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The Impact of Government Policy on Consumer Purchase Intention of New Energy Vehicles

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ABSTRACT

This study focuses on the relationship between consumer attitude towards government policy of new energy vehicles and the purchase intention. Based on the planned behavior theory, taking behavior attitude, subjective norms, and perceived behavioral control as the intermediary variables, we analyze how environmental awareness and consumer attitude to government policy of new energy vehicles affect the intention of purchase behavior. Empirical results show that attitude towards policy have a positive impact on the purchase intention. The environmental awareness is intermediated by subjective norms and perceptual behavioral control and then have an indirect impact toward the intention of purchase behavior, and the attitude towards government policy of new energy vehicles can not only affect through the intermediary role of the subjective norms and perceptual behavioral control, but also directly affect the purchase intention. Therefore, the influence of the attitude toward government policy of new energy vehicles on the intention of consumers is stronger than the environmental awareness. Compared to consumer environmental awareness as an internal driving factor, attitudes towards policies, as an external driving factor, have a more significant impact on consumers' intentions to purchase new energy vehicles.

1. Introduction

The issue of global warming has become increasingly serious, and automobile exhaust emissions are a major contributor to this problem in China. To address this issue, it is crucial to accelerate the promotion of new energy vehicles as a replacement for traditional fuel vehicles (Chen Zhen, Yanga Lijun, 2021). However, despite the growing acceptance of new energy vehicles in recent years, they still lack a significant market share in China. For instance, in 2022, sales of new energy vehicles in China reached 6.887 million units, a year-on-year increase of 93.4%, but still fall short compared to traditional fuel vehicles.

Moreover, the new energy subsidy policy, although ongoing, has been affected by fraud, leading to a reduction in fiscal subsidies that is expected to continue. This situation is likely to weaken the sales of new energy vehicles (Zhou Yan, Pan Yao, 2019). Furthermore, the purchase subsidy policy for new energy vehicles has been terminated, prompting the government to reevaluate its promotion policy. This raises questions about how the government can adjust the direction of its promotion policy, how consumer purchase intention of new energy vehicles may change in response to government policy, and the impact of policy changes on the development of the new energy vehicle industry. These are crucial questions that require urgent attention from the government, automotive industry, and academic community, as they have both theoretical value and practical significance.

To address these challenges, the government should focus on developing a comprehensive promotion policy that takes into account the current market demand, consumer preferences, and the costs and benefits of new energy vehicles. This approach could involve a range of incentives, including tax breaks, subsidies for charging infrastructure, and initiatives to encourage the adoption of new energy vehicles by public institutions. Furthermore, the government should collaborate with the automotive industry to develop new energy vehicles that are affordable, efficient, and attractive to consumers.

The changes in government policy are likely to affect consumer purchase intention of new energy vehicles. The withdrawal of purchase subsidies may discourage some consumers from buying new energy vehicles, especially those who are more price-sensitive. However, other factors such as the environmental benefits of new energy vehicles, rising fuel costs, and technological advancements

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may continue to encourage consumers to switch to new energy vehicles. Thus, it is crucial for the government and automotive industry to work together to ensure that consumers are well-informed about the benefits of new energy vehicles and that they have access to the necessary infrastructure to support their adoption.

In conclusion, the promotion of new energy vehicles in China is a complex issue that requires a multi-faceted approach. The government and automotive industry must work together to develop policies that incentivize consumers to switch to new energy vehicles while ensuring that they are affordable and efficient. By doing so, China can reduce its carbon emissions, improve air quality, and lead the way in the development of new energy vehicles.

Consumption is a key driver of economic growth, and fiscal subsidies were initially implemented to stimulate market demand for new energy vehicles by reducing the cost of car purchases for consumers. The objective was to promote the economic effect of automobile manufacturing enterprises and drive the overall development of the new energy vehicle industry. Therefore, evaluating how policy adjustments affect consumer purchase intention is crucial in determining the efficacy of policy changes and informing future adjustments.

Our study aims to analyze the drivers of consumer and explore the factors influencing consumer purchase intention for new energy vehicles. There are two main contributions of this article. Firstly, we expand on the traditional planned behavior theory to develop a decision-making model for new energy vehicle purchase behavior and discuss the main drivers and influencing factors of consumer purchase intention. This model provides a theoretical basis for comprehensively understanding the interaction between consumers' attitudes towards new energy vehicle policies and their purchase behavior intentions. Secondly, our study examines the association between attitudes towards and purchase intention of new energy vehicle policies, respectively. This clarifies the different impacts of promotional policies on different market demand groups and provides support for the new round of adjustments to the promotion policy of new energy vehicles. Furthermore, this study provides insights for new energy vehicle companies to develop corresponding marketing strategies in the post-subsidy era.

Overall, our study provides a comprehensive and systematic analysis of the drivers of consumer purchase intention for new energy vehicles, offering valuable insights for policymakers and industry stakeholders.

2. Literature review

2.1 Purchase intention

Purchase intention refers to consumers' inclination to purchase goods, and it serves as an indicator for their actual shopping behavior. In essence, it reflects consumers' subjective willingness to adopt purchase behavior (Li et al., 2009). Research on the factors that influence consumer purchase intention can be mainly categorized into the following three areas:

Firstly, psychological factors significantly impact consumer purchase intention of new energy vehicles. Kong Deyong, for instance, believed that psychological factors, which include both personal and external factors, play a crucial role in consumers' purchase of pure electric vehicles (Kong, 2018). By positively influencing consumers' psychology through policies and enhancing their purchase intention through psychological suggestions, the choices of individual consumers can create a pro-new energy vehicle atmosphere in society, eventually changing the attitudes of the entire population towards new energy vehicles (Sabrina et al., 2019).

Secondly, environmental factors also impact consumer purchase intention of new energy vehicles. With environmental protection becoming increasingly important, only those vehicles that align with social sustainability will be supported, acknowledged, and eventually purchased by consumers. New energy vehicles, with their ability to reduce vehicle exhaust pollution and save gasoline, contribute to improved market competitiveness (Li et al., 2020).

Thirdly, product attribute factors also influence consumer purchase intention of new energy vehicles. These factors include vehicle quality, performance, endurance mileage, charging convenience, and other attributes that relate to vehicle quality and consumer usage experience (Niu, 2018; Zhou et al.,2018). New energy vehicles, despite their environmentally friendly nature, remain consumer goods, and their product factors inevitably impact consumer purchase intention.

In addition to the previously discussed psychological, environmental, and product attribute factors, recent research has identified several other factors that can significantly influence consumers' purchase intention of new energy vehicles. One such factor is social influence. According to Zhang, X (2019), social influence, which includes both normative and informational influences, can significantly affect consumer purchase intention of new energy vehicles. Normative influence refers to the pressure that individuals feel to conform to social norms, such as the desire to be seen as environmentally conscious. Informational influence, on the other hand, refers to the impact that social interactions, media coverage, and advertising can have on consumers' perceptions of new energy vehicles.

Another factor that can influence consumer purchase intention of new energy vehicles is perceived risk. Sabrina (2019) found that consumers' perceived risk associated with new energy vehicles, such as concerns about their safety, reliability, and resale value, can negatively impact their purchase intention. Therefore, policymakers and manufacturers need to take measures to address consumers' perceived risks and provide them with accurate information to alleviate their concerns.

In addition, consumers' trust in new energy vehicle technology can also influence their purchase intention. Tu, JC (2019) suggested that consumers' trust in new energy vehicle technology, which encompasses their confidence in the technology's safety, reliability, and performance, can positively impact their purchase intention. Therefore, manufacturers should focus on building consumers' trust in new energy vehicle technology by improving their product quality and reliability and ensuring their safety.

Lastly, consumers' personal characteristics, such as their age, income, and education level, can also influence consumer purchase intention of new energy vehicles. Yin& Li. (2022) found that younger, more educated, and environmentally conscious consumers are more likely to have a positive purchase intention towards new energy vehicles. Therefore, policymakers and manufacturers should target these groups with appropriate marketing strategies and policies to promote the adoption of new energy vehicles.

In summary, consumer purchase intention of new energy vehicles is influenced by various factors, including psychological, environmental, product attribute, social influence, perceived risk, trust in technology, and personal characteristics. Policymakers and manufacturers need to take these factors into account and design effective policies and products that meet consumers' preferences and

needs.

2.2 Government policy and purchase intention of New energy vehicle

The government's policies promoting new energy vehicles have three main functions: publicity and guidance, tax relief and subsidies, and vehicle enterprise image and brand building. Each policy impacts consumer purchase intention in specific ways. Firstly, the publicity and guidance policy can increase consumers' understanding and interest in new energy vehicles, thereby improving their consumer purchase intention, especially in the face of reduced sales volumes due to a reduction in government subsidies. (Alex et al.,2009; Lou & Wang, 2017). Secondly, Li et al.,(2017) found that government subsidies play a crucial role in encouraging consumers to purchase new energy vehicles; tax relief and subsidies significantly reduce the cost of purchasing new energy vehicles, making them more price-competitive than traditional fuel vehicles, thus increasing consumer purchase intention (Zhang et al., 2019; Klabi & Binzafrah, 2023). Thirdly, the government can improve consumers' recognition and trust in the new energy vehicle brand by building the vehicle enterprise image and brand, thus increasing consumer purchase intention. This improvement can be amplified through word-of-mouth publicity among consumers. (Wang et al., 2021).

Moreover, the study found that government policies aimed at promoting public awareness of the environmental benefits of new energy vehicles are also important in increasing consumer purchase intention. Another study by Han et al. (2020) found that the government's provision of free charging facilities and other support measures can positively affect consumer purchase intention.

In addition to the above policies, government regulations and incentives related to the development of charging infrastructure also play a crucial role in influencing consumer purchase intention. For example, research by Zheng (2018) found that the availability of charging stations significantly influences consumers' purchase intention of new energy vehicles. In addition, the study found that government incentives to promote the development of charging infrastructure can increase consumer confidence in new energy vehicles and ultimately increase their purchase intention.

Finally, some studies have highlighted the importance of government policies in promoting technological innovation in the new energy vehicle industry. For example, a study by Yin (2019) found that government policies aimed at promoting the development of advanced battery technologies can significantly improve consumer perceptions of new energy vehicles and increase their purchase intention.

In summary, government policies play a critical role in promoting consumer purchase intention of new energy vehicles. The policies can influence consumer purchase intention through various means, such as subsidies, charging infrastructure development, technological innovation, and public awareness campaigns. Therefore, it is essential for governments to continue to develop and implement effective policies to promote the adoption of new energy vehicles, which will ultimately contribute to the development of a sustainable transportation system.

3. Numerical approach

3.1 Theoretical basis and assumptions

The planned behavior theory was developed by Icek Ajzen, who found that human behavior is not entirely voluntary, but is influenced by control. He expanded the Theory of Reasoned Action by introducing the concept of "Perceived Behavioral Control," which resulted in the development of a new behavior theory research model - the planned behavior theory. This theory comprises five factors: behavioral attitude, subjective norms, perceived behavioral control, behavioral intention, and behavior. Our research applies the planned behavior theory to the study of new energy vehicle purchase intention. Specifically, we focus on analyzing the mediating roles of behavioral attitudes, subjective norms, and perceived behavioral control between consumers' environmental awareness, their attitudes towards policies, and their purchase intention. We construct a diagram of the influence relationship between the various variables in our research based on the following assumptions, as illustrated in Fig1.

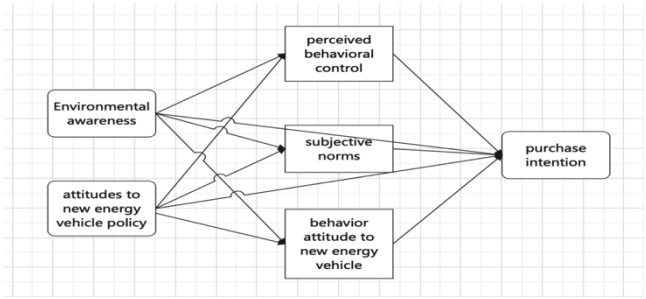

Fig. 1.variable relationship model

2.2 Sample selection and data sources

3.1.1 behavior attitude

Behavior attitude refers to an individual's subjective evaluation of their positive or negative attitude towards a specific behavior (Ajzen I, 2002). In the context of our research, behavior attitude is mainly reflected in individuals' subjective feelings towards purchasing new energy vehicles. A more positive attitude towards the behavior is associated with a higher likelihood of purchasing a new energy vehicle. Based on this, we propose the following assumptions for our research.

H1: Personal purchase intention is affected by the behavior attitude of new energy vehicle, and the two are positively related. That is, the more positive behavior attitude, the higher the purchase intention.

3.1.2 subjective norms

Subjective norms refer to the perceived social pressure or influence from the individual's social environment when considering a specific behavior (Ajzen I, 2002). In our research, subjective norms refer to the influence that individuals feel from their social networks when considering the purchase of new energy vehicles. The stronger the perceived subjective norms, the higher the likelihood that consumers will purchase new energy vehicles. Therefore, we propose the following assumptions in our research.

H2: Personal purchase intention is affected by the subjective norms of new energy vehicle, and the two are positively related. That is, the stronger the subjective norms, the higher the purchase intention of the purchase.

3.1.3 perceived behavioral control

Perceived behavioral control refers to an individual's belief about their ability to overcome obstacles and successfully perform a specific behavior, based on their past experience and expectations (Ajzen I, 2002). In the context of our research, perceived behavioral

control refers to personal factors such as life experience, self-awareness, financial situation, and knowledge of new energy vehicles that influence the purchase of new energy vehicles. As people's understanding of new energy vehicles deepens, it can positively impact their purchase intention. Therefore, our research proposes the following assumptions.

H3: Personal purchase intention is affected by the perceived behavioral control of the behavior when buying new energy vehicles, and the two show positive correlations. That is, the stronger the control of the perception behavior, the stronger the purchase intention.

Environmental awareness means that individuals pay attention to environmental protection, sustainable development and other aspects in their actions, consumption and life, pay attention to the economical use of natural resources and the reduction of environmental pollution, minimize the negative impact on the environment, and take positive measures. measures to improve and protect the environment. In this paper, environmental awareness means that when consumers buy new energy vehicles, they mainly pay attention to the reduction of exhaust emissions and the use of renewable resources instead of fuel energy, so as to reduce environmental pollution, and use this as a starting point to promote sustainable development. Create a better ecological environment. Therefore, this paper puts forward the following hypothesis.

H4: The personal behavior attitude of new energy vehicle behavior is affected by the environmental awareness of individuals when buying new energy vehicles, and the two show a positive correlation. That is, the stronger the environmental awareness, the stronger the attitude of its personal behavior.

H5: The personal subjective norms of new energy vehicles are affected by the environmental awareness of individuals when buying new energy vehicles, and the two show a positive correlation. That is, the stronger the environmental awareness, the stronger its subjective norms.

H6: The personal perceived behavioral control of new energy vehicles is affected by the environmental awareness of individuals when buying new energy vehicles, and the two show a positive correlation. That is, the stronger the environmental awareness, the stronger the control of its personal perception.

H7: Personal purchase intention is affected by the environmental awareness of individuals when buying new energy vehicles, and the two show positive correlations. That is, the stronger the environmental awareness, the stronger the personal purchase intention.

Attitude towards new energy vehicle policy refers to an individual's perception and feelings towards government policies that affect the new energy vehicle market. The impact of policy on consumers may vary based on their personal views and beliefs. In our research, we aim to explore the relationship between consumers' attitudes towards the government's relevant policies and their consumer purchase intention for new energy vehicles. We hypothesize that consumers' attitudes towards the policy will have a significant impact on their new energy vehicle purchase behavior. Therefore, our research proposes the following assumptions.

H8: The personal behavior attitude of new energy vehicle behavior is affected by the attitudes to new energy vehicle policy of individuals, and the two show a positive correlation. That is, the stronger the environmental awareness, the stronger the attitude of its personal behavior.

H9: The personal subjective norms of new energy vehicles are affected by the attitudes to new energy vehicle policy of individuals, and the two show a positive correlation. That is, the stronger the environmental awareness, the stronger its subjective norms.

H10: The personal perceived behavioral control of new energy vehicles is affected by the attitudes to new energy vehicle policy of individuals, and the two show a positive correlation. That is, the stronger the environmental awareness, the stronger the control of its personal perception.

H11: Personal purchase intention is affected by the attitudes to new energy vehicle policy of individuals, and the two show positive correlations. That is, the stronger the environmental awareness, the stronger the personal purchase intention.

3.2 Research methods

Based on the Theory of planned behavior, this study mainly studies the relationship between consumers' attitudes towards the government's new energy vehicle policies and their purchase intentions. Since this paper is based on the Theory of planned behavior, we take Behavior attitude, Subjective norms and Perceived behavioral control as three intermediary variables. And the independent variable of this article is Attention to Policy and Environmental Awareness, the dependent variable is Purchase intent. Therefore, the study used Logistic regression model to determine the relationship between these variables. The Logistic regression model of this study is set as follows:

$$Y_{it} = \alpha_i + \beta X_{it} + \mu_{it} \tag{1}$$

Among them, the dependent variable $Y=\{Pi\}^T$ is Purchase intention; The explanatory variable $X=\{Atp,Ea\}^T$ is Attitudes to policy and Environmental awareness. Then, build a Mediating Effect Model between Behavioral attitude, Subjective norms and Perceived behavioral control and Purchase intention

$$\begin{cases} Ews_{it} = \breve{\alpha}_l + \delta\breve{\alpha}_1 X_{it} + \mu_{it} \\ M_{it} = \breve{\beta}_l + \breve{\beta}_1 X_{it} + \varepsilon_{it} \\ Ews_{it} = \breve{\gamma}_l + \breve{\gamma}_1 X_{it} + \breve{\gamma}_2 M_{it} + \mu_{it} \end{cases} \tag{2}$$

Among them, the explanatory variable and the dependent variable are the same as above; Intermediary variables $M=\{Atc, Sn, Pbc\}^T$ are Behavior attribute, Subjective norms, and Perceived behavioral control.

3.3 Variable measurement

The explanatory variables, mediating variables, and dependent variables used in this article are all derived from the data obtained from the questionnaire in the Hangzhou area. The measurement form of the main questions in the survey questionnaire mainly adopts the Likert five level scale, with each question being a numerical option from 1 to 5, representing "completely unimportant" to "completely important". A five levels scale can make it easier for respondents to determine their location, thereby ensuring more accurate data. The software used in this empirical analysis is Spss software.

(1) Explanatory variables. purchase intention, the data for this variable comes from personal questionnaire data obtained in the Hangzhou area. Ajzen defines intention as the subjective probability of an individual engaging in a specific behavior, which can be used to predict the occurrence of actual behavior. In the field of new energy vehicles, the industry generally has a unified understanding of purchase intention, that is, the willingness to understand and choose to purchase and promote new energy vehicles. For example, in Li

Meixia's (2013) study on the influencing factors and marketization of pure electric vehicle purchase decisions from a consumer perspective, consumers believe that in the next five years, China's pure electric vehicles will move towards marketization, and they will choose pure electric vehicles when purchasing cars. I believe that I will have a pure electric vehicle in the next decade to measure consumer purchase decisions. Therefore, this article sets items based on two aspects, namely "Do you have any plans to purchase new energy vehicles" and "Are you saving money to buy new energy vehicles", and calculates the factors of the variables through variable inversion for these two questionnaire questions.

(2) Dependent variables. Environmental awareness, the data for this variable comes from personal questionnaire data obtained in the Hangzhou area. Environmental awareness can serve as an important factor in predicting individual pro environmental behavior, reflecting consumers' level of understanding and understanding of environmental issues and protection. Consumers who use electric vehicles often have stronger pro environmental awareness. Therefore, based on the research of Wu et al. (2019) and combined with the actual situation of the new energy vehicle consumption market in Hangzhou, this article designed corresponding measurement questionnaire questions, which include three questionnaire questions: "When driving, I will think about exhaust emissions", "I think new energy vehicle is helpful to the environment", and "I think I have an observation to protect the environment", And perform variable inversion to calculate the factors of the variables for these three questionnaire questions; Attributes to policy, the data for this variable comes from personal questionnaire data obtained in the Hangzhou area. So far, relevant experts and scholars at home and abroad have conducted extensive research on the marketing performance of new energy vehicles and the promotion of product sales through government preferential policies. For example, Wang Xiafang (2015), represented by Guangzhou City, conducted a special study on consumers' willingness to purchase new energy vehicles from the perspective of government policies, selecting direct preferential policies, indirect preferential policies The three dimensions of supporting policies have a significant positive correlation with purchase intention. This article is based on Wang's research and combined with the actual situation of the new energy vehicle consumption market in Hangzhou, and designs corresponding measurement questionnaire questions. The variable includes two questionnaire questions, namely "Do you think the government's new energy subsidiary policy can attract you" and "Do you think the license plate policy for new energy vehicles can attract you", And perform variable inversion to calculate the factors of the variables for these two questionnaire questions.

(3) Intermediary variables. In view of the fact that Fishbein's Theory of reasoned action and Ajzen's Theory of planned behavior have been very popular and mature in their research on attitudes, consciousness and behavior, and the academic circles have also conducted different depth studies on the influencing factors involved in the mature theory from various directions, and there are very mature scales for measuring the three influencing factors, namely, behavior attitude, perceived behavioral control, and subjective norms. However, since the rise of new energy vehicles has not been long, there are not many measurement items combined with new energy vehicles. This article refers to the relevant research of Wang et al., and combines the actual situation of the new energy vehicle consumption market in Hangzhou to summarize and design corresponding measurement variables. The data of these intermediary variables are all obtained from personal questionnaire data obtained in the Hangzhou area. The specific questions are as follows: The behavior attribute variable contains three questionnaire questions, namely "If you are ready to change cars, are you willing to change to new energy vehicles" and "Will you recommend new energy vehicles to others"; Perceived behavioral control, this variable contains three questionnaire questions, namely "Do you think new energy vehicles can meet daily needs", "Do you think new energy vehicles can meet daily needs", "Your variable conditions support your purchase of new energy vehicles"; Subjective norms, this variable contains three questionnaire questions, namely "Does anyone next to you advise you to buy a new energy vehicle", "Do many people around you use new energy vehicles", "If people around you buy new energy vehicles, would you buy them". Finally, the specific questionnaire questions for these three variables were inverted to calculate the factors of the variables.

4. Results

4.1 Data source and analysis

In recent years, Hangzhou has increasingly focused on the development of the new energy vehicle market as the vehicle industry is a key area for Hangzhou's implementation of the "New Manufacturing Plan." Hangzhou aims to promote high-quality development of the new energy vehicle industry and exceed foreign counterparts. To this end, Hangzhou published the "Fourteenth Five-Year Plan" for the development of energy conservation and the new energy vehicle industry in 2021. By the end of 2022, the number of new energy vehicles in Hangzhou was about 460,000, and the buses in the main urban area were 100% electrified, leading the promotion of new energy vehicles nationwide. Hence, Hangzhou is an ideal source of relevant data for our research, and the convenience of data collection and comparison strengthens the credibility of our findings across different groups.

All data used in this research were obtained from online questionnaires. The questionnaire content was created, verified, and evaluated by myself, my tutor, and professional teachers, and was released in April. In total, 1,128 questionnaires were collected, and 1,045 were deemed valid, yielding an effective rate of 92.5%. To ensure the authenticity and validity of the data, all online questionnaires were completed by Hangzhou citizens through WeChat, ensuring the validity of the sample.

4.2 Descriptive statistics

The relevant questionnaire data collected through our previous survey in Hangzhou, which outlines the basic attributes of the questionnaire sample used in this study. Among the respondents, the number of women (51.87%) exceeds that of men (48.13%). Regarding age distribution, respondents aged under 22 years old accounted for 17.89%, those between 23 and 32 years old accounted for 24.21%, those between 33 and 42 years old accounted for 34.55%, those between 43 and 52 years old accounted for 18.56%, and those aged 53 years and above accounted for 4.78%. More than half of the respondents are between 23 and 42 years old, which is consistent with the actual situation in China. In terms of educational background, the majority of respondents hold a college degree (45.07%), followed by an undergraduate degree (29.57%), which is similar to the current societal trend. The majority of respondents are ordinary staff (45.84%) in terms of occupation, reflecting the basic situation in Chinese society. Regarding monthly income, respondents' income is

predominantly below 30,000 RMB, which is consistent with the wage levels in Chinese society.

4.3 Empirical analysis

4.3.1 Reliability and validity analysis

Our research conducted Confirmatory Factor Analysis on the survey questionnaire data. We used SPSS software to perform the KMO and Bartlett tests. The KMO value obtained was 0.979, which exceeds the threshold of 0.9, indicating that the data is suitable for factor analysis. The results are presented in Tab1. Additionally, the significance value (SIG) in the Bartlett's Test of Sphericity is 0.000, which is less than 0.05, indicating that the data has a significant correlation among its variables. Moreover, the "Approximate Chi-Square" value is 3152.722, and the SIG value is 0.000, which is much less than 0.05. This indicates that the correlation matrix of the observation variable in our research cannot be the unit matrix and that it can reflect the relationship of data from multiple dimensions. Therefore, the data can undergo factor analysis.

Tab. 1. Test results

KMO sampling suitability quantity	0.979	
Bartlett's special sphericity test	Approximate chi-square	3152.722
	free degree	120
	conspicuousness	0
Clone Bach Alpha	0.972	

In addition to the confirmatory factor analysis, our research also tested the reliability of the questionnaire using Cronbach's α coefficient. The obtained coefficient is 0.972, which indicates that our research has a high level of reliability. The detailed results also are presented in Tab 1.

4.3.2 Factor analysis

In our research, we conducted a reverse coding of the questionnaire variables and re-evaluated the purchase intention of the variable dimensions related to new energy vehicle attitudes, subjective norms, perception of behavior control, environmental awareness, and policy attitudes. We then analyzed the factor load and common factor variance of these dimensions, as presented in Tab.2. The results of this analysis met the data requirements for testing an irregular model, indicating that the approach is feasible.

Tab. 2. Indicator Classification Summary

Variable	Factor loading	α coefficient	CR	Communalities
PI	0.917	0.829	0.841	0.841
PI1	0.849			0.721
PI2	0.838			0.706
ATC	0.879	0.810	0.773	0.773
ATC1	0.849			0.721
ATC2	0.829			0.696
SN	0.936	0.868	0.876	0.876
SN1	0.838			0.705
SN2	0.863			0.744
SN3	0.805			0.652
PBC	0.948	0.865	0.898	0.898
PBC1	0.865			0.751
PBC2	0.817			0.714
PBC3	0.927			0.676
EA	0.871	0.866	0.762	0.859
EA1	0.805			0.762
EA2	0.804			0.651
EA3	0.944			0.649
ATP	0.878	0.872	0.771	0.892
ATP1	0.849			0.771
ATP2	0.810			0.724

4.3.3 Correlation analysis

Based on the analysis of the Pearson correlation between the dimensions of purchase intention, Environmental awareness, attitudes towards new energy vehicle policy, behavior attitude, subjective norms, and perceived behavioral control, our research shows that the relevant data, as displayed in Tab 3, indicates a significant positive correlation between each pair of dimensions, with the Pearson index ranging from 0.7 to 1.0.

Tab. 3. Pearson correlation analysis

	PI	ATC	SN	PBC	EA	ATP
PI	1					
ATC	.741**	1				
SN	.831**	.782**	1			
PBC	.853**	.806**	.859**	1		
EA	.815**	.775**	.852**	.854**	1	
ATP	.849**	.790**	.868**	.885**	.847**	1

4.3.4 Multicollinearity analysis

In addition, our research conducts a linear regression analysis of each dimension to test its unique explanatory power. The specific results are presented in Tab 4. It is worth noting that all the variance inflation factors (VIFs) of each variable are greater than 1 but less than 10, indicating that there is no problem of multicollinearity among the dimensions.

Tab. 4. Coefficient of variance expansion

Variable	VIF	Standardization coefficient
ATC	3.289	.009
SN	5.501	.194
PBC	6.347	.314
EA	4.936	.139
ATP	6.192	.279

4.3.5 Hypothesis verification

Making relevant path analysis of each dimension, and calculate the standardization path coefficient and corresponding important coefficient between each dimension, then verify the assumptions mentioned in the previous article based on the path analysis results. In the end, the conclusion is shown in Tab 5, and it can be seen from the table: When the attitude of new energy vehicles has an impact on the intention of purchase, this path does not show significant ($Z = 0.161$, $P = 0.872 > 0.05$). Therefore, H1 is not supported.

When the purchase intention of the buyer is affected by the subjective norms, and its path coefficient value is $0.195 > 0$, showing the significance of 0.01 levels ($Z = 2.694$, $P = 0.007 < 0.01$). Therefore, H2 is supported.

When the purchase intention of the buyer is affected by perceived behavioral control, its path coefficient value is $0.314 > 0$, showing the significant level of 0.01 level ($Z = 4.133$, $P = 0.000 < 0.01$). Therefore, H3 is supported.

When the purchase intention of the buyer is affected by the Environmental awareness, its path coefficient value is $0.374 > 0$, showing the significant level of 0.01 level ($Z = 4.955$, $P = 0.000 < 0.01$). Therefore, H4 is supported.

When the subjective norms of the buyer are affected by the Environmental awareness, the path coefficient value is 0.413> 0, showing the significant level of 0.01 (Z = 7.122, P = 0.000 <0.01). Therefore, H5 is supported.

When the perceived behavioral control of the buyer is affected by the Environmental awareness, its path coefficient value is 0.370> 0, showing the significance of the 0.01 level (Z = 6.728, P = 0.000 <0.01). Therefore, H6 is supported.

When the purchase intention of the buyer is affected by the Environmental awareness, it does not show significant (Z = 1.838, P = 0.066> 0.05). Therefore, H7 is not supported.

When the buyer's attitude of the new energy vehicle is affected by the attitude to new energy vehicle policy, its path coefficient value is 0.473> 0, showing the significance of 0.01 level (Z = 6.272, P = 0.000 <0.01). Therefore, H8 is supported.

When the subjective norms of the buyer are affected by the attitude to new energy vehicle policy, the path coefficient value is 0.518> 0, showing the significant significance of the 0.01 level (Z = 8.926, P = 0.000 <0.01). Therefore, H9 is supported.

When the perceived behavioral control of the buyer is affected by the attitude to new energy vehicle policy, its path coefficient value is 0.571> 0, showing the significant level of 0.01 level (Z = 10.372, P = 0.000 <0.01). Therefore, H10 is supported.

When the purchase intention of the buyer is affected by the attitude to new energy vehicle policy, its path coefficient value is 0.279> 0, showing the significant level of 0.01 level (Z = 3.196, P = 0.000 <0.01). Therefore, H11 is supported.

Tab. 5. Dimension Path Analysis

X	→	Y	Standardized path coefficient	SE	z (		
ATP	→	PBC	0.571	0.055	10.		
EA	→	PBC	0.37	0.055	6.7		
ATP	→	SN	0.518	0.057	8.9		
EA	→	SN	0.413	0.058	7.1		
ATP	→	ATC	0.473	0.055	6.2		
EA	→	ATC	0.374	0.056	4.9		
ATP	→	PI	0.279	0.089	3.1		
EA	→	PI	0.14	0.079	1.8		
PBC	→	PI	0.314	0.078	4.133	0.000	H3
SN	→	PI	0.195	0.074	2.624	0.009	H2
ATC	→	PI	0.009	0.077	0.161	0.872	H1

Note: → indicates the path impact relationship

Our research also analyzed the environmental awareness and attitudes of policy to explore the covariance relationship between these two variables. According to the results, we can see that the standardized path system value of the covariance relationship between the Environmental awareness and the attitude towards the policy is 1.066, which is larger than 0. Moreover, it also has the significant level of 0.01 levels (Z = 9.344, P = 0.000 <0.01). Therefore, our research has the following conclusions. There is a positive covariance relationship between environmental awareness and attitudes towards policy.

4.4 Research Summary

Tab 5 presents the path coefficients obtained from our analysis of the relationship between the different dimensions of the questionnaire. Based on these coefficients, we have created Fig2, which illustrates the path relationships between each dimension.

Our path analysis reveals that the consumer purchase intention is not directly affected by the attitude towards new energy vehicle policy. Environmental awareness also has an indirect effect on purchase intention through subjective norms and perceived behavioral control. On the other hand, the attitude towards new energy vehicle policy is positively related to consumer purchase intention, as shown by the path coefficients. This suggests that consumers' purchase intention is affected not only by their attitude towards new energy vehicle policy, but also by their subjective norms and perceived behavioral control.

Furthermore, our analysis shows that consumers' attitude towards new energy vehicle policy is related to their environmental awareness, and this relationship has a significant impact on their purchase intention. These findings support the premise of our research, which focuses on the impact of new energy government promotion policies.

In summary, our path analysis provides a comprehensive understanding of the relationship between the different dimensions of the questionnaire and their impact on consumer purchase intention. These insights can be used to guide policymakers and businesses in developing effective strategies to promote new energy vehicles.

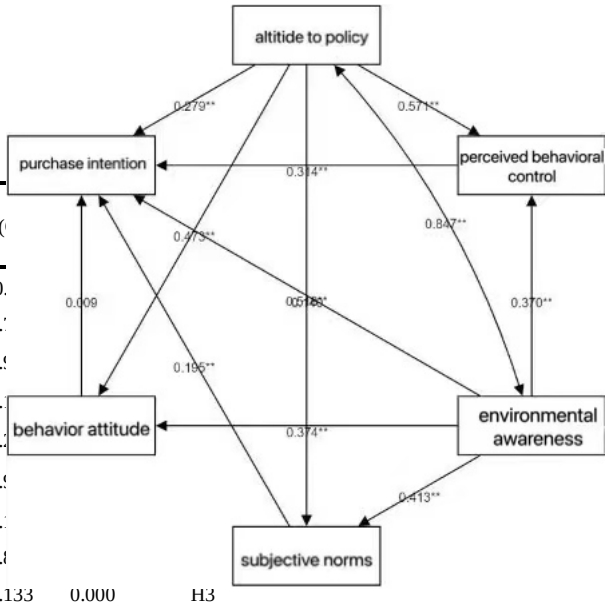

Fig.2. Path relationship of each dimension

5. Conclusion

Based on the current rapid development of the new energy vehicle market and the supportive government's attitude towards the industry, our research analyzed the factors affecting consumers' purchase of new energy vehicles, with a focus on government promotion policies. We expanded on the traditional planned behavior theory and examined the interaction between consumer purchase intention and their attitudes towards new energy vehicles, subjective norms, perceived behavioral control, environmental awareness, and policy attitudes towards new energy vehicle policies through hypothesis verification. Our research identified several key factors that can affect consumer purchase intention of new energy vehicles, and our conclusion indicates that consumers' environmental awareness positively impact their subjective norms and perceived behavioral control, which ultimately affects their purchase intention.

Additionally, consumers' attitudes towards new energy vehicle policy have both direct and indirect effects on their purchase intention through the two intermediary factors mentioned earlier. However, our research found that consumers' attitude towards new energy vehicles does not have a direct impact on their purchase intention.

This research can be used as a reference by the Hangzhou Government, which can effectively propose corresponding policies based on consumers' environmental awareness and attitudes towards policies, to promote the stable development of the new energy vehicle market in Hangzhou and drive the development of the national new energy vehicle market. This will accelerate the process of replacing traditional fuel vehicles with new energy vehicles, bringing convenience to the public's personal transportation while promoting low-carbon emission reduction in China.

The innovation of our research is to study the response of new energy vehicle consumers' attitudes to government policies and the impact of environmental awareness on consumer purchase intention, and through the analysis of intermediary variables, explore the impact mechanism of these factors on consumer purchase intention. Specifically, our research finds that attitude responses to policies have a more significant impact on consumers' intention to purchase NEVs than consumers' environmental awareness. In addition, we also found that consumers' attitudes to policy responses can not only indirectly affect purchase intentions through the role of mediating variables, but also directly affect purchase intentions. This finding is of great significance for explaining the behavioral intention of consumers to purchase new energy vehicles, and provides a certain theoretical and practical reference for the development of the new energy vehicle market.

However, due to limited professional knowledge and thesis writing experience, our research is not in-depth enough. Furthermore, our data source is limited to Hangzhou City, Zhejiang Province, so there are limitations to our conclusions and whether they can be applied nationwide is unknown. In future research, scholars can conduct more specific and comprehensive empirical analysis using nationwide data and adapting the methods described in our research, while trying to eliminate factors that may affect the results. This will help verify whether the conclusions reached in our research can be extended to the whole country and can be used to propose more relevant policy.

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References

[1] Chen Zhen, Yang Lijun. Countermeasures for the development of my country's new energy vehicle industry under the background of low-carbon economy [J]. Automotive Practical Technology, 2021,46(15):218-220.

[2] Zhou Yan, Pan Yao. Fiscal subsidies and tax relief——An analysis of new energy vehicle industry policy from the perspective of transaction costs ［J］. Management World, 2019, 35(10):133-149.

[3] Li Dongjin, Wu Bo, Wu Ruijuan. The Model of Chinese Consumers' Purchase Intention—A Revision to Fishbein's Model of Reasonable Behavior [J]. Management World, 2009, (01): 121-129+161.

[4] Kong Deyong. Research on New Energy Vehicle Purchase Willingness and Influencing Factors [J]. Modern Marketing (Business Edition), 2018 (04): 32-33.

[5] Sabrina Habich-Sobiegalla, Genia Kostka, Niklas Anzinger. Citizens' electric vehicle purchase intentions in China: An analysis of micro-level and macro-level factors[J]. Transport Policy,2019,79.

[6] Li Chuang, Ye Lulu, Wang Liping. The impact of new energy vehicle consumption promotion policy on potential consumers' purchase intention ［J］.Chinese Management Science, 2020: 1-11.

[7] Niu Liwei. Research on Consumers' Willingness to Purchase New Energy Vehicles and Decision Factors [D]. Modern Economic Information, 2018, 4:343-345.

[8] Zhou Jun, Li Bin, Wang Kebin. Investigation and research on factors affecting the consumption of new energy vehicles [J]. Modern Commerce and Industry 2018, 15:1-4.

[9] Zhang, X, Wang, K, Hao, Y. The impact of government policy on preference for NEVs: The evidence from China[J].Energy policy,2019.

[10] Tu, JC, Yang, C. Key Factors Influencing Consumers' Purchase of Electric Vehicles[J]. Sustainablity, 2019: 3863.

[11] Yin Ya-Rong, Li Yuan, Zhang Yan. Influencing factor analysis of household electric vehicle purchase intention of Hai Nan Free Trade Port under the background of low-carbon lifestyle[J]. Energy Reports,2022,8(S7).

[12] Alex C., Peter de H, Julia S.W. Consumer support for environmental policies: an application to purchases of green cars [D]. Ecological Economics, 2009(68) 2078-2086.

[13] Lou Yiping, Wenhuan Wang. Customers' Attitude on New Energy Vehicles' Policies and Policy Impact on Customers' Purchase Intention [J]. Energy Procedia, 2017(105). 2187-2193.

[14] Li, W., Chen, Y., & Huang, Z. (2017). The impact of government subsidies on new energy vehicle industry: A comparative study between China and US. Energy Policy, 100, 277-287.

[15] Zhang J., Qin H B, Wang S Y. Young People's Behaviour Intentions Towards Reducing PM2．5 in China: Extending the Theory of Planned Behavior [J]. Resources Conservation and Recycling,2019(141): 99-108.

[16] Klabi Fethi, Binzafrah Faiz. Exploring the relationships between Islam, some personal values, environmental concern, and electric vehicle purchase intention: the case of Saudi Arabia[J]. Journal of Islamic Marketing,2023,14(2).

[17] Sun Hongxia, Lu Huirong. Evolutionary game analysis between government and enterprises in the post-subsidy era of new energy vehicles［J］.Soft Science, 2018, 32(2):24－29.

[18] Zhao hua Wang, Chenyao Zhao, Jianhua Yin, Bin Zhang. Purchasing intentions of Chinese citizens on new energy vehicles: How should one respond to current preferential policy?[J]. Journal of Cleaner Production,2017,161.

[19] Wang Chao, Yang Wei, He Haonan, LEEYong-Ki. New energy vehicle government promotion policy and consumer purchase intention - an empirical study from Xi'an [J]. Soft Science, 2021,35(07):38-44 .

[20] Han, Z., Xie, J., & Li, H. (2020). The effects of government support on consumers' adoption of electric vehicles: Evidence from China. Energy Policy, 144, 111635.

[21] Zheng Ajian. Research on investment opportunities brought by the rapid development of new energy vehicles to Charging station [J]. Science and Technology Information, 2018,16 (34): 50-51.

[22] Ajzen I. Perceived Behavioural Control, Self－efficacy, Locus of Control, and the Theory of Planned Behavior ［J］.Journal of Applied Social Psychology,2002,32(4) : 665－683.

[23] Yin Jielin, Zhang Ziqian, Liao Ganli, Ge Xinquan. A study on consumer willingness to purchase new energy vehicles based on technology acceptance model and perceived risk theory [J]. Prediction, 2019, 38 (6): 83-89.

[24] Meixia Li. Research on influencing factors and marketization of pure electric vehicle purchase decisions based on consumer perspective [D]. Shanghai: East China University of Science and Technology, 2013.

[25] Wu J W,Liao H,Wang J W,et al. The Role of Environmental Concern in the Public Acceptance of Autonomous Electric Vehicles: A Survey from China ［J］.Transportation Research Part A: Traffic Psychology and Behaviour, 2019(60) : 37-46.

[26] Wang Xiafang. Research on the Impact of New Energy Vehicle Policies in Guangzhou on Consumers' Purchase Intention [D]. Guangdong: Jinan University, 2015.

[27] Xu, G., Hu, X., & Huang, W. (2021). The Influence of Perceived Risk on Consumers' Purchase Intention of New Energy Vehicles: A Case Study of China. Journal of Cleaner Production, 315, 128237.

[28] Zhao, Q., & Liu, X. (2021). Social Influence and Purchase Intention of New Energy Vehicles: An Empirical Study in China. Journal of Cleaner Production, 295, 126238.

[29] Liu, D., Zhao, D., & Wang, X. (2020). The effects of government incentives and charging infrastructure on consumer intention to adopt new energy vehicles in China. Energy Policy, 139, 111339.

[30] Yu, C., Geng, Y., Sarkis, J., & Xue, B. (2018). Analysis of government policies for promoting new energy vehicles in China. Journal of Cleaner Production, 172, 1467-1478.

[31] Zhao C, Zhang M, Wang W． Exploring the Influence of Severe Haze Pollution on Residents' Intention to Purchase Energy － saving Appliances［J］.Journal of Cleaner Production,2019 (212) : 1536．

[32] Priessner A, Sposato R, Hampl N．Predictors of Electric Vehicle Adoption: An analysis of Potential Electric Vehicle Drivers in Austria［J］． Energy Policy,2018: 122．

[33] White L V, Sintov N D． You are What You Drive: Environmentalist and Social Innovator Symbolism Drives Electric Vehicle Adoption Intentions［J］.Transportation Research Part A,2017.

[34] Li, Jizi, Zhou, Yuping, Yu, Dengke. Consumers' Purchase Intention of New Energy Vehicles: Do Product-Life-Cycle Policy Portfolios Matter? ［J］ Sustainability.2020: 1711

[35] Lin, Boqiang, Shi, Lei. Do environmental quality and policy changes affect the evolution of consumers' intentions to buy new energy vehicles［J］.Applied Energy. 2022: 118582.

[36] Wang, Zhaohua, Dong, Xiaoyang. Determinants and policy implications of residents' new energy vehicle purchases: the evidence from China［J］. Nat Hazards,2015.

[37] Sun Huiqian, Jing Peng, Wang Baihui, Cai Yunhao, Ye Jie, Wang Bichen. The effect of record-high gasoline prices on the consumers' new energy vehicle purchase intention: Evidence from the uniform experimental design[J]. Energy Policy,2023,175.

[38] Ivanova Gulnaz, Moreira António Carrizo. Antecedents of Electric Vehicle Purchase Intention from the Consumer's Perspective: A Systematic Literature Review[J]. Sustainability,2023,15(4).

[39] Nagarajan Shanmugavel, Chidambaram Alagappan. An exploration on electric vehicle purchase intention[J]. International Journal of Electric and Hybrid Vehicles,2023,15(1).

[40] Vafaei-Zadeh Ali, Wong Teik-Kheng, Hanifah Haniruzila, Teoh Ai Ping, Nawaser Khaled. Modelling electric vehicle purchase intention among generation Y consumers in Malaysia[J]. Research in Transportation Business & Management,2022,43.

[41] Wang Xiao Wu, Cao Yu Mei, Zhang Ning. The influences of incentive policy perceptions and consumer social attributes on battery electric vehicle purchase intentions[J]. Energy Policy,2021.

[42] Xingjun Ru, Haibo Qin, Shanyong Wang. Young people's behavior intentions towards reducing PM2.5 in China: Extending the theory of planned behaviour[J]. Resources, Conservation & Recycling,2019,141.

[43] Beatriz Junquera, Blanca Moreno, Roberto Álvarez. Analyzing consumer attitudes towards electric vehicle purchasing intentions in Spain: Technological limitations and vehicle confidence[J]. Technological Forecasting & Social Change,2016,109.

[44] Huan LIU, Hitomi SATO, Takayuki MORIKAWA. Influences of Environmental Consciousness and Attitudes to Transportation on Electric Vehicle Purchase Intentions[J]. Asian Transport Studies,2015,3(4).

[45] Emmanuel Chéron. Electric vehicle purchasing intentions: The concern over battery charge duration[J]. Transportation Research Part A,1997,31(3).

[46] Verma, Meghna, Ashish Verma, and Mahim Khan. Factors Influencing the Adoption of Electric Vehicles in Bengaluru[J]. Transportation in Developing Economies,2020.

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