

Analysis of Consumer Behavior Based on the Theory of Planned Behavior for Exchanging Gasoline Vehicles for New Energy Vehicles

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Abstract. This study focuses on the key behavioral motivations of consumers exchanging traditional gasoline vehicles for new energy vehicles to cope with greenhouse gas emission challenges in the transportation sector and promote green economic development. Based on the frame of the theory of planned behavior, this study has made a deep discussion on the influence mechanism of consumer exchange intention through three core variables, including attitude, subjective norm and perceived behavior control. It uses the questionnaire method to collect 212 valid samples. Statistical Package for the Social Sciences method is used to carry out reliability and validity tests, correlation analysis and linear regression analysis. The results show that perceived behavior control has the most significant positive impact ($B=0.468, p<0.001$) on the behavior intention of exchanging new energy vehicles of consumers. Although attitude and subjective norm originally have a significant positive impact on the intention of exchange, they are significantly weakened after the introduction of perceived behavior control. This study reveals that enterprises and policymakers should prefer to promote perceived behavior control feelings of consumers and emphasizes the significance of solving actual non-subjective obstacles to stimulate consumers' exchange behavior rather than single environmental protection attitude promotion.

Keywords: Green economy; theory of planned behavior; exchange intention; new energy vehicles; consumer behavior.

1. Introduction

In recent years, the concepts of sustainable development and green economy have become more and more important to cope with the challenges brought by increasingly serious global environmental issues such as global warming. Traditional economic mode prefers some indices about production or economic development, such as Gross Domestic Product, Gross National Product, the speed of economic growth, and so on. While the green economy is based on the principle of sustainable development to develop the economy and take environmental protection and ecological balance into consideration [1].

In fact, if people continue to depend on the use of fossil fuels, including coal, petroleum, and natural gas, it will lead to an unacceptable temperature increase of 3 °C or even more, resulting in disastrous consequences [2]. Therefore, how to reduce the use of fossil fuels is one of the important methods to slow down the trend of global warming. The United Nations Industrial Development Organization points out that reducing greenhouse gas emissions is one part of the Paris Agreement [3]. The necessity has drawn people's attention to the high pollution field of the transportation sector, which has released over one-fourth of global total emissions of greenhouse gas. The reason is that most automobiles, trucks, ships and planes rely on fossil fuels to work. The use of fossil fuel in vehicles enables them to be the main source of greenhouse gas, especially the main source of carbon dioxide.

Now, new energy vehicles have undoubtedly broken this situation. Electric vehicles are the most common sustainable transportation mode [4]. New energy vehicles have effectively reduced the environmental pollution caused by the pollutants released by petroleum products such as gasoline, diesel and so on [5]. Because the market share of new energy vehicles is less than that of traditional fuel vehicles, this article will conduct a case-study on the exchange from traditional fuel-powered

vehicles to new energy vehicles to analyze what kind of factors are having the biggest influence on the behavior intention of consumers from the perspective of consumer behavior in the theory of planned behavior [5]. Meanwhile, this article will also seek some probable measures to promote the industry of new energy vehicles and the application of the green economy.

2. Literature View

Previous studies have demonstrated that the theory of planned behavior's suitability is a framework for quantifying and experimentally determining factors influencing environmentally conscious purchasing [6]. However, the current study has not reached a relatively unified conclusion on which factor has the greatest influence on consumers' behavioral intention. From the analysis of integrating theory of planned behavior and value-attitude-behavior mode by Ye and Yan, the conclusion is that attitude has a significant influence on the exchange intention of consumers [7]. While Zhao believes that individual attitude and individual subjective norm have the greatest influence on behavior [8]. These studies are more inclined towards the Theory of Reasoned Action (TRA), which is the predecessor of theory of planned behavior and only includes attitude and subjective norms rather than relying on theory of planned behavior itself [9]. At present, among the academic circles all the conclusions point out that attitude or subjective norm has the greatest influence on the exchange of new energy vehicles. But supplementary research on TRA carried out by Ajzen finds that human behavior is not totally voluntary but under control [10]. The two types of research mentioned above just focus on the influence of individuals' attitude or subjective norm and cannot explain a phenomenon that an ordinary charging station or a fast one would significantly hinder or promote the purchasing behavior intention on battery electric vehicles, and the situation of the charging station has nothing to do with the individuals [4]. For this reason, Ajzen expands the content with one new concept of "perceived behavior control" to develop into a new behavioral theory research model - theory of planned behavior [10]. Although the research of Hu et al. mentions that the three elements will all influence behavior intention, the depth of influence of different variables on behavior intention is not compared, which is difficult to determine the best measures to perform a perfect program to have the greatest influence on the behavior intention [6]. Therefore, this article will clearly analyze the influence on the exchange behavior intention of the consumers through the three variables, including attitude, subjective norm and perceived behavior control in theory of planned behavior through a questionnaire and find one or several elements having the biggest influence on the behavior intention to provide reference for enterprises, organizations and governments.

3. Research Method

This research adopts a questionnaire survey and collects data through the Internet, using Statistical Package for the Social Sciences (SPSS) to analyze how the dependent variable "exchange behavior intention" is influenced by the independent variables of "attitude", "subjective norm" and "perceived behavior control".

3.1. Questionnaire Survey

3.1.1. Questionnaire design

This questionnaire aims to investigate and understand consumers' attitudes, intentions, and influencing factors regarding new energy vehicle exchange behavior in the context of the green economy. The theory of planned behavior serves as the fundamental analytical framework. By integrating China's green economy policies and the practical promotion of new energy vehicles, the study explores how attitude, subjective norms, and perceived behavior control affect consumers' intentions to replace traditional vehicles with new energy vehicles. Through quantitative analysis of consumers' behavioral motivations, the research provides empirical evidence to assist government

agencies and automobile companies in formulating more targeted promotion strategies and financial support policies.

The questionnaire is divided into three main sections. The first section collects respondents' basic demographic information, including gender, age, occupation, education level, income, and city type, which helps characterize the sample's demographic profile and ensure representativeness. The second section examines consumers' awareness of new energy vehicles and green economy policies, covering knowledge of new energy vehicles, supporting infrastructure, government policy support, and green economy channels. This section combines multiple-choice and single-choice questions to reflect consumers' perceptions of external policies and resources. As shown in Table 1, the third section contains the core scales based on Ajzen's theory of planned behavior model, including four latent variables: attitude, subjective norm, perceived behavior control, and exchange intention [10].

The scale design draws on mature literature and is adapted to the actual context. The attitude dimension items mainly reference Buhmann, who studied electric vehicle consumers' intentions and validated the influence of attitude variables, providing strong theoretical relevance and practical explanatory power [11]. The subjective norm dimension is also based on this literature, further combined with China's new energy vehicle promotion policies, making it more applicable to the social behavioral context under the green economy. The perceived behavior control dimension refers to the research findings of Xu Xinxian, reflecting individuals' perceived ability and environmental constraints when executing exchange behavior [12]. The behavioral intention dimension follows Setyawan et al. regarding green product purchase intentions, with good reliability and wide application. All items use a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) [13]. This questionnaire survey was conducted online via the "Wenjuanxing" platform from mid-June to early July 2025, lasting about three weeks. A total of 231 questionnaires were distributed, with 212 valid responses recovered, resulting in an effective response rate of 91.77%.

3.1.2. Survey participants

A total of 231 questionnaires were distributed in this study, and 212 valid responses were collected, yielding an effective response rate of 91.77%. Questionnaires with illogical answers, missing options, or obviously invalid responses were excluded. Only complete and logically consistent samples were retained for further analysis. Table 1 presents the demographic characteristics of the respondents.

In terms of gender distribution, 49.53% of the respondents were male and 50.47% were female, indicating a relatively balanced gender ratio. Regarding age structure, the majority of respondents were aged 26–35 (35.38%) and 36–45 (33.96%), suggesting that the primary group interested in replacing vehicles with new energy vehicles is concentrated among young and middle-aged individuals. With respect to occupation, enterprise employees accounted for the largest proportion (46.23%), followed by public institution staff (20.75%) and freelancers (19.34%), while civil servants made up 13.68%. In terms of educational background, the majority held associate degrees (34.43%) or bachelor's degrees (33.02%), indicating a generally high level of education among the respondents. Regarding income level, 30.66% of respondents had a monthly income below CNY 3,000, but the overall income structure was relatively balanced, with 46.22% earning more than CNY 6,001 per month, suggesting that the sample includes consumers with diverse economic backgrounds. As for city type, respondents from first-tier cities accounted for 35.38%, second-tier cities 31.13%, and those from third tier and lower-tier cities for 33.49%, indicating that the sample covered different levels of urban areas, which helps provide a more comprehensive understanding of new energy vehicle exchange intentions.

3.1.3. Reliability analysis of the questionnaire

As shown in Table 2, the alpha coefficients of all four latent variables exceeded 0.7, indicating good internal consistency and high reliability of the scales.

Table 1. Frequency statistics of respondents' demographic information.

Item	Option	Frequency	Percentage
Gender	Male	105	49.53%
	Female	107	50.47%
Age	25 years old and below	28	13.21%
	26–35 years old	75	35.38%
	36–45 years old	72	33.96%
	46 years old and above	37	17.45%
	Enterprise Employee	98	46.23%
Occupation	Public Institution Staff	44	20.75%
	Civil Servant	29	13.68%
	Freelancer	41	19.34%
Highest Education Level	High School and below	40	18.87%
	Associate degree	73	34.43%
	Bachelor's Degree	70	33.02%
	Master's Degree and above	29	13.68%
Monthly Income	Below CNY 3,000	65	30.66%
	CNY 3,001–6,000	49	23.11%
	CNY 6,001–10,000	48	22.64%
	Above CNY 10,001	50	23.58%
City Type	Third tier and below cities	75	35.38%
	Second-tier cities	66	31.13%
	First-tier cities	71	33.49%
Total		212	100%

Table 2. Reliability test.

Dimension	Number of Items	Cronbach's Alpha
Attitude	3	0.853
Subjective Norm	4	0.88
Perceived Behavior Control	5	0.918
Exchange Intention	4	0.909

3.1.4. Validity analysis of the questionnaire

The questionnaire assessed for sampling adequacy as shown in Table 3, and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value was 0.814, exceeding the 0.6 threshold. Bartlett's test of sphericity yielded a p-value less than 0.001, indicating that the data are of good quality and reliability.

Table 3. KMO and Bartlett's test results.

KMO	0.814
Approx. Chi-Square	2284.099
Bartlett's Test of Sphericity	df 120
	p-value 0.000

4. Finding and Discussion

4.1. Descriptive Statistical Analysis

To gain a comprehensive understanding of respondents' overall tendencies across the latent variables, descriptive statistical analysis was conducted on the four dimensions: Attitude, Subjective Norm, Perceived Behavior Control, and Exchange Intention. The results are shown in Table 4. Among them, Subjective Norm had the highest mean score, indicating that social influences—such as the opinions of others and government policies - play a guiding role in exchange behavior to a certain extent. The Attitude dimension followed, reflecting that some respondents recognize the

environmental and responsible consumption attributes of new energy vehicles. The mean score of Perceived Behavior Control was 2.835, suggesting that perceived barriers still exist in terms of resource access, infrastructure, and personal capability. The Exchange Intention dimension had a mean of 2.794, indicating that although some respondents acknowledge the positive value of new energy vehicles, a strong behavioral intention to replace vehicles has not yet been formed. In terms of standard deviations, the values are relatively large across all dimensions, reflecting the diversity of consumer motivations and willingness to adopt new energy vehicles.

In summary, while some respondents hold a positive attitude toward new energy vehicles and feel a degree of social approval, their overall intention to replace vehicles remains weak - possibly limited by perceived behavior control factors. Further policy guidance and green economic support are needed to lower behavioral thresholds and strengthen exchange intentions.

Table 4. Descriptive statistical analysis.

Variable	Minimum	Maximum	Mean	Standard Deviation
Attitude	1	5	2.909	1.244
Subjective Norm	1	5	2.936	1.239
Perceived Behavior Control	1	5	2.835	1.199
Exchange Intention	1	5	2.794	1.28

4.2. Correlation Analysis

Table 5. Correlation analysis.

	Attitude	Subjective Norm	Perceived Behavior Control	Exchange Intention
Attitude	1			
Subjective Norm	0.318**	1		
Perceived Behavior Control	0.227**	0.271**	1	
Exchange Intention	0.223**	0.251**	0.470**	1

* $p < 0.05$ ** $p < 0.01$

Pearson correlation coefficients were used to examine the relationships among the four dimensions: Attitude, Subjective Norm, Perceived Behavior Control, and Exchange Intention. The results shown in Table 5 indicate that all variables are significantly and positively correlated, suggesting a certain degree of linear association and providing a sound basis for further regression analysis.

Overall, the correlation analysis supports the positive relationships among the variables proposed in the theory of planned behavior framework. In particular, Perceived Behavior Control has the most significant impact on exchange intention, indicating that in the promotion of green economy policies, reducing consumers' perceived costs of resource access and improving infrastructure are key external factors for encouraging exchange behavior.

4.3. Regression Analysis

Three sets of regression models were constructed to examine the stepwise impact of variables on behavioral intention by sequentially introducing control variables, core attitudinal and subjective norm variables, and the perceived behavior control variables. The detailed results are shown in Table 6

In Model 1, only control variables such as gender, age, occupation, education level, income, and city type were included. The model demonstrated weak explanatory power ($R^2 = 0.038$, $p > 0.05$), and most control variables did not reach statistical significance. Only “occupation” remained significant across all three models ($p < 0.05$), suggesting that occupation has a certain independent influence on exchange intention.

Table 6. Regression analysis results.

Variables		B	t	p	B	t	p	B	t	p
		3.239	5.5	0.000*	1.906	3.035	0.003*	1.054	1.825	0.07
Control Variables	Gender	0.013	0.076	0.939	-	-	0.933	-	-	0.292
	Age	-	-	0.738	0.001	0.007	0.995	0.055	0.598	0.55
	Occupation	-	-	0.012*	-	-	0.002*	-0.22	-	0.001*
		0.191	2.526		0.234	3.216	*	3.368		*
	Education Level	-	-	0.487	-	-	0.593	-	-	0.458
	Monthly Income	0.082	0.696		0.061	0.536		0.076	0.744	
	Region Type	0.023	0.261	0.794	0.034	0.403	0.687	0.028	0.365	0.715
Independent Variables	Attitude	0.082	0.763	0.446	0.127	1.24	0.216	0.184	1.989	0.048*
	Subjective Norm				0.212	2.912	0.004**	0.138	2.087	0.038*
	Perceived Behavior Control				0.199	2.723	0.007**	0.108	1.614	0.108
	R ²							0.468	6.997	0.000**
Model Fit	Adjusted R ²		0.038			0.14			0.308	
	F-value		0.01			0.106			0.277	
			1.362			4.141**			9.99**	
Dependent Variable: Exchange Intention										
* p<0.05 ** p<0.01										

Model 2 incorporated two core theories of planned behavior variables: Attitude and Subjective Norm. The explanatory power of the model increased significantly ($R^2 = 0.140$, $p < 0.01$). Both variables had a significant positive impact on exchange intention: Attitude ($B = 0.212$, $p = 0.004$) and Subjective Norm ($B = 0.199$, $p = 0.007$). This indicates that consumers' environmental perceptions and sense of social acceptance positively contribute to the formation of their intention to replace vehicles with new energy vehicles.

In Model 3, after adding Perceived Behavior Control, the model's goodness-of-fit improved substantially, with R^2 increasing to 0.308, indicating the best explanatory power ($F = 9.990$, $p < 0.01$). At this stage, Perceived Behavior Control became the dominant factor affecting exchange intention ($B = 0.468$, $p < 0.001$), while the coefficient of Attitude decreased to 0.138 ($p = 0.038$), and Subjective Norm became non-significant ($B = 0.108$, $p = 0.108$). This suggests that when real-world control factors—such as access to funding, policy support, and infrastructure availability—are taken into account, the marginal effects of Attitude and Subjective Norm are significantly weakened or partially replaced.

In the context of the green economy, Perceived Behavior Control, as a non-motivational factor, exerts a more direct and significant influence on the intention to purchase new energy vehicles, acting as a potential “bottleneck” in converting intention into actual behavior. Although the public may hold pro-environmental attitudes and experience social encouragement, facing practical barriers - such as the range of new energy vehicles, incomplete charging facilities, and frequent occupation of new energy vehicles' charging parking spaces by petrol cars - can greatly suppress behavioral motivation [14].

4.4. Suggestion

Therefore, due to the greatest influence of perceived behavior control on exchange intention, future green economic policies should focus on enhancing consumers' perceived behavior control factors, particularly improving non-motivational factors that individuals cannot control, such as price, charging facilities, and policies. Meanwhile, it is also beneficial to strengthen the sense of control over one's own will, to promote the positive correlation effect of attitudes and subjective norms on the behavioral intention of exchange.

For the enterprises, they can adopt a more cost-effective pricing strategy to sell at a low profit margin but in large quantities to promote the large-scale application of new energy vehicles. Meanwhile, enterprises should make more efforts on the cruising property of new energy vehicles to make breakthroughs in technologies such as battery duration and charge speed to solve the concerns of the consumers.

According to Hood's theory, the government should make good use of four policy tools, such as strengthening the availability of subsidies, completeness of infrastructure and stability of subsidy policies to promote the perceived behavior control as well as the attitude and subjective norm of consumers to stimulate their positive effects to facilitate the realization of exchange intention [15]. Through the policy tool of nodality, the government can place more importance on environmental protection with information on the environmental benefits of new energy vehicles or educate people to realize environmental problems and the advantages of new energy vehicles. Through the policy tool of treasure, the government can provide support for the consumers with exchange subsidies, interest-free or low-interest loans and the new energy vehicle manufacturers with tax incentives, interest-free loans and other support policies to bring down the cost and price of new energy vehicles. Through the policy tool of authority, the government can restrict or even prohibit the sale of fuel vehicles through legislation. For example, China's Hainan Province has made a definite target to realize 100% new energy vehicles on the island by prohibiting the sale of fuel vehicles by the year 2030. Through the policy tool of the organization, governments of all countries can establish a special department to coordinate and manage the promotion of new energy vehicles. For example, Hong Kong Special Administrative Region Government has established the Supervision Committee for Promoting the Use of Electric Vehicles, which is chaired by the financial secretary. In this committee, members from different sectors make suggestions on strategies and specific measures for the promotion of electric vehicles in Hong Kong.

5. Conclusion

This article takes consumers' intention on the exchange of new energy vehicles as the core of the research through the analysis of three variables of attitude, subjective norm and perceived behavior control, aiming to clarify the actual impact of each variable on the exchange intention. The research results show that perceived behavior control has a significant positive influence on the exchange intention of consumers. Whether the consumers can successfully solve the practical problems in the process of exchange, such as whether the charging facilities are convenient, the exchange cost is controllable, the after-sales guarantee is complete and so on will directly determine the strength of their exchange intention.

Although consumers' environmental awareness of new energy vehicles (such as recognizing their value in reducing carbon emissions) and sense of social identity (such as being influenced by the exchange behavior of other people and positive social evaluations) can both stimulate the exchange intention and to some extent, the influence of two factors is significantly weakened or even replaced due to the restriction of perceived behavior control. For instance, if it is not convenient for consumers to charge for the new energy vehicles in living areas, their exchange intention will still reduce obviously even though they have recognized the environmental significance of the new energy vehicles.

Based on the research results, this article puts forward some targeted suggestions, including optimizing charging infrastructure, improving the subsidy policy for vehicle exchange, and so on, to provide a reference for the promotion of new energy vehicles. It should be emphasized that environmental protection is common responsibility of all people. The Earth is our only home. To achieve sustainable development, it is an inevitable trend for the replacement of fuel vehicles by new energy vehicles. This process still requires many collaborative efforts by multiple parties.

In addition, there are two limitations in this research. One limitation is that the adopted theory of planned behavior model has certain boundaries which may miss some potential variables such as

consumption habits, trust in technology and so on. The other limitation is that the research only focuses on Chinese market, which means the result may be influenced by local policies, infrastructure levels and so on. And the conclusion may have limited guidance for other countries and regions. For further study, it should expand the sample volume and increase the research subjects from a global scope to provide a more universal theoretical support for the global promotion of new energy vehicles.

References

- [1] Jumayeva Z. The formation of the green economy concept, stages of development and its relevance. *International Journal of Artificial Intelligence*, 2025, 1(3): 262-266.
- [2] Holechek J L, Geli H M E, Sawalhah M N, et al. A global assessment: can renewable energy replace fossil fuels by 2050? *Sustainability*, 2022, 14(8): 4792.
- [3] United Nations Industrial Development Organization. UNIDO: the role of electric transportation in environmental protection is of vital importance. United Nations. 2020.
- [4] Neves S A, Marques A C. What has driven the adoption of BEV and PHEV in the EU? *Research In Transportation Business & Management*, 2025, 60(15): 101331.
- [5] Su C W, Yuan X, Shao X F, et al. Explore the environmental benefits of new energy vehicles: evidence from China. *Annals Of Operations Research*, 2023.
- [6] Hu X F, Yusof R N R, Mansor Z D. Consumers' purchase intentions towards new energy vehicles based on the theory of planned behaviour on perceived value: an empirical survey of China. *World Electric Vehicle Journal*, 2025, 16(3): 120.
- [7] Ye L, Yan L. Research on the influence of consumer values on the purchase intention of new energy vehicles. *Advances In Psychology*, 2023, 13(08): 3465-3478.
- [8] Zhao Y L. The impact of consumer behavior awareness on consumer behavior under TPB theory. In: Barstow C, Briel H, eds. *Connecting ideas, cultures, and communities*. Routledge, 2024, 14(2): 207-212.
- [9] Ajzen I, Fishbein M. *Understanding attitudes and predicting social behavior*. Prentice-Hall, 1980.
- [10] Ajzen I. From intentions to actions: a theory of planned behavior. In: Kuhl J, Beckmann J, eds. *Action control: from cognition to behavior*. 1985, 12(4): 11-39.
- [11] Buhmann K M, Rialp-Criado J, Rialp-Criado A. Predicting consumer intention to adopt battery electric vehicles: extending the theory of planned behavior. *Sustainability*, 2024, 16(3): 1284.
- [12] Xu X X. Research on the influencing factors of consumers' purchase decisions of digital art collections based on the theory of planned behavior. *Jingdezhen Ceramic University*, 2025.
- [13] Setyawan A, Noermijati N, Sunaryo S, Aisjah A. Green product buying intentions among young consumers: extending the application of theory of planned behavior. *Problems And Perspectives in Management*, 2018, 16(4): 145-154.
- [14] Legal Daily. Insufficient charging piles have hindered installation... It's too difficult to charge a new energy vehicle. *Xinhuanet*, 2024.
- [15] Hainan Government. Transcript: "Department and bureau director's corridor" of the third session of the seventh people's congress of Hainan province. *Hainan Provincial Industry and Information Technology Department*, 2024.