

## Factors Influencing User Adoption of New Energy Vehicles in Guizhou's Economic and Environmental Development

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### Abstract

*Environmental issues have sparked a new scientific and technological revolution and industrial transformation trend. China, at the forefront, has boldly outlined the national strategy for developing new energy vehicles (NEV). In a remarkable display of initiative, auto and IT manufacturers have collaborated closely, striving to promote industrial development. Their concerted efforts have yielded significant results, propelling NEVs into a development trend in the automobile market, bolstered by national policies. This study, conducted through an online questionnaire distributed to 385 participants in Guizhou, delves into the impact of NEV development on the Guizhou economy and strategies to manage consumer acceptance. The findings underscore that factors influencing economic, functional, and social values significantly impact user adoption of NEV, providing a comprehensive understanding of the factors that drive NEV adoption in Guizhou.*

**Keywords :** User Adoption, New Energy Vehicles, Economic Development

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### INTRODUCTION

New energy vehicles (NEVs) are powered by new or hybrid energy between traditional and new energy. These mainly include pure electric vehicles, plug-in hybrid vehicles, and fuel cell vehicles. In recent years, with the intensification of global climate change and the energy crisis, the new energy automobile industry has become an important strategic area for countries to promote green and low-carbon development, enhance industrial competitiveness, and promote economic growth (Kumar & Alok., 2020). As the world's most significant automobile and new energy vehicle market, China has actively implemented the national strategy of developing new energy vehicles and promoted the high-quality and sustainable development of the new energy vehicle industry by strengthening technological innovation, optimizing the policy environment, and improving infrastructure. This proactive approach has brought numerous benefits to the economy and society, fostering optimism about the potential of NEV development (Su et al., 2020). This article analyses the benefits of new energy vehicles to economic development from the following four aspects. The new energy automobile industry has stimulated market vitality and consumer demand. Technological, product, and business model innovation have provided more diversified, innovative, and convenient products services, satisfying consumers' personalized needs. Diversified and high-quality demand has promoted consumption for their usage experience in NEV.

This study explores the user experience of NEVs under the situation of Guizhou's economic and environmental development with the following objectives:

1. To examine the influencing mechanisms of Guizhou user adoption of NEV based on economic, functional, and social values under the current trends.

2. To offer suggestions for NEV manufacturers on improving users' satisfaction and value perception by enhancing their usage of attitudes and expectations on economic and environmental development in Guizhou.

Therefore, this study examines the impact of three independent variables, economic, functional, and social values, on the NEV user's adoption dependent variable.

## THEORITICAL FOUNDATION

### Diffusion Of Innovation Theory

Diffusion of Innovation Theory is the diffusion of innovation, which is a theory about persuading people to accept new ideas, new things, and new products through the media, focusing on the impact of popular culture on society and culture (Rogers, 1983). The innovation diffusion model is a model for studying and classifying various groups of people who adopt innovations. Its theoretical guiding idea is that some people will be more open-minded and willing to adopt innovations in the face of innovation. The description of the process of innovation diffusion mentioned above believes that the diffusion of innovation consists of five steps: knowledge, persuasion, decision, implementation, and confirmation. Rogers' innovation diffusion audience is divided into five categories: 1. Innovators, 2. Early Adopters, 3. Early Majority, 4. Late Majority, and 5. Laggards. Adopting NEV will benefit the car industry's and the environment's development.

### Definition of Maslow's Hierarchy of Needs

Maslow's hierarchy of needs is considered a motivational theory in the study of psychology that includes a five-level model of human needs that most in our society often depict as levels within a pyramid shape in identification. Viewing from the bottom of the hierarchy upward, the needs are physiological (food and clothing), safety (job security), social needs (friendships), esteem, and self-actualization. This five-stage model can be divided into deficit needs and growth needs. The first four levels are often called defect requirements (D requirements), while the highest is called growth requirements (B requirements). The study by Papaleontiou-Louca et al. (2021) pointed out that people need motivation to achieve specific needs, and some needs take precedence over others. NEV would take over the traditional car model due to the innovative technology offering car drivers a solid motivation to have a better experience in both car usage and protecting the environment.

### Definition of Customer Perceived Value

Sweeney & Soutar (2001) defined customer value as customers' perceived preferences and evaluations of product attributes, attribute performance, and consequences according to the customer's goals and objectives. Trong (2013) defined value as a function of product features, quality issues, delivery, service, and price, and later added that "the consumers always determine value on their terms, timing and will" and that "value is a perception, opinion or understanding made up of measurable components according to the need and desire." Perceived value is a customer's perception of a comprehensive form of service evaluation of the use of a product or service. Value perceptions may also vary based on usage. Value is "a function of the overall quality and price of a company's products and services compared to competitors" (Mokhtar et al, 2005).

### Terms

1. User adoption refers to the parties who use your technology, products, or services. This term is generally mentioned in business but is increasingly used in innovation and ICT. In business, it usually refers to the purchaser of a product or service; technological innovation usually refers to the user of technological innovation results. In this study, NEV is considered a technological innovation in the car industry, and its adoption by car users will push economic and environmental growth (Acheampong et al., 2019).

2. Economic value is the value that a person places on an economic good based on the benefit they derive from it. It is often estimated based on the person's willingness to pay for the good, typically measured in currency units (Huang et al., 2024). This study will focus on cost subsidy, operational saving, and price reduction risk by adopting NEV over the traditional models.
3. Functional value refers to a valuable car that should be of good quality and functional. Practical solutions include storage compartments (for quantity and size). Another aspect influencing a car's future RV is its road performance, which is highly associated with customers' expectations (Straub, 2009). On the other hand, safety features will also be a critical factor in selecting users. This study will also evaluate innovative features and the sustainability risk of adopting NEVs.
4. Social value refers to a business's positive impact on society and the environment. This can include creating jobs, supporting local communities, and reducing carbon emissions. Societal values determine the broad direction of a country's economic policies and can result in particular legislation being passed or not. Social value initiatives can bring tangible benefits to local communities, such as improved education, healthcare, and economic development (Milakis et al., 2017).

## **HYPOTHESIS**

### **The Impact of Economic Value on User Adoption**

Economic value is usually expressed as the price of an asset or commodity in the market. This price reflects people's supply and demand relationship for the item and the perception of its use value. From an economic perspective, anything meaningful to people and society can be regarded as economic value. In addition, economic value is also closely related to resource allocation, market supply and demand, price fluctuations, etc., reflecting the measurement of the benefits that economic actors obtain from products and services (Zhu et al., 2021).

H1. Economic value has no significant impact on user adoption of new energy vehicles.

### **The Impact of Functional Value on User Adoption**

In addition to environmental protection benefits, new energy vehicles have huge technological and intelligence advantages. The control system of new energy vehicles is more intelligent and can realize multiple driving modes, making driving more convenient and safer. In addition, new energy vehicles also adopt advanced energy management systems that can effectively manage the energy usage of batteries and motors, making driving more economical and efficient (Han et al., 2017). Taking autonomous driving as an example, cars can obtain information about the surrounding environment through high-precision maps, lidar, cameras, and other sensors, analyze and make decisions, and ultimately achieve autonomous driving. This can improve driving comfort and safety and solve problems such as fatigue and negligence in human driving (Gao et al., 2023).

H2. Functional value has no significant impact on user adoption of new energy vehicles.

### **The Impact of Personal Level on Purchase Intention**

Social value in NEV refers to the public's acceptance and awareness of new energy vehicles. With the improvement of environmental awareness and the government's vigorous promotion of new energy vehicles, more and more consumers are beginning to understand and accept new energy vehicles. However, due to the relatively low popularity of new energy vehicles in the market, some consumers have doubts about their performance and safety, which has affected the promotion of new energy vehicles to a certain extent (Lee et al., 2017). To increase social awareness, the new energy vehicle industry needs to strengthen communication and interaction with the public so that

consumers can more intuitively understand the advantages and characteristics of new energy vehicles through test drives, experience activities, etc. At the same time, the industry also needs to strengthen publicity and education to improve the public's awareness and acceptance of new energy vehicles (Zhang et al., 2018).

H3. Social value has no significant impact on user adoption of new energy vehicles.

## CONCEPTUAL FRAMEWORK

Empirical results show that consumer adoption of new energy vehicles can be effectively predicted by three essential characteristics: user adoption through value and satisfactory perception. Furthermore, this research will focus on economic aspects (cost subsidies, operational savings, and price reduction risks), functional aspects (innovative features and sustainability risks), and social aspects (status symbols, social contributions, and reputational risks) by influencing consumption. Researchers' views on the characteristics of innovation have a significant impact on the adoption of new energy vehicles. Theoretically, this study contributes to analyzing how innovative technology affects consumer adoption of electric vehicles and identifies numerous important antecedents of this behavior. On the other hand, it contributes to the local economy, which will also be based on user attitudes and perceptions of usage outcomes.

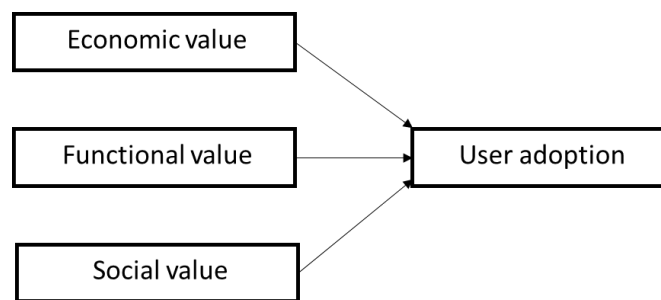


Figure 1. The Conceptual Framework

## RESEARCH METHODS

### Population and Sample

This research population comprises car users from Guizhou, China, who adopt NEVs to improve economic and environmental development. A sample of 399 was collected for this study's analysis in January 2024 through the WeChat Survey Platform.

This study's minimum research sample size is based on the study of Kadam & Bhalerao (2010)

1. The margin of error (confidence interval) - 95%
2. Standard deviation 0.5
3. 95% - Z Score = 1.96
4. Sample size formula =  $(Z\text{-score})^2 * Std\ Dev*(1\text{-StdDev}) / (\text{margin of error})^2$
5.  $(1.96)^2 * 0.5(0.5) / (0.05)^2$
6.  $(3.8416 * 0.25) / 0.0025$
7.  $0.9604 / 0.0025 = 384$
8. 384 respondents would be needed for this study based on a confidence level of 95%

### Research Model

Regression analysis is a set of statistical tools and methods for estimating the relationship between a dependent variable and one or more independent variables. It can be used to assess the strength of relationships between variables and model future relationships between them. SPSS20.0 included the test of correlation coefficient of determination, multiple linear regression, and testing this study's hypotheses.

## RESULT AND DISCUSSION

### Regression analysis of various variables on user adoption

The model summary is as follows: The correlation coefficient (R) is 0.935, and the coefficient of determination (R<sup>2</sup>) is 0.915. The adjusted R<sup>2</sup> is also 0.922, indicating that the model fits well. The model explains 92.2% of the variance in user adoption through economic, functional, and social values. The Durbin-Watson test result is 2.093, which is approximately 2, suggesting that the residuals are independent and the model does not suffer from serial correlation problems.

**Table 1.** Summary of the regression analysis model of constructs and user adoption

Model	R	R <sup>2</sup>	Adjust R Square	Standard estimate error	Durbin-Watson
1	0.935a	0.915	0.922	0.93321	2.093

The results of the single-factor analysis indicate that there are significant differences between the independent and dependent variables. The regression sum of squares is 3665.221, the residual sum is 231.422, and the significance level is 0.000, less than the significance level of 0.01. The study shows a considerable effect between economic value, functional value, social value, and user adoption.

**Table 2.** ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3665.221	3	3647.316	4421.343**	.000 <sup>c</sup>
	Residual	231.422	381	0.466		
	Total	3896.643d	384			

\*\* p ≤ .01

a. Dependent variable: User adoption

b. Predictor variables: Economic value, functional value, and social value

**Table 3.** Multiple Linear Regression Analysis Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.335	1.552		6.223	.004
	Economic value	.221*	.043	.253	2.112	.021
	Functional value	.115*	.038	.138	2.335	.011
	Social value	.402*	.031	.432	3.672	.015

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\*p≤0.05

- a. Dependent Variable: User adoption
- b. Predictor variables: Economic value, functional value, and social value

The regression equation of the multiple linear regression analysis

$$Y = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + e$$

$$Y = 4.335 + 0.221 X_1 + 0.115 X_2 + 0.402 X_3$$

*Description:*

Y = User Adoption

$\alpha$  = Constant

X1 = Economic Value

X2 = Function Value

X3 = Social Value

e = Error

$\beta_1$  = First Regression Coefficient Number

$\beta_2$  = Second Regression Coefficient Number

$\beta_3$  = Third Regression Coefficient Number

The table displays economic, functional, and social values and user adoption coefficients. By adding constants to the inequality, it can be concluded that there is a significant interplay between these values.

### **Interpretation of Research Results**

Car users are crucial in selecting new energy vehicles (NEVs) to improve their perception of economic and environmental development. The independent economic, functional, and social variables influence this selection process of the dependent variable of user adoption.

#### **The Effect of Economic Level on Purchase Intention**

The result of testing the first hypothesis indicates that economic value significantly impacts the car user adoption of NEV based on the standard regression coefficient of the economic value is 0.221,  $t=2.112$ , and the significance level is  $0.021 < 0.05$ . It shows that the economic value significantly impacts user adoption. Therefore, H1 is not established.

#### **The Effect of Emotional Level on Purchase Intention**

The result of testing the second hypothesis indicates that functional value significantly impacts the car user adoption of NEV based on the standard regression coefficient of functional value, which is 0.115,  $t=2.335$ , and the significance level is  $0.011 < 0.05$ . It shows that the functional value significantly impacts user adoption. Therefore, H2 is not established.

#### **The Effect of Personal Level on Purchase Intention**

The result of testing the third hypothesis indicates that social value significantly impacts the car user adoption of NEV based on the standard regression coefficient of social value, which is 0.402,  $t=3.672$ , and the significance level is  $0.015 < 0.05$ . It shows that social value significantly impacts user adoption. Therefore, H3 is not established.

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## CONCLUSIONS

### Research Results

H1 Economic value has no significant impact on user adoption of new energy vehicles.

H2 Functional value has no significant impact on user adoption of new energy vehicles.

H3 Social value has no significant impact on user adoption of new energy vehicles.

### Managerial Implications

According to a research study, when choosing NEVs for transportation needs, economic, functional, and social values significantly impact the adoption of Guizhou car users in China. This study found that all three influencing variables are crucial for future economic and environmental development. However, understanding and predicting consumer behavior has been a challenge for both researchers and market experts. Consumers' attitudes towards a product or service are the antecedent of purchase behavior. The cost subsidy, operational saving, and price reduction risks are related to economic value, while the innovative feature and sustainability risks are related to functional value. On the other hand, status symbol, social contribution, and reputation risk are related to social value and affect the attitude of implications on user adoption. NEV manufacturers should impose sustainable policies and designs to encourage users' decision-making when purchasing NEVs.

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