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## Determinants and Consequence on Perception of New Energy Vehicles: A Conceptual Study

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### Abstract

In recent years, the widespread use of automobiles has brought convenience to people's production and life. However, the rapid growth of car ownership has raised concerns about energy security, climate change, and air pollution. If new energy vehicles can be popularized, problems such as environmental pollution and resource scarcity will be significantly alleviated. However, the market communication and the enthusiasm of consumers to purchase new energy vehicles are still not ideal. Therefore, this study has three objectives; for the above research objectives, this paper takes the "stimulus-organism-response" (S-O-R) model as the research framework, takes the marketing stimulus (S: cost of use) as the antecedent variable, and takes the consumer perceived value (O: Perceived Functional Value, Perceived Emotional Value, Perceived Social Value) is the mediator variable, and Response (R: Purchase Willingness) is the outcome variable. In this study, the authors examine how usage cost and consumers' perceived value affect the purchase intention of new energy vehicles. In addition, compared with previous studies, previous researchers' studies on new energy vehicle purchase intentions were based on government subsidies; however, in the absence of subsidies, do product prices and usage costs affect consumers' purchase intentions? There are few related studies. Therefore, this paper conducts research and fills in the gaps. In addition, this study's results will help scholars re-understand the importance of product price and usage cost in influencing consumers' perceived value and decision to purchase new energy vehicles. At the same time, it also provides references and suggestions for the government and enterprises to promote the marketization of new energy vehicles.

**Keywords:** Usage Cost, Perceived Functional Value, Perceived Emotional Value, Perceived Social Value, Consumer Purchase Intention.

### Introduction

One of the key factors contributing to air pollution and impairment to human health are glasshouse gases like carbon dioxide (CO<sub>2</sub>). Large-scale glasshouse gas emissions have the potential to contribute to both climate change and global warming (Pani et al., 2022). In recent years, car usage and purchase rates have been increasing, and the burning of fossil fuels is the main cause of carbon emissions (Zhou, et al., 2019). The transport sector is estimated to be responsible for 25% of global carbon emissions, with three-quarters of these emissions coming from road transport (Zubair et al., 2023). Reducing the use of conventional

gasoline vehicles plays an important role in mitigating carbon emissions and solving serious environmental problems. Using new energy vehicles is one of the critical strategies for reducing carbon emissions; hence it is crucial to increase public awareness of their use (Zhou et al., 2022).

According to the International Energy Agency, the growth of the electric vehicle market is primarily driven by government policies; in other words, the government is the most critical factor influencing the public's adoption of electric vehicles (Xu et al., 2020). Many nations have developed policies in recent years to promote the creation and purchase of new energy vehicles (Mali, et al., 2022). In Europe and the United States, some countries have popularized the benefits of electric vehicles, besides, policies such as tax -free, free parking, priority use of bus lanes, exemption of road tolls have been announced (Trębecki et al., 2022). The Chinese government has also enacted several favourable policies to encourage the development of electric vehicles. For example, subsidies for electric vehicle manufacturers, charging stations, etc. In addition, it also provides measures such as free purchase tax, green special licenses to encourage potential consumers to adopt electric vehicles (Hu et al., 2020).

Despite the policy promotion and the government's widespread support, the adoption rate of many national electric vehicles failed to achieve the original goal (Mukherjee & Ryan, 2020). The same problem has also been encountered in the Chinese market (Liu et al., 2022). According to the new energy vehicle industry development plan (2021-2035), electric vehicle sales in China will surpass total car sales in 2025; by 2035, pure electric vehicles will dominate the electric vehicle market. In 2021, however, the total number of automobiles in China reached 296 million, and new energy vehicles accounted for only 6.78 million, or 2.29 percent of the total, and this is quite a distance from the 20% goal of the plan to develop the new energy vehicle industry (Zhang et al., 2022). Some publics are interested in electric vehicles but are suspicious, which greatly affects the diffusion of electric vehicles in the market (Dong et al., 2020). In recent years, the government's subsidies for new energy vehicles will gradually cancel. Therefore, it is urgent to find new methods to improve the public's understanding of electric vehicles and improve their willingness.

Numerous automobiles influence consumers' decisions to purchase new energy vehicles. These factors relate to product characteristics, including price, performance, range, charging time, and ease of use (Kim et al., 2022). Some are related to external contextual factors, such as subsidy policies and charging facilities, etc. (Murugan & Marisamynathan, 2022). In addition, consumer psychological factors are also one of the reasons for purchasing decisions, such as perceived risk, emotions and attitudes, norms and environmental awareness, etc. (Hamed et al., 2023). In previous studies, many researchers believed that price is one of the factors that affect the purchase of new energy vehicles (Vafaei-Zadeh et al., 2022), however, most of the related research on price focused on two factors: subsidy policy and product price. In addition, researchers have also found that usage cost has an impact on the purchase of new energy vehicles, but related research is relatively lacking, and there is no specific research showing how usage cost studies the adoption of new energy vehicles. The current study aims to bridge this research gap.

The "stimulus-organism-response" (SOR) model is used as the fundamental research framework in this study to examine how the usage cost (S) of new energy vehicles affects

consumers' perceptions of value (O: perceived functional value, perceived emotional value, and perceived social value), which in turn affect consumers' purchase intentions (R). The rest of this article will go into further depth about some of the study's variables, research assumptions, and research implications.

## **Literature Review and Conceptual Framework**

### **Consumer Purchase Intention**

Consumer purchase intention refers to a consumer's propensity to purchase a product or service shortly. It is an individual's plan or decision to buy a product or service based on their needs, preferences, and available resources (Hewei & Youngsook, 2022). In studies such as new energy vehicle purchase propensity, customers' perception of the functional value of new energy vehicles affects consumers' purchase intentions. This perception includes both good and bad aspects. Xie et al (2022) studied the relationship between innovation characteristics and purchase intention. They found that consumers interested in emerging technologies are more likely to accept new energy vehicles because new technologies attract them to buy. Irfan and Ahmad (2021) found that when customers feel the progressive nature of NEVs, their attitude towards NEVs is more favorable, and they are more likely to buy new vehicles. However, there are also adverse effects. According to the research of Hao, et al (2022) , the cruising range of new energy vehicles is only enough for short-distance travel; customers are worried about the need for long-distance travel, so they refuse to buy NEV.

When studying the purchase intention of new energy vehicles, some scholars believe that consumers' perceived emotions will affect consumers' purchase intention. Xiang et al (2021) found that consumers are more concerned about whether the price of new energy vehicles can satisfy them and whether an acceptable price can make them feel happy and increase the possibility of purchasing. In other words, the price will have a related emotion on the consumer's purchase propensity, affecting the purchase propensity. Palit, Bari, and Karmaker (2022) found that some consumers may be attracted by the cost-saving advantages of new energy vehicles; for example, the cost of charging is lower than the cost of fuel, resulting in happiness and a desire to buy new energy vehicles. In addition, new energy vehicles are among the luxury goods in many countries. Consumers' purchase of luxury goods can highlight their economic strength and make them appear different; this feeling makes consumers have a great sense of superiority; in turn, this sense of superiority will strongly stimulate consumers to buy luxury goods and generate the desire to continue buying (Nobre et al., 2022).

In terms of social environment, previous researchers have also found that social and environmental factors will affect the purchase of new energy vehicles. Zhang et al (2022) found that new energy vehicles have a good effect on environmental protection, which has become an essential reason buyers accept goods. Therefore, advertisements for new energy vehicles should emphasize their energy-saving performance and environmental protection, which will significantly increase consumers' adoption rate of new energy vehicles. Fan et al (2022), based on the complex network evolutionary game theory, found that from the consumers' perspective, both social influences and environmental factors will affect consumers' willingness to choose new energy vehicles. Campisi, et al (2022) surveyed Enna city, a size typical of small Italian urban centers, to identify the main variables influencing consumers' willingness to purchase new energy vehicles. Their research shows that

environmental awareness and product price acceptability are the most influential determinants of purchase intention. In addition, Lashari et al(2022) research results on consumers' purchase of new energy vehicles show that consumers' perception of the environment substantially impacts the purchase of electric vehicles. Roh et al (2022) found a positive correlation between perceived value and trust in a Chinese consumer study.

### **The Relationship between Usage Cost and Perceived Functional Value**

The cost of use will increase customers' recognition of the practicality of new energy vehicles. Su et al (2021) pointed out that rising oil prices have become one of the reasons consumers pay more attention to new energy vehicles. Consumers also feel the functional advantages of new energy vehicles because of their low energy costs. Also, Shah and Kaka (2022), who conducted a study on the electricity consumption of consumers of new energy vehicles, showed that electric vehicles are more fuel efficient and cheaper to fuel than conventional vehicles cost. Low energy costs highlight the advantages of NEVs and positively impact perceived functional value. In addition, Rao (2020) found in his research on new energy vehicles that the impact of traditional vehicle resistance factors on the sales growth of the new energy vehicle market from high to low is: cost considerations, technical factors, and consumer factors. This study shows that the cost of use of consumers affects consumers' perceived functional value of new energy vehicles and their willingness to purchase. Analysis results of Liang et al (2023) show that EVs have a larger market share than other vehicles when usage costs grow faster than energy prices and inflation. The study also shows that when oil prices rise, consumers will be optimistic about the functional value of new energy vehicles. Whether the cost of use will affect consumers' perception of the functional value of new energy vehicles. Therefore, based on the above research, the following proposition is proposed:

Proposition 1a: Low usage cost positively influences perceived functional value.

### **The Relationship between Usage Cost and Perceived Emotional Value**

The cost of use will impact consumers' perceived emotional value. First of all, in terms of fuel cost and electricity price comparison, fuel prices in many countries are much higher than electricity prices, so new energy vehicles can save consumers much money Xue et al (2021); the saved money can allow consumers to have more disposable funds to effectively meet more needs of consumers, thereby affecting their mood (Moè & Katz, 2021). In addition, price fairness positively impacts customers' perceived emotional value in terms of using the price to affect consumers' judgments of fairness (Malc et al., 2021). In many countries, although oil prices have changed frequently over the past few years, it is still significantly more expensive than electricity. Comparing electricity and gasoline costs will change perceptions of pricing fairness. Furthermore, price fairness is mediated by customer perceived value, increasing customer satisfaction (Matsuoka, 2022). According to the results of their study, when the fuel price is higher than the electricity price, consumers' perception of price fairness has a positive impact on their emotional value perception; that is, excessive oil prices make consumers more emotionally reassured about electric vehicles. Therefore, in terms of perceived emotion, a fair perception of the cost of use will directly impact customer pleasure. Based on previous research, the following proposition is drawn

Proposition 1b: Low usage cost positively influences perceived emotional value.

### **The Relationship between Usage Cost and Perceived Social Value**

Regarding the perceived social value of increased usage costs, current research focuses on the impact of increased usage costs on air quality and consumption costs. Regarding consumption costs, current research mainly focuses on living costs and industrial costs. Concerning food spending, it is often assumed that agricultural product prices will rise with oil prices; that is, there is a positive relationship between them (Xu & Hsu, 2022). In the case of maize, high oil prices have increased market demand for maize, which is often converted into biofuels for industrial manufacturing in industrialized economies (Cavelius, et al., 2023). The price of corn, one of the main foods, will also rise due to rising oil prices, which increases the cost of living for consumers and endangers society. As oil prices rise, producers' production costs will increase and be passed on to society, harming society and affecting consumers' perception of social value. Research has shown that fuel pricing regulations impact air quality in terms of air pollution, and the changes in fuel prices can lead to changes in fuel/fuel demand and, thus, vehicle emissions (Raeissi et al., 2022). In addition, Zafar et al (2022) results show that increased gasoline costs significantly impact improving air quality and reducing emissions. The increase in fuel prices will reduce the frequency of household use of fuel vehicles. Existing research shows that with the increase in fuel prices, pollutant emissions will significantly improve. The reduction of pollutants is of great help to improve the environment, especially in developing countries, allowing consumers to feel the social value of rising fuel prices and have a positive impact. Although, in terms of cost, rising fuel prices will hurt the perceived social value, consumers are more inclined to consider environmental protection or sustainable development when choosing new energy vehicles. Whether the cost of use will affect consumers' perception of the social value of new energy vehicles, this study makes the following proposition

Proposition 1c: Low usage cost positively influences perceived social value.

### **The Relationship between Perceived Functional Value and Consumer Purchase Intention**

In most studies on the effect of perceived functional value on consumers' purchase intentions, functional value has been shown to play an essential role in determining whether customers are likely to purchase related goods. In perception study on marketing applications, Luo et al(2022) discovered the functional value significantly impacted purchase intent. Chakraborty and Dash (2023) finds that awareness of health-related functional value influences purchase frequency. The functional value of an electric vehicle is the usefulness and benefits that customers derive from using an electric vehicle. Therefore, vehicle performance is a crucial factor influencing customers' purchase choices (Palit et al., 2022). In the study conducted by Ziegler and Abdelkafi (2022), the most prominent disadvantage of purchasing electric vehicles in the past was the time required to reach a complete state of charge and obtain a suitable driving range. These functional disadvantages affected consumers' purchase intentions. In addition, the better the safety, cruising range, charging time, battery life, and charging infrastructure of the vehicle, the higher the enthusiasm of buyers to purchase electric vehicles (Ghasemi-Marzbali, 2022). In recent years, the quality of new energy vehicle products has been continuously improved. In addition, sales data show that consumers' willingness to buy energy vehicles during the New Year has dramatically increased. Price is also one of the essential indicators to measure the value of functions (Salem & Alanadoly, 2022). A few years ago, in order to promote the reform of the automobile industry and the popularization of electric vehicles, governments at all levels issued a series of subsidies and support policies for

electric vehicles, encouraging car companies to conduct technology and battery research, and increasing consumer purchases by providing tax cuts and subsidies. Willingness and purchasing power (Zheng et al., 2022). However, the reduction of subsidies in recent years will impact the sales of new energy vehicles. Under the current new environment, there is not enough research on whether the functional value perceived by consumers impacts the sales of new energy vehicles. However, based on previous research, the following proposition is formulated

Proposition 2a : Perceived functional value positively influences consumer purchase intention.

### **The Relationship between Perceived Emotional Value and Consumer Purchase Intention**

Regarding the relationship between perceived emotional value and customers' purchase intentions, current research mainly focuses on the emotional factors that commodities bring to consumers, which affect consumers' purchase intentions. Among the influences of emotional value on consumers' purchase intention, the fewer negative emotions in the purchase process, the greater the possibility of purchase (Zhai et al., 2022). The shorter the buying decision time, the greater the time pressure on consumers to buy; this stress increases, as does anxiety, negative emotions, and perceived risk, leading to purchase abandonment. This unpleasant purchase experience can damage customers' value perception and purchase intention (Nofal et al., 2022). In addition, former researchers explain the influence of perceived emotional value on purchase intention. For example, a study related to NEV assumes that cognitive tests elicit emotions that correspond to consumer behavior, such as purchase intentions (He, et al., 2022). In the marketing literature, previous researchers generally believe that happy emotions affect customers' purchase intention and loyalty. For example, Song et al (2022) pointed out that consumers' pleasure perception may affect their propensity to repurchase. In addition, Guo et al (2022) found that positive emotions can predict consumer behavior better than negative emotions when examining the impact of positive and negative emotions on behavioral intentions because good emotions often lead to customers' purchase intentions. These previous findings were corroborated by Chakraborty and Dash (2023) who showed that positive emotions significantly increased consumers' purchase intentions in a food-related study. When purchasing an electric vehicle, people expect a comfortable and enjoyable driving experience (Sun et al., 2022). The environmental protection characteristics and pleasant and comfortable driving experience of electric vehicles meet the psychological needs of various consumers. In addition, environmentally conscious customers strongly desire to reduce carbon emissions. So, when customers see the emotional value in the driving experience and the reduction in carbon emissions, they decide to go electric. Under the current new environment, there is not enough research on whether consumers' perceived emotional value impacts the sales of new energy vehicles. Based on this study, the following proposition is put forward:

Proposition 2b: Perceived emotional value positively influences consumer purchase intention.

### **The Relationship between Perceived Social Value and Consumer Purchase Intention**

In a study on the impact of perceived value on consumer purchases, Sun et al (2022) explores how consumers' trust propensity affects their continuous use intention. The findings suggest that perceived social value has a considerable beneficial effect on customers' purchase

propensity. Huo et al (2022) believe that corporate social responsibility image may affect customers' confidence in the company, affecting consumers' purchase intention. When customers have a good impression of the company's skills and social responsibility image, their confidence in the company will rise, thereby increasing their willingness to buy. In addition, if consumers recognize the benefits of organic food to society, it may increase customer trust and thus increase consumers' willingness to purchase (Tan et al., 2022). Bhat et al (2022) found that perceived social value has a significant and indirect positive correlation with purchasing NEVs. The findings suggest that consumers' knowledge of green purchasing behaviors and the positive social image generated by green purchasing behaviors may motivate people to participate in green shopping behaviors and purchase hydrogen-fueled vehicles in the future. In China, in addition to the environmental protection and social value perception given to consumers by the car itself, the social image created by purchasing green products is also a driving factor for people to buy new energy vehicles. Purchasing green products plays a more critical role in the good social image of Chinese consumers; therefore, the social value brought by the purchase of new energy vehicles may be more important than environmental concerns, and this key factor will increase customers' purchase propensity. This conclusion is consistent with other research showing that in collectivist countries, social evaluation and social status may be more important drivers of individual environmental protection actions (Liao et al., 2022). Under the current new environment, there is not enough research on whether consumers' social value perception impacts the sales of new energy vehicles. Therefore, the following proposition is drawn:

Proposition 2c: Perceived social value positively influences consumers' purchase intention.

### Conceptual Framework

A framework has been created to show the impact of usage cost (S) on consumer perceived value (O), which in turn affects consumer willingness to purchase (R). The theoretical framework is shown in Figure 1.

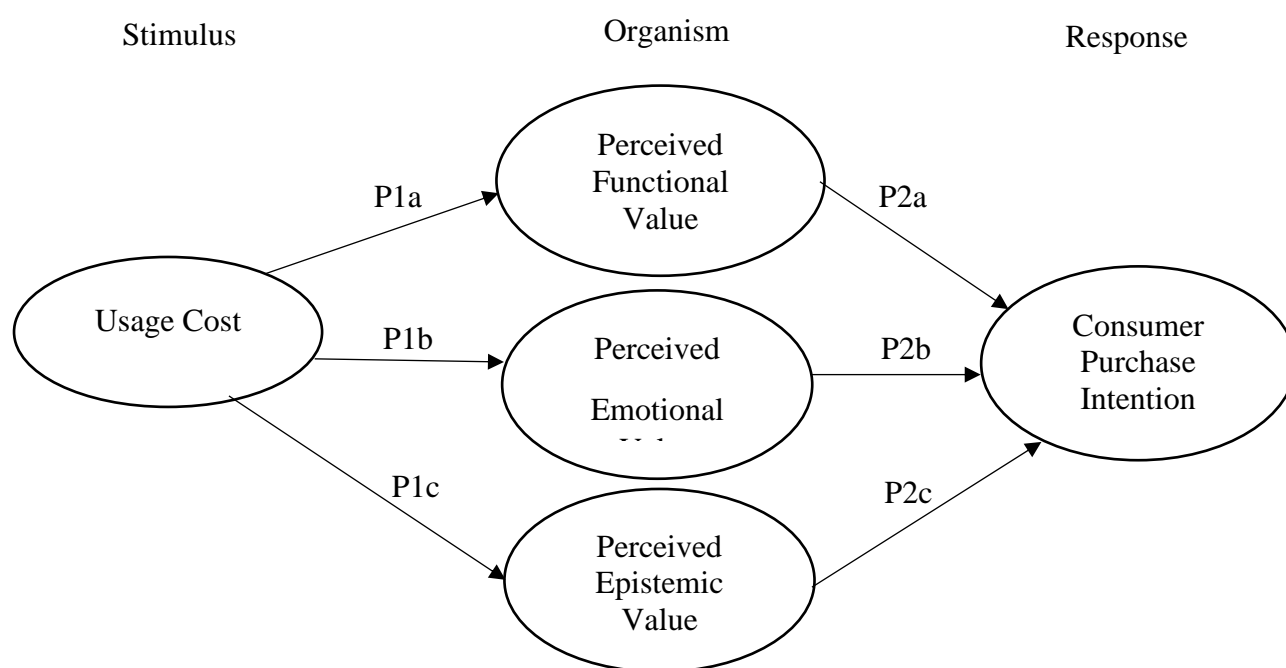


Figure 1: Proposed Conceptual Framework



### Research Implications

This study uses the SOR theoretical model as the framework, uses the cost of new energy vehicles as a stimulus variable, and then explores how the cost of use affects consumers' perceived value. The research also demonstrates how consumer perception of value impacts customers' propensity to buy new energy cars, which is important for selling and adopting new energy vehicles. Therefore, this study's findings should aid future studies in completely comprehending the psychological processes consumers go through when acquiring new energy vehicles.

In terms of practical application, the purchase volume of new energy vehicles is still relatively low, and car dealers have applied various methods but failed to increase the sales of new energy vehicles effectively. This study uses the SOR framework to investigate the psychological aspects of customers. The findings of the investigation and analysis will provide helpful advice to businesses and indicate ways to increase customer interest in new energy vehicles. The way enterprises intervene has important practical significance for the government and enterprises to accelerate the commercialization of new energy vehicles.

In terms of new energy vehicles usage, countries around the world started almost simultaneously. In many countries, due to the government's strong support for the new energy vehicle industry, significant progress has been made in technology and innovation capabilities, thereby achieving the goal of environmental protection. At the same time, other industries related to new energy vehicles have also developed simultaneously, further highlighting the status of new energy vehicles in the global automotive industry. How to achieve the expected market goals, not only meet the daily life and travel needs of residents but also reduce the environmental pollution caused by motor vehicles, is a crucial issue to be considered. The research results of this paper help enrich the market demand research and policy research of the new energy automobile industry and have specific reference value and practical significance for policymakers to promote the development of the new energy automobile industry.

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