literature, which suggests that individuals are more likely to avoid purchasing EVs when they perceive the potential risks as significant. 3rd, the study provides important insights into the role of PFR in adopting EVs. The findings suggest that PFR negatively affects PI, indicating that potential EV adopters may consider financial risk a major barrier to their decision-making process. These results underscore the importance of addressing consumers' financial concerns when promoting EV adoption. Possible strategies to address these concerns include improving financial incentives, reducing the PFRs associated with EVs, and increasing public awareness of the long-term cost savings associated with owning an EV. Additional research is needed to understand better the factors influencing EV adoption and identify the most effective policies and incentives to promote the transition to low-carbon transportation.

5.2. Managerial implications of the study

There is great uncertainty regarding the global volumes, growth rates, and overall development of the EV market. Therefore, it is not easy to have reliable predictions about EVs (D'Adamo, Rosa 2019). Concentrating on actual EV adoption behaviour, rather than only intentions, will become more appropriate and important as the EV market develops (Rezvani *et al.* 2015). In various countries, EVs are still in their infancy. EVs will become more acceptable in transportation markets, with developing technology, increasing battery performances, and emerging environmental concerns (Khazaei 2019). As the prevalence of EVs increases, countries may face energy issues, highlighting the need to be aware of the global energy crisis. This awareness requires various new technical solutions. One of the most essential solutions is for countries to use sustainable energy sources (Noorollahi *et al.* 2020). The adoption of EVs is crucial for achieving a sustainable energy transition. The adoption of EVs is expected to prompt individuals toward sustainable energy behaviour (Peters *et al.* 2018).

Technological advancement is leading to significant increases in energy consumption, with electricity playing a crucial role. With the proliferation of EVs, consumers' energy demand is expected to increase unexpectedly. However, resources are limited. Therefore, smart systems focusing on energy efficiency in production, distribution, and usage can be considered as alternatives to resources for sustainable energy and society (Kumar *et al.* 2022). Thus, there may be a need for increased investment in renewable energy sources such as solar, wind, hydroelectric, etc., to support sustainability goals and combat climate change. Additionally, technological investments may be necessary to store the energy obtained.

The findings of this study also have important managerial implications. 1st, the study suggests that policymakers and manufacturers should focus on promoting the environmental benefits of EVs to increase PI. This can be achieved by providing information about the positive impact of EVs on the environment and through marketing campaigns that highlight the environmental benefits of EVs. 2nd, uninformed or misinformed consumers may be reluctant to purchase EVs. Therefore, consumers need to be informed about the quality of EVs (Adhikari *et al.* 2020). 3rd, manufacturers promote environmental conservation and green living to enhance consumers' awareness of and desire for EVs (Tu, Yang 2019). As one of the main agendas for sustainable and green economy development, formulating effective strategies for greening the transport sector should be the state's priority. Electrification is essential to reducing carbon emissions and increasing energy efficiency in the transportation sector. A comprehensive and systemic policy strategy for technology development and diffusion is required to overcome the obstacles to future radical technologies in the transportation sector and manage public acceptance (Sang, Bekhet 2015). 2nd, manufacturers should focus on improving the PPBs of EVs to increase PI. This can be achieved by developing EVs with longer driving ranges, faster charging times, and lower maintenance costs. The development of innovative charging infrastructure that addresses the range anxiety of potential adopters can also improve the perceived performance of EVs. Therefore, the more miles are driven, the better the EV's cost per mile. However, the price is usually the priority for consumers. The public's perception of this technology can be enhanced by including savings per year of travel in its marketing materials (Hinnüber *et al.* 2019). Although the global number of EV charging stations is currently low compared to regular gasoline vehicles, they are being improved and increased. EVs' driving range and recharge time provide a competitive advantage to support the vehicle's capabilities (Tuan *et al.* 2022). As long as the charging time is not shortened significantly and access to charging infrastructures is easy, the adverse effects of the charging problem cannot be ignored (He, Hu 2022). Future EV users will benefit from the answers to outstanding technical issues that will hopefully be resolved or addressed soon. One of these ideas is to accelerate the charging process by developing and manufacturing extra-fast chargers (Sobiech-Grabka *et al.* 2022). 3rd, policymakers and manufacturers should address the PPRs associated with EV adoption. This can be achieved by providing information about the reliability and safety of EVs and through developing warranties and service contracts that provide consumers with peace of mind. Therefore, automakers must prioritize research and development into solutions that will improve battery safety and capacity. Allowing consumers free test drives may be necessary to expand their EV knowledge. Governments and automakers need to coordinate efforts to inform consumers about EVs' financial benefits, driving comfort and safety, environmental friendliness, and psychological benefits (Lashari *et al.* 2021). Public charging stations for EVs constitute a significant factor for many purchasers. Therefore, to overcome the difficulty in charging EVs, the government installed charging heaps in key cities as a model and attracted investment from relevant sectors through subsidies (Tu, Yang 2019).

The results suggest that financial risk may be a significant concern for potential EV adopters. This result is consistent with the studies we referenced (Park *et al.* 2018; Tunçel 2022) in establishing the hypothesis. Given the high initial cost of EVs, manufacturers and policymakers should offer financial incentives and subsidies to encourage adoption. To increase sales, the government should provide people with free or subsidized credit, free insurance, and free parking. This will create a new vision for PI (Bhalla *et al.* 2018). In addition, exemption from some purchase taxes (Sobiech-Grabka *et al.* 2022) will encourage EV purchases. Improvements in consumer purchasing patterns are another result of increased environmental awareness. Government agencies and businesses must foster customer enthusiasm for eco-friendly products through green marketing tactics. Consumers' environmental consciousness and literacy can be influenced by marketing campaigns that inform and persuade them to make more ecologically responsible product and consumption choices (Abbasi *et al.* 2021).

EV vendors would prioritize the satisfaction of early adopters and leverage their positive experiences to sway the decisions of potential buyers. In particular, the EV advertising campaign should feature early adopters and their good experiences with EV ownership (Shalender, Sharma 2021). EV managers can communicate the benefits of EVs to clients through auto-indicate events, other portals such as newspapers, and social media platforms (Jain *et al.* 2022). Because social media has key psychologically stimulating effects in recognizing and accepting EVs, managers, and decision-makers should improve their cooperation with media enterprises to boost their efforts to promote EVs via the Internet (Xu *et al.* 2019). When traditional products are on the market, a client must see an added value to choose a new product. Producers must prioritize safety and environmental aspects, which can provide a significant competitive advantage in the long run (Junquera *et al.* 2016).

From a sustainable country perspective, EVs offer a range of environmental, economic, and social benefits that align with the broader goals of sustainable development. For example, from an environmental perspective, EVs produce no tailpipe emissions, reducing the negative impacts of transportation on air quality and climate change (Creutzig *et al.* 2011; Haddadian *et al.* 2016; Junquera *et al.* 2016; Kumar, Alok 2020). In addition, the use of clean energy to fuel the batteries of EVs can make them even more sustainable.

From an economic perspective, EVs offer new opportunities for growth and innovation, creating jobs in the renewable energy sector and spurring technological advances in battery technology and charging infrastructure. In addition, as the cost of batteries and EVs continues to decrease, they are becoming increasingly competitive with traditional gasoline-powered vehicles, offering a more cost-effective option for consumers.

However, the widespread adoption of EVs faces challenges, including high upfront costs, range anxiety, and the need for supportive infrastructure. Addressing these challenges will require a comprehensive approach that includes supportive policies and infrastructure investments. For example, governments can provide tax incentives and rebates for EV purchases, invest in charging infrastructure and public education campaigns, and work with industry stakeholders to develop standardized charging protocols and other supporting technologies.

EV manufacturers should enhance the performance of EVs, including acceleration, range, and driving experience. This will attract more potential customers and encourage the preference for EVs. Notably, efforts should be made to increase the capacity of EVs, leading to a significant increase in sales. Additionally, they should make pricing competitive and attractive by offering better and more attractive sales campaigns than traditional vehicles. This will effectively influence potential customers. Manufacturers should produce cars in different styles and models in EVs, not only focusing on sedans or SUVs but also manufacturing vehicles for urban use, such as Nissan Micra and Toyota Yaris, or sports-style vehicles like Ferrari. This approach will cater to different tastes and preferences of customers while maintaining the continuation of familiar styles in traditional vehicles in EVs. Offering privileged advantages in after-sales support services for EV buyers will be crucial. For instance, providing discounts for maintenance up to 30000 km or more extended warranty periods can encourage consumers to purchase EVs. Manufacturers should also consider using advanced technology in EVs for technology enthusiasts.

Campaigns should be organized to inform customers about the environmental benefits of EVs, and educational programs should be provided. Using statements that emphasize environmental benefits in advertising and campaigns will also contribute to creating environmental awareness among consumers. This can positively influence consumers' intentions to use EVs by increasing their environmental consciousness. Manufacturers should prefer cost-reducing policies to reduce customers' perception of financial risk. Dealers should facilitate the purchase of EVs by offering various financing options to reduce financial risk. This can be achieved by providing favourable credit conditions, implementing low-interest rates, or applying long-term payment plans.

Ultimately, the success of EVs and sustainable transportation more broadly will depend on the willingness of countries to embrace a more sustainable future. Countries can build a more resilient and fair future for all by prioritizing sustainable practices in transportation and other sectors.

5.3. Limitations of the study and suggestions for future research

Some limitations to this study should be considered while interpreting the results. 1st, the sample of this study was limited to the Turkish and Lithuanian populations, which may restrict the generalizability of the findings to other contexts. According to the latest data on EV ownership by Turkish Statistical Institute (in Turkish: *TÜİK – Türkiye İstatistik Kurumu*) in Turkey (01/12/2021), the ratio of EVs to all vehicles is 0.7%. According to the reported data for Lithuania (31/12/2022), this rate is 0.66%. It is estimated that this number has increased slightly today. This is thought to be one of the reasons for the small research sample. 2nd, this study only focused on the intention to purchase EVs and not actual purchase behaviour. 3rd, the study relied on self-reported participant data, which may be subject to response bias. Finally, the study did not consider other factors influencing PI, such as government incentives or charging infrastructure.

Despite the valuable insights generated from this study, a few areas still need to be explored in the future. One limitation of this study is that it focuses only on the intention to purchase EVs. Future research can explore the actual purchase behaviour of EVs and the factors that may affect them. For example, geographical location may influence the decision to purchase an EV. Driving in the city usually entails shorter distances, which solves the problem of the EV's limited range while going short distances. However, people's ability to charge their devices at home may need to be improved. Also, this factor is important to think about because city dwellers are typically more eco-conscious than their rural counterparts. An increase in driving time can lead to both favourable and unfavourable experiences. Therefore, a person's length of license tenure can be an important indicator of their usage intentions (Moons, Pelsmacker 2012).

Future research can explore how cultural and societal differences may impact the relationship between the variables studied in this research in different countries. Future research can build upon the present study by examining the impact of cultural factors on the PI of EVs. Future studies can explore the role of government policies and incentives in promoting the adoption of EVs. Finally, future research can investigate the moderating effects of demographic factors such as age, gender, and income on the relationship between the factors affecting PI and the actual adoption of EVs.

This study focused on the potential customers' perceptions and did not consider the perspective of EV manufacturers and suppliers. The degree to which EVs help the environment, for example, by lowering greenhouse gas emissions and exposing fewer people to them, depends on several factors, such as the type of EV, energy source, driving and charging behaviours, charging station availability, government legislation, and climate (Javid *et al*. 2022). In addition, green-minded shoppers are less price-conscious shoppers for EVs. Consequently, consumers are prepared to shell out additional pay for products that minimize their environmental impact. Consumers, for example, will pay more for organic items (Bhutto *et al*. 2021). That is why it would be instructive to investigate how people's feelings about the environment affect their feelings about EVs. Therefore, future research can explore how EV manufacturers and suppliers can improve the PEB and PPB while reducing perceived risks to increase consumer acceptance.

6. Conclusions

This study aimed to examine the factors affecting the PI of EVs among potential customers. The results indicate that PEB and PPB positively affect the PI of EVs. In contrast, PPR and PFR have a negative effect on the PI of EVs.

The theoretical implications of this study are that the PEB and PPB positively impact the PI of EVs. This study also provides evidence that PPR and PFR are crucial factors that negatively influence EV PI. This study contributes to the literature on sustainable mobility by emphasizing the importance of promoting EVs' PEB and PPB while reducing the PPR associated with EV adoption.

From a managerial perspective, the results suggest companies should emphasize EVs' environmental and performance benefits in their marketing efforts to increase customer intention to purchase. Companies should also develop strategies to mitigate PPR and reduce the financial burden of EV adoption to encourage customer adoption.

There are some limitations to this study. 1st, the sample size was limited to 398 participants, which may not represent the entire population. This study was conducted in a specific region and cultural context, and the results may not be generalizable to other regions and cultures. Finally, this study did not consider the influence of social and psychological factors, such as attitude and subjective norms, on EV adoption. The findings obtained from the research primarily demonstrate the use of appropriate scales, as the validity and reliability of the scales used in the study were tested and reported in the findings section. The data obtained from the research cover 2 countries, namely Turkey and Lithuania, thus encompassing perspectives from different societies. Furthermore, during the participant selection through convenience sampling for the research, preference was given to individuals with as much knowledge as possible about EVs. This approach enhances the reliability of the data.

Future research could consider a larger and more diverse sample to enhance the generalizability of the results. Future studies could also explore the role of social norms and psychological factors in EV adoption to provide a more comprehensive understanding of the factors influencing customer adoption of sustainable mobility solutions.

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Disclosure statement

The authors report there are no competing interests to declare.

Appendix

Table A. Survey questionnaire

PEB	
PEB1	EVs will contribute to environmental sustainability (Xu *et al.* 2019)
PEB2	EVs will encourage a reduction in pollution (Xu *et al.* 2019)
PEB3	EVs are important for protecting natural resources (Xu *et al.* 2019)
PEB4	I believe that EVs help to protect the environment (Ali, Naushad 2022)
PEB5	Using EVs can reduce existing pollution (Ali, Naushad 2022)
PEB6	EVs are beneficial for reducing carbon emissions and mitigating energy shortages (Wang *et al.* 2018)
PEB7	I believe that the use of EVs can improve the environment quality (Wu *et al.* 2019)
PPB	
PPB1	I think that the driving comfort of EVs will be good (Lai *et al.* 2015)
PPB2	I think that the driving performance of EVs will be good (Lai *et al.* 2015)
PPB3	Fuel purchase is not required and thus potentially saves your money in the long term (Moeletsi 2021)
PPB4	EVs can improve my travel efficiency and quality of life (Wang *et al.* 2018)
PPB5	EVs are useful for reducing transportation-related expenses (Wang *et al.* 2018)
PPB6	I believe that the use of EVs can improve traffic quality (Wu *et al.* 2019)
PFR	
PFR1	Battery prices for EVs will be high (She *et al.* 2017)
PFR2	The cost of electricity will be high (She *et al.* 2017)
PFR3	Routine maintenance costs for EVs will be high (She *et al.* 2017)
PFR4	I am afraid of incurring financial losses when using EVs (Wang *et al.* 2018)
PFR5	High purchase price will be (Berkeley *et al.* 2018)
PFR6	If many people switch to electric cars, the cost of electricity is likely to increase, making it less advantageous (Giansoldati *et al.* 2020)
PPR	
PPR1	Using EVs for long distance is difficult because of the lack of charging stations on highways (Giansoldati *et al.* 2020)
PPR2	Recharging an EV during a trip will take a very long time (Giansoldati *et al.* 2020)
PPR3	The uncertainty rate on maintenance, service and repair infrastructure is high (Berkeley *et al.* 2018)
PPR4	The presence of public charging stations is not sufficient (Berkeley *et al.* 2018)
PPR5	If I used an EV, I would always be worried about the battery running out (Giansoldati *et al.* 2020)
PI	
PI1	I want to buy an EV (Ali, Naushad 2022)
PI2	I have a plan to buy an EV in the coming years (Ali, Naushad 2022)
PI3	I prefer to buy an EV over a traditional vehicle (Ali, Naushad 2022)
PI4	When I buy a new car, I plan to buy an environmentally friendly EV (Xu *et al.* 2019)
PI5	I recommend my friends to buy EVs (Lai *et al.* 2015)
PI6	I think it would be good to have an EV (Lai *et al.* 2015)
PI7	Buying an EV is a good idea. (Xu *et al.* 2019)
PI8	I think it is smart to buy an EV (Xu *et al.* 2019)
PI9	I look forward to more brands and models of EVs being available on the market (Xu *et al.* 2019)
PI10	I would be willing to pay more for a vehicle that I know is less harmful to the environment (Bunce *et al.* 2014)

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