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Supporting Environment Sustainability: Purchasing Intentions Relating to Battery Electric Vehicles in Taiwan

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Abstract: Global warming remains a prominent topic of discussion in numerous countries, with transportation being a key contributor to significant greenhouse gas emissions. To address this issue, governments and the automotive industry in advanced nations are actively promoting a shift from traditional gasoline cars to a variety of electric vehicles. This study adopts the Technology Acceptance Model and perceived value model as its theoretical framework, focusing on environmental awareness and customer experience to analyze the decisive factors influencing consumers' decisions to purchase battery electric vehicles. By employing a questionnaire survey design, a total of 322 valid responses were collected, and the findings indicate that environmental awareness and customer experience significantly impact perceived quality. Moreover, the study reveals that purchase intention is positively influenced by an enhanced user attitude towards battery electric vehicles. Consumers view these vehicles as valuable, influencing their willingness to purchase and shaping their post-use perceptions, whether positive or negative. To encourage greater adoption, automakers can focus on promoting environmental awareness and organizing more customer-centric experiential activities.

Keywords: environmental awareness; customer experience; technology acceptance model; perceived value model; battery electric vehicle

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1. Introduction

Global warming is the main issue facing many countries. Transportation is the largest fuel consumer in terms of greenhouse gas emissions [1]. The emergence of transportation challenges, notably encompassing issues like air pollution, traffic congestion, accidents, and excessive noise, has propelled a wave of technological advancements in the realm of vehicle innovation. Notably, significant strides in electric powertrains and autonomous driving stand as pivotal influencers in shaping the future landscape of mobility. Electric vehicles (EVs) have gained recognition as a compelling solution for fostering sustainable urban transportation. Their ability to curb reliance on oil, mitigate air pollution, and potentially yield substantial health and environmental advantages is widely acknowledged. Many nations have established targets and implemented policies aimed at widespread EV adoption, indicating a probable significant presence of EVs within future vehicle fleets.

Ülengin [2], Thøgersen and Ebsen [3] proposed that governments should prepare specific policies to immediately reduce transportation gas emissions in order to slow down climatic change. Orlov and Kallbekken [4] pointed out Norway as the most successful country in terms of promoting the use of battery electric vehicles because the government proposed "incentives" like free charging, free tolls, and free parking. In order to stimulate the purchasing of electric vehicles by consumers, the Taiwan government promoted preferential exempt vehicle license tax as well as free fuel tax and free vehicle license tax for purchasing battery electric vehicles [5]. The automotive industry is transforming with the

times, moving away from original gasoline cars to multi-type electric vehicles [6]. Wang and Dong [7] indicated that plug-in electric vehicles could effectively reduce transportation energy consumption and solve environmental pollution problems. Orlov and Kallbekken [4] indicated that, among types of electric vehicles in Norway, plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) could largely reduce greenhouse gas emissions and air pollution. Kim et al. [8] stated that battery electric vehicles would be a new choice for replacing gasoline cars in the global automotive industry, and the sales volume would be annually increased in many countries. Cox et al. [9] also pointed out the important role of battery electric vehicles (BEVs) in future transportation systems.

Electric vehicles, such as hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs), are regarded as a new choice for replacing internal combustion engines to reduce air pollution and greenhouse gas emissions [10]. Nevertheless, battery electric vehicles are new in the automotive market, and most consumers do not have experience in terms of using them [11].

Although the demand for electric vehicles is on the rise in China, America, and Europe, the rate of increase in Taiwan is significantly lower compared to that in these aforementioned countries. Hsieh [5] also highlighted that battery electric vehicles are still in their early stages in Taiwan [12], with relatively fewer numbers compared to American and European countries (such as Norway). In alignment with greenhouse gas reduction objectives, the Taiwan government plans to implement a policy promoting the comprehensive electrification of new automotive sales by 2040 [13].

Road transport is a big contributor to CO_2 emissions, and electric vehicles are widely considered an important means to reduce emissions from road transport. However, despite picking up speed in recent years, the diffusion of EVs is still limited in Taiwan. Hence, our study aims to explore the factors influencing consumers' decisions to purchase electric vehicles, particularly in the context where battery electric vehicles are still emerging products. This endeavor seeks to assist relevant industries in developing marketing strategies.

Based on a review of previous research focusing on the intention to purchase battery electric vehicles, the Theory of Planned Behavior (TPB) and its antecedent, the Theory of Reasoned Action (TRA), are among the most widely employed reasoned action theories, particularly in studies examining decisions related to purchasing an EC. Moreover, investigations into the adoption of new technologies, products, or services have often utilized another derivative of the TRA, namely, the Technology Acceptance Model (TAM). The TAM has also found application in research on EC adoption. Therefore, we employed the TAM model and incorporated external factors that have not been considered as our conceptual basis. For instance, Thøgersen [14] delved into the reasons behind the low usage of electric vehicles in Denmark by exploring the influence of "subjective norm" and "attitude" within the Theory of Reasoned Action. The study revealed that Danes would be more inclined to purchase electric vehicles with an improved attitude and a heightened sense of moral obligation towards using environmentally friendly cars. In a study by Huang and Ge [15] on the development of electric vehicles in Beijing, the authors analyzed consumers' purchase intentions using the TPB. Their findings indicated that attitude and perceived behavior control positively impacted purchase intentions, while subjective norms exhibited negative effects.

Furthermore, Kim et al. [8] emphasized the significance of offering consumers first-hand experience in driving battery electric vehicles, particularly within the automotive industry in Korea. This study integrates the "Technology Acceptance Model" proposed by Davis [16] and Monroe and Krishnan's [17] "perceived value model", which encompass elements such as "external variables", "perceived usefulness", "perceived ease of use", "user attitude", "purchase intention", "price", "perceived quality", "perceived sacrifice", and "perceived value".

Additionally, the perceived value model was employed. According to the value-based adoption model (VAM), in the context of consumer purchase decisions, value signifies the holistic assessment of an item's utility, derived from a thorough evaluation of its benefits

and risks. A stronger perception of value tends to correlate with a more positive inclination towards adopting the innovation, mirroring findings observed in studies of information technology innovations. Researchers have explored the value attributes influencing consumers' attitudes toward and behavior intentions. Nonetheless, limited attention has been directed toward identifying the relationship between perceived value and the adoption of EVs.

In this study, a combination of these two models and additional external variables, specifically environmental awareness and customer experience, are integrated to comprehensively analyze the decision-making factors influencing consumers' choices in purchasing battery electric vehicles.

2. Literature Review

2.1. Electric Vehicle

Electric vehicles, mainly controlled by batteries, combine the advantages of zero exhaust emissions and zero noise, their structures are also easily produced and have lower costs [18]. Miao et al. [19] indicated that electric vehicles were generally accepted as the most advantageous transportation in terms of oil crises and environmental protection. Huang and Ge [15] regarded the development of electric vehicles as an important measure to reduce the demand for energy supply and reduce exhaust emissions as well as enhance air quality. Electric vehicles, in comparison with petrol or diesel engine vehicles, could provide more energy saving and environmental protection as cars in cities would not generate exhaust emissions, not depend on fossil fuels, and provide higher efficacy [20].

Dogan and Ozmen [21] pointed out that batteries are the energy source of electric vehicles (EVs), which are driven by electric motors. According to their different structures and parts, electric vehicles could be classified into hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), fuel cell electric vehicles (FCEVs), and battery electric vehicles (BEVs). HEVs are the mainstream in current markets, making up about 67.5% of total sales of these types of electric vehicles, primarily because petrol is still the main power of HEVs and consumers have not been forced to change their use habits [22]. Wang et al. [23] outlined that the advantages of electric vehicles are that they reduce carbon dioxide emissions and decrease the problem of needing petrol. Jin et al. [24] indicated that gasoline cars would be controlled in three major cities, Paris, Amsterdam, and Brussels, by 2030 and prohibited in the world by 2025. Although there are still 5–10 years for control or prohibition, battery electric vehicles will be the future trend.

2.2. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), proposed by Davis [16], is an extension of the Theory of Reasoned Action (TRA). Wu et al. [25] pointed out that the difference between TRA and TAM is that the former could be applied to people-related behaviors, while the latter was simply suitable for information technology-related behavior, which was often used for discussing the public acceptance of new science or new technology [26], and broadly applied to research in various fields, such as transportation [27]. Wu et al. [28] indicated that the TAM proposed the causality among internal attitudes, beliefs, intentions, and behaviors and explained the perceived ease of use and perceived usefulness. Moreover, scholars have utilized TAM as their research model, as it has been regarded as a model capable of proving the use of new technologies [29].

Pai and Huang [30] proposed that perceived usefulness and perceived ease of use would affect user attitudes toward new technology. Wang et al. [23] regarded perceived usefulness as people being able to enhance their work performance when using a specific system or technology, leading to positive effects on the attitude, behavioral intention, and actual use. Perceived ease of use refers to the use of a specific system or technology by people that does not place strain on the user, highlighting the positive effects of the system [28]. User attitude refers to the positive or negative feelings that users may have when using certain technologies that affect their behavior [31].

2.3. External Variable of Technology Acceptance Model

Davis et al. [26] mentioned that external variables in TAM would affect users' internal attitudes, beliefs, and intentions. Two external variables of environmental awareness and customer experience are used for this study. Environmental awareness refers to individual awareness of environmental issues and a willingness to solve the problems [32]. Okada et al. [33] mentioned that environmental awareness used to be applied to studies; environmental awareness stimulated consumers to use electric vehicles. Liu et al. [11] regarded BEVs as being the most effective and environmentally friendly vehicles to replace gasoline cars. The purchase of battery electric vehicles could protect the environment and reduce carbon dioxide emissions. Therefore, it is used as an external variable of environmental awareness in this study.

Customer experience refers to the interaction between consumers and brands and the interactive reaction between consumers and products or companies [34]. Liu et al. [11] indicated that BEVs are a new product that most consumers have not used before, resulting in consumers misunderstanding BEVs and not purchasing BEVs. Taking Mainland China as the research object, Jin et al. [24] indicated that consumers changed their ideas about BEV after the experience. Schmalfuß et al. [35] stressed the importance of consumers' experience in BEV as it could overcome preconception about BEVs and persuade them that BEVs are convenient means of transportation. For this reason, customer experience is included as one of the external variables for this study.

2.4. Perceived Value Model

Monroe and Krishnan [17] proposed the perceived value model to discuss the relations between price, quality, and perceived value and regarded the important role of perceived value in consumers' purchase decisions when purchasing products with higher perceived values. Monroe and Krishnan's [17] perceived value model is applied in this study to discuss decision factors in consumers purchasing battery electric vehicles. Five variables of perceived price, perceived quality, perceived sacrifice, perceived value, and purchase intention were used.

Perceived price is regarded as the external characteristic of products and stands for the real price or target price of products to stimulate consumer purchasing decisions [36]. Teas and Agarwal [37] considered that price and brand were the commonly considered factors, and price could be indicative of the products' inflated monetary value or a signal of product quality [38].

Zeithaml [39] pointed out that the judgment of perceived quality is related to the products' overall excellence or superiority. Regarding consumers, perceived quality refers to higher perceived product quality, which enhances purchasing intentions [17]. Liao et al. [40] defined perceived quality as the difference in consumers' perception and expectation of products or services. Drennan et al. [41] regarded perceived quality as consumers' evaluation of overall product satisfaction. Pai and Huang [30] indicated that perceived ease of use refers to a product that does not require too much time or effort in terms of learning to use the technology. Chen [42] explained the idea of perceived usefulness as the use of new products being helpful for users' lives and work. The combination of the two affects product purchase intentions. Accordingly, perceived usefulness and ease of use are included in perceived quality in this study.

Perceived sacrifice refers to the acquisition of products or services when making decisions [39,43]. Shukla [44] indicated that consumers make sacrifices when making final purchase decisions for almost every competitive product and service. Lee et al. [36] defined perceived sacrifice as consumers who are willing to pay the cost of the acquired product. Yang and Peterson [45] divided perceived sacrifice into two factors: monetary and non-monetary sacrifice. The former referred to price, and the latter referred to the time, cost, and effort of searching for the product. Dodds et al. [46] integrated perceived price into perceived sacrifice as they perceived sacrifice and perceived price to be the same ideas.

Perceived value is acquired based on consumers' serious evaluation of products or services, and value could be defined as the comparison between consumers' acquisition and payment, i.e., the value comparison between profit and sacrifice [39]. Lee et al. [36] regarded price as the indicator to measure quality as well as the sacrifice after purchasing products. More sacrifice would be paid for higher product prices to reduce purchase intention. Liao et al. [40] pointed out perceived value as consumers' evaluation of products after paying for and acquiring the products.

Purchase intention refers to consumers' perception of products or services, or consumers' purchase intentions after evaluation [47]. Chang and Wildt [48] indicated that purchase intention was generally related to consumers' behaviors, perceptions, and attitudes. Purchase intention might be changed due to price, perceived quality, or perceived value.

We reviewed the literature relating to the TAM or perceived value model in different countries, see Table 1. We incorporated these two models and environmental concerns to propose a conceptual model to investigate the variables for purchase intentions relating to electric cars.

Table 1. The literature relating to purchase intentions in different countries.

Literature	Research Topic	Country	Research Variables
Wang et al. [23]	The role of environmental concern in the public acceptance of autonomous electric vehicles	China	Perceived usefulness; perceived ease of use; environmental concern; behavior intention on electric vehicles
Kim et al. [49]	Perceived value and adoption intention for electric vehicles	Korea	Perceived value; environmental innovativeness; environmental concern; financial incentive; non-financial policy
Kim et al. [8]	Consumer intentions to purchase battery electric vehicles	Korea	Prior experience with EVs; Knowledge about EVs; Public incentive Parking incentive
Thøgersen and Ebsen [3]	Perceptual and motivational reasons for the low adoption of electric cars	Demark	Prior experience with EVs; Psychological factors (perceived ease of use, perceived (un)certainty); Behavior intention
Wu, Liao, Wang and Chen [28]	Public acceptance of autonomous electric vehicles	China	Green perceived usefulness; Perceived ease of use; Environmental concern Perceived value
Current Study	Consumer intentions to purchase battery electric vehicles	Taiwan	Perceived quality Perceived sacrifice Environmental awareness Consumer experience Purchase intention on electric vehicles

2.5. Research Hypotheses

Okada et al. [33] proposed that environmental awareness would lead consumers to purchase electric vehicles. Xu et al. [50] pointed out the greater importance of perceived quality than environmental awareness and stressed the extreme importance of perceived quality on consumers' purchase intentions. Kim et al. [49] suggested that the positive effect of individual environmentally friendly behavior on consumers' attitudes towards electric vehicles further affects the use of electric vehicles. People with higher environmental awareness were more willing to use electric vehicles with higher perceived value than those without such awareness. Therefore, H1 is proposed in this study.

H1: *Environmental awareness shows positive and significant effects on perceived quality.*

He and Zhan [51] pointed out the positive effect of personal norms on the intention to use electric vehicles. Sang and Bekhet [52] considered that environmental issues and similar factors would positively affect consumer acceptance of electric vehicles. Thøgersen [14] found the significant effect of economic sacrifice in relation to protecting the environment

on the purchase of green products. Hedlund [53] indicated that people might criticize the disparity between environmental protection and actual behavior, but greater environmental awareness revealed smaller perceived sacrifice, and vice versa. Accordingly, H2 is proposed in this study.

H2: *Environmental awareness reveals negative and remarkable effects on perceived sacrifice.*

Quality and satisfaction stand as pivotal elements in research concerning marketing, retail, and service management. Kim and Choi [54] highlighted the significance of comprehending customers' experiential quality as a fundamental factor for fostering positive customer experiences, contributing to overall success. Biedenbach and Marell [55] emphasized that product trial experiences play a pivotal role in individual learning by allowing consumers to evaluate products. Moreover, when consumers acquire additional relevant information, this information is often amalgamated with their perceived quality. Schmalfuß et al. [35] suggested that short-distance test drives of battery electric vehicles can positively impact consumers' acceptance and evaluation. As a result, this study introduces H3 based on these premises.

H3: *Customer experience presents positive and notable effects on perceived quality.*

The value of products or services is closely related to customers' sacrifice when purchasing or using products [56]; larger sacrifices reveal lower values. Customers generally measure sacrifice in terms of price or time, e.g., higher prices, longer time spent for product acquisition (such as waiting time for delivery), and longer time spent to become familiar with a new product, indicate a larger sacrifice. To reduce customers' perceived sacrifice in terms of specific products, product experience is an effective way for customers to evaluate the perceived sacrifice after purchasing products. Miao et al. [19] suggested that actual use allowed consumers to discern correct evaluations of products and reduce doubt in terms of products. In this case, consumers with actual use experience (driving or taking a ride) before the use of electric vehicles truly experience the accelerating time, comfort, aesthetic design of the appearance, charging time and convenience, or the operation compatibility with gasoline cars and electric vehicles, which might enhance the understanding of electric vehicles, reduce doubt about the purchase or use of electric vehicles, and reduce perceived sacrifice [11]. As a result, H4 is proposed in this study.

H4: *Customer experience appears negative and significant effects on perceived sacrifice.*

Attitude refers to individual knowledge acquisition and the positive or negative evaluation of products or services, and the quality value of products comes from the characteristics and attributes [57]. Monroe and Krishnan [17] considered that consumers with higher perceived product quality have enhanced purchase intentions. He et al. [58] regarded the positive effects of attitude on the need for long-distance driving and the use of hybrid electric vehicles. Consumers with higher perceived quality of products or services have greater user attitudes. Accordingly, H5 is proposed in this study.

H5: *Perceived quality shows positive and remarkable effects on user attitude.*

Perceived quality, as an intangible characteristic, cannot be easily measured. Liao et al. [40] pointed out quality as an important intervening variable between price and value. Sánchez-Fernández and Iniesta-Bonillo [59] revealed the remarkable effect of perceived quality on perceived value. Liao et al. [40] pointed out price as the key factor in value as well as the intervening variable between perceived quality and perceived value. As a consequence, H6 is proposed in this study.

H6: *Perceived quality reveals positive and notable effects on perceived value.*

Liao et al. [40] revealed that consumers often evaluated products in terms of price. For example, expensive luxury goods represented excellent value; on the contrary, products with lower prices represented low value. Teas and Agarwal [37] found that quality and sacrifice were the prerequisites of the external characteristics of products. Shukla [44] detailed an insignificant, negative effect of perceived sacrifice on perceived value. According to the above literature, H7 is proposed in this study.

H7: *Perceived sacrifice presents negative and significant effects on perceived value.*

Zeithaml [39] regarded perceived value as the comparison result between profit and sacrifice. Swait and Sweeney [60] considered that perceived value might affect consumer attitude. Chen et al. [61] pointed out the positive effects of perceived value on consumer attitudes toward the purchase of electric motorcycles. Salehzadeh and Pool [62] divided perceived value into three dimensions: social value, individual value, and function value. The research results revealed positive effects of attitude on perceived value. According to the above literature, perceived value significantly affects attitude, but some studies also show the positive effects of attitude on perceived value. For this reason, H8 is proposed in this study.

H8: *Perceived value appears positive and remarkable effects on user attitude.*

Past research pointed out the positive effects of attitude towards different types of products and services on purchase intention. For instance, attitude towards the purchase of fashion accessories would positively affect purchase intentions [63]. Schmalfuß et al. [35] pointed out the positive and remarkable effects of attitude on consumers' purchase intentions. Thøgersen and Ebsen [3] indicated that consumers' willingness to purchase electric vehicles would increase with their attitude toward electric vehicles. Therefore, H9 is proposed in this study.

H9: *User attitude shows positive and notable effects on purchase intention.*

Consumers would evaluate cost and profit when purchasing products; they might purchase the product after considering the potential advantages acquired from the products [60]. From a large pool of research results, Zeithaml [39] proposed that consumers with a better perception of products or services would perceive higher value to enhance their purchase intention. Lee et al. [36] indicated that perceived value positively affected purchasing intentions because, when the perceived quality was higher than perceived sacrifice, consumers would present perceived value of service or products, furthering purchasing intentions. Ng et al. [64] pointed out the notable effects of consumers' perceived value on the willingness to purchase electric vehicles. Thus, H10 is proposed in this study.

H10: *Perceived value reveals positive and significant effects on purchase intention.*

3. Research Method

3.1. Conceptual Model

Based on the literature review, the conceptual model has been proposed. This model comprises seven variables: environmental awareness, customer experience, perceived quality, perceived price, user attitude, perceived value, and purchase intention. Their relationships are also demonstrated in Figure 1.

3.2. Definition and Measurement of Research Variable

There are seven research variables in this study. Referring to the definitions in previous pieces of literature, the operational definitions and design questions are explained in the following. The questionnaire items are organized in Table 2.

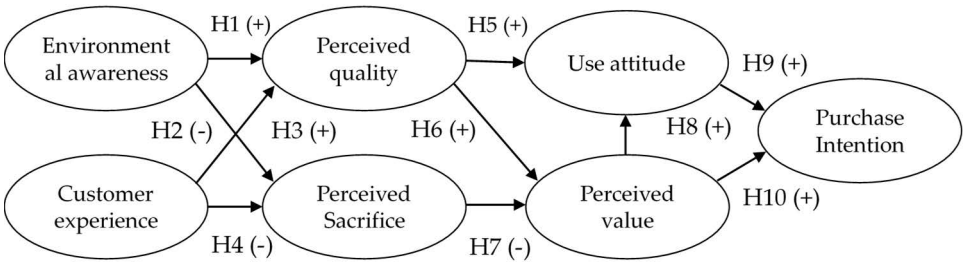

Figure 1. Research structure.

Table 2. Definition of variables and questionnaire items.

Variable	Question	Source
Environmental awareness (EA)	1. I think that people should change the behavior to reduce climate change and protect environment. 2. I concern about human behavior and the effect on climate change and environment. 3. I think that climate change would threaten me and my family. 4. I think that battery electric vehicles could help the sustainable development of environment. 5. I think that battery electric vehicles would reduce environmental pollution. 6. I think that battery electric vehicles are important for saving the natural resource on the earth.	Bamberg [32]; Kim et al. [49]; Xu et al. [65]
Customer experience (CE)	1. My past experience in driving battery electric vehicles was good. 2. My past experience in taking battery electric vehicles was good. 3. I heard that users' experience in battery electric vehicles was good.	Liu et al. [11]; Thomas [34]
Perceived quality (PQ)	1. I think that battery electric vehicles could reduce the emission of carbon dioxide and release the problem of energy shortage. 2. I think that battery electric vehicles could reduce my family's expense on transportation. 3. I think that battery electric vehicles could enhance my quality of life.	Monroe and Krishnan [17]; Wang et al. [23]
Perceived Sacrifice (PS)	1. For me, the cost for replacing batteries for battery electric vehicle is high. 2. For me, the price of battery electric vehicles and the cost for batteries reduce the attraction to me, in comparison with gasoline cars. 3. I think that battery electric vehicles are too expensive. 4. In comparison with gasoline cars, I think that the consumption cost for battery electric vehicles is lower. 5. I think that the government should subsidize the purchase of battery electric vehicles. 6. I think that the resale (second hand) price of battery electric vehicles is low.	Lee et al. [36]; Schuitema et al. [66]; Hagman et al. [67]; Degirmenci and Breitner [68]
Perceived value (PV)	1. I think that battery electric vehicles are a good deal. 2. I think that battery electric vehicles are a good choice. 3. I think that electric vehicles are valuable. 4. I think that battery electric vehicles are easy to operate. 5. I think that battery electric vehicles present better advantage, compared to other types of vehicles. 6. I tend to purchase battery electric vehicles because of the function/low financial risk. 7. I think that battery electric vehicles present good performance.	Zeithaml [39]; Kim et al. [49]; Al-Jundi et al. [69]

Table 2. *Cont.*

Variable	Question	Source
Use attitude (UA)	1. I think that it is excellent to drive battery electric vehicles. 2. Driving battery electric vehicles is a smart decision. 3. I am interested in battery electric vehicles. 4. I think that it is a good idea to buy battery electric vehicles. 5. I think that it is necessary to use battery electric vehicles.	Wang et al. [23]; Taylor and Todd [31]; Xu et al. [65]
Purchase Intention (PI)	1. I will consider battery electric vehicles when buying a car in the future. 2. I would recommend battery electric vehicles to friends. 3. I hope that there are more brands and styles of battery electric vehicles in the market.	Kim et al. [8]; Wang et al. [23]; Younus et al. [31]; Xu et al. [65]

According to Bamberg [32], environmental awareness is defined as "individual awareness of environmental issues and willingness to solve environmental problems". The measurement of environmental awareness is based on the work of Kim et al. [49] and Xu et al. [65]. With revision, six questionnaire items were developed. Referring to Thomas [34], customer experience is defined as "consumers' overall evaluation of experience in driving or taking battery electric vehicles". The measurement refers to the work of Liu et al. [11] and, after revision, three questionnaire items were developed.

Referring to Monroe and Krishnan [17], perceived quality is defined as "battery electric vehicles being able to promote consumers' quality of life". The measurement method is based on the work of Wang et al. [23] and, after revision, three questionnaire items were developed. Referring to Grewal et al. [43], Zeithaml [39], and Lee et al. [36], perceived sacrifice is defined as "the sacrifice which consumers being willing to pay for battery electric vehicles". The measurement refers to the work of Schuitema et al. [66], Hagman et al. [67], and Degirmenci and Breitner [68] and, after revision, six questionnaire items were developed.

Referring to Zeithaml [39], perceived value is defined as "consumers, with deliberate evaluation, regarding battery electric vehicles being valuable and worth of the price". The measurement refers to the work of Kim et al. [49] and Al-Jundi et al. [69], and, after revision, seven questionnaire items were developed. User attitude, referring to Taylor and Todd [31], is defined as "the positive or negative perception when using battery electric vehicles to affect user behavior". The measurement refers to the work of Wang et al. [23] and Xu et al. [65], and, after revision, five questionnaire items were developed.

Purchase intention, after referring to Younus et al. [47], is defined as "the possibility of consumers purchasing battery electric vehicles after evaluating and purchasing battery electric vehicles". By referring to Kim et al. [8], Wang et al. [23], and Xu et al. [65] to revise the measurement, three questionnaire items were developed.

3.3. Questionnaire Design and Sampling

For quantitative research, a questionnaire survey was used as the research tool in this study. With Likert's five-point scale, the agreement was measured from extremely disagree (1) to extremely agree (5). With convenience sampling, experience in using, taking, and purchasing vehicles is the research background.

Prior to distributing the formal questionnaire, a pretest was conducted using 40 online questionnaire copies via Google Forms. Based on the feedback from this pretest, adjustments were made to the wording of the items to refine and finalize the formal questionnaire. Potential consumers were invited to participate in filling out the questionnaires, and as a token of appreciation, all respondents received a gift valued at approximately USD 10. A total of 350 copies of the formal online questionnaire (using Google Forms) were distributed

in Taiwan, and 336 copies were collected. After deleting invalid copies, a total of 322 valid copies were retrieved, with a retrieval rate of 95.8%.

After collecting, checking, and deleting invalid questionnaires, SPSS and AMOS were used for data analysis, including descriptive statistics, reliability analysis, validity analysis, Pearson correlation analysis, and structural equation modeling.

4. Research Result

4.1. Sample Structure Analysis

Among the 322 respondents to the questionnaire, 46.9% of the subjects were male, and 53.1% were female; 52.5% of the subjects had college and university education levels, 39.1% had above graduate school levels of education, and 8.4% had below senior high and vocational school levels of education. For monthly average income, 36.6% had an income of TWD 30,001~50,000, 22% had an income below TWD 30,000, 16.8% had an income of TWD 50,001~70,000, 13.7% had an income above TWD 90,001, and 10.9% had an income of TWD 70,001~90,000. The vehicles used by the subjects' families were as follows: 88.2% used gasoline cars, 10.2% used diesel engine vehicles, 7.8% used hybrid electric vehicles, 2.5% used battery electric vehicles, and 4.9% were without the use of a vehicle.

The age structure of the subjects was as follows: 37.9% were in the 20~29 age range, 27.6% were in the 50~59 age range, 21.7% were in the 40~49 age range, 8.4% were in the 30~39 age range, 3.7% were above 60, and 0.6% were under 19. The occupations of the subjects were as follows: 21.1% were employed in manufacturing, 17.7% were employed in the service industry, 15.8% were employed in business, 10.9% were students, 9.1% were classified as other, 7.8% were military, public, and teaching personnel, 7.8% had freelance employment or were retired, 5.6% were health care workers, and 4.3% were employed in industry and agriculture, showed in Table 3.

4.2. Measurement Model Analysis

After Confirmatory Factor Analysis (CFA), all standardized factor loadings appeared to be above 0.5. Factor loading of PI3 lower than 0.7 reveals that the observed variable lacked reliability and was thus deleted. After the deletion, the factor loadings, after CFA, appear to be above the standard, but PV4 and PQ2 residuals are not independent. This reveals that two such observed variables present similar points of view. PI3, PV4, and PQ2 are then deleted. From Table 4, χ^2/df, GFI, AGFI, and RMSEA appear to have obvious improvements within the acceptable range, and the residuals are positive and remarkable without disobeying the estimate.

There are seven variables in the research model: environmental awareness, customer experience, perceived quality, perceived sacrifice, user attitude, perceived value, and purchase intention. Table 5 shows the composite reliability (C.R.) of variables higher than 0.7, representing the consistency of the questionnaire. The AVE of the variables is higher than 0.5, except for perceived quality, which is 0.493, revealing proper convergence. In addition, the loadings of items are higher than 0.7. Conforming to the standard proposed by Guieford [70] and Fornell and Larcker [71], the seven variables in this study present convergent validity.

Discriminant validity aims to test the high correlations of the items in the variables. It could be acquired by comparing the AVE square root and correlation coefficients of variables. Table 6 shows that the correlation coefficients of variables are smaller than 0.85, and the AVE square root is higher than the correlation coefficients, proving the discriminant validity of the measured variables.

Table 3. Sample characteristics.

Variable	Type	No. of Sample	%	Variable	Type	No. of Sample	%
gender	male	151	46.9	age	under 19	2	0.6
	female	171	53.1		20~29	122	37.9
educational attainment	senior high/vocational schools	27	8.4		30~39	27	8.4
	colleges and universities	169	52.5		40~49	70	21.7
	graduate schools and above	126	39.1		50~59	89	27.6
average monthly income	TWD 30,000 and below	71	22		above 60	12	3.7
	TWD 30,001~50,000	118	36.6	occupation	student	35	10.9
	TWD 50,001~70,000	54	16.8		military, public, and teaching personnel	25	7.8
	TWD 70,001~90,000	35	10.9		industry and agriculture	14	4.3
	TWD 90,001 and above	44	13.7		business	51	15.8
type of car in the family	gasoline car	284	88.2		manufacturing	68	21.1
	diesel engine vehicle	33	10.2		service industry	57	17.7
	hybrid electric vehicle	25	7.8		health care worker	18	5.6
	battery electric vehicle	8	2.5		freelance or retirement	25	7.8
	no car in the family	16	4.9		others	29	9.0

Table 4. CFA fit index comparison.

	χ^2/df	GFI	AGFI	RMSEA
original model	2.825	0.824	0.781	0.075
model deleting PI3	2.861	0.831	0.787	0.077
model deleting PI3, PV4	2.943	0.833	0.787	0.078
model deleting PI3, PV4, PQ2 (formal model)	2.800	0.850	0.806	0.075
acceptable range	<5	>0.8	>0.8	<0.08

Table 5. Reliability and composite reliability.

	No. of Item	AVE	C.R.	Cronbach's α
environmental awareness	3	0.798	0.922	0.920
customer experience	3	0.626	0.833	0.829
perceived quality	2	0.493	0.701	0.690
perceived sacrifice	3	0.510	0.754	0.742
user attitude	5	0.684	0.915	0.911
perceived value	6	0.596	0.899	0.898
purchase intention	2	0.792	0.884	0.883

Table 6. Pearson correlation coefficient and AVE square root.

	Mean	S.D.	1	2	3	4	5	6	7
1. environmental awareness	4.191	0.621	1.000						
2. customer experience	3.324	0.608	0.284 **	1.000					
3. perceived quality	3.628	0.839	0.687 **	0.296 **	1.000				
4. perceived sacrifice	3.896	0.565	0.365 **	0.153 **	0.397 **	1.000			
5. perceived value	3.449	0.778	0.585 **	0.490 **	0.719 **	0.348 **	1.000		
6. user attitude	3.542	0.915	0.569 **	0.465 **	0.671 **	0.325 **	0.849 **	1.000	
7. purchase intention	3.683	0.841	0.532 **	0.458 **	0.583 **	0.287 **	0.768 **	0.857 **	1.00
AVE square root			0.893	0.791	0.650	0.714	0.772	0.827	0.890

Note: **: $p < 0.05$.

4.3. Structural Model Analysis

According to the measurement model, this mode presents favorable goodness-of-fit that structural model analysis preceded. The χ^2/df, GFI, AGFI, and RMSEA of this research model show values of 3.064, 0.832, 0.8, and 0.08, respectively, within the good fit range. The analysis results are presented with the path relationship diagram to express the relationship between variables.

Estimating the path relationship among variables with structural model, the analysis results are organized in Figure 2. In Figure 2, environmental awareness presents positive and significant effects on perceived quality ($\beta = 0.784$, $p < 0.01$). In other words, consumers with environmental awareness regard battery electric vehicles as being useful and of high quality, supporting H1. Customer experience reveals positive and remarkable effects on perceived quality ($\beta = 0.246$, $p < 0.01$), showing that consumers consider usefulness and high quality after personal experience and friends' experience in using or riding in battery electric vehicles. Therefore, H3 is supported.

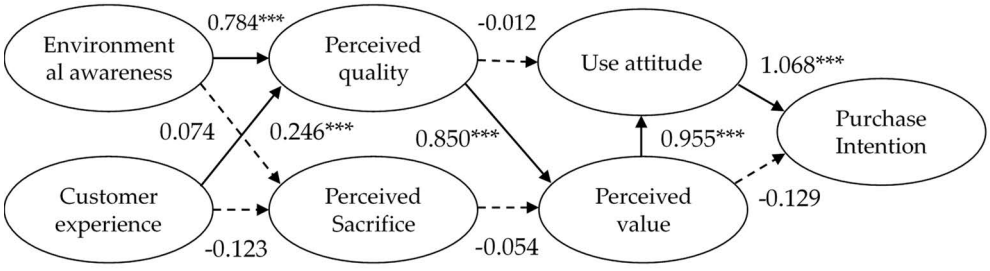

Figure 2. Structural model analysis of battery electric vehicles. ***: $p < 0.01$.

Perceived quality shows positive and notable effects on perceived value ($\beta = 0.850$, $p < 0.01$), revealing that consumers with deliberate considerations regard battery electric vehicles as being useful, of high quality, valuable, and a good deal, supporting H6. Perceived value revealed positive and significant effects on user attitude ($\beta = 0.955$, $p < 0.01$),

representing that consumers with deliberate considerations regard battery electric vehicles as being valuable and a good deal, while positive or negative perceptions in the process affect user behavior. Therefore, H8 is supported. User attitude presents positive and remarkable effects on purchase intention ($\beta = 1.068$, $p < 0.01$) that consumers would purchase battery electric vehicles according to the evaluation (positive or negative perception). This supports H9.

4.4. Additional Analysis

The price of battery electric vehicles is higher than for general gasoline cars and famous brands (e.g., Tesla), focusing the target customers on high-income groups [5] in Taiwan. The variable relationship of sample groups with different incomes is further analyzed in this study. Lu [72] indicated that the top 20% yearly income of the salaried population in Taiwan was 0.838 million dollars, a monthly income of about TWD 70,000. Therefore, TWD 70,000 is used as the grouping standard to classify the lower-income group with an income under TWD 70,000 and the higher-income group with an income above TWD 70,000. In total, 243 and 79 copies of the questionnaire were, respectively, collected from such two groups for structural model analysis. The samples were also compared in terms of differences.

4.4.1. Lower Income Group Analysis

From Figure 3, environmental awareness and customer experience do not remarkably affect the perceived sacrifice of the first group with an income under TWD 70,000, and the effects of perceived quality on user attitude, perceived sacrifice on perceived value, and perceived value on purchase intention are not notable. On the other hand, environmental awareness and customer experience show positive and significant effects on perceived quality ($\beta = 0.701$, $p < 0.01$; $\beta = 0.296$, $p < 0.01$) and perceived quality positively and remarkably affects perceived value, user attitude, and purchase intention ($\beta = 0.907$, $p < 0.01$; $\beta = 0.903$, $p < 0.01$; $\beta = 1.054$, $p < 0.01$).

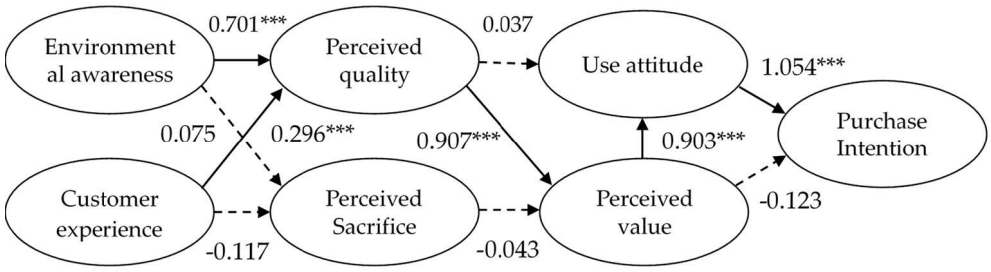

Figure 3. Structural model analysis of the lower income group. ***: $p < 0.01$.

4.4.2. Higher-Income Group Income

In comparison with the second group with an average monthly income above TWD 70,000, Figure 4 reveals positive and remarkable effects of environmental awareness on perceived quality ($\beta = 1.007$, $p < 0.01$) and perceived quality on perceived value ($\beta = 0.557$, $p < 0.01$). On the other hand, perceived value reveals positive and notable effects on user attitude and user attitude on purchase intention ($\beta = 0.877$, $p < 0.01$; $\beta = 0.910$, $p < 0.01$). Nevertheless, environmental awareness and customer experience do not appear to significantly affect perceived sacrifice, and the effects of customer experience on perceived quality, as well as the effects of perceived quality on user attitude, perceived sacrifice on perceived value, and perceived value on purchase intention, are not remarkable.

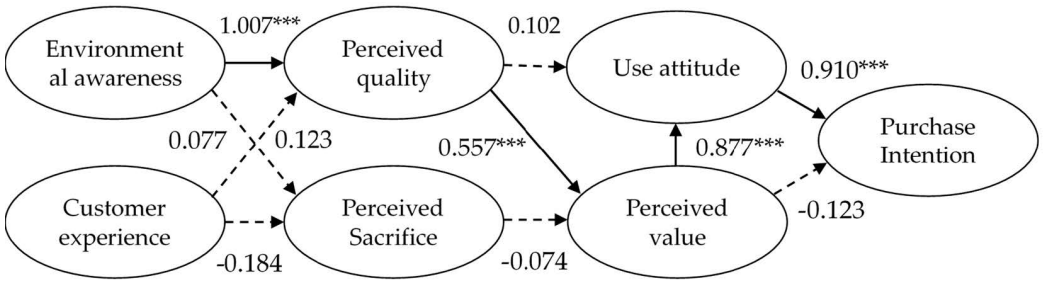

Figure 4. Structural model analysis of higher-income group. ***: $p < 0.01$.

4.5. Discussion

The empirical results reveal positive and remarkable effects of environmental awareness on perceived quality, which is consistent with the research results of Xu et al. [50] and Kim et al. [49]. Consumers with environmental awareness show a higher perceived value of battery electric vehicles and are more willing to purchase battery electric vehicles.

Moreover, environmental awareness does not appear to have notable effects on perceived sacrifice. Hedlund [53] mentioned the higher environmental awareness, the smaller the perceived sacrifice, and the lower environmental awareness, the higher the perceived sacrifice. It is considered in this study that the price of battery electric vehicles is higher when compared to other types of electric vehicles; it also means that people who are willing to purchase battery electric vehicles do not consider monetary sacrifice; however, greater environmental awareness reveals that environmental awareness would not affect consumers' perceived sacrifice.

Customer experience shows positive and remarkable effects on perceived quality, with the same research results of Schmalfuß et al. [35] and Biedenbach and Marell [54]. Since customer experience is regarded as the key to personal learning before purchasing products, consumers would have greater acceptance and evaluation after the experience. It is considered in this study that it is necessary to have consumers perceive that battery electric vehicles would enhance their quality of life when experiencing battery electric vehicles. Liu et al. [29] and Hinnüber et al. [73] also indicated that after experiencing battery electric vehicles, consumers would have reduced misunderstandings in terms of battery electric vehicles to further enhance purchase intentions.

However, customer experience does not significantly affect perceived sacrifice. Because most consumers are aware of the medium and high prices of battery electric vehicles; therefore, test drive experiences will not decrease perceived monetary sacrifice. Perceived quality does not reveal significant effects on user attitude. Monroe and Krishnan [17] revealed that high perceived quality of products or services would enhance consumers' user attitudes. The results show that perceived quality affects user attitude through perceived value, not directly influence attitude.

Perceived quality presents positive and notable effects on perceived value, consistent with the research results of Sánchez-Fernández and Iniesta-Bonillo [59]. Perceived value shows positive and remarkable effects on user attitude, revealing that consumers regard battery electric vehicles as being able to promote the quality of life, furthering positive or negative perceptions of battery electric vehicles. Nonetheless, perceived sacrifice does not notably affect perceived value, which is consistent with the research results of Shukla [44]. Liao et al. [40] indicated that consumers would show the product value with the price.

User attitude has positive and significant effects on purchase intention, consistent with the research results of Das [63] and Schmalfuß et al. [35]. After experiencing battery electric vehicles, consumers would present positive or negative evaluations to further enhance the purchase intention. Such a result corresponds to the argument of Thøgersen and Ebsen [3], that enhancing attitude would increase purchase intention. On the other hand, perceived value does not show remarkable effects on purchase intention. Dodds et al. [46] regarded perceived product value as the critical factor in consumers' purchase decisions. However,

it is considered in this study that consumers are affected by purchase intention through positive or negative perceptions in the evaluation of battery electric vehicles.

Finally, the research hypotheses and empirical results are summarized in Table 7. The hypotheses verification results of overall samples, higher-income group and lower-income group are summarized in Table 7.

Table 7. Hypotheses test results of overall samples, higher-income group and lower-income group.

Hypothesis	Overall Sample (n = 322)	Groups	
		Lower-Income (n = 243)	Higher-Income (n = 79)
H1: Environmental awareness shows positive and significant effects on perceived quality	✓	✓	✓
H2: Environmental awareness reveals negative and remarkable effects on perceived sacrifice	×	×	×
H3: Customer experience presents positive and notable effects on perceived quality	✓	✓	×
H4: Customer experience appears negative and significant effects on perceived sacrifice	×	×	×
H5: Perceived quality shows positive and remarkable effects on user attitude	×	×	×
H6: Perceived quality reveals positive and notable effects on perceived value	✓	✓	✓
H7: Perceived sacrifice presents negative and significant effects on perceived value	×	×	×
H8: Perceived value appears positive and remarkable effects on user attitude	✓	✓	✓
H9: User attitude shows positive and notable effects on purchase intention	✓	✓	✓
H10: Perceived value reveals positive and significant effects on purchase intention	×	×	×

✓: supported; ×: not supported.

5. Conclusions

With the global issue of climate change affecting the world, many countries have initiated campaigns urging people to protect the environment. The automotive industry is consistently promoting the adoption of emerging battery electric vehicles, while governments are actively supporting and advocating for electric vehicles to become the primary choice for consumers. However, despite these efforts, the majority of consumers in Taiwan continue to purchase gasoline-powered cars. Moreover, as battery electric vehicles are still emerging products, encouraging consumer adoption has become a significant concern for the automotive industry.

The research findings indicate that environmental awareness and customer experience significantly influence perceived quality. Presently, there are limited venues, mostly motor show centers or department stores, offering exhibitions for consumer experience with electric vehicles. Therefore, it is proposed in this study that the automotive industry, in an effort to shift consumers' entrenched purchasing habits, should collaborate with enterprises, local governments, and schools to organize experiential activities. This collaborative approach aims to increase exposure and accessibility for more individuals to interact with battery electric vehicles.

Most previous research on battery electric vehicles focused on the antecedents for purchase intention and use intention and based on the Theory of Planned Behavior and the Theory of Reasoned Action without incorporating numerous external factors. However, this study aims to enhance the research structure by integrating the perceived value model and the Technology Acceptance Model as theoretical frameworks. This integration involves external variables, such as environmental awareness and customer experience, beyond the

discussion of consumers' purchase intentions. It expands the application of the perceived value theory and TAM model.

For managerial suggestions, battery electric vehicles are emerging products in Taiwan, but consumers could be incentivized to purchase battery electric vehicles due to the resulting advantages in terms of the environment and themselves. Therefore, the following suggestions are proposed in this study. (1) Motor plants could cooperate with local medium and small enterprises to hold family days to reach more consumers with consumption power, provide more opportunities for potential consumers to experience battery electric vehicles, and actively offer opportunities for consumers to view cars not merely in motor plants or show centers. (2) Propose different marketing strategies according to consumers' incomes. The research results find out different factors in consumers with significant incomes. It is suggested in this study that the automotive industry and firms could make various marketing tactics aimed at different groups. (3) Cost sacrifice is less taken into account when purchasing vehicles because most people present certain ideas about the price of battery electric vehicles and regard electric vehicles as being middle- and high-price vehicles. The sample structure analysis results in this study revealed that gasoline cars are still the consumers' first choice. As a result, there will be further development of battery electric vehicles in the automotive industry, and the promotion of new products or prices being acceptable for most consumers would facilitate greater consumer willingness to purchase.

Due to constraints regarding location, time, and expertise, this study still has certain imperfections. The following are the limitations of this research, accompanied by explanations. First, as the research sample primarily focused on Taiwan, it is suggested that future researchers expand their investigations to other countries. Secondly, this study did not incorporate considerations for charging factors of purely electric vehicles. This is an issue that pure electric vehicles are expected to face in the future. By addressing this aspect, a more comprehensive exploration can be conducted on how purely electric vehicles can achieve substantial sales volumes among emerging products, thus making them a preferred choice for more consumers when purchasing automobiles. Finally, this research utilized environmental consciousness and customer experience as external variables. It is recommended that future studies incorporate different factors to enrich the research findings.

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References

1. Acar, C.; Dincer, I. The potential role of hydrogen as a sustainable transportation fuel to combat global warming. *Int. J. Hydrogen Energy* **2020**, *45*, 3396–3406. [CrossRef]
2. Ülengin, F.; Isık, M.; Ekici, S.Ö.; Özaydın, Ö.; Kabak, Ö.; Topçu, Y.I. Policy developments for the reduction of climate change impacts by the transportation sector. *Transp. Policy* **2018**, *61*, 36–50. [CrossRef]
3. Thøgersen, J.; Ebsen, J.V. Perceptual and motivational reasons for the low adoption of electric cars in Denmark. *Transp. Res. Part F Traffic Psychol. Behav.* **2019**, *65*, 89–106. [CrossRef]
4. Orlov, A.; Kallbekken, S. The impact of consumer attitudes towards energy efficiency on car choice: Survey results from Norway. *J. Clean. Prod.* **2019**, *24*, 816–822. [CrossRef]

5. Hsieh, L.L. 2019 Review and Outlook for Global Finished Vehicle and Electric Vehicle Industry. *J. Mechatron. Ind.* **2020**, *442*, 41–47.
6. Destek, M.A.; Sinha, A. Renewable, non-renewable energy consumption, economic growth trade openness and ecological development countries. *J. Clean. Prod.* **2020**, *242*, 118537. [CrossRef]
7. Wang, Z.H.; Dong, X.Y. Determinants and policy implications of residents' new energy vehicle purchases: The evidence from China. *Nat. Hazards* **2016**, *82*, 155–173. [CrossRef]
8. Kim, J.H.; Lee, G.; Park, J.Y.; Hong, J.; Park, J. Consumer intentions to purchase battery electric vehicles in Korea. *Energy Policy* **2019**, *132*, 736–743. [CrossRef]
9. Cox, B.L.; Mutel, C.L.; Bauer, C.; Beltran, A.M.; Vuuren, D.V. Uncertain environmental footprint of current and future battery electric vehicles. *Environ. Sci. Technol.* **2018**, *52*, 4989–4995. [CrossRef]
10. Beak, Y.; Kim, K.; Maeng, K.; Cho, Y. Is the environment-friendly factor attractive to customers when purchasing electric vehicles? Evidence from South Korea. *Bus. Strategy Environ.* **2020**, *29*, 996–1006. [CrossRef]
11. Liu, R.; Ding, Z.; Jiang, X.; Sun, J.; Jiang, Y.; Qiang, W. How does experience impact the adoption willingness of battery electric vehicles? The role of psychological factors. *Environ. Sci. Pollut. Res.* **2020**, *27*, 25230–25247. [CrossRef]
12. Lin, M.W. Challenges and opportunities for global electric vehicle development. *J. Pet.* **2020**, *56*, 1–28.
13. Hsieh, L.L. Development Strategy for Taiwan's Electric Vehicle Industry-Refer to the eMove 360° Exhibition. *J. Mechatron. Ind.* **2022**, *466*, 59–64.
14. Thøgersen, J. Psychological determinants of paying attention to eco-labels in purchase decisions: Model development and multinational validation. *J. Consum. Policy* **2000**, *23*, 285–313. [CrossRef]
15. Huang, X.; Ge, J. Electric vehicle development in Beijing: An analysis of consumer purchase intention. *J. Clean. Prod.* **2019**, *216*, 361–372. [CrossRef]
16. Davis, F.D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* **1989**, *13*, 319–340. [CrossRef]
17. Monroe, K.B.; Krishnan, R. The effect of price on subjective product evaluations. In *The Perception of Merchandise and Store Quality*; Jacoby, J., Olson, J., Eds.; Lexington Books: Lexington, MA, USA, 1985; pp. 209–232.
18. Lei, G.; Luo, X.; Cai, L.; Gao, L.; Dai, N.; Xu, Q.; Tan, Z. Research on smart EFK algorithm for electric vehicle battery packs management system. *J. Intell. Fuzzy Syst.* **2020**, *38*, 257–262. [CrossRef]
19. Miao, R.; Xu, F.; Zhang, K.; Jiang, Z. Development of a multi-scale model for customer perceived value of electric vehicles. *Int. J. Prod. Res.* **2014**, *52*, 4820–4834. [CrossRef]
20. Baum, M.; Dibbelt, J.; Gemsa, A.; Wagner, D.; Zündorfa, T. Shortest feasible paths with charging stops for battery electric vehicles. *Transp. Sci.* **2017**, *53*, 1627–1655. [CrossRef]
21. Dogan, V.; Ozmen, M. Belief in environmentalism and independent/interdependent self-construal as factors predicting interest in and intention to purchase hybrid electric vehicles. *Curr. Psychol.* **2017**, *38*, 1464–1475. [CrossRef]
22. Ajanovic, A. The future of electric vehicles: Prospects and impediments. *Wiley Interdiscip. Rev. Energy Environ.* **2015**, *4*, 521–536. [CrossRef]
23. Wang, S.; Wang, J.; Li, J.; Wang, J.; Liang, L. Policy implications for promoting the adoption of electric vehicles: Do consumer's knowledge, perceived risk and financial incentive policy matter? *Transp. Res. Part A Policy Pract.* **2018**, *117*, 58–69. [CrossRef]
24. Jin, F.; An, K.; Yao, E. Mode choice analysis in urban transport with shared battery electric vehicles: A stated-preference case study in Beijing, China. *Transp. Res. Part A Policy Pract.* **2020**, *133*, 95–108. [CrossRef]
25. Wu, Y.H.; Chu, S.Y.; Fang, W.C. An empirical study of trust and TAM-An example of online shopping. *J. Inf. Manag.* **2008**, *15*, 123–152.
26. Davis, F.D.; Bagozzi, R.; Warshaw, P. User acceptance of computer technology: A comparison of two theoretical models. *Manag. Sci.* **1989**, *35*, 982–1002. [CrossRef]
27. Schlüter, J.; Weyer, J. Car sharing as a means to raise acceptance of electric vehicles: An empirical study on regime changes in automobility. *Transp. Res. Part F Traffic Psychol. Behav.* **2019**, *60*, 185–201. [CrossRef]
28. Wu, J.; Liao, H.; Wang, J.W.; Chen, T. The role of environmental concern in the public acceptance of autonomous electric vehicles: A survey from China. *Transp. Res. Part F Traffic Psychol. Behav.* **2019**, *60*, 37–46. [CrossRef]
29. Liu, A.C.; Chou, T.Y. An integrated Technology Acceptance Model to approach the behavioral intention of smart home appliance. *Int. J. Organ. Innov.* **2020**, *13*, 95–118.
30. Pai, F.Y.; Huang, K.I. Applying the technology acceptance model to the introduction of healthcare information systems. *Technol. Forecast. Soc. Chang.* **2011**, *78*, 650–660. [CrossRef]
31. Taylor, S.; Todd, P. Assessing IT usage: The role of prior experience. *MIS Q.* **1995**, *19*, 561–570. [CrossRef]
32. Bamberg, S. How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. *J. Environ. Psychol.* **2003**, *23*, 21–32. [CrossRef]
33. Okada, T.; Tamaki, T.; Managi, S. Effect of environmental awareness on purchase intention and satisfaction pertaining to electric vehicles in Japan. *Transp. Res. Part D Transp. Environ.* **2019**, *67*, 503–513. [CrossRef]
34. Thomas, A. Multivariate hybrid pathways for creating exceptional customer experiences. *Bus. Process Manag. J.* **2017**, *23*, 822–829. [CrossRef]
35. Schmalfuß, F.; Mühl, K.; Krems, J.F. Direct experience with battery electric vehicles (BEVs) matters when evaluating vehicle attributes, attitude and purchase intention. *Transp. Res. Part F Traffic Psychol. Behav.* **2017**, *46*, 47–69. [CrossRef]

36. Lee, C.C.; Chuang, Y.T.; Huang, H.C.; Huang, S.Y.; Chen, W.Y. The impact of performance risk and financial risk on perceived value—A case study of landscaped houses. *Asian J. Empir. Res.* **2013**, *3*, 870–883.
37. Teas, R.K.; Agarwal, S. The effects of extrinsic product cues on consumers' perceptions of quality, sacrifice, and value. *J. Acad. Mark. Sci.* **2000**, *28*, 278–290. [CrossRef]
38. Kim, H.W.; Xu, Y.; Gupta, S. Which is more important in internet shopping, perceived price or trust? *Electron. Commer. Res. Appl.* **2012**, *11*, 241–252. [CrossRef]
39. Zeithaml, V.A. Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *J. Mark.* **1988**, *52*, 2–22. [CrossRef]
40. Liao, K.H.; Chen, S.H.; Jhou, Y.S. An exploration of factors influencing the potential customers' perceived value in aesthetic medicine. *Commer. Manag. Q.* **2019**, *20*, 109–130.
41. Drennan, J.; Sullivan, G.; Previte, J. Privacy, risk perception, and expert online behavior: An exploratory study of household end users. *J. Organ. End. User Comput.* **2006**, *18*, 1–22. [CrossRef]
42. Chen, S.Y. Using the sustainable modified TAM and TPB to analyze the effects of perceived green value on loyalty to a public bike system. *Transp. Res. Part A Policy Pract.* **2016**, *88*, 58–72. [CrossRef]
43. Grewal, D.; Monroe, K.B.; Krishnan, R. The effects of price-comparison advertising on buyers' perceptions of acquisition value, transaction value, and behavioral intentions. *J. Mark.* **1998**, *62*, 46–59.
44. Shukla, P. Effects of perceived sacrifice, quality, value, and satisfaction on behavioral intentions in the service environment. *Serv. Mark. Q.* **2010**, *31*, 466–484. [CrossRef]
45. Yang, Z.; Peterson, R.T. Customer perceived value, satisfaction, and loyalty: The role of switching costs. *Psychol. Mark.* **2004**, *21*, 799–822. [CrossRef]
46. Dodds, W.B.; Monroe, K.B.; Grewal, D. Effects of price, brand, and store information on buyers' product evaluations. *J. Mark. Res.* **1991**, *28*, 307–319.
47. Younus, S.; Rasheed, F.; Zia, A. Identifying the factors affecting customer purchase intention. *Glob. J. Manag. Bus. Res.* **2015**, *15*, 8–13.
48. Chang, T.Z.; Wildt, A.R. Price, Product Information, and Purchase Intention: An Empirical Study. *J. Acad. Mark. Sci.* **1994**, *22*, 16–27. [CrossRef]
49. Kim, M.K.; Oh, J.; Park, J.H.; Joo, C. Perceived value and adoption intention for electric vehicles in Korea: Moderating effects of environmental traits and government supports. *Energy* **2018**, *159*, 799–809. [CrossRef]
50. Xu, L.; Prybutok, V.; Blankson, C. An environmental awareness purchasing intention model. *Ind. Manag. Data Syst.* **2018**, *119*, 367–381. [CrossRef]
51. 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.* **2017**, *172*, 3546–3556. [CrossRef]
52. Sang, Y.N.; Bekhet, H.A. Modelling electric vehicle usage intentions: An empirical study in Malaysia. *J. Clean. Prod.* **2015**, *92*, 75–83. [CrossRef]
53. Hedlund, T. The impact of values, environmental concern, and willingness to accept economic sacrifices to protect the environment on tourists' intentions to buy ecologically sustainable tourism alternatives. *Tour. Hosp. Res.* **2011**, *11*, 278–288. [CrossRef]
54. Kim, H.; Choi, B. The influence of customer experience quality on customers' behavioral intentions. *Serv. Mark. Q.* **2013**, *34*, 322–338. [CrossRef]
55. Biedenbach, G.; Marell, A. The impact of customer experience on brand equity in a business-to-business services setting. *J. Brand. Manag.* **2009**, *17*, 446–458. [CrossRef]
56. Nasution, H.N.; Mavondo, F.T. Customer value in the hotel industry: What managers believe they deliver and what customer experience. *Int. J. Hosp. Manag.* **2008**, *27*, 204–213. [CrossRef]
57. Monirul, I.M.; Han, J.H. Perceived quality and attitude toward tea & coffee by consumers. *Int. J. Bus. Res. Manag.* **2012**, *3*, 100–112.
58. He, L.; Wang, M.; Chen, W.; Conzelmann, G. Incorporating social impact on new product adoption in choice modeling: A case study in green vehicles. *Transp. Res. Part D Transp. Environ.* **2014**, *32*, 421–434. [CrossRef]
59. Sánchez-Fernández, R.; Iniesta-Bonillo, M.Á. The concept of perceived value: A systematic review of the research. *Mark. Theory* **2007**, *7*, 427–451. [CrossRef]
60. Swait, J.; Sweeney, J.C. Perceived value and its impact on choice behavior in a retail setting. *J. Retail. Consum. Serv.* **2000**, *7*, 77–88. [CrossRef]
61. Chen, H.S.; Chen, C.Y.; Chen, H.K.; Hsieh, T. A Study of relationships among green consumption attitude, perceived risk, perceived value toward hydrogen-electric motorcycle purchase intention. *AASRI Procedia* **2012**, *2*, 163–168. [CrossRef]
62. Salehzadeh, R.; Pool, J.K. Brand attitude and perceived value and purchase intention toward global luxury brand. *J. Int. Consum. Mark.* **2016**, *29*, 74–82. [CrossRef]
63. Das, G. Factors affecting Indian shoppers' attitude and purchase intention: An empirical check. *J. Retail. Consum. Serv.* **2014**, *21*, 561–569. [CrossRef]
64. Ng, M.; Law, M.; Zhang, S. Predicting purchase intention of electric vehicles in Hong Kong. *Australas. Mark. J.* **2018**, *26*, 272–280. [CrossRef]
65. Xu, Y.; Zhang, W.; Bao, H.; Zhang, S.; Xiang, Y. A SEM–Neural network approach to predict customers' intention to purchase battery electric vehicles in China's Zhejiang province. *Sustainability* **2019**, *11*, 3164. [CrossRef]

66. Schuitema, G.; Anable, J.; Skippon, S.; Kinnear, N. The role of instrumental, hedonic and symbolic attributes in the intention to adopt electric vehicles. *Transp. Res. Part A Policy Pract.* **2013**, *48*, 39–49. [CrossRef]
67. Hagman, J.; Ritzén, S.; Stier, J.J.; Susilo, Y. Total cost of ownership and its potential implications for battery electric vehicle diffusion. *Res. Transp. Bus. Manag.* **2016**, *18*, 11–17. [CrossRef]
68. Degirmenci, K.; Breitner, M.H. Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transp. Res. Part D Transp. Environ.* **2017**, *51*, 250–260. [CrossRef]
69. Al-Jundi, S.A.; Shuhaiber, A.; Augustine, R. Effect of consumer innovativeness on new product purchase intentions through learning process and perceived value. *Cogent Bus. Manag.* **2019**, *6*, 1698849. [CrossRef]
70. Guieford, J.P. *Fundamental Statistics in Psychology and Education*, 4th ed.; McGram-Hill: New York, NY, USA, 1965.
71. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
72. Lu, T.H. Is Your Income above "Level"? Accounting Office: 2/3 of Taiwan's Lower than Average! 3 Industries with the Best Salary. 2021. Available online: https://www.managertoday.com.tw/articles/view/64385 (accessed on 3 July 2023). (In Chinese).
73. Hinnüber, F.; Szarucki, M.; Szopik-Depczyńska, K. The effects of a first-time experience on the evaluation of battery electric vehicles by potential consumers. *Sustainability* **2019**, *11*, 7034. [CrossRef]