Journal of Economics and Management Sciences; Vol. 8, No. 4; 2025
ISSN 2576-3008 E-ISSN 2576-3016
https://doi.org/10.30560/jems.v8n4p73

Research on NEV Consumption and Co-Development in Tianjin: Based on the Policy-Technology-Demand Framework and AI-Driven Empirical Analysis

Heng Zheng[1], Tianyu Xu[1] & Shuimu Zhan[1]

[1] Tiangong University, China

Correspondence: Heng Zheng, Tiangong University, Tianjin, China.

Received: July 25, 2025; Accepted: August 6, 2025; Published: August 7, 2025

Abstract

Against the backdrop of global carbon reduction strategies and the rapid development of artificial intelligence, this study focuses on the new energy vehicle market in Tianjin, employing questionnaire surveys, in-depth interviews, and empirical analysis methods. Based on 920 valid questionnaires, the study analyzes consumer behavior. The findings reveal that the middle-aged group (25–35 years old) and the middle-income bracket (annual income of 100,000–200,000 yuan) constitute the main consumer base, with their purchasing decisions significantly influenced by policy subsidies, the availability of charging infrastructure, and range anxiety; New energy vehicle user satisfaction is primarily driven by safety, with charging convenience and after-sales service identified as key areas for improvement. To address issues such as inadequate infrastructure, the study proposes establishing a collaborative mechanism guided by the government, led by enterprises, and involving societal participation; to address the inadequacy of the market service system, it recommends establishing a standardized service system and value protection mechanism to regulate after-sales service and the used vehicle market; To address the disconnect between environmental values and consumer behavior, a guidance system should be established to strengthen environmental education, improve incentive policies, and promote the implementation of corporate environmental technologies; To address the mismatch between technological adoption and user perception, a demand-driven and scenario-based technology R&D and promotion model should be established to clarify technical standards, adjust R&D directions, and enhance technological outreach. The research findings provide theoretical guidance and practical strategies for the development of the regional new energy vehicle market, thereby enhancing the development level of Tianjin's new energy vehicle market.

Keywords: carbon emission reduction, new energy vehicles, AI, intelligent driving, potential users, logistics

1. Introduction

1.1 Research Background

Against the backdrop of accelerating global energy structure transformation and carbon emission reduction strategies, the new energy vehicle industry has become a key area in the restructuring of the transportation energy system. As Chen Yuanbo (2024) [1] pointed out, new energy vehicles are more environmentally friendly and practical than traditional fuel vehicles, and can promote the development of a low-carbon economy. According to data from the International Energy Agency (IEA), global sales of new energy vehicles exceeded 10 million units in 2022, with a penetration rate of 14%, marking the entry of the transportation sector's electrification transformation into a phase of scaled-up development. The Chinese government has designated new energy vehicles as a strategic emerging industry, driving industry development through policies such as purchase subsidies. In 2024, national production and sales of new energy vehicles surpassed 10 million units for the first time, maintaining China's position as the global leader for the tenth consecutive year. As one of the first national demonstration cities for the promotion and application of new energy vehicles, Tianjin leverages its robust automotive industry foundation. In 2022, the production of new energy vehicles accounted for 25.6% of the city's total vehicle production, significantly higher than the national average.

However, the mismatch between supply and demand for charging infrastructure is becoming increasingly prominent (2025)[2]. Data from the National Energy Administration shows that the vehicle-to-charging-station ratio nationwide dropped to 2.26:1 in 2024, but regional structural imbalances are significant. For example, in Tianjin, due to the cold winter climate, the power grid coverage rate is less than 60%, and the public fast-charging network coverage is insufficient, forming a bottleneck for market development. Particularly in terms of the coordinated development of vehicles, charging stations, and the grid, how to achieve the organic integration of charging demand forecasting, grid load optimization, and the integration of distributed energy has become an urgent technical and economic challenge.

1.2 Research Significance

This study focuses on the current situation of the new energy vehicle market in Tianjin, charging pile usage efficiency and vehicle-pile synergy mechanism, theoretically, it can enrich the system dynamics paradigm of regional industrial development and deepen the cognition of new type of demand-side response of electric power system by constructing market penetration dynamics model and charging facility layout evaluation system; policy can provide a reference for the local government to optimize the post-subsidy degradation policy (2022) [3], promote the new type of Policy can provide reference for local governments to optimize the policy after subsidy regression (2022) [3], promote the integration of new infrastructures, and help the industry to shift from policy-driven to market-driven; the social and environmental level can alleviate the user's "mileage anxiety" by optimizing the charging facilities, and accelerate the replacement of fuel vehicles, and the synergy of charging piles with photovoltaic and energy storage can improve the resilience of the power grid, and promote the green and intelligent transformation of transportation and energy systems.

1.3 Research Design

This study focuses on issues in the new energy vehicle market in Tianjin. First, a policy-technology-demand theoretical framework was constructed through a literature review. Then, a survey design was developed, with consumer characteristics and purchasing motives as the core, using a combination of stratified and quota sampling methods. A total of 1,000 questionnaires were distributed online (with 920 valid responses collected), supplemented by in-depth interviews to gather additional information. Subsequently, quality control and data analysis were conducted, employing binary logistic regression and K-means clustering methods to identify key influencing factors. These were combined with a three-dimensional framework and spatial econometric models to evaluate charging network optimization schemes. Finally, based on the analysis results, systematic strategies were proposed across infrastructure, technology, services, and environmental sustainability dimensions to provide guidance for regional industrial development.

2. Research Methods

2.1 Literature Review Method

By systematically sorting out and analysing the relevant literature on policy-driven mechanisms, charging facility planning and new energy vehicle technology innovation, this study understands their development history, theoretical foundations and practical experiences, providing theoretical support and background information for the study.

2.2 Questionnaire Survey

By designing a scientific and reasonable questionnaire to survey the consumer group of new energy vehicles, we get the overall perception of the consumer group on the new energy vehicle market, and further understand the users' attitudes towards charging piles, green policies and intelligent driving.

2.3 Model analysis method

Through the quantitative analysis of consumer evaluation of various aspects of new energy vehicles through the model, it helps to understand consumer perception and demand for new energy vehicle market, so as to foresee the development prospects and thus put forward suggestions, and provide certain reference for the development of new energy vehicle industry in other places of China. This project mainly uses univariate descriptive analysis, multiple linear regression analysis, logistic regression analysis and other methods for analysis.

3. Overview of the Policy-Technology-Demand Framework and AI-Driven

3.1 Concept of the Policy-Technology-Demand Framework

The Policy-Technology-Demand Framework is an integrated tool for systematically analyzing the development of the new energy vehicle industry, with its core focus on analyzing the interaction and synergy among the three dimensions (2023)[4]: The policy dimension focuses on government regulatory measures, such as Tianjin's "One Base, Three Zones" strategy and tiered replacement subsidies, which aim to lower consumer barriers, optimize infrastructure layout, and influence the market; The technology dimension encompasses core technologies and supporting technologies, such as battery range and charging station density. Breakthroughs in these areas can alleviate "range anxiety," enhance competitiveness, and support the implementation of policies; The demand dimension centers on consumer behavior, including purchase intent and usage experience, reflecting how demand drives technological R&D and policy adjustments. The synergistic logic among the three dimensions is that policies ensure technological implementation, technology meets demand upgrades, and demand drives policy and technological innovation. This framework is used in research to identify market bottlenecks and propose synergistic strategies to promote the industry's transition from policy-driven to market-driven development.

3.2 Concept of the AI-Driven

AI-Driven as an important driving force of new energy vehicle consumption intention in the new era, the core lies in the application of technology to directly enhance the attractiveness of the product and the user's perceived value, which in turn strengthens the purchase intention.The integration of AI technology and new energy vehicles has spawned functions such as intelligent driving assistance, voice interaction, and real-time road condition prediction (2025)[5], which simplifies the driving process and improves safety and convenience. At the same time, the ability of AI algorithms to analyse user behaviour data can help car companies optimise the configuration of features for different groups, reducing the mismatch between technology and demand. This makes AI-driven not only become the highlight of product differentiation competition, but also transformed into a key thrust to stimulate consumer intent, especially in northern regions such as Tianjin, which can target to solve the geographical use of the pain points, and enhance user acceptance and willingness to buy.

4. Tianjin New Energy Vehicle Market Status

4.1 Consumer Purchase Intention

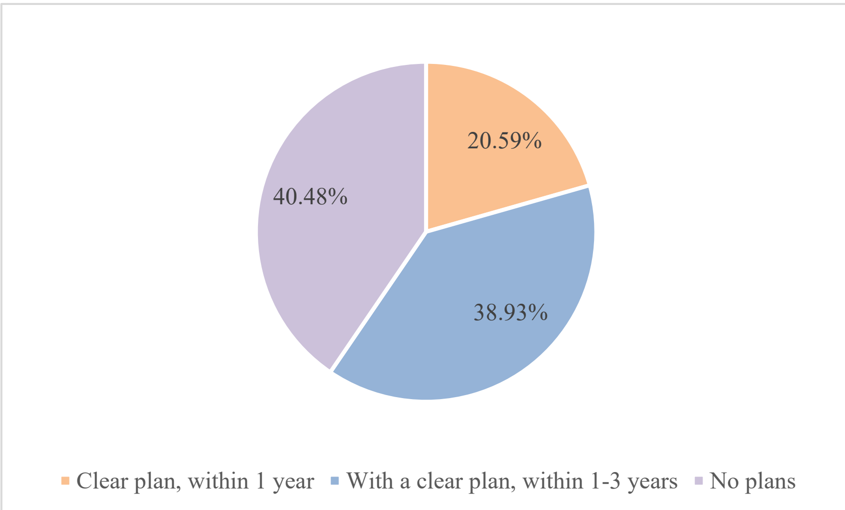

Figure 1. Consumer purchase intention

From the data of purchase status 20.59% of the respondents have a clear plan to buy within 1 year, 38.93% plan to buy within 1-3 years, while 40.48% have no purchase plan for the time being. Overall, nearly 60% of potential users have different time span of car purchase planning, reflecting that the market has a certain consumption potential, but there are still more than 40% of the crowd holding a wait-and-see attitude. Although some people have not acted for the time being, more than half of the potential users have a clear purchase planning, which shows that people's willingness to buy is not low; the market penetration rate of new energy vehicles is relatively low, and it is still necessary to strengthen the market promotion and publicity.

4.2 Consumer Perception of AI Technology

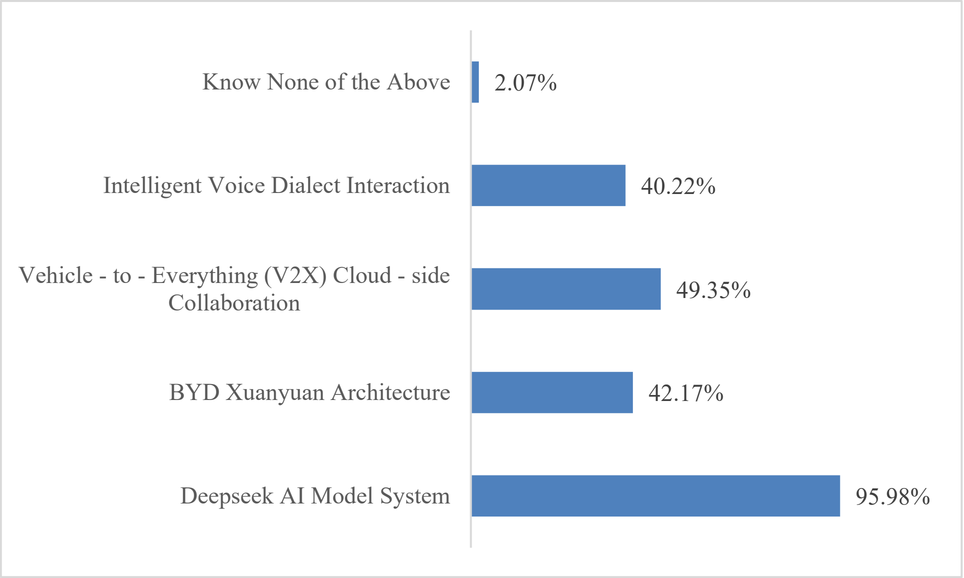

Figure 2. Consumer awareness of AI technologies for new energy vehicles

The survey shows that although 95.98% of the respondents have heard of the DeepSeek AI big model system, their knowledge of specific technical architectures (e.g., BYD Xuanjie Architecture is only known to 42.17%) and application scenarios (Telematics Cloud Collaboration 49.35%, Intelligent Speech Dialect Interaction 40.22%) is significantly low. This phenomenon of "high awareness and low recognition" reflects the disconnection between the spread of technology concepts and the actual needs of users. Further analysis reveals that only 38.24% of potential users are looking forward to the dialect interaction function, while 78.55% are concerned about cloud-based road prediction, indicating that consumers are more concerned about the implementation of AI technology in improving driving safety (e.g., emergency braking response) and practicality (e.g., auto-parking and navigation), rather than mere technical parameters or conceptual marketing.

4.3 Consumer Environmental Awareness

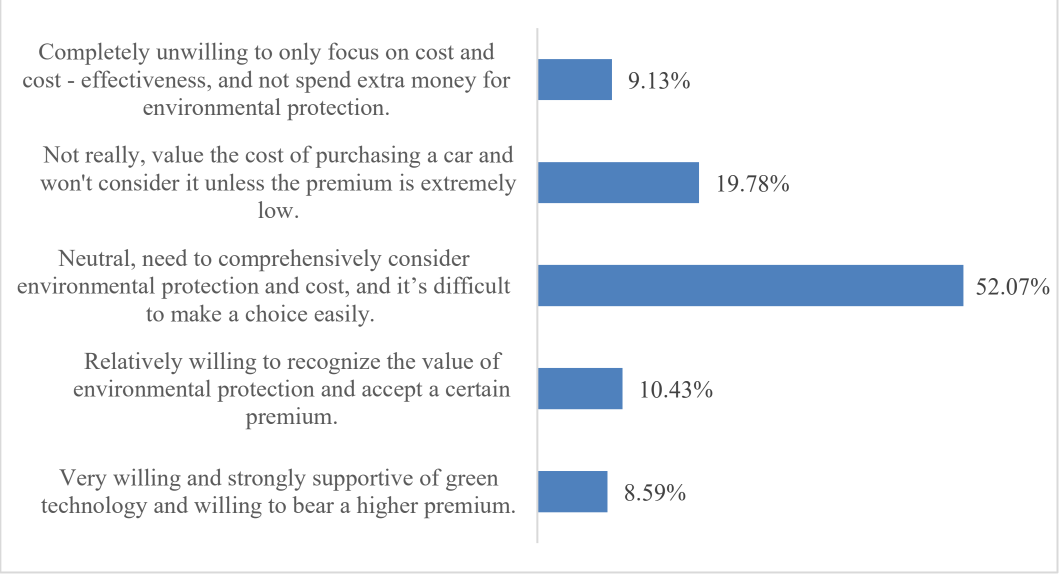

Figure 3. Consumers' environmental awareness of new energy vehicles

When asked whether they are willing to pay a higher purchase cost for environmental protection, only 8.59% said "very willing", 19.78% explicitly refused, and 52.07% chose "need to consider comprehensively". This result is highly correlated with potential users' choice of price range: 33.91% preferred the 100,000-150,000 RMB model, and acceptance of the technology premium was concentrated at 3%-5% (40.31%). The data reveals that consumers are sensitive to environmental costs and need to reduce the green premium through technological innovation to enhance their willingness to pay. In addition, although 76.9% of respondents recognise the role of new energy vehicles in reducing urban carbon emissions ("very large" or "large"), only 10.38% of potential users consider environmental protection as the primary factor in purchasing a vehicle, while 52.77% are more concerned about the economy and practicality. Economy and Practicality. Among those who have already purchased a car, "energy-saving and environmental protection/reducing carbon emissions" ranked third (3.3 points), significantly lower than "attractive intelligent features" (4.41 points) and "low cost of use" (3.69 points). (3.3 points), significantly lower than "attractive intelligent features" (4.41 points) and "low cost of use" (3.69 points). This suggests that although the value of environmental protection is widely recognised, it has not yet been transformed into a core driving force in actual consumer decision-making.

5. Analysis and Conclusions

5.1 Analysis of Factors Influencing Consumer Purchase Decision Using Binary Logistic Regression

Table 1. Regression analysis results

Variant	Coefficient β	Robust SE	z	Odds Ratio	Marginal Effect
Intercept	-2.874	0.317	-0.907	——	——
Knowledge of Carbon Reduction Benefits	0.523**	0.098	5.34	1.688	+12.4%*
Knowledge of Subsidy Policy	0.461	0.085	5.42	1.586	+9.7%
Expectation for Charging Infrastructure	0.597	0.124	4.81	1.816	+15.2%**
Age Group	0.214	0.057	3.75	1.238	+5.3%
Income Level	0.189	0.049	3.86	1.208	+4.6%
Range Anxiety	-0.682	0.131	-5.21	0.505	-16.8%***

By employing a binary logistic regression model, this study analyzed the factors influencing consumers' purchasing decisions for new energy vehicles, with consumer purchasing intent as the dependent variable (intending to purchase = 1, currently not intending to purchase = 0). The study incorporated personal information such as gender, age, and income, as well as independent variables including awareness of carbon emission reduction benefits, purchasing motives, and barriers to purchase. Variables were screened using Pearson and Spearman correlation tests, retaining significantly correlated variables ($|r| \geq 0.3$ and $p < 0.05$) such as understanding of carbon emission reduction benefits, understanding of subsidy policies, age group, expectations for improved charging infrastructure, and range anxiety. A regression model was constructed and its validity was tested. The results showed that the model's likelihood ratio chi-square value was 217.35, P=0.012, with an accuracy rate of 90.3%, indicating overall good performance.

The regression results indicated that subsidy policies significantly influence purchasing decisions, particularly among the 30-40 age group. For every level increase in policy awareness, the probability of purchase increases by 12%, making this group the primary policy-sensitive consumer demographic; The impact of charging infrastructure completeness is equally prominent, with consumers strongly desiring improved charging infrastructure having a 1.8 times higher purchase probability than others, indicating a need to prioritize charging network deployment in regions with high marketization levels. Age and income exhibit synergistic effects: among the 30-40 age group, each increase in income level raises the purchase probability by 18%, but the age effect is weaker among high-income groups (annual income exceeding 500,000), who prioritize vehicle performance. Range anxiety is the primary barrier, with consumers concerned about range being 17% less likely to purchase, and this decline reaching 28% in cold regions. Additionally, if actual range is 10% lower than advertised, the likelihood of purchase plummets by 24%. While most acknowledge the potential of autonomous driving technology, fewer than 20% believe it is sufficiently mature. Consumers prioritize practicality and safety, with core functionalities remaining the primary demand.

In summary, promoting new energy vehicles requires a three-pronged approach: strengthening policy communication to enhance policy awareness among the younger generation; prioritizing the improvement of charging infrastructure in non-restricted cities; and addressing range anxiety, particularly by enhancing battery performance in cold regions and disclosing accurate data to alleviate consumer concerns, thereby fostering long-term market confidence in new energy technology.

5.2 An Analysis of Overall Experience Satisfaction among NEV Owners Using a Multiple Linear Regression Model

Table 2. Regression coefficients and significance tests

Variable	Unstandardized Coefficient (B)	Std. Error (SE)	Standardized Coefficient (Beta)	t-value	Sig. (p-value)
(Constant)	0.690	0.307	-	2.247	0.025
Satisfaction with Driving Range	0.042	0.029	0.043	1.467	0.143
Charging Convenience	0.141	0.042	0.146	3.358	<0.001
Charging Cost	0.056	0.034	0.057	1.625	0.105
Intelligent Features	0.051	0.031	0.052	1.674	0.095
Safety	0.568	0.047	0.591	12.201	<0.001
After-sales Service	0.094	0.034	0.103	2.752	0.006
Resale Value	-0.048	0.025	-0.051	-1.964	0.050

Based on a multiple linear regression model, this study investigates the overall satisfaction of consumers who have purchased new energy vehicles. The dependent variable is the overall satisfaction with the use of new energy vehicles (on a 10-point scale), while the independent variables are the scores for seven functional dimensions: range, charging convenience, charging cost, intelligent features, safety, after-sales service, and residual value. The aim is to quantify the contribution of each functional dimension to overall satisfaction. In the study, data preprocessing was conducted, with all variables achieving 100% completeness (valid sample size of 342). Residuals passed normality tests, and VIF values were all less than 5, eliminating severe multicollinearity interference; The model fit results showed an adjusted R^2 of 0.772, indicating that the seven independent variables collectively explained 77.2% of the variance in overall satisfaction. The F-value was 165.5 with $p < 0.001$, demonstrating strong predictive power.

The regression results show that safety has the highest contribution to overall satisfaction (Beta = 0.591). For every 1-point increase in user satisfaction with battery safety and collision protection, overall satisfaction increases by 0.568 points, highlighting users' high priority on core safety technologies; Charging convenience (Beta = 0.146) and after-sales service (Beta = 0.103) also have significant impacts. Optimizing charging station coverage density and usage convenience can increase satisfaction by 0.141 points, while improving after-sales service response efficiency and service center density by 1 point can increase satisfaction by 0.094 points. Resale value exhibits a negative effect (Beta = -0.051), reflecting users' concerns about the depreciation rate of electric vehicles. The impacts of range capability, charging costs, and intelligent features did not reach statistical significance, possibly because current mainstream models already meet basic range requirements, shifting user anxiety toward charging efficiency, and the practicality or measurement dimensions of intelligent features may be insufficient.

Based on the above conclusions, targeted recommendations should focus on prioritizing strategies around core drivers. Automakers should prioritize investments in battery thermal management systems, body structure safety design, and charging network expansion to maximize user satisfaction. For intelligent features, they can develop user-perceivable interaction innovations such as "voice assistant scenario customization." Additionally, they can alleviate users' concerns about residual value and reduce their perceived financial risks through battery leasing and official used car certification buyback programs.

6. Conclusions and Recommendations

6.1 Research Conclusions

Data analysis indicates that the primary consumer base consists of middle-aged individuals over 30 years old and the middle-income bracket. This demographic not only prioritizes external incentives such as policy subsidies but also emphasizes vehicle practicality and usage costs. Their consumption logic balances policy, cost, and technology, with the market transitioning from an exploratory phase to a more practical orientation.

In terms of user experience, inconvenient charging and unstable range are the main bottlenecks. Issues such as uneven regional distribution of infrastructure, peak-hour queues, and battery degradation in winter are prominent. Additionally, inadequate after-sales service and low resale value further impact user experience and market acceptance; In terms of smart technology awareness, consumers prioritize practical features like real-time traffic predictions and pay little attention to technical specifications. They are willing to pay for proven practical features, but there is a disconnect between corporate technology marketing and user needs, necessitating a stronger focus on demand-driven feature development; In terms of environmental awareness, users acknowledge the emissions reduction benefits of new energy vehicles but rarely prioritize environmental considerations as the primary factor when purchasing a vehicle, instead focusing on economic factors. This is linked to consumers' insufficient understanding of the full lifecycle carbon footprint and companies' environmental marketing that emphasizes concepts over practical implementation.

6.2 Issues in the NEV Marke

Through a multi-dimensional study, it was found that there are four core issues in Tianjin's new energy vehicle market: infrastructure and technology, uneven distribution of charging networks, severe winter range degradation, low efficiency of fast charging and high cost of battery replacement; market services, fewer after-sales outlets, insufficient maintenance capacity, the lack of second-hand vehicle evaluation standards, low value retention rate, forming a "buy new not buy old! " cycle; environmental protection, the user recognises the value of emission reduction, but rarely to environmental protection as the primary factor in the purchase of cars, corporate publicity heavy concept light practice, battery recycling system lagging behind; technical cognition, companies focus on intelligent driving and other technology research and development, the user is more concerned about the basic needs of the technology publicity and practical experience is out of step with the structural contradiction between cutting-edge technological innovation and market demand.

6.3 Recommendations and Strategies

Breakthrough infrastructure and technology bottlenecks, the need for government-enterprise-society collaboration: the government encrypts the charging pile layout, builds an intelligent scheduling platform, and supports the research and development of solid-state batteries and other technologies to improve the low-temperature range and fast charging (2025)[6]; car companies combine with scientific research institutes to study the technology, and explore shared charging modes. Improve the market service system, to build a standardised mechanism: the government to develop after-sales specifications, promote the layout of outlets and personnel training, and establish battery health certification standards; enterprises to build a battery recycling system (2025)[7], and to explore leasing modes to reduce the threshold of purchasing a car. To promote the integration of environmental protection and consumption, multi-dimensional guidance is needed: the government popularises carbon footprint knowledge and pushes carbon point rewards; enterprises publish carbon emission data and set up recycling networks; and society pushes low-carbon concessions to enhance the value of environmentally friendly behaviours. Bridging the technological cognitive mismatch requires demand-orientation: the government should set intelligent driving standards and push liability insurance; enterprises should prioritise the development of practical functions and focus on demonstrating functional value; society should enhance popularisation of science and build a closed loop of user feedback.

Acknowledgments

This paper was supported by the Innovation and Entrepreneurship Training Program for College Students of Tiangong University.

References

[1] Chen, Y. (2024). The Development Status and Countermeasures of China's New Energy Vehicles. *Science, Technology and Innovation*, *(5)*, 126–128. https://doi.org/10.15913/j.cnki.kjycx.2024.05.036

[2] Zhang, J. (2025). Research on the Optimization Strategy of Battery Management System for New Energy Vehicles. *Automobile Maintenance Technician*, *(14)*, 39–40.

[3] Li, H., & Chen, S. (2022). A Study on the Market Stratification of Sensitivity to the NEV Purchase Subsidy Phase-out Policy: An Empirical Analysis Based on Regression Discontinuity Design. *Economic Research Journal*, *(8)*, 89–103.

[4] Pu, G. (2023). *NEV Subsidy Policy, Demand Substitution, and Industrial Development* [Doctoral dissertation,

Dongbei University of Finance and Economics]. https://doi.org/10.27006/d.cnki.gdbcu.2023.000013

[5] Guo, W. (2025, March 3). Domestic AI Large Models Drive Automobiles Towards a New "Intelligent" Track. *New Energy Vehicle News*, *8*. https://doi.org/10.28896/n.cnki.nxnqc.2025.000075

[6] Li, W. (2025, April 13). The Construction of Public Charging Piles Needs to Advance in Both "Quantity" and "Quality". *Legal Daily*, *5*. https://doi.org/10.28241/n.cnki.nfzrb.2025.002257

[7] Zhang, J. (2025). Research on the Optimization Strategy of Battery Management System for New Energy Vehicles. *Automobile Maintenance Technician*, *(14)*, 39–40.