

Article

Consumers' Purchase Intentions Towards New Energy Vehicles Based on the Theory of Planned Behaviour on Perceived Value: An Empirical Survey of China

Xiaofang Hu ^{1,*} , Raja Nerina Raja Yusof ¹  and Zuraina Dato Mansor ² ¹ School of Business and Economics, Universiti Putra Malaysia, Serdang 43400, Selangor, Malaysia; nerina@upm.edu.my² Department of Marketing & Management, School of Economics and Management, Universiti Putra Malaysia, Serdang 43400, Selangor, Malaysia; aina_m@upm.edu.my

* Correspondence: gs60062@student.upm.edu.my

Abstract: With the escalating environmental issues, the imperatives to mitigate greenhouse gas emissions and advance energy products through innovation, energy production, and consumption frequently result in environmental externalities. Conventional markets frequently struggle to address these external factors, resulting in market failures. Consumers are more aware of the environmental repercussions, regulatory mandates, and potential economic benefits of new energy vehicles (NEVs). Consequently, there has been a substantial surge in the demand for NEVs as alternatives to conventional vehicles. This study analyses the method by which innovative technology moves from the stage of purchase intention dissemination toward market adoption and explores strategies to expedite this process. Moreover, it examines how the intentions of customers to purchase ecologically friendly energy goods and their receptiveness to such products affect the expansion of the market. Further analysis indicates that the factors influencing consumers' attitudes towards NEVs include the adoption of ecological innovation, awareness of environmental product knowledge, and perceived value of innovative, environmentally friendly energy products. The purpose of this study is to expand upon the existing literature on consumer demand, examining the influential factors that extend the Theory of Planned Behaviour (TPB) to enhance consumer intention through internal mechanisms. It explicitly focuses on these aspects, as well as perceived risk (PR) and perceived value (PV), to identify gaps in the literature and contribute to intentions to purchase NEVs in China. This study presents a thorough research framework for efficiently examining customer demand for comparable eco-friendly energy products. It investigates the potential influence of attitudes, subjective norms, perceived behavioural control, and environmental perceptions, specifically those concerning environmental knowledge and concerns. Moreover, personal factors such as attitude, normative beliefs, and perceived control beliefs were found to impact consumer attitudes towards NEVs. The key factor influencing purchasing intention was the attitude towards NEVs. Simultaneously, subjective norms did not have a direct effect on purchase intentions. However, social influence played a significant role in the decision-making process, with perceived behavioural control and subjective norms exerting considerable influence.

Keywords: purchase intention (PI); theory of planned behaviour (TPB); new energy vehicles (NEVs); perceived value (PV)



Academic Editor: Grzegorz Sierpiński

Received: 24 December 2024

Revised: 7 February 2025

Accepted: 10 February 2025

Published: 21 February 2025

Citation: Hu, X.; Yusof, R.N.R.; Mansor, Z.D. Consumers' Purchase Intentions Towards New Energy Vehicles Based on the Theory of Planned Behaviour on Perceived Value: An Empirical Survey of China. *World Electr. Veh. J.* **2025**, *16*, 120. <https://doi.org/10.3390/wevj16030120>

Copyright: © 2025 by the authors. Published by MDPI on behalf of the World Electric Vehicle Association. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Consumers play a pivotal role in economic activities within society, and their consumption patterns and purchasing behaviours exhibit a wide range of complexities and multifaceted phenomena [1]. The growing concerns about environmental issues and global warming have increased public interest in green and ecologically friendly products [2]. As a result, there has been an increase in environmental consciousness and a shift towards sustainable consumption, influencing consumer choices [3]. The absence of consumer purchase intention data is a substantial obstacle to implementing green operations within the industry, hindering the development of efficient business and green marketing strategies [4]. Global ecological dynamics have undergone significant changes due to the simultaneous growth in population and economic activities. The rapidly growing population is anticipated to exceed 9.1 billion by 2050 [5]; this demographic trend is highly challenging [6] and is expected to significantly augment the strain on natural resources and energy systems. It is essential to prioritise economic growth, and this notion [6,7] has developed into a critical and enduring approach to addressing the intricate environmental challenges we confront. The trajectory of increasing global greenhouse gas (GHG) concentrations poses a significant threat to humanity's overall well-being. Prioritising this [8] is crucial to guaranteeing the long-term viability and welfare of our planet and its inhabitants. Table 1 lists widely recognised types of NEVs.

Table 1. Types of new energy vehicles (NEVs).

No.	Vehicle Type	Definition/Description
1	Battery Electric Vehicles (BEVs)	Only rechargeable batteries are used to power these fully electric automobiles. They do not have an internal combustion engine and emit no pollution from their tailpipes. They only use electricity that has been stored for propulsion.
2	Hybrid Electric Vehicles (HEVs)	These vehicles use gasoline, internal combustion engines, electric motors, and batteries. The electric motor assists the engine, improving fuel efficiency.
3	Plug-In Hybrid Electric Vehicles (PHEVs)	Like HEVs, PHEVs have a bigger battery that connects to an outside power source. PHEVs use a finite all-electric range before switching to their internal combustion engine to increase the driving range.
4	Fuel Cell Electric Vehicles (FCEVs)	These vehicles use hydrogen as fuel, converting it into electricity through a fuel cell stack. They emit only water vapour and have longer ranges than battery electric vehicles but require access to hydrogen refuelling stations.
5	Extended-Range Electric Vehicles (EREVs)	These vehicles primarily run on electricity and use an internal combustion engine as a generator to charge the battery and extend the driving range. The engine does not directly power the wheels.

NEVs have become a prominent research topic in recent years. Although Sovacool et al. [7] regard climate change as the most significant challenge of the twenty-first century,

and despite the low-carbon innovations as shown in Figure 1, swift progress observed in the NEV sector, and the integration of environmentally friendly practices [9], a considerable portion of NEVs have received unfavourable feedback owing to their inability [10–13] to meet customer expectations of a holistic user experience. Undoubtedly, there is notable difficulty in accurately interpreting the underlying motives behind the prospective adoption of NEVs, especially among Chinese consumers [13].

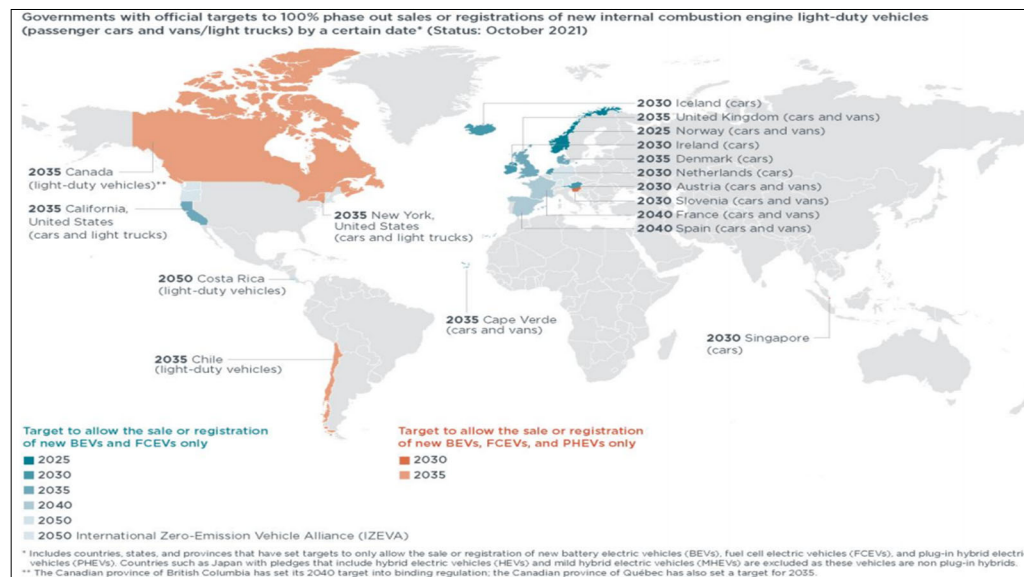


Figure 1. Schedule of fossil-fuel vehicle phase-out (Source: International Council on Clean Transportation (ICCT), 2021).

Gallo and Marinelli [14] suggest thoroughly implementing three transportation solutions: alternative electrification integration on a global scale, low-emission vehicles, and hybrid and electric vehicles; these strategies collectively pave the way for the introduction of sustainable and resilient modes of transportation. The term “New Energy Vehicles (NEVs)” encompasses a broad range of technologies, primarily focusing on vehicles that use alternative energy sources to replace traditional fossil fuels [15]. This includes electric vehicles (EVs), hybrid electric vehicles (HEVs), and hydrogen fuel cell vehicles (HFCVs). Hydrogen fuel cell vehicles (HFCVs) have recently emerged as a new driver for change [16]. A key distinction is drawn between NEVs and traditional vehicles, highlighting the convergence path of the industry’s development [17] as shown in Table 2, with new, constantly changing technologies in the scope of NEVs.

Table 2. The development of the definition of new energy vehicles (NEVs).

Time Phase	Representative Point of View	Author
Academics	The country initially perceived NEVs, including BEVs, PHEVs, and hydrogen-powered fuel cell electric vehicles [FCEVs]).	Sovacool et al., 2019 [13]
Industry	NEVs are used to designate automobiles that are wholly or predominantly powered by electric energy, which include plug-in electric vehicles, battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell electric vehicles (FCEV).	World Bank, 2011

According to the United Nations Energy Organization's definition (2022), NEVs are intertwined with the concept of intelligent living, emphasising the role of sustainable transportation in enhancing the travel experience [18]. As the NEV industry continues to evolve, developing a robust theoretical and practical framework is critical to navigating the complexity of this dynamic landscape [19,20]. Amid a crucial stage in the transition of the automobile industry, nations ingeniously integrated the advancement of NEVs with goals aimed at guaranteeing energy security and tackling climate change [21]. Raze, the World Bank Country Director for China, spoke at the 2021 Global Energy Transition Forum (GETF) and highlighted that China is uniquely positioned in the global energy landscape. The International Bank for Reconstruction and Development (IBRD) shows that the world's largest emitter of greenhouse gases boasts the world's largest installed renewable energy capacity and is a global leader in electricity production (IBRD, 2021).

The discussion and comparison of the NEV industry has become increasingly complex, and many problems are surfacing [22]; sales are still growing, but that demand needs to catch up to carmakers and other companies [23]. One significant issue is the substantial gap in consumers' understanding of NEVs, leading to increased uncertainty regarding their willingness to purchase [24,25]. Despite significant government efforts to promote NEVs, only 22% of consumers have accepted this product (International Energy Agency, 2023). However, recruiting new customers and keeping hold of current NEV users appear to be challenging issues for the sector [24,26]. Consumers may need more support regarding the adoption of intelligent transportation innovations in NEVs. Addressing this industry gap necessitates interdisciplinary research collaborations. Perception is central to reflecting the growing social demand for products and meeting the changing preferences of consumers [27]. This shift in perceived practices is conducive to increasing consumer satisfaction; some studies on NEVs emphasise the critical nodes of the intersection of value perception and perception theory [28]. As the NEV industry continues to evolve, developing a robust theoretical and practical framework is critical to navigating the complexity of this dynamic landscape [19,20].

Therefore, this study aims to analyse the characteristics of NEV purchase intention, and the motivation for this study stems from major problems that have led to an investigation into the factors that influence customers' intention to purchase NEVs in China. This study can assist in assessing and forecasting the factors that impact customers' buying choices, ultimately resulting in a rise in the acceptance and usage of eco-friendly products. The contribution of this study is as follows: This study suggests a more appropriate assessment framework for measuring consumers' willingness to buy environmentally friendly products. Furthermore, it proposes an operational standard for forecasting the influence of customers' purchasing behaviour on promoting the adoption of environmentally conscious consumption. The subsequent sections clearly outline and summarise the main question, as well as both questions and the objective of the investigation.

2. Conceptual Framework and Hypotheses

2.1. Theoretical Foundation

2.1.1. Theory of Planned Behaviour (TPB)

Figure 2 shows the TPB, developed in 1991. The idea aimed to "explain all activities people can exercise self-control". This model's most important element is the behavioural purpose, which is affected by beliefs about the likelihood that an activity will have the desired effect and by judgements about the advantages and disadvantages of that effect. The policy directly impacts choice intention more than the indirect effect since the user's rational buyers want to promote market potential and product enhancement through attitude, subjective norm, and perceived behavioural control [29].

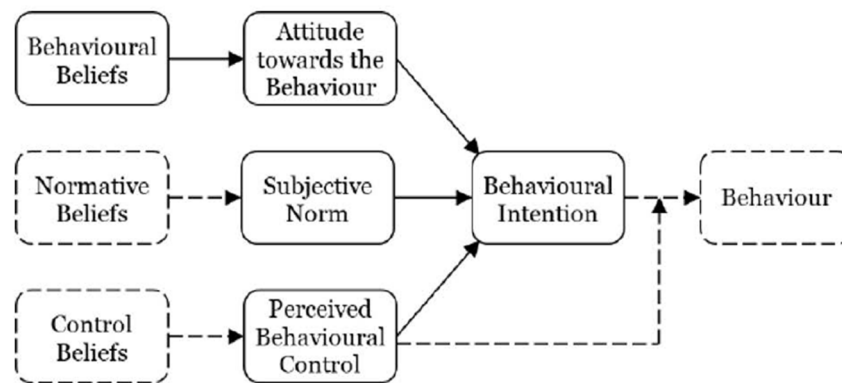


Figure 2. Model of the Theory of Planned Behaviour (Resource: Ajzen, 1991 [29]).

2.1.2. Theory of Perceived Value (TPV)

This study mainly concentrates on the value classified as the value for creative solutions; the perceived value (PV) theory as shown in Table 3, which was proposed over 20 years ago, is now deemed unreliable. Sanchez-Fernandez and Iniesta Bonillo [30] conducted a study that suggested a framework. They found that having positive general prosocial attitudes can influence individuals' green consumption values, leading to greater acceptance of green advertising and purchase behaviour. An essential aspect of the field is the consumption value theory given by Maccioni et al. [31], which seeks to establish a comprehensive framework for explaining green consumer behaviour. Previous scholars have identified five types of consumption values that influence consumer choice-making: emotional, functional, social, price, and situational values. However, numerous other academics have concentrated on the elements linked to characterising and elucidating green customer PV. Furthermore, the green PV dimension may fluctuate based on the specific data collection technique, as many biological metrics can be used to examine behavioural, emotional, and cognitive burdens. Various eco-design techniques used for the products may have had different effects on PV under the currently available data and further characterisation of the products and images [32].

Table 3. Theoretical arguments of the theory of perceived value (PV).

Scholar	Year	Key Insights	Market and Products
Maccioni L. et al. [31]	2019	Role of perceived value in sustainable products, focusing on environmental and social responsibility	Sustainable products market, green consumer goods market
Cao & Hui [32]	2022	Role of perceived value in cross-border e-commerce, especially the impact of cultural differences	Cross-border e-commerce market
Alanazi F [22]	2023	Perceived value in digital marketing, particularly the impact of social media platforms	Digital marketing, social media market
Alanazi, F., & Alenezi, M [15]	2024	Perceived value in digital products and services, including user experience, data privacy, security, and technological adaptability	Digital products and services market, including software, applications, and online services

2.1.3. Theory of Perceived Risk (TPR)

With the advancement of technology in recent decades, there has been a significant rise in the frequency of iterative product updates. As shown in Table 4, the TPR tends to perceive risks based on factors such as the potential severity of harm; research by various authors [33,34] has shown that perceived risks, such as higher upfront costs, potential

depreciation, limited charging infrastructure, and concerns about battery performance, significantly influence consumers' attitudes and intentions towards adopting NEVs—more importantly, the [35] uncertainty surrounding the risk, the control individuals have over the risk, and the benefits associated with engaging in risky behaviour. Cognitive factors, such as knowledge and past experiences, as well as affective factors, play a role as well [35], according to Nisal and Thilina (2019) [36], the authors of the TPR, and individuals who have evaluated the extension to the Technology Acceptance Model (TAM), which consists of five dimensions associated with NEVs. The TPR has been extensively studied in the context of NEVs, including performance, physical, financial, time, and psychological risks, providing valuable insights into consumers' risk perceptions and decision-making processes. These studies highlight then Table 4. importance of understanding consumers' perceived risks in shaping effective marketing strategies, communication efforts, and policy interventions to promote the adoption of NEVs.

Table 4. Theoretical arguments of the theory of perceived risk (TPR).

Scholar	Year	Key Insights	Market and Products
Wang & Chen [28]	2018	Perceived risk in social media and online shopping	E-commerce and social media markets
Nisal & Thilina [36]	2019	Extension to the Technology Acceptance Model, consisting of five dimensions	Electric vehicle markets, performance risk, physical risk, financial risk, time risk, and psychological risk
Zhang & Zhao [34]	2020	Perceived risk in mobile payments and financial technology	Financial technology and mobile payment markets
Aufa, A.A., & Marsasi, E.G. [33]	2022	Social risk, performance risk, physical risk, financial risk, time risk, and psychological risk	Recycled products

2.2. Hypothesis Development

2.2.1. Extending of the TPB and NEV Purchase Intentions

People can have infinite beliefs about any action but can only concentrate on a small subset of those beliefs at any given time [37]. These fundamental beliefs greatly influence one's intentions and actions. Contrarily, opinions about the likelihood of uncertain events represented by subjective probabilities are decided upon through the mediation of beliefs [38]. These assume that a person's attitude is a product of their salient behavioural beliefs, which indicate the expected results or characteristics of their conduct and thus depend on expectation beliefs [39,40]. This belief-based analysis has been used in numerous studies to better understand behaviour [40]. As a result, the TPB favours the statement that "people's intentions and actions are guided by their beliefs about purchasing a product rather than by the objective attributes of the product" [41]. Therefore, this study hypothesises a positive relationship between behavioural beliefs and attitudes.

Hypothesis 1: *"Behavioural Beliefs (BB) positively influence the Attitudes (AT) of New Energy Vehicle (NEV) consumers in China".*

In the context of social norms and normative beliefs, the idea of social influence has been examined in the TPB. According to [29] the TPB, accepting normative beliefs within a social group affects people's subjective normative motivation to enhance their self-image within that social group [42]. Consumers appear more conscious of and concerned

with how they appear in social groups [43]. Unfortunately, they can only concentrate on a small number of the various beliefs about any action at any given time [36]. These fundamental beliefs greatly influence one's intentions and actions. Contrarily, opinions about the likelihood of uncertain events represented by subjective probabilities are decided upon through the mediation of beliefs [44]. This belief-based analysis has been used in numerous studies to better understand behaviour. TPB describes the nature of the connection between behavioural and normative beliefs and attitudes in this way [41]. As a result, this study hypothesises that subjective norms and normative beliefs have a positive relationship.

Hypothesis 2: *“Normative Beliefs (NB) positively influence the Subjective Norm (SN) of New Energy Vehicle (NEV) consumers in China”.*

The Social Cognitive Theory of Bandura (1977), which looks at how easy or difficult behaviour seems to be, is the foundation for self-efficacy. Bandura's work on self-efficacy emphasised the role of cognitive, social, and environmental factors in shaping an individual's beliefs about their capabilities. Perceived behavioural control measures how well a person can control specific factors that either help or constrain their behaviour to function in each circumstance [45]. Ajzen [42] contends that control beliefs that support or interfere with the performance of a behaviour are related to perceived behavioural control [46]. The underlying variable shows the proposed structural model. Since consumers are active subjects, the industry seeks expanded sales and innovative profits. As a result, this study hypothesises that there is a positive relationship between perceived behavioural control and control beliefs.

Hypothesis 3: *“Control Beliefs (CB) positively influence the Perceived Behavioural Control (PBC) of New Energy Vehicle (NEV) consumers in China”.*

Alderfer and Sternthal discovered a significant relationship between attitudes toward products and brands and purchase intentions. Wei [47] also came to a similar conclusion. Engel, Blackwell, and Miniard [48] added that the attitude toward price has a significant relationship to purchase intention. In addition, Lin et al. [49] discovered that the attitude toward perceived value has a substantial relationship to purchase intention. According to Huddleston and Moreau, purchase intention is significantly influenced by brands, prices, and perceived quality, in addition to the attitudes toward the products mentioned above. Other factors, such as personal circumstances and external influences, can also impact a person's purchase decision. Therefore, this study hypothesises that attitudes have a significant relationship to the purchase intention of NEVs and potential consumers in China's provinces.

Hypothesis 4: *“Attitudes (AT) significantly influence the Purchase Intention (PI) of New Energy Vehicle (NEV) consumers in China”.*

A study in the journal Transportation Research Part D: Transport and Environment by Xu et al. [50] found that subjective norms were significantly related to the purchase intention of NEVs among Chinese consumers. They found that individuals were likelier to purchase NEVs if they perceived that their friends and family members approved of such vehicles or believed owning an NEV was socially desirable. Zhao et al. [51] found that subjective norms significantly positively affected purchase intentions for NEVs. They also found that this effect was mediated by attitudes towards the environment and perceptions of these vehicles' fuel efficiency and cost-effectiveness. Other researchers who have studied the

relationship between subjective norms and purchase intentions for NEVs include Bredahl et al. [52]. Therefore, this study hypothesises that subjective norms significantly influence the purchase intention of NEV consumers in China.

Hypothesis 5: “Subjective Norm (SN) significantly influences the Purchase Intention (PI) of New Energy Vehicle (NEV) consumers in China”.

Consumers’ perception of having personal control over consumption and purchase decisions is called perceived behavioural control. In other words, despite having a favourable attitude toward engaging in a behaviour, a person may decide against doing so when faced with perceived obstacles. Consumer skills and abilities are implied by perceived difficulty, which is believed to affect how much control an individual has over their behaviour [53]; people who feel more in control of their behaviour act with greater intention. For instance, Barbarossa et al. [54] found that PBC is positively correlated with intending to buy green personal care products. At the same time, Jiménez et al. [55] assessed the detrimental effects of PBC on purchases of green paper towels. With the price of green products, a similar contrast can be seen. For example, in some cases, going green is less expensive than remanufacturing a laptop [56], whereas in other cases, going green is the costliest option and hurts final purchase intention, such as with electric cars [57]. As a result, each target behaviour needs to be evaluated separately because these factors demonstrate that causal factors may differ significantly between behaviours and individuals [58]. According to Ajzen [29], the direction of the PBC–intention relationship depends on people’s behaviour. Therefore, this study hypothesises that PBC has a significant relationship to the purchase intention of NEVs and potential consumers in China.

Hypothesis 6: “Perceived Behavioural Control (PBC) significantly influences the Purchase Intention (PI) of New Energy Vehicle (NEV) consumers in China”.

2.2.2. Environmental Knowledge and Concern and Perceived Value

In previous research, the authors analysed the driving characteristics of the EK and EC and designed a series of experiments on NEVs’ perceived value. The NEVs in the perceived value experiments are calculated and listed in Table 5. Each segment was selected for the research and analysis’s database collection. The definitions presented are as follows.

Table 5. Correlation of environmental knowledge and concern with perceived value.

Variable	Detailed Analysis	Hypothesis	References
Environmental Knowledge (EK)	Environmental knowledge refers to consumers’ awareness and understanding of environmental issues and the benefits of eco-friendly products.	H1: Higher environmental knowledge positively correlates with higher perceived value of NEVs.	Kang et al. [59]
Environmental Concern (EC)	Environmental concern refers to the degree of importance consumers place on environmental protection and sustainability.	H2: Greater environmental concern positively correlates with the higher perceived value of NEVs.	Qomariah et al. [60]
Combined Analysis and Summary	Both environmental knowledge and concern play crucial roles in shaping the perceived value of NEVs. Environmental knowledge provides a rational understanding of their practical benefits, while environmental concern adds an emotional and value-based dimension to this perception.		Bocken et al. [61]

Under the ideal sustainable value proposition, value can be created simultaneously for many stakeholders, including clients, shareholders, suppliers, and partners, as well as for society and the environment [62]. A sustainable value proposition is generally thought to include a promise of the benefits that a company’s products will bring to customers and society, considering both short-term profitability and long-term sustainability [62–64].

As a result, this study hypothesises that assessments of perceived consumption could be validated using consumer perceptions of value. Although there are connections between EK, EC, and PV aspects in a value proposition, each element is elaborated separately and summarised for analytical purposes.

Hypothesis 7: *“Environmental Knowledge (EK) has a significant relationship With the Perceived Value (PV) of New Energy Vehicle (NEV) consumers in China”.*

Hypothesis 8: *“Environmental Concern (EC) has a significant relationship with the Perceived Value (PV) of New Energy Vehicle (NEV) consumers in China”.*

2.2.3. Perceived Risk and Perceived Value

To validate the above regularity, another experiment was carried out. The risk–benefit trade-off suggests that consumers weigh the perceived risks of sustainable products against their perceived benefits. Higher perceived risks, such as uncertainties about product effectiveness, environmental impact, or higher costs, can lead to lower perceived value. Conversely, suppose consumers perceive the benefits of sustainable products, such as reduced environmental impact or improved personal well-being, as outweighing the associated risks. In that case, they are more likely to perceive them as having higher value. Consumers rely on signals or cues from sustainable products to infer their quality, reliability, and benefits. Perceived risk serves as a signal of potential adverse outcomes, and if consumers perceive lower risks associated with sustainable products, they are more likely to perceive higher value. Consumers’ trust in sustainable product claims and the credibility of the information sources play a significant role in shaping the relationship between perceived risk and perceived value. Consumers’ emotions and moral considerations also influence the relationship between the perceived risk and perceived value of sustainable products. Consumers with strong emotional connections to environmental or social causes may perceive higher value in sustainable products despite potential risks.

Hypothesis 9: *“Perceived Risk (PR) negatively influences the Perceived Value (PV) of New Energy Vehicles (NEVs) among consumers in China”.*

2.2.4. Environmental Knowledge and Concern and Purchase Intentions

Nations worldwide are putting great effort into establishing and implementing sustainable development goals [65,66]. As indicated in the literature, the concept of sustainability is a significant issue, raising concerns in the global industry [67]. Ensuring residents and guests lead healthy lives through social, environmental, and economic systems is crucial [67]. Several countries have emphasised the value of sustainable development and the green economy as a new development strategy. Numerous studies have revealed that customers’ intentions are influenced by both psychological and personal aspects [68]. Consumer attitudes toward sustainable consumption are determined by gender, age, education, and personal beliefs [69]. Nature is one’s “emotional, empirical unity with the natural world”. It has also been mentioned that individuals with a higher degree of connection to nature have a better attitude towards the environment, are more willing to participate in activities related to sustainability, and are more concerned about the negative impact of human activities on the environment [70,71].

Hypothesis H10: *“Environmental Knowledge (EK) positively influences the relationship with the Purchase Intention (PI) of New Energy Vehicles (NEVs) among consumers in China”.*

Hypothesis H11: *“Environmental Concern (EC) positively influences the relationship with the Purchase Intention (PI) of New Energy Vehicles (NEVs) among consumers in China”.*

2.2.5. Perceived Risk and Purchase Intention

Perceived risk is a broad concept that can affect various aspects of economic activity, including consumer behaviour and the demand for products and services. D’Souza et al. [72] indicate how perceived risk can influence consumer attitudes, values, and decision making and how these factors can affect the demand for products and services, including green products. Ying and Ying studied the influencing factors of consumers’ purchase intentions regarding NEVs based on perceived risk and the involvement degree combined with demographic variables. As such, according to Nekmahmud and Fekete-Farkas [73], perceived risk has been an area of interest for researchers studying consumers in various fields. Economically minded academics posit that reasonable risk is necessary to obtain the most benefit for the least amount of money [74]. Second, monetary incentives or price controls can encourage consumers to make energy-saving choices [75]. Numerous studies have revealed, however, that these measures fall short of expectations because social factors like habits and emotions skew our perceptions of rationality [76]. Therefore, this study hypothesises that perceived risk hurts the relationship to NEV purchase intentions and that the effect is more significant among consumers with deeper concerns about perceived risk.

Hypothesis 12: *“Perceived Risk (PR) has a significant influence on the relationship with the Purchase Intention (PI) of New Energy Vehicles (NEVs) among consumers in China”.*

2.2.6. Mediating Variables

Compared with the theory of rational, planned behaviour and the influence of irrational belief and according to the concept of dynamic psychology, the subjective will of human activities is conducive to predicting and determining human activities. The resources for expanding product sales and competitive advantage are valuable, rare, imitable, and irreplaceable. Therefore, as part of the Theory of Planned Behaviour, promoting consumer intention to expand external sources, such as irrational information, can be a link for the industry to obtain resources to study consumer intentions.

Hypothesis 13: *“Perceived value (PV) mediates the relationship between Environmental Knowledge (EK) and Purchase Intention (PI) of New Energy Vehicle (NEV) customers in China”.*

Hypothesis 14: *“Perceived value (PV) mediates the relationship between the Environmental Concern (EC) and Purchase Intention (PI) of New Energy Vehicle (NEV) customers in China”.*

Hypothesis 15: *“Perceived value (PV) mediates the relationship between Perceived Risk (PR) and Purchase Intention (PI) of New Energy Vehicle (NEV) Customers in China”.*

2.2.7. Perceived Value and NEV Purchase Intentions

The influence of perceived intention to value is based on the TPB, and price sensitivity, green consumption awareness, and innovation characteristics are added to explore consumers’ purchase intentions [77]. Minjie conducted an empirical study on the private purchase demands of potential consumers of electric vehicles by taking the users who participated in test drives of electric vehicles in Shanghai International Automobile City as the research object. These concepts are too broad and lack evidence, the existing related research value perception of NEVs is insufficient, and it is easy for the actual investigation process to answer a problem, which affects the validity of the accuracy of the results of the survey and data analysis; thus, to value the perception of the influence of NEV purchase

intentions for specific research, “Customer Perceived Value (CPV) refers to evaluating a product or service’s usefulness after weighing customers’ perceived benefits and the costs they incur when purchasing a good or service. It is a personal emotion, related to consumers’ opinions on value, quality, and price [78]. Customer-perceived value, also called perceived value, is how a customer evaluates or rates a product or service in contrast to rival offerings and moves a product outside of a consumer’s view of it [79]. Some authors conducted an exploratory study on the variables that affect consumers buying NEVs.

Hypothesis 16: “The greater the Perceived Value (PV), the higher the New Energy Vehicle (NEV) purchase intention”.

The organisation of this research’s methodology is illustrated in Figure 3. This study aims to expand the existing literature by examining the factors influencing consumer purchase intentions for NEVs in China through an extended TPB framework.

As part of this study’s extension of Ajzen’s TPB, the behavioural beliefs, normative beliefs, control beliefs in attitudes, subjective norms, and perceived behavioural control were all analysed; the theory is flexible enough to accommodate these three additional antecedents to the primary structure. Perceived value theory also discusses how different consumers assess the value of products or services. Consumers are believed to avoid risk, even though they intend to do so because the perceived benefits for NEVs are uncertain, given that they are an emerging product. Investigating the value of a customer’s environmental knowledge and concerns is essential to see if these factors impact the relationship between intentions and behaviour. This study will focus on behavioural, normative, and control beliefs, incorporating environmental knowledge and concern and exploring multiple dimensions of customer perceived value. The strategic integration of NEVs into the framework of green products represents a forward-looking approach to addressing the challenges of emerging product markets. By addressing these gaps, this study aims to provide practical insights and recommendations to promote the adoption of NEVs and support the development of a sustainable market for green products. This study intends to investigate the factors that impact consumers’ inclinations toward purchasing NEVs. This study proposes the following conclusions from the current research and theoretical framework. Multiple global literary works have examined the occurrence of clients buying NEVs. There is disagreement on the utility of NEVs and the importance of providing support. The situation with faith-based guidance is similarly intricate. It establishes the trajectory for continued growth and assistance in enhancing the literature for the upcoming NEV market.

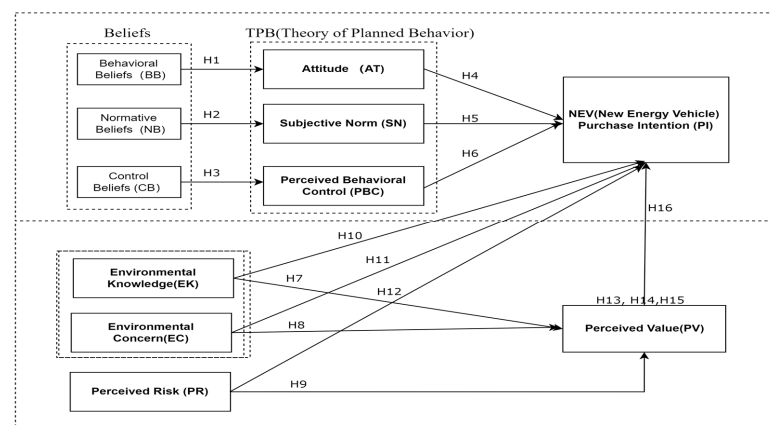


Figure 3. Research flowchart.

3. Methodology

This study's goals include identifying the theory behind consumer decision-making processes and investigating NEV purchase intentions, barriers, and risks. The following search terms were chosen: "New Energy Vehicles (NEVs)", "purchase intention", "Theory of Planned Behaviour", "perceived value", "perceived risk", and "sustainable consumption". Through an academic search engine connected to 583 different bibliographic repositories, including open access journal directories, Web of Science, Wiley Online Libraries, Scopus, and ScienceDirect, specific keywords were searched for article titles, abstracts, and keywords for readily available publications. Inclusion and exclusion criteria were created to assist in selecting appropriate articles and minimising the number of publications. Additionally, the research design provides a framework or game plan for the study's goals.

3.1. Data Collection and Sample Design

First-tier cities' (including Beijing, Shanghai, Guangzhou, and Shenzhen City) development schedule of fuel vehicle strategies and the roadmap of electric vehicle charging infrastructure in China (2021) show that Guangzhou and Shenzhen contain the most charging piles in China, with 161,000 charging piles, far more than Shanghai in second place, with 97,000, and Beijing, ranked third. China's most significant economic and first consumption region is the first-tier city, which leads the country in terms of annual GDP, total retail sales of consumer goods, and per capita disposable income (Economy of China, 2021). Referring to Bukhari [80], the target sample to be investigated follows the guidelines provided by Krejcie and Morgan's sample size table. The total population of China in 2021 was 1412 million, and the population of the first-tier cities (Beijing, Shanghai, Guangzhou, and Shenzhen) was 74.7 million, of which the population over the age of 16 was 59.79 million. According to Krejcie and Morgan's table for Determining Sample Size for a Finite Population, the population was over 69 million (95%), and the rounded-up minimum sample size was 369. Hence, the minimum sample required for this study is approximately 420. However, due to considerations related to cost, time constraints, and some uncertainties, and referring to the table above, the results of the data validity reference survey amounted to 71.5% of this number. A priori power analysis indicated that the study's sample size needed to be more than 516.08, and, subject to our final confirmation, the sample size was increased to 583 to attain more dependable and accurate results. We ultimately opted for 583 via an online questionnaire distribution method focused more on specific areas in four designated first-tier cities (Beijing, Shanghai, Guangzhou, and Shenzhen).

By employing a combination of stratified and purposive sampling, this study categorises consumer groups from China's first-tier cities. It focuses on a specific age group within these cities for in-depth analysis as shown in Table 6. Stratified sampling ensures the adequate representation of geographic subgroups, particularly first-tier cities such as Beijing, Shanghai, Guangzhou, and Shenzhen, which exhibit significant differences in economic development, infrastructure, and consumer behaviour. As shown in Table 7, these differences are critical in understanding variations in acceptance and demand for new energy vehicles (NEVs). Meanwhile, purposive sampling concentrates on a specific age group, allowing for a deeper exploration of how age influences consumer preferences for NEVs. This integrated approach ensures both broad coverage and targeted insights, offering a more accurate and comprehensive perspective on the diverse preferences and behaviours of Chinese consumers toward NEVs. The findings provide valuable guidance for developing targeted marketing strategies and analysing market acceptance across different segments of the NEV market in China.

Table 6. Overview of respondents' characteristics.

Variables	Description	Expected Sign
Region	Urban/rural	+
Gender	Female	+
	Male	+
Age	Respondent's age	+
Income	Respondent's monthly income (RMB)	+
Marital Status	Single	+
Education	Level of education: primary school, secondary school, diploma, undergraduate, and postgraduate	+
Occupation	Standard of living indicators	+

Footnote: The "+" symbol indicates the expected positive relationship between the variable and the outcome of interest (e.g., likelihood of adopting a product, service, or behavior). For example, higher income, higher education levels, or urban residence are expected to positively influence the outcome.

Table 7. Research segments of new energy vehicles (NEVs).

Attributes	Description	Expected Sign	Attributes
Range	Above/100 km/300 km/500 km	+	Range
Fast charging	3 km/5 km/10 km	+	Fast charging
Owner car	none/one car/two cars	+	Owner car
Driving age	1 year/3 years/more than 5 years	+	Driving age
Concerned environmental protection	No/Constant/Occasionally attention	+	Concerned environmental protection
Price	The purchase price for the vehicle will depend on the amount of tax or incentive.	+	Price

Footnote: The + symbol indicates the expected positive relationship between the attribute and the likelihood of purchasing or adopting new energy vehicles (NEVs). For example, a higher range, faster charging, or greater environmental concern is expected to positively influence consumer preference for NEVs.

3.2. Instrument Measures

Eleven constructs—behavioural beliefs, normative beliefs, control beliefs, attitudes, subjective norms, perceived behavioural control, environmental knowledge and concern, perceived risk, perceived value, and purchase intention—are included in this study. A questionnaire was created under Ajzen's [81] recommendations for the format of TPB questionnaires, which have received extensive research and approval from academic and professional communities [29,81]. To attain the objective of this study, the Likert scale was used, operating under the assumption that the collective replies to several items collectively contribute to the ultimate score. The researchers utilised a construct measurement scale as presented in Table 8, which was modified and implemented, drawing upon prior research. In this context, a 5-point Likert scale was employed to assess the independent variables, while a 7-point Likert scale was utilised to evaluate the dependent variables. The utilisation of closed-term statements was contingent upon the investigation's specific objectives and the research subjects' inherent qualities. Participants utilised a 5-point Likert scale encompassing responses ranging from "strongly disagree" to "strongly agree" to indicate their level of agreement with each issue. A quantitative study was conducted, utilising an online questionnaire approach due to time restrictions, regional dispersion, and adherence to cost-saving principles to measure the constructs as outlined in Table 8.

Table 8. Measurement of constructs.

No.	Constructs	ITEMS Variable Scales	Reference	Criteria
Behavioural Belief Strength (BBS) Scale				
1	Behavioural Beliefs (BB)	I believe driving NEVs is a relaxing way of living.	Hoque & Hossan (2020) [82]	0.787
2		I believe driving NEVs is a convenient way of meeting daily recommended travel mode.	Hoque& Hossan (2020) [82]	0.853
3		I can determine the differences between NEV products by test driving.	Hoque & Hossan (2020) [82]	0.799
4		I believe buying NEVs would enable me to help save the environment.	Yadav (2017) [83]	0.80
5		I believe buying NEVs would enable me to be a responsible citizen.	Yadav (2017) [83]	0.79
6		I believe buying NEVs would enable me to stay in a clean and better environment.	Yadav (2017) [83]	0.75
7		I believe buying NEVs would enable me to perform eco-friendly practices.	Yadav (2017) [83]	0.78
8		In my opinion, NEVs are good-quality vehicles.	Alcalde-Rabanal et al. (2022) [84]	0.76
9		In my opinion, My family/kids/husband like NEVs.	Alcalde-Rabanal et al. (2022) [84]	0.79
Normative Belief Strength (NBS) Scale				
10	Normative Beliefs Strength (NB)	My family think I should drive NEVs.	Hoque & Hossan (2020) [82]	0.723
11		My friends and colleagues believe I should drive NEVs.	Hoque & Hossan (2020) [82]	0.704
12		My co-worker believes I should drive NEVs.	Hoque & Hossan (2020) [82]	0.647
13		My family thinks I should purchase NEV products in place of traditional fossil fuel-powered vehicle.	Bhutto et al. (2022) [85]	0.981
14		My friend thinks I should purchase NEV products in place of traditional fossil fuel-powered vehicle.	Bhutto et al. (2022) [85]	0.891
15		My family thinks I should purchase green products in place of conventional non-green products	Yadav (2017) [83]	0.72
16		My friends think I should purchase green products instead of conventional non-green products.	Yadav (2017) [83]	0.82
17		My colleagues think I should purchase green products instead of conventional non-green products.	Yadav (2017) [83]	0.79
18		I value the opinions and feelings of my family and friends about my NEV consumption behaviour.	Bhutto et al. (2022) [85]	0.915
Control Beliefs Strength (CBS) Scale				

Table 8. Cont.

No.	Constructs	ITEMS Variable Scales	Reference	Criteria
19	Control Beliefs (CB)	I believe that while buying the NEVs, the location needs to be convenient.	Yadav (2017) [83]	0.65
20		I believe buying NEVs requires time and effort.	Yadav (2017) [83]	0.76
21		I believe that I can plan to purchase NEVs ahead of time.	Blue & Marrero (2006) [86]	0.757
22		In my opinion, my company/school/others that pay(s) for my expenses encourage(s) me to use NEVs	Yadav (2016) [83]	0.76
23		My willingness to pay a premium for quality NEVs will encourage me to purchase them.	Hoque & Hossan (2020) [82]	0.858
24		In my opinion, I am not able to choose NEVs when driving outside my home.	Blue & Marrero (2006) [86]	0.84
25		I will find it hard to break my driving habits if I drive an NEV.	Blue & Marrero (2006) [86]	0.84
26		I lack the confidence to drive NEVs.	Blue & Marrero (2006) [86]	0.84
27		In my opinion, the cost of NEVs is not a problem for me.	Blue & Marrero (2006) [86]	0.757
Attitude Scale				
28	Attitude (AT)	I like the idea of purchasing a NEV.	Kamalanon et al.(2022) [87]	0.810
29		I consider the adoption of NEVs favourable.	Shalender & Sharma (2021) [88]	0.87
30		I consider the adoption of NEVs desirable.	Shalender & Sharma (2021) [88]	0.87
31		Environmental protection is essential to me when I purchase NEVs.	Kamalanon et al. (2022) [87]	0.757
32		I have a favourable attitude toward purchasing NEVs.	Kamalanon et al. (2022) [87]	0.802
Subjective Norms Scale				
33	Subjective Norms (SN)	People will have a good impression of me if I purchase NEVs.	Kamalanon et al. (2022) [87]	0.838
34		While adopting a new vehicle, I consider the wishes of other people who are important to me.	Shalender, & Sharma (2021) [88]	0.87
35		Most people who are important to me would expect that I should buy NEVs.	Kamalanon et al. (2022) [87]	0.764
36		The people who influence my opinions prefer that I adopt the NEVs while adopting a vehicle in the future.	Shalender & Sharma (2021) [88]	0.82
Perceived Behavioural Control Scale				

Table 8. Cont.

No.	Constructs	ITEMS Variable Scales	Reference	Criteria
37	Perceived Behavioural Control (PBC)	I can find where to buy NEVs when I decide to adopt them.	Shalender & Sharma (2021) [88]	0.85
38		I can afford to buy NEV brands, even if they are slightly expensive.	Bhutto et al. (2022) [86]	0.84
39		The price of NEVs is essential when I decide to adopt them.	Shalender & Sharma (2021) [88]	0.84
40		The repair and maintenance of the NEVs are essential when I adopt them.	Shalender & Sharma (2021) [88]	0.84
41		If NEVs are available in dealerships, I am sure that I will only buy NEV products and brands.	Bhutto et al. (2022) [86]	0.775
42		Choosing whether to buy or not buy NEVs is solely my decision.	Bhutto et al. (2022) [86]	0.889
Environmental Knowledge Scale				
43	Environmental Knowledge (EK)	I am very knowledgeable about environmental issues.	Kamalanon et al. (2022) [87]	0.769
44		NEVs are Eco friendly.	Rusyani (2021) [89]	0.794
45		I know more about recycling than the average person.	Kamalanon et al. (2022) [87]	0.069
46		I know how to select products and packages that reduce the amount of landfill waste.	Kamalanon et al. (2022) [87]	0.069
47		I know that I buy products and packages that are environmentally safe.	Kamalanon et al. (2022) [87]	0.069
48		I know I buy green products that can help protect the environment.	Okur et al. (2023) [90]	0.780
Environmental Concern Scale				
49	Environmental Concern (EC)	I would describe myself as an environmentally responsible person.	Kamalanon et al. (2022) [87]	0.731
50		I want to buy an NEV due to the air pollution crisis.	Kim et al. (2023) [91]	0.768
51		NEVs help build a sustainable environment.	Rusyani (2021) [89]	0.726
52		NEVs minimise waste and recycle it.	Rusyani (2021) [89]	0.764
53		The use of NEVs makes me feel happy.	Rusyani (2021) [89]	0.757
Perceived Risk Scale				

Table 8. *Cont.*

No.	Constructs	ITEMS Variable Scales	Reference	Criteria
54	Perceived Risk (PR)	In my opinion, the environmental crisis has become more severe in recent years.	Zheng et al. (2022) [92]	0.752
55		Buying NEVs may make me spend more money.	Walsh et al. (2014) [93] Hu et al. (2024) [94]	0.804
56		The safety and reliability of NEVs may not be good enough.	Hu et al. (2024) [94] Hermundsdottir (2022) [95]	0.821
57		I have concerns regarding the performance of NEVs as compared to traditional gasoline-powered vehicles.	Zheng et al. (2022) [92]	0.807
58		I believe that using NEVs could involve considerable time losses considering their disadvantages (e.g., limited driving range and long charging times).	Zheng et al. (2022) [92]	0.779
Perceived Value Scale				
59	Perceived Value (PV)	NEVs Offers value for money.	Walsh et al. (2014) [93]	0.75
60		NEVs have consistent quality.	Okur (2023) [90]	0.733
61		NEVs Would improve the way I am perceived.	Walsh et al. (2014) [93]	0.71
2		NEVs will help me feel acceptable.	Walsh et al. (2014) [93]	0.72
63		NEVs are the ones that I would feel relaxed about using.	Okur (2023) [90]	0.855
Purchase Intention Scale				
64	Purchase Intention	I intend to buy NEVs in the future.	Kim et al. (2023) [91]	0.851
65		My willingness to buy NEVs is high.	Kim et al. (2023) [91]	0.816
66		I have a high chance of buying NEVs in the future.	Kim et al. (2023) [91]	0.819
67		I will pay more for an NEV that has more environmental benefits.	Kim et al. (2023) [91]	0.814

3.3. Data Analysis and Planning

Analysis Introduction: the scales in the model were evaluated for reliability, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA). To test the hypotheses in the theoretical framework, this study uses structural equation modelling (SEM) to analyse the influence of various factors on consumers' intention to buy NEVs. Structural equation modelling (SEM) techniques, including Covariance-Based SEM (CB-SEM), Partial Least Squares SEM (PLS-SEM), and AMOS-SEM, are widely used for analysing complex relationships among variables. Each method has strengths and weaknesses, making them suitable for different research goals and conditions. Table 9 shows a comprehensive comparison.

Table 9. Comparison of CB-SEM and PLS-SEM and Amos-SEM.

Criterion	CB-SEM	PLS-SEM	AMOS-SEM
Orientation	Parameter oriented	Prediction oriented	Parameter oriented
Approach	Covariance based	Variance based	Covariance based
Assumptions	Parametric	Nonparametric	Parametric
Latent Variable Scores	Indeterminate	Explicitly estimated	Indeterminate
Applicable to Formative or Reflective Model	Reflective indicators only	Formative or reflective model	Reflective indicators only
Implications	Optimal for parameter accuracy	Optimal for prediction accuracy	Optimal for parameter accuracy
Model Complexity	Slight to moderate (e.g., <100 indicators)	Large (e.g., 100 constructs, 1000 indicators)	Small to moderate
Sample Size	Minimum 200 to 800 cases	Minimum 30 to 100 cases	Medium to large sample sizes
Software	EQS, AMOS, LISREL, SEPATH	Smart PLS, PLS-GUI, PLS-GRAPH	AMOS
Research Goal	Theory testing, confirmation	Predicting-oriented, exploratory	Theory testing, confirmation
Data Distribution Requirements	Normal distribution required	No distributional assumptions	Normal distribution required
Use of Latent Variable Scores	Generally not used	Used in subsequent analyses	Generally not used

3.4. Statistical Test Procedure

Our aim was to effectively analyse whether the data followed a normal distribution, guiding further statistical analysis and model development. Residual normality is another commonly used test method in regression analysis. We may determine whether the residuals fit the normal distribution by producing a histogram and a QQ plot and applying the statistical test procedure described in Table 10.

Table 10. Comparison of statistical test procedures.

No.	Method	Application Scope	Characteristics
1	Histogram	Any sample size	Intuitive and easy-to-understand
2	Q-Q Plot	Any sample size	Intuitive and easy-to-understand
3	Shapiro–Wilk Test	Small samples ($n < 50$)	Precise, commonly used for small samples
4	Kolmogorov–Smirnov Test	Large samples	Suitable for large samples, conservative
5	Anderson–Darling Test	Large samples	Sensitive to tail differences
6	Lilliefors Test	Large samples, unknown mean and variance	Modified K-S test
7	Jarque–Bera Test	Large samples	Based on skewness and kurtosis, often used in economic data analysis
8	D’Agostino’s K-squared Test	Any sample size	Based on skewness and kurtosis, it is suitable for various data types
9	Cramér-von Mises Test	Large samples	Different measure of CDF, high sensitivity
10	Residual Analysis	Residuals in regression	Combines visual methods and statistical tests to assess the normality of residuals

It is customary to assess the normality of residuals in regression analysis. One can utilise histograms and Q-Q plots of residuals to determine if the residuals conform to

a normal distribution. Additionally, statistical tests can be employed to evaluate the normality of the residuals. To summarize the research methodology in Table 11: Research Methodology Overview.

Table 11. Research methodology overview.

No.	Research Aspect	Description	Methodology
1	Purpose	Test theories and hypotheses	SPSS 22.0
2	Approach	Statistically measure and test	PLS-SEM
3	Data collection	Structured response	Quantitative Research
4	Research objectivity samples	The researcher distanced themselves from the observe	Online questionnaire
5	Samples	Large samples for generalisable results	Target Population: 517 consumers in first-tier cities in China
6	Most often used	Descriptive research	Non-Probability Sampling Procedures

4. Results

A total of 583 questionnaires were collected in this survey, and 467 valid questionnaires were obtained after eliminating invalid questionnaires, with an effective rate of 80.1%. Secondly, PLS-SEM analysed the participants' demographic information in the survey, including the user's gender, education, age, and monthly income. The details are shown in Table 12.

Table 12. Demographic characteristics statistics.

No.	Demographic	Demographic Variable	N	%
1	Age	[18, 29]	55	11.777
		(30, 40]	130	27.837
		(41, 50]	165	35.332
		(51, 60]	117	25.054
2	Gender	Male	248	53.105
		Female	219	46.895
3	Education	High school and less	154	32.976
		Degree	196	41.97
		Master	84	17.987
		PhD and above	33	7.066
4	Family Demography	1~2	105	22.484
		3~5	254	54.39
		5 above	108	23.126
		Single	77	16.488
5	Marital	Married	158	33.833
		Divorced	175	37.473
		Others	57	12.206
		Student	4	0.857
6	Occupation	Enterprise employee	214	45.824
		Enterprise manager	23	4.925
		Government sector	20	4.283
		Academician	33	7.066
		CEO/COO	5	1.071
		Top manager	27	5.782
		Middle manager	48	10.278
		Supervisor	3	0.642
		Professional	7	1.499
		Engineer	78	16.702
7	Income	Other	5	1.071
		3000 or less	84	17.987
		(3000, 8000]	105	22.484
		(8001, 15,000]	154	32.976
		15,000 or above	82	17.559
		Unemployed or prefer not to say	42	8.994

4.1. Measurement Model Assessment

Reliability and Validity of Measurement Instruments

The metric reliability of the measurement model is measured by looking at the project load. According to the effectiveness guidelines, when each item has a payload of at least

0.7, it has satisfactory indicator reliability and is significant at a significant level of at least 5%. According to PLS-SEM analysis, all projects showed as Table 13 a load of more than 0.7. Therefore, all indicators are reliable.

According to existing studies, Cronbach's alpha coefficient and combination reliability must be greater than 0.7. The data analysis results show that the Cronbach's alpha of each potential variable in this study was greater than the threshold value, ranging from 0.859 to 0.944, and all were greater than 0.7, indicating good internal consistency as the Table 14. of the model in this study.

Table 13. Indicator reliability of the items.

Path	OS	SM	SD	t	p Values
AT1 <- AT	0.85	0.84	0.01	60.40	0.00
AT2 <- AT	0.82	0.82	0.02	51.22	0.00
AT3 <- AT	0.80	0.80	0.02	43.74	0.00
AT4 <- AT	0.82	0.82	0.02	50.62	0.00
AT5 <- AT	0.83	0.83	0.01	57.95	0.00
BB1 <- BB	0.85	0.85	0.01	60.02	0.00
BB2 <- BB	0.83	0.83	0.02	54.45	0.00
BB3 <- BB	0.82	0.82	0.01	57.98	0.00
BB4 <- BB	0.84	0.84	0.01	62.75	0.00
BB5 <- BB	0.81	0.81	0.02	53.05	0.00
BB6 <- BB	0.84	0.84	0.01	61.35	0.00
BB7 <- BB	0.84	0.83	0.02	56.83	0.00
BB8 <- BB	0.83	0.82	0.02	52.54	0.00
BB9 <- BB	0.82	0.82	0.02	49.78	0.00
CB1 <- CB	0.79	0.79	0.02	48.93	0.00
CB2 <- CB	0.80	0.80	0.02	45.91	0.00
CB3 <- CB	0.80	0.80	0.02	44.56	0.00
CB4 <- CB	0.80	0.80	0.02	45.18	0.00
CB5 <- CB	0.78	0.78	0.02	43.77	0.00
CB6 <- CB	0.77	0.76	0.02	34.40	0.00
CB7 <- CB	0.83	0.82	0.02	55.44	0.00
CB8 <- CB	0.80	0.80	0.02	43.13	0.00
CB9 <- CB	0.79	0.79	0.02	41.96	0.00
EC1 <- EC	0.82	0.82	0.02	47.78	0.00
EC2 <- EC	0.82	0.82	0.02	46.95	0.00
EC3 <- EC	0.81	0.81	0.02	43.47	0.00
EC4 <- EC	0.83	0.83	0.02	47.98	0.00
EC5 <- EC	0.78	0.78	0.02	36.39	0.00
EK1 <- EK	0.80	0.80	0.02	44.95	0.00
EK2 <- EK	0.79	0.78	0.02	37.38	0.00
EK3 <- EK	0.82	0.82	0.02	51.28	0.00
EK4 <- EK	0.80	0.80	0.02	45.07	0.00
EK5 <- EK	0.81	0.81	0.02	50.92	0.00
EK6 <- EK	0.81	0.81	0.02	47.08	0.00
NB1 <- NB	0.83	0.83	0.02	55.67	0.00
NB2 <- NB	0.82	0.82	0.02	54.47	0.00
NB3 <- NB	0.82	0.82	0.01	58.14	0.00
NB4 <- NB	0.83	0.83	0.02	52.69	0.00
NB5 <- NB	0.82	0.82	0.01	58.25	0.00
NB6 <- NB	0.80	0.80	0.02	47.03	0.00
NB7 <- NB	0.84	0.84	0.01	64.22	0.00
NB8 <- NB	0.82	0.82	0.02	55.88	0.00
NB9 <- NB	0.80	0.80	0.02	47.10	0.00
PBC1 <- PBC	0.80	0.80	0.02	40.10	0.00
PBC2 <- PBC	0.79	0.79	0.02	43.21	0.00
PBC3 <- PBC	0.82	0.82	0.02	51.12	0.00
PBC4 <- PBC	0.80	0.80	0.02	46.30	0.00
PBC5 <- PBC	0.80	0.80	0.02	43.43	0.00
PBC6 <- PBC	0.82	0.82	0.02	48.45	0.00
PI1 <- PI	0.88	0.88	0.01	74.38	0.00
PI2 <- PI	0.87	0.87	0.01	81.64	0.00
PI3 <- PI	0.87	0.86	0.01	65.93	0.00
PI4 <- PI	0.87	0.87	0.01	73.95	0.00
PR1 <- PR	0.86	0.86	0.02	51.22	0.00
PR2 <- PR	0.84	0.84	0.02	45.10	0.00
PR3 <- PR	0.86	0.86	0.02	50.78	0.00
PR4 <- PR	0.88	0.88	0.01	68.80	0.00
PR5 <- PR	0.85	0.85	0.02	56.20	0.00
PV1 <- PV	0.83	0.82	0.03	31.47	0.00
PV2 <- PV	0.83	0.83	0.02	43.10	0.00
PV3 <- PV	0.83	0.83	0.02	38.52	0.00
PV4 <- PV	0.82	0.82	0.02	37.40	0.00
PV5 <- PV	0.83	0.83	0.02	45.32	0.00
SN1 <- SN	0.84	0.84	0.02	57.54	0.00
SN2 <- SN	0.84	0.83	0.02	49.97	0.00
SN3 <- SN	0.85	0.85	0.01	60.25	0.00
SN4 <- SN	0.83	0.83	0.02	48.91	0.00

Combinatorial reliability refers to the degree to which a group of items consistently measure the underlying structure. If the composite reliability value is at least 0.7, then convergence validity holds. According to the Table 15. below, the overall reliability of the certified structure ranges from 0.904 to 0.953.

Table 14. Internal consistency of the construct.

	Cronbach's Alpha
AT	0.882
BB	0.944
CB	0.927
EC	0.871
EK	0.89
NB	0.939
PBC	0.894
PI	0.893
PR	0.911
PV	0.884
SN	0.859

Table 15. Composite reliability of the construct.

	Composite Reliability (rho c)
AT	0.914
BB	0.953
CB	0.939
EC	0.907
EK	0.916
NB	0.949
PBC	0.919
PI	0.926
PR	0.934
PV	0.915
SN	0.904

4.2. Structural Model Assessment

4.2.1. Variance Inflation Factor (VIF)

Collinearity refers to the non-independence of predictor variables, usually in regression-type analysis. It is a common feature of any descriptive ecological data set and can be a problem for parameter estimation because it inflates the variance of regression parameters, potentially leading to the wrong identification of relevant predictors in a statistical model. Many statistical routines, notably those most used in ecology, are sensitive to collinearity [96,97]. Parameter estimates may be unstable, standard errors on estimates may be inflated, and, consequently, inference statistics may be biased. A VIF value above five should be identified as a potential collinearity problem. Based on the finding in Table 16, there is no collinearity among the construction since the value of VIF is between 1 and 1.589.

Table 16. The collinearity of the construction.

Variance Inflation Factor (VIF)	
AT -> PI	1.565
BB -> AT	1
CB -> PBC	1
EC -> PI	1.589
EC -> PV	1.185
EK -> PI	1.47
EK -> PV	1.222
NB -> SN	1
PBC -> PI	1.419
PR -> PI	1.234
PR -> PV	1.131

4.2.2. Coefficient of Determination (R²)

In 1998, Chin suggested that R² values of 0.67, 0.33, and 0.19 are substantial, moderate, and weak, respectively. According to Barclay, Higgins, and Thompson (1995) [98], the R² values of the endogenous constructs measure the model's predictive power. The Table 17. shown the R squares of AT 0.214 (moderate), PBC 0.123 (weak), PI 0.477 (substantial), PV 0.349 (significant), and SN 0.217 (moderate) are indicated in the Table 17 provided.

Table 17. R square of the construct.

	R-Square	R-Square Adjusted
AT	0.214	0.212
PBC	0.123	0.121
PI	0.477	0.469
PV	0.349	0.345
SN	0.217	0.215

4.2.3. The Effect Size f²

Cohen (1998) [99] was credited with evaluating the f². According to Cohen, f² is utilised to examine the predictor construct's relative impact on the endogenous construction. To attain this Table 18, the f² examines the strength of an exogenous contribution to elaborate a given construction concerning the R². Ideally, a given predecessor construct is used to estimate the R², where the R² can be lower when one of the predecessor constructs is eliminated or excluded. Therefore, the R² difference values when ascertaining the model with and without the predecessor constructs are typically called the effect size. Cohen (1998) [99] suggests a threshold of 0.35, 0.15, and 0.2 as large, medium, and trim. Moreover, when an exogenous construct firmly explains an endogenous construction, the difference between the excluded and included R² ought to be high, thus contributing to a high f².

Table 18. F square of the construct.

	AT	PBC	PI	PV	SN
AT			0.028 (s)		
BB	0.272 (m)				
CB		0.141 (s)			
EC			0.022 (s)	0.125 (s)	
EK			0.019 (s)	0.111 (s)	
NB					0.277 (m)
PBC			0.019 (s)		
PI					
PR			0.039 (s)	0.047 (s)	
PV			0.033 (s)		
SN			0.037 (s)		

4.2.4. Predictive Relevance (Q2)

Q2 values are measures of the model's predictive relevance [100]. Smart-PLS uses a blindfolding procedure with a cross-validated approach to calculate Q2 values as shown in Table 19. Q2 values larger than zero for a specific reflective endogenous latent variable are indicative of the path model's relevance to that construction. The PLS calculation measures the model's predictive relevance of the exogenous construct [100]. Based on the results, the model must have predictive relevance, as the values of Q2 are more significant than zero. As shown, construct cross-validated redundancy ranges between 0.079 and 0.355, while construct cross-validated communality ranges between 0.495 and 0.581.

Table 19. Predictive relevance of the construction.

	Construct Cross-Validated Redundancy	Construct Cross-Validated Communality
AT	0.143	0.515
PBC	0.079	0.509
PI	0.355	0.581
PV	0.236	0.519
SN	0.150	0.495

5. Discussions and Conclusions

5.1. Discussions

Through the research and analysis of the above data as shown in Figure 4, including conditional valuation methods and structural equation models, we used the TPB to measure respondents' willingness to purchase NEVs. A questionnaire survey was adopted to estimate the relevant values and determine the desire to acquire. The perceived value model was used to deduce the perceived value effect of respondents on NEVs. The simple model and interaction model were derived and discussed. The results showed in the Table 20. that both R2 and f2 were increased. This means that interaction models have higher accuracy and improvements than simple models. In terms of analysis, the consumer feedback data response model fit the data studied, and most of the assumptions were accepted. The results showed that the test results were consistent with the theory. This study found that considerable preference heterogeneity should be considered if we design to provide NEV preferences. This could be helpful information for the industry as consumers face income restraints and expensive green vehicle maintenance. Therefore, they should prioritise providing services and facilities related to environmentally friendly vehicles. For example, if NEV charging stations are needed in certain areas, industries and governments should consider providing such facilities. Estimated costs should be prioritised to ensure beneficial and positive returns for both parties. All of the findings and analyses were used to achieve the objectives of this research.

Comparing these findings with previous studies, this research highlights the significance of preference heterogeneity in designing NEV-related policies. Prior research suggests that consumers face financial constraints and high green vehicle maintenance costs, necessitating industry and government support to develop appropriate infrastructure, such as expanding charging networks. For example, studies by Wang et al. (2020) and Zhang and Li (2021) emphasise that charging convenience significantly affects consumer adoption of NEVs. This study aligns with their findings, reinforcing the fact that policymakers should prioritise cost-effective infrastructure solutions to facilitate adoption. Moreover, consumer awareness regarding NEV value perception continuously evolves, influencing market adoption rates. Studies such as those by Li et al. (2019) argued that perceived value, including environmental benefits and financial savings, plays a crucial role in con-

sumer decision making. This study builds upon prior research by further analysing the specific perceived value components that shape NEV purchase intentions. It suggests that a structured approach—including diverse consumer experiences and SMARTPLS-based data evaluations—can help refine existing frameworks to align with evolving consumer expectations. The findings also support the role of marketing strategies in driving NEV adoption. Previous studies, such as those by Kim et al. (2018), highlight the impact of green marketing and consumer trust in shaping sustainable purchasing behaviour. This study extends these insights by showing that integrating a green marketing mix—encompassing environmental knowledge, perceived value, and perceived risk—can enhance consumer engagement and confidence in NEVs. Unlike traditional marketing approaches, NEV marketing requires a strong alignment with sustainability principles to reinforce positive consumer perceptions. Furthermore, this research underscores the role of psychological and behavioural factors, corroborating findings from prior studies on consumer behaviour. Studies such as those by Ajzen (1991) and Steg and Vlek (2009) emphasised the importance of attitudes, subjective norms, and perceived behavioural control in shaping pro-environmental behaviours. By integrating these factors within the TPB framework, this study expands upon their conclusions, demonstrating that a comprehensive understanding of consumer psychology is essential for fostering NEV adoption.

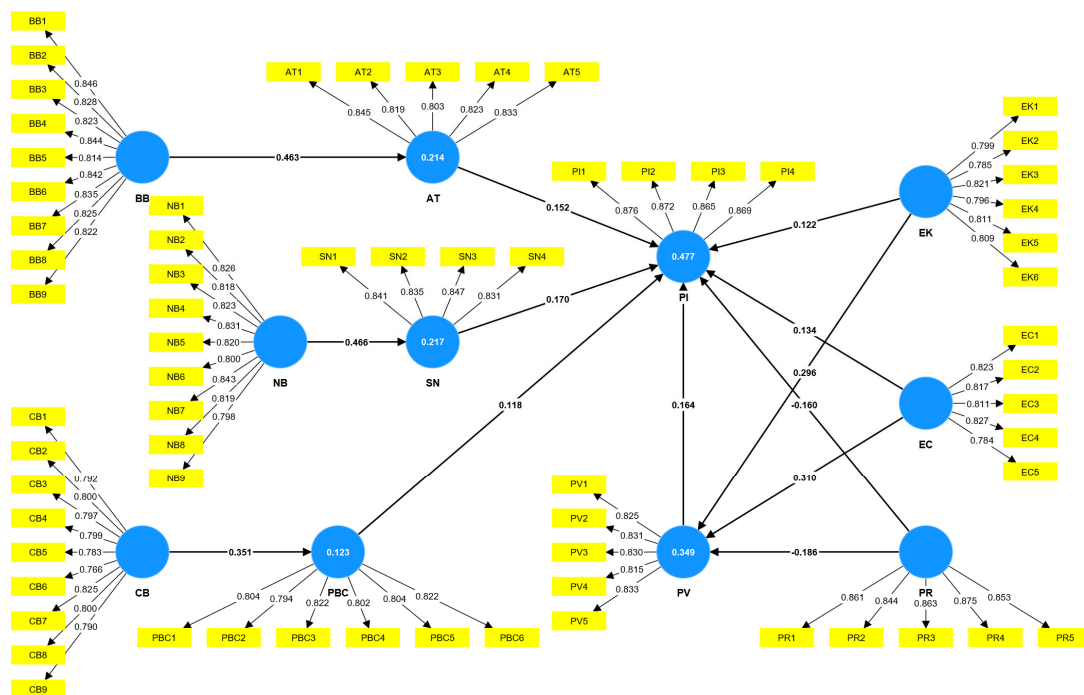


Figure 4. The forces on an EWL of a simplified case.

Table 20. Direct and indirect results.

Path	OS	SM	SD	Value	<i>p</i> Value	95%CI	Result
PR -> PV -> PI	−0.031	−0.031	0.012	2.511	0.012	[−0.059, −0.011]	Accepted
EC -> PV -> PI	0.051	0.051	0.018	2.808	0.005	[0.019, 0.091]	Accepted
EK -> PV -> PI	0.049	0.048	0.017	2.879	0.004	[0.019, 0.087]	Accepted

The results of previous studies on green purchase intentions are significant, which supports the belief that green purchase intention is a sufficient representative of green consumption behaviour. This shows that promoting the positive intentions of consumers should be the primary goal of NEVs because the intentions indicate the actual behaviour of

consumers. Therefore, if the NEV industry wants to enhance consumers' green purchase intentions, given the importance of marketing to enterprises, this study suggests that NEVs use a green marketing mix as one of the essential marketing tools to stimulate consumers' green purchase intentions. Subsequently, marketing enables enterprises to tap into key trends and meet consumers' needs and aspirations, indicating that the product is valuable to them. These explain why NEVs need to consider the influencing factors to penetrate the green market successfully. Unlike the traditional market sales mix, the scope of the green marketing mix of NEVs requires apparent compliance with the principle of sustainability. At the same time, all the variables in the marketing mix must fit together in one direction to convey the same signal to consumers. This study reveals that all green marketing mix variables (i.e., environmental knowledge, environmental concerns, perceived value, perceived risk, beliefs, attitudes, and perceived behavioural control) are essential in explaining consumers' pro-NEV purchase intentions. The strength of the overall concept of the comprehensive research framework of influencing factors is highly dependent on how NEV-related participants modify these variables, as mentioned earlier.

5.2. Contributions of This Study

This study's contribution is of excellent significance for studying the changing business environment, especially green products in the economy. This investigation endeavours to make a theoretical contribution to the body of knowledge concerning consumer behaviour. Regarding management contributions, this study furnishes practitioners and decision-makers with a comprehensive set of management guidelines.

This study significantly contributes to understanding consumer intentions toward NEVs by validating and extending the Theory of Planned Behaviour (TPB). It demonstrates the TPB's suitability as a framework for quantifying and experimentally determining factors influencing environmentally conscious purchasing. By incorporating environmental knowledge, concerns, and beliefs, this research advances the TPB model, addressing gaps in the literature and offering a nuanced psychological perspective.

The study integrates the TPB and PR theory and perceived value theory alongside the TPB to develop a comprehensive framework, explaining the determinants of green purchasing intentions and their interplay. This multidisciplinary approach highlights the critical role of green marketing mix variables—such as product attributes, price, perceived value, and psychological factors—in shaping consumer behaviour. It provides actionable insights into overcoming challenges like consumer acceptance and familiarity with NEV technologies.

By conceptualising NEVs as distinct from traditional transport modes, this work refines the theoretical mechanisms underlying environmentally responsible behaviour. Its findings underscore the importance of all examined variables, collectively and individually, in influencing pro-environmental purchase intentions. As one of the pioneering studies to explore these dimensions cohesively, it sets a foundation for future research while offering practical guidance for expanding NEV markets.

This study's originality lies in its methodological rigour and theoretical innovation. It expands the TPB into new contexts while maintaining clarity, simplicity, and applicability. It reaffirms and extends the TPB's assumptions, demonstrating its relevance in diverse pro-environmental decision-making scenarios, thereby contributing meaningfully to the academic corpus and the green transportation sector.

5.3. Limitations of This Study

The limitation of this study is its focus on the extended Theory of Planned Behaviour (TPB) while primarily examining perceived risk (PR) and perceived value (PV) as internal

mechanisms influencing consumer intention. Other potential psychological, social, or economic factors that may impact NEV purchase intention were not explored in depth. Additionally, this study's scope was limited to the Chinese market, which might have restricted the generalizability of the findings to other cultural or economic contexts. Future research could incorporate a broader range of influencing factors and conduct cross-cultural comparisons to enhance the applicability of the results.

Author Contributions: Methodology, X.H.; software, X.H.; formal analysis, X.H.; writing—original draft, X.H.; writing—review and editing, X.H.; visualisation, X.H.; supervision, R.N.R.Y. and Z.D.M.; project administration, R.N.R.Y. and Z.D.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived for this study due to relevant regulations of Universiti Putra Malaysia (https://tncpi.upm.edu.my/upload/dokumen/20240129150803SOP_2_PROTOCOL_REVIEW.pdf) (accessed on 15 October 2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Acknowledgments: We extend our heartfelt appreciation to School of Business and Economics, Universiti Putra Malaysia, and Fei Xiaotao from Department of Automobile Engineering, Jiangsu Vocational College of Electronics and Information, and X.H. for his and her guidance on paper edition and manuscript submission.

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

Abbreviations

NEVs	New Energy Vehicles
TPB	Theory of Planned Behaviour
GEO	Global Environment Outlook
IBRD	International Bank for Reconstruction and Development
ICCT	International Council on Clean Transportation
IEA	International Energy Agency
OECD	Organisation for Economic Cooperation and Development
OICA	International Organization of Motor Vehicle Manufacturers
PCA	Paris Climate Agreement
TAM	Technology Acceptance Model
GHG	Global Greenhouse Gas

References

1. Sostar, M.; Ristanovic, V. Assessment of Influencing Factors on Consumer Behavior Using the AHP Model. *Sustainability* **2023**, *15*, 10341. [\[CrossRef\]](#)
2. Zhuang, W.; Luo, X.; Riaz, M.U. On the Factors Influencing Green Purchase Intention: A Meta-Analysis Approach. *Front. Psychol.* **2021**, *12*, 644020. [\[CrossRef\]](#) [\[PubMed\]](#)
3. Ansu-Mensah, P. Green product awareness effect on green purchase intentions of university students': An emerging market's perspective. *Future Bus. J.* **2021**, *7*, 48. [\[CrossRef\]](#)
4. Škatarić, G.; Vlahović, B.; Užar, D.; Spalevic, V.; Novičević, R. The influence of green marketing on consumer environmental awareness. *J. Agric. For.* **2021**, *67*, 21–36. [\[CrossRef\]](#)
5. Adam, D. How far will global population rise? Researchers can't agree. *Nature* **2021**, *597*, 462–465. [\[CrossRef\]](#)
6. Daszkiewicz, T. Food Production in the Context of Global Developmental Challenges. *Agriculture* **2022**, *12*, 832. [\[CrossRef\]](#)

7. Sovacool, B.K.; Bergman, N.; Hopkins, D.; Jenkins, K.E.; Hielscher, S.; Goldthau, A.; Brossmann, B. Imagining sustainable energy and mobility transitions: Valence, temporality, and radicalism in 38 visions of a low-carbon future. *Soc. Stud. Sci.* **2020**, *50*, 642–679. [CrossRef]
8. Gansser, O.A.; Reich, C.S. Influence of the New Ecological Paradigm (NEP) and environmental concerns on pro-environmental behavioral intention based on the Theory of Planned Behavior (TPB). *J. Clean. Prod.* **2023**, *382*, 134629. [CrossRef]
9. Wang, Z.X.; Jantan, A.H.B.; Wu, R.X.; Gong, Y.; Cao, M.R.; Wong, P.P.W.; Wang, L. Exploring consumers' intention toward domestic energy-saving vehicles: Some insights from China. *Front. Psychol.* **2022**, *13*, 927709. [CrossRef]
10. Wang, H.; Gui, H.; Ren, C.; Liu, G. Factors Influencing Urban Residents' Intention of Garbage Sorting in China: An Extended TPB by Integrating Expectancy Theory and Norm Activation Model. *Sustainability* **2021**, *13*, 12985. [CrossRef]
11. Chen, Z.; Zhang, K.; Jia, S. Influence factors and risk analysis of new energy vehicles from the perspective of system. *Environ. Sci. Pollut. Res.* **2021**, *28*, 62891–62906. [CrossRef] [PubMed]
12. Hu, H.; Dong, W.; Zhou, Q. A comparative study on the environmental and economic effects of a resource tax and carbon tax in China: Analysis based on the computable general equilibrium model. *Energy Policy* **2021**, *156*, 112460. [CrossRef]
13. Sovacool, B.K.; Abrahamse, W.; Zhang, L.; Ren, J. Pleasure or profit? Surveying the purchasing intentions of potential electric vehicle adopters in China. *Transp. Res. Part A Policy Pract.* **2019**, *124*, 69–81. [CrossRef]
14. Gallo, M.; Marinelli, M. Sustainable mobility: A review of possible actions and policies. *Sustainability* **2020**, *12*, 7499. [CrossRef]
15. Alanazi, F.; Alenezi, M. Driving the future: Leveraging digital transformation for sustainable transportation. *J. Infrastruct. Policy Dev.* **2024**, *8*, 3085. [CrossRef]
16. Shin, J.; Badgwell, T.A.; Liu, K.H.; Lee, J.H. Reinforcement Learning—Overview of recent progress and implications for process control. *Comput. Chem. Eng.* **2019**, *127*, 282–294. [CrossRef]
17. Liu, Y.; Chen, L.; Huang, C. Study on the Carbon Emission Spillover Effects of Transportation under Technological Advancements. *Sustainability* **2022**, *14*, 10608. [CrossRef]
18. The History of the Electric Car. Energy.gov. Available online: <https://www.energy.gov/articles/history-electric-car> (accessed on 20 December 2024).
19. Kumaradeepan, V.; Azam, S.; Tham, J. Factors Influencing of Social Media on Consumer Perception and Purchase Intention Towards Brand Loyalty: A Conceptual Paper. *Int. J. Prof. Bus. Rev.* **2023**, *8*, e01571. [CrossRef]
20. Tsou, C.T. Deciphering the accelerated expansion of China's NEV sector post-2020: A cross-system analysis using multi-level perspective. *Sci. Public Policy* **2024**, *52*, 32–49. [CrossRef]
21. Xie, R.; An, L.; Yasir, N. How Innovative Characteristics Influence Consumers' Intention to Purchase Electric Vehicle: A Moderating Role of Lifestyle. *Sustainability* **2022**, *14*, 4467. [CrossRef]
22. Alanazi, F. Development of Smart Mobility Infrastructure in Saudi Arabia: A Benchmarking Approach. *Sustainability* **2023**, *15*, 3158. [CrossRef]
23. More Alarm Bells Sound on Slowing Demand for Electric Vehicles-Business Today. Available online: <https://www.businesstoday.in/auto/story/more-alarm-bells-sound-on-slowing-demand-for-electric-vehicles-403290-2023-10-26> (accessed on 20 December 2024).
24. Saud, M.K.; Hasan, Z.; Saud, Z. A Conceptual Paper on the Effects of Green Intellectual Capital on Business Sustainability. *Inf. Manag. Bus. Rev.* **2023**, *15*, 231–238. [CrossRef]
25. Zahoor, A.; Yu, Y.; Zhang, H.; Nihed, B.; Afrane, S.; Peng, S.; Sapi, A.; Lin, C.J.; Mao, G. Can the new energy vehicles (NEVs) and power battery industry help China to meet the carbon neutrality goal before 2060? *J. Environ. Manag.* **2023**, *336*, 117663. [CrossRef] [PubMed]
26. Immonen, A.; Kiljander, J.; Aro, M. Consumer viewpoint on a new kind of energy market. *Electr. Power Syst. Res.* **2020**, *180*, 106153. [CrossRef]
27. Tjoe, T.; Samsul Bahri, R.; Alamsyah, D.; Ghofar, K.; Rohaeni, H. Perceived Value Mediation Model to Improve Customer Expectation and Loyalty. In Proceedings of the 2nd South American International Conference on Industrial Engineering and Operations Management, Sao Paulo, Brazil, 5–8 April 2021; pp. 1210–1215. [CrossRef]
28. Wang, C.; Sinha, P.N.; Zhang, X.; Wang, S.; Lee, Y.K. The impact of NEV users' perceived benefits on purchase intention. *Travel Behav. Soc.* **2024**, *34*, 100681. [CrossRef]
29. Ajzen, I.; Driver, B.L. Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the theory of planned behavior. *Leis. Sci.* **1991**, *13*, 185–204. [CrossRef]
30. Sanchez-Fernandez, R.; Iniesta-Bonillo, M.A. The concept of perceived value: A systematic review of the research. *Mark. Theory* **2007**, *7*, 427–451. [CrossRef]
31. Maccioni, L.; Borgianni, Y.; Basso, D. Value Perception of Green Products: An Exploratory Study Combining Conscious Answers and Unconscious Behavioral Aspects. *Sustainability* **2019**, *11*, 1226. [CrossRef]
32. Cao, H.; Li, F.; Zhao, K.; Qian, C.; Xiang, T. From value perception to behavioural intention: Study of Chinese smallholders' pro-environmental agricultural practices. *J. Environ. Manag.* **2022**, *315*, 115179. [CrossRef]

33. Aufa, A.; Gunanto, E. The Influence of Perceived Risk and Loyalty on Purchase Intention of Fashion Products Based on the Theory of Perceived Risk. *J. Ekon. Akunt. Dan Manaj.* **2023**, *22*, 67. [CrossRef]
34. Wang, Z.; Zhang, J.; Zhao, H. The Selection of Green Technology Innovations under Dual-Credit Policy. *Sustainability* **2020**, *12*, 6343. [CrossRef]
35. Slovic, P. Perception of Risk. *Science* **1987**, *236*, 280–285. [CrossRef]
36. Gunawardane, N.; Dk, T. The effect of perceived risk on the purchase intention of electric vehicles: An extension to the technology acceptance model. *Int. J. Electr. Hybrid Veh.* **2019**, *11*, 73. [CrossRef]
37. Miller, M.C. The Role of Beliefs in Identifying Rising Powers. *Chin. J. Int. Politics* **2016**, *9*, 211–238. [CrossRef]
38. Institute, Investments & Wealth. The Human Side of Decision Making: Thinking Things Through with Daniel Kahneman, PhD. *J. Invest. Consult.* **2012**, *13*, 5–14. Available online: <https://ssrn.com/abstract=2144471> (accessed on 7 February 2025).
39. Ajzen, I.; Fishbein, M. *Understanding Attitudes and Predicting Social Behavior*; Prentice-Hall: Saddle River, NJ, USA, 1980; Available online: <https://api.semanticscholar.org/CorpusID:142061533> (accessed on 7 February 2025).
40. Chaturvedi, P.; Kulshreshtha, K.; Tripathi, V.; Agnihotri, D. Exploring consumers' motives for electric vehicle adoption: Bridging the attitude–behavior gap. *Benchmarking Int. J.* **2023**, *30*, 4174–4192. [CrossRef]
41. Michie, S.; Johnston, M. Behavior Change Techniques. In *Encyclopedia of Behavioral Medicine*; Gellman, M.D., Turner, J.R., Eds.; Springer: New York, NY, USA, 2013; pp. 182–187. [CrossRef]
42. Ajzen, I.; Gilbert Cote, N. Attitudes and the prediction of behavior. In *Attitudes and Attitude Change*; Psychology Press: East Sussex, UK, 2008; pp. 289–311.
43. Social Perception | 3 | Social Psychology Through Experiment | Henri T. Available online: <https://www.taylorfrancis.com/chapters/edit/10.4324/9781315727929-3/social-perception-henri-tajfel> (accessed on 20 December 2024).
44. Lefkowitz, J. The constancy of ethics amidst the changing world of work. *Hum. Resour. Manag. Rev.* **2006**, *16*, 245–268. [CrossRef]
45. Kahneman, D.; Tversky, A. Variants of uncertainty. *Cognition* **1982**, *11*, 143–157. [CrossRef]
46. Cheng, S.; Lam, T. The role of the customer–seller relationship in the intention of the customer to complain: A study of Chinese restaurateurs. *Int. J. Hosp. Manag.* **2008**, *27*, 552–562. [CrossRef]
47. Wei, L.C. How Effectively Does Social Media Influence Malaysian Consumers to Purchase Electronic Vehicles (EVs) Using the Engel-Blackwell-Miniard Model (EBM). Ph.D. Thesis, Universiti Tunku Abdul Rahman (UTAR), Petaling Jaya, Malaysia, 2023.
48. Souza, J.; Tondolo, V.; Sarquis, A.; Longaray, A.; Tondolo, R.; Costa, L. Effect of perceived value, risk, attitude and environmental consciousness on the purchase intention. *Int. J. Bus. Environ.* **2020**, *11*, 11–31. [CrossRef]
49. Lin, B.; Shi, L. Identify and bridge the intention-behavior gap in new energy vehicles consumption: Based on a new measurement method. *Sustain. Prod. Consum.* **2022**, *31*, 432–447. [CrossRef]
50. Xu, Y.; Du, J.; Khan, M.A.S.; Jin, S.; Altaf, M.; Anwar, F.; Sharif, I. Effects of Subjective Norms and Environmental Mechanism on Green Purchase Behavior: An Extended Model of Theory of Planned Behavior. *Front. Environ. Sci.* **2022**, *10*, 779629. [CrossRef]
51. Zhao, J.; Su, Y.; Fang, M.; Su, M. Embracing new energy vehicles: An empirical examination of female consumer perspectives. *J. Retail. Consum. Serv.* **2024**, *80*, 103925. [CrossRef]
52. Bredahl, L.; Grunert, K.G.; Fertin, C. Relating consumer perceptions of pork quality to physical product characteristics. *Food Qual. Prefer.* **1998**, *9*, 273–281. [CrossRef]
53. Kian, T.P.; Chia, L.H. Consumer Purchase Intention for Organic Personal Care Product. *GATR J. Manag. Mark. Rev.* **2021**, *6*, 213–221. [CrossRef]
54. Barbarossa, C.; De Pelsmacker, P. Positive and Negative Antecedents of Purchasing Eco-friendly Products: A Comparison Between Green and Non-green Consumers. *J. Bus. Ethics* **2016**, *134*, 229–247. [CrossRef]
55. Jiménez-Parra, B.; Rubio, S.; Vicente-Molina, M.A. Key drivers in the behavior of potential consumers of remanufactured products: A study on laptops in Spain. *J. Clean. Prod.* **2014**, *85*, 488–496. [CrossRef]
56. He, X.; Zhan, W. How to activate moral norm to adopt electric vehicles in China? An empirical study based on extended norm activation theory. *J. Clean. Prod.* **2018**, *172*, 3546–3556. [CrossRef]
57. Stern, P.C. Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues* **2000**, *56*, 407–424. [CrossRef]
58. Liu, P.; Teng, M.; Han, C. How does environmental knowledge translate into pro-environmental behaviors?: The mediating role of environmental attitudes and behavioral intentions. *Sci. Total Environ.* **2020**, *728*, 138126. [CrossRef]
59. Kang, W. Residence and Education Moderate the Longitudinal Association between Environmental Concern (EC) and Proenvironmental Behavior. *Sustainability* **2022**, *14*, 14716. [CrossRef]
60. Qomariah, A.; Prabawani, B. The Effects of Environmental Knowledge, Environmental Concern, and Green Brand Image on Green Purchase Intention with Perceived Product Price and Quality as the Moderating Variable. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *448*, 012115. [CrossRef]
61. Bocken, N.; Boons, F.; Baldassarre, B. Sustainable business model experimentation by understanding ecologies of business models. *J. Clean. Prod.* **2019**, *208*, 1498–1512. [CrossRef]

62. Laukkanen, M.; Tura, N. The potential of sharing economy business models for sustainable value creation. *J. Clean. Prod.* **2020**, *253*, 120004. [CrossRef]
63. Patala, S.; Jalkala, A.; Keränen, J.; Väisänen, S.; Tuominen, V.; Soukka, R. Sustainable value propositions: Framework and implications for technology suppliers. *Ind. Mark. Manag.* **2016**, *59*, 144–156. [CrossRef]
64. McIlroy, R.C.; Baden, D.A.; Brown, J.; Gauthier, S.M.; Swierczynski, J.; Wilks, S.A. Clean vs green: The impact of reading short stories on sustainable and healthy cleaning behaviours. *Discov. Sustain.* **2024**, *5*, 356. [CrossRef]
65. Sarkodie, S.A.; Strezov, V. Effect of foreign direct investments, economic development and energy consumption on greenhouse gas emissions in developing countries. *Sci. Total Environ.* **2019**, *646*, 862–871. [CrossRef]
66. Al-Shetwi, A.Q. Sustainable development of renewable energy integrated power sector: Trends, environmental impacts, and recent challenges. *Sci. Total Environ.* **2022**, *822*, 153645. [CrossRef]
67. Vidal, D.G.; Oliveira, G.M.; Pontes, M.; Maia, R.L.; Ferraz, M.P. The influence of social and economic environment on health. In *One Health*; Elsevier: Amsterdam, The Netherlands, 2022; pp. 205–229. [CrossRef]
68. Grebitus, C.; Printezis, I.; Printezis, A. Relationship between Consumer Behavior and Success of Urban Agriculture. *Ecol. Econ.* **2017**, *136*, 189–200. [CrossRef]
69. Miniero, G.; Codini, A.; Bonera, M.; Corvi, E.; Bertoli, G. Being green: From attitude to actual consumption. *Int. J. Consum. Stud.* **2014**, *38*, 521–528. [CrossRef]
70. Mayer, F.S.; Frantz, C.M. The connectedness to nature scale: A measure of individuals' feeling in community with nature. *J. Environ. Psychol.* **2004**, *24*, 503–515. [CrossRef]
71. Nisbet, E.K.L.; Gick, M.L. Can health psychology help the planet? Applying theory and models of health behaviour to environmental actions. *Can. Psychol. Psychol. Can.* **2008**, *49*, 296–303. [CrossRef]
72. D'Souza, C.; Wong, W.; Haber, N.E.; Brouwer, A.R.; Niininen, O. Online impulse purchases versus planned purchases and the role of visual attributes. *J. Glob. Fash. Mark.* **2024**, *15*, 504–522. [CrossRef]
73. Nekmahmud, M.; Fekete-Farkas, M. Why Not Green Marketing? Determinates of Consumers' Intention to Green Purchase Decision in a New Developing Nation. *Sustainability* **2020**, *12*, 7880. [CrossRef]
74. Ahmad, M.; Ahmed, Z.; Alvarado, R.; Hussain, N.; Khan, S.A. Financial development, resource richness, eco-innovation, and sustainable development: Does geopolitical risk matter? *J. Environ. Manag.* **2024**, *351*, 119824. [CrossRef]
75. Wang, B.; Wang, X.; Guo, D.; Zhang, B.; Wang, Z. Analysis of factors influencing residents' habitual energy-saving behaviour based on NAM and TPB models: Egoism or altruism? *Energy Policy* **2018**, *116*, 68–77. [CrossRef]
76. Loock, C.M.; Staake, T.; Thiesse, F. Motivating Energy-Efficient Behavior With Green Is: An Investigation of Goal Setting and the Role of Defaults. *MIS Q.* **2013**, *37*, 1313–1332. [CrossRef]
77. Muraguri, E.K.; Jin, S.; Samake, A. Modeling the role of perceived green value and consumer innovativeness in green products' consumption intention within the theory of planned behavior. *Sustinere J. Environ. Sustain.* **2020**, *4*, 94–116. [CrossRef]
78. Zeithaml, V.A. Service Quality, Profitability, and the Economic Worth of Customers: What We Know and What We Need to Learn. *J. Acad. Mark. Sci.* **2000**, *28*, 67–85. [CrossRef]
79. Wichmann, J.R.K.; Uppal, A.; Sharma, A.; Dekimpe, M.G. A global perspective on the marketing mix across time and space. *Int J. Res. Mark.* **2022**, *39*, 502–521. [CrossRef]
80. Bukhari, S.A. Sample Size Determination Using Krejcie and Morgan Table; 2021. Available online: https://www.researchgate.net/publication/349118299_Sample_Size_Determination_Using_Krejcie_and_Morgan_Table (accessed on 7 February 2025).
81. Ajzen, I. Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior. *J. Appl. Soc. Psychol.* **2002**, *32*, 665–683. [CrossRef]
82. Hoque, M.Z.; Hossan, A. Understanding the Influence of Belief and Belief Revision on Consumers' Purchase Intention of Liquid Milk. *SAGE Open* **2020**, *10*, 2158244020922972. [CrossRef]
83. Yadav, R.; Pathak, G.S. Determinants of Consumers' Green Purchase Behavior in a Developing Nation: Applying and Extending the Theory of Planned Behavior. *Ecol. Econ.* **2017**, *134*, 114–122. [CrossRef]
84. Alcalde-Rabanal, J.; Nieto, C.; Carriedo, A.; Mena, C.; Barquera, S. Behavioral and normative beliefs that influence Mexican consumers to purchase packaged food in urban supermarkets. *Salud Pública México* **2022**, *64*, 280–289. [CrossRef]
85. Hauslbauer, A.L.; Schade, J.; Drexler, C.E.; Petzoldt, T. Extending the theory of planned behavior to predict and nudge toward the subscription to a public transport ticket. *Eur. Transp. Res. Rev.* **2022**, *14*, 5. [CrossRef]
86. Blue, C.L.; Marrero, D.G. Psychometric Properties of the Healthful Eating Belief Scales for Persons at Risk of Diabetes. *J. Nutr. Educ. Behav.* **2006**, *38*, 134–142. [CrossRef]
87. Kamalanon, P.; Chen, J.S.; Le, T.T.Y. "Why Do We Buy Green Products?" An Extended Theory of the Planned Behavior Model for Green Product Purchase Behavior. *Sustainability* **2022**, *14*, 689. [CrossRef]
88. Shalender, K.; Sharma, N. Using extended theory of planned behaviour (TPB) to predict adoption intention of electric vehicles in India. *Environ. Dev. Sustain.* **2021**, *23*, 665–681. [CrossRef]

89. Rusyani, E.; Lavuri, R.; Gunardi, A. Purchasing Eco-Sustainable Products: Interrelationship between Environmental Knowledge, Environmental Concern, Green Attitude, and Perceived Behavior. *Sustainability* **2021**, *13*, 4601. [[CrossRef](#)]
90. Tam, F.Y.; Lung, J.W.Y. Impact of COVID-19 and innovative ideas for a sustainable fashion supply chain in the future. *Foresight* **2023**, *25*, 225–248. [[CrossRef](#)]
91. Kim, N.; Lee, K. Environmental Consciousness, Purchase Intention, and Actual Purchase Behavior of Eco-Friendly Products: The Moderating Impact of Situational Context. *Int. J. Environ. Res. Public Health* **2023**, *20*, 5312. [[CrossRef](#)] [[PubMed](#)]
92. Zheng, S.; Liu, H.; Guan, W.; Yang, Y.; Li, J.; Fahad, S.; Li, B. Identifying Intention-Based Factors Influencing Consumers' Willingness to Pay for Electric Vehicles: A Sustainable Consumption Paradigm. *Sustainability* **2022**, *14*, 16831. [[CrossRef](#)]
93. Walsh, G.; Shiu, E.; Hassan, L.M. Replicating, validating, and reducing the length of the consumer perceived value scale. *J. Bus. Res.* **2014**, *67*, 260–267. [[CrossRef](#)]
94. Hu, X.; Yusof, R.N.R.; Mansor, Z.D. Research on the influence of consumer Perceived Value on the purchase of new energy vehicles. *Salud Cienc. Tecnol.-Ser. Conf.* **2024**, *3*, 921. [[CrossRef](#)]
95. Hermundsdottir, F.; Haneberg, D.H.; Aspelund, A. Analyzing the impact of COVID-19 on environmental innovations in manufacturing firms. *Technol. Soc.* **2022**, *68*, 101918. [[CrossRef](#)]
96. Stewart, G.W. Collinearity and Least Squares Regression. *Stat. Sci.* **1987**, *2*, 68–84. [[CrossRef](#)]
97. Chatfield, C. Model Uncertainty, Data Mining and Statistical Inference. *J. R. Stat. Soc. Ser. A Stat. Soc.* **1995**, *158*, 419–466. [[CrossRef](#)]
98. Barclay, D.; Thompson, R.; Higgins, C. The Partial Least Squares (PLS) Approach to Causal Modeling: Personal Computer Use as an Illustration. *Technol. Stud.* **1995**, *2*, 284–324.
99. Cohen, J. A Power Primer. *Psychol. Bull.* **1992**, *112*, 155–159. [[CrossRef](#)]
100. Sarstedt, M.; Ringle, C.; Hair, J. Partial Least Squares Structural Equation Modeling. In *Handbook of Market Research*; Springer: Berlin/Heidelberg, Germany, 2021; pp. 1–47. [[CrossRef](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.