New Energy Vehicle Brand Sales Trend Forecast and User Evaluation Research

Na Tang [1*], Xuefei Zeng [2], Ying Jiang [3] , Haoyu Zheng [4], Yiyi Zhou [5], Yan Lan Guo [6],

[1,2,3,4,5,6] *School of Business, Geely University of China, Chengdu, Sichuan, 641423,China*

Article Information

Received: 21-11-2024

Revised: 28-11-2024

Published: 05-12-2024

Keywords

Forecasting;Evaluation; Sales Trends; New Energy Vehicle Brands

****Correspondence Email:***

tangna@guc.edu.cn

Abstract

In the context of green economic development, new energy vehicles, as one of the representatives of innovation-driven development and environmental protection and energy conservation, are currently in a leading position in the market. This paper selects eight representative well-known brands, namely BYD, Li Auto, Xiaopeng, Geely, NIO, Changan Automobile, SAIC-GM and ORA, for quantitative analysis, with the aim of identifying future sales trends and conducting a precise business evaluation of new energy vehicles, as well as exploring the key factors affecting sales. The study was empirically tested using ARIMA time series forecasting, principal component analysis, linear regression analysis and neural network models. The results showed that brand identification behavior and personalized products have the most significant positive impact on sales. Therefore, this study believes that car brand collection, forwarding, personalized production and quality control are the key factors and improvement priorities that will affect future sales.

1. Introduction

As the main strategic direction of the deep transformation of the automobile industry, new energy vehicles have an important position and role in the development of China's green economy. Since the 18th Party Congress, China has successively formulated the industrial development plan from 2020 to 2035 with new energy vehicles as the core, based on the current market environment, this industry is developing very rapidly, and the domestic new energy vehicle market share is getting bigger and bigger, which all shows that the new energy automobile industry in the market shows a strong vigor and vitality, and its prospect is immeasurable. The comprehensive strength of new energy vehicles is relatively strong, is for the high-quality development of the economy into a more efficient, more sustainable and powerful kinetic energy.

Based on the above background, this study sets the purpose as predicting the trend of new energy vehicle sales, comprehensively evaluating them based on the trend, and exploring the strategic layout and direction of new energy vehicles. This study locks the scope to 20 brands such as BYD, Ideal, Geely and so on to conduct quantitative research, firstly, collect brand data and establish a database, then choose a model to forecast the sales of new energy vehicles by using the ARIMA model, and then use the principal component analysis, linear regression analysis and neural network model to look for influencing factors in multi-dimensions, and finally, conduct in-depth discussion based on the findings of the empirical analysis to draw conclusions and recommendations.

This study not only profoundly reveals the future market prospects and overall state of new energy vehicles in the spatial and temporal scope, and provides theoretical guidance to its commercial field by digging out the representative influence dimensions; but also in practice, it can put forward effective solutions for the actual problems of new energy automobile industry such as breakthrough in scale and obstruction of development potential, and provide new ideas and methods for optimizing and upgrading China's future new energy industry pattern.

1.1 Literature review

Status of research

The development of new energy vehicles is a major trend in the current economic and ecological environment, and is also a major highlight in today's high-tech industry. Most of the existing researches mainly focus on the development of new energy vehicle technology, user acceptance and behavioral research, policy and market environment, and they have a positive impact on promoting the popularization and development of new energy vehicles [Mou, L., Zou, Y., & Jiang, H.]. However, new energy vehicles still have problems such as relatively outdated technology, insufficient policy support, lagging charging facility construction, and low-carbon environmental aspects [Li, X.]. These positive and negative dimensions work together especially in the sales and development trend of new energy vehicles .

From the sales point of view, China's new energy vehicles are booming stage, but the market share is still far smaller than traditional cars [Xu, M.]. At the same time, in addition to science and technology, some studies have pointed out that vehicle subsidies, charging piles and other factors have a greater impact on the sales of new energy vehicles [Jiang, H.], the urgent need to improve these factors have put forward higher requirements for the majority of car companies, so in the context of the "double carbon", for the rapid growth of new energy automobile market, companies need to differentiate their strategies to enhance Therefore, under the background of "dual carbon", for the rapid growth of the new energy vehicle market, enterprises need to differentiate their strategies to strengthen innovation and service experience, optimize sales channels and promotional activities, and enhance competitiveness and consumer satisfaction through scientific pricing [Long, D.].

From the development trend, China's new energy automobile industry has become a new round of energy revolution, information technology revolution and other intersections, coupled with market-driven to become a reality, belonging to the new energy era has come. New energy automobile products in the future in the environmental protection, energy saving, intelligence, etc. will certainly win the market recognition, become China's future automobile industry a strong support, China's new energy automobile industry will be healthy, rapid and sustainable development [Li, C.].

Overall, according to the current state of research, new energy vehicles will definitely seize the opportunity of the automobile market and become a new driving force to lead the development of new energy.

Theoretical foundations

New Energy Vehicles (NEVs) are automobiles that use non-traditional fuels or are equipped with innovative powertrains, including pure electric vehicles, plug-in hybrids, fuel cell vehicles, and general hybrids, aiming to reduce dependence on oil and tailpipe emissions. In recent years, the development of green economy with new energy vehicles as the main line has a strong pulse, which has attracted many scholars to conduct research in this direction. Huang Dong's (2017) study emphasized the importance of government policy support for industrial growth, and policy measures accelerated market shaping [Huang, D., & Xu, X.]. Wang Song in (2019) pointed out that the economic benefits of pure electric vehicles are significant, and their economic attractiveness will increase with the improvement of battery performance and cost reduction [Wang, S.]. Mao Jianmin (2022) mentioned that the industrialization of new energy vehicles has a strong dependence on technological innovatio [Mao, J.]. Deng Qingrui (2024) believes that new energy vehicles are extremely powerful from any perspective of sustainability, especially in digital marketing [Deng, Q.].

China's new energy vehicle industry has been on the rise since the beginning of the 21st century, and government policy support has been increasing. 2009's "Ten Cities, One Thousand Vehicles" program and financial subsidy policies have contributed to the expansion of the market scale, establishing China as the world's largest market. Technological innovation is the key to the industry's development, and advances in battery technology have improved the performance of new energy vehicles. Policy influence and market drive are the twin wheels of the industry's development. Government policies supported the industry's initial growth, and as the market matured, policies shifted to creating a market environment and strengthening infrastructure development. Chinese companies are demonstrating their competitiveness in the global market while promoting international cooperation.

In summary, the development of new energy automobile industry promotes industrial chain innovation and employment growth, boosts regional economic development, and leads the automobile industry to transform into intelligent manufacturing.

2. Research Methods

2.1 Data selection

Based on the above literature, this study takes the comprehensive indexes of 20 new energy brands as the main data content, in which a database has been selected and established for data organization, citation and construction of various models.

Table1. Data settings

	variant	variable dimension
independent variable	brand identity	Like Kambi, Comment, Favorite, Retweet
	Perceived Productivity	Quality Control 1 (number of complaints), Quality Control 2 (crash test structural safety), and complaint to sales ratio, Personalized production (number of branded option packages), personalization (number of downloads)
intermediary variable	Brand Interaction	Baidu search index (cumulative daily value for the past four years)
moderator variable	deal	Frequency of buzzwords (cumulative data from official media for the past four years)
implicit variable	brand value	Brand value increase, sales, user satisfaction, market share

2.2 Main research methods

This study mainly used SPSS26 & SPSS27 for data analysis.The first is ARIMA time series forecasting model, we use Principal component analysis,linear regression analysis,and BP neural network

Specifically, firstly, the future sales and development trend of the new energy vehicle segment in well-known automobile brands are predicted by constructing a time series prediction model; secondly, in order to explore the main dimensions affecting the sales of new energy vehicles, 13 independent variables, such as brand likes, comments, favorites, and retweets, are selected on the regression model, and the data results are streamlined into four principal components to improve the identification accuracy; again, the data are analyzed using a linear regression analysis to screen out the components with the most prominent roles and discuss the reasons for the formation of effective and ineffective components respectively; finally, using the BP neural network model, the model data is summarized to form the final research assessment report. Innovative points: the Institute

2.3 Quantitative ARIMA time series forecasting

This part of the study mainly selected new energy vehicles among the BYD, Ideal, Xiaopeng, Geely, Azure, Chang'an Automobile, SAIC-GM, Ola, a total of eight brands for quantitative prediction, the overall import of sales data for a total of three years from January 2021 to December 2023, due to the fact that the sales data of these brands is basically complete, so the common prediction is carried out, the prediction time is up to December 2025, to fully guarantee the timeliness of the data. Fully guarantee the timeliness of the data, at the same time, according to the final results presented in-depth understanding of the new energy vehicle brand development trend, which will be used to explore the relevant influencing factors and development decisions.

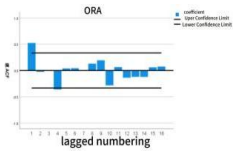

Fig1.Stationarity Ananlysis of ORA

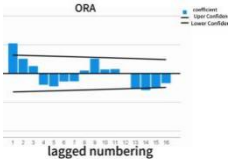

Fig2.Stationarity Ananlysis of ORA

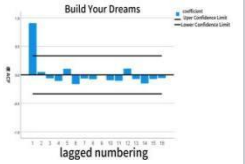

Fig3.Stationarity Ananlysis of BYD

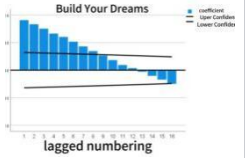

Fig4.Stationarity Ananlysis of BYD

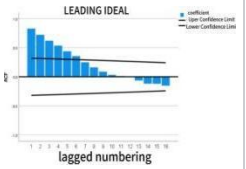

Fig5.Stationarity Ananlysis of LEADING IDEAL

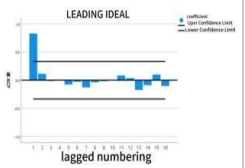

fig6.Stationarity Ananlysis of LEADING IDEAL

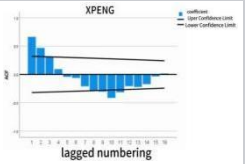

Fig7.Stationarity Ananlysis of XPENG

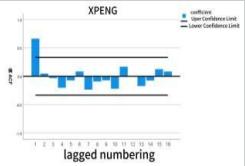

Fig8.Stationarity Ananlysis of XPENG

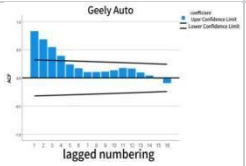

Fig9.Stationarity Ananlysis of Geely Auto

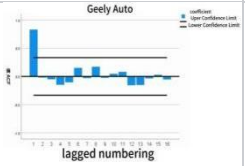

Fig10.Stationarity Ananlysis of Geely Auto

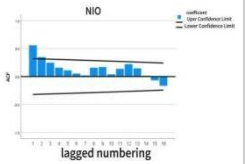

Fig11.Stationarity Ananlysis of NIO

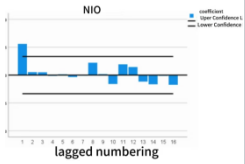

Fig12.Stationarity Ananlysis of NIO

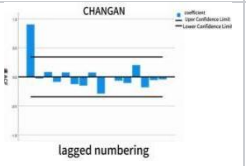

Fig13.Stationarity Ananlysis of CHANGAN

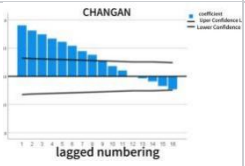

Fig14.Stationarity Ananlysis of CHANGAN

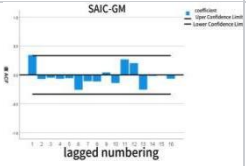

Fig15.Stationarity Ananlysis of SAIC-GM

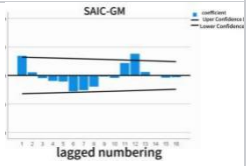

Fig16.Stationarity Ananlysis of SAIC-GM

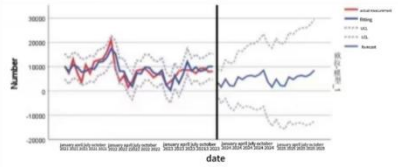

Fig17. Brand Forecast Graph1

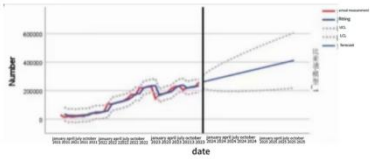

Fig18. Brand Forecast Graph2

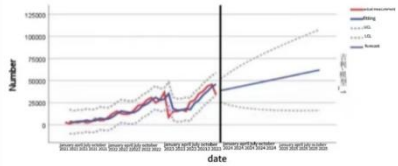

Fig19. Brand Forecast Graph3

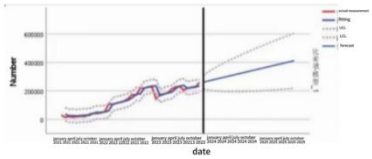

Fig20. Brand Forecast Graph4

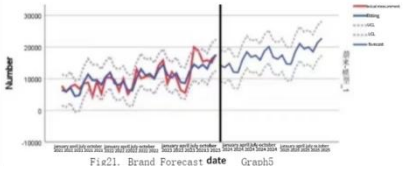

Fig21. Brand Forecast Graph5

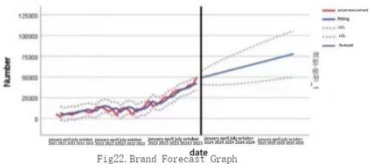

Fig22. Brand Forecast Graph

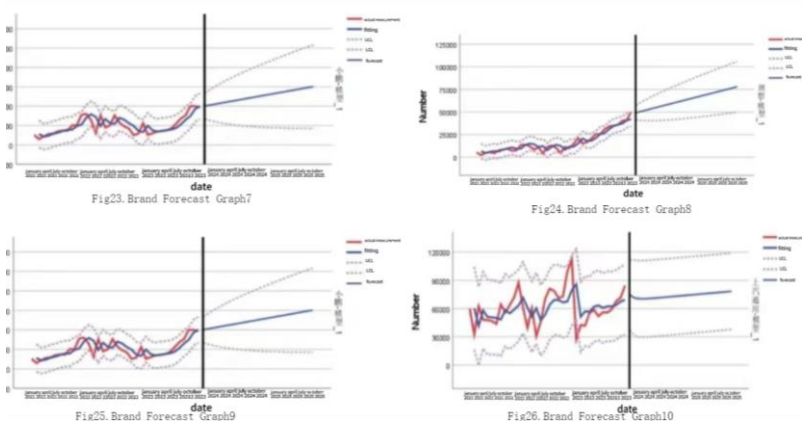

Fig23. Brand Forecast Graph7

Fig24. Brand Forecast Graph8

Fig25. Brand Forecast Graph9

Fig26. Brand Forecast Graph10

From the figure, it can be seen that most of the numbers of the autocorrelation (ACF) and partial autocorrelation (partial ACF) plots of the series are located inside the confidence intervals, indicating that the series is basically smooth, and the next step of constructing an ARIMA model to derive the prediction results can be carried out. The next step of constructing the ARIMA model can be carried out to obtain the prediction results. The model parameters of ARIMA derived here can be set as (1, 1, 1).

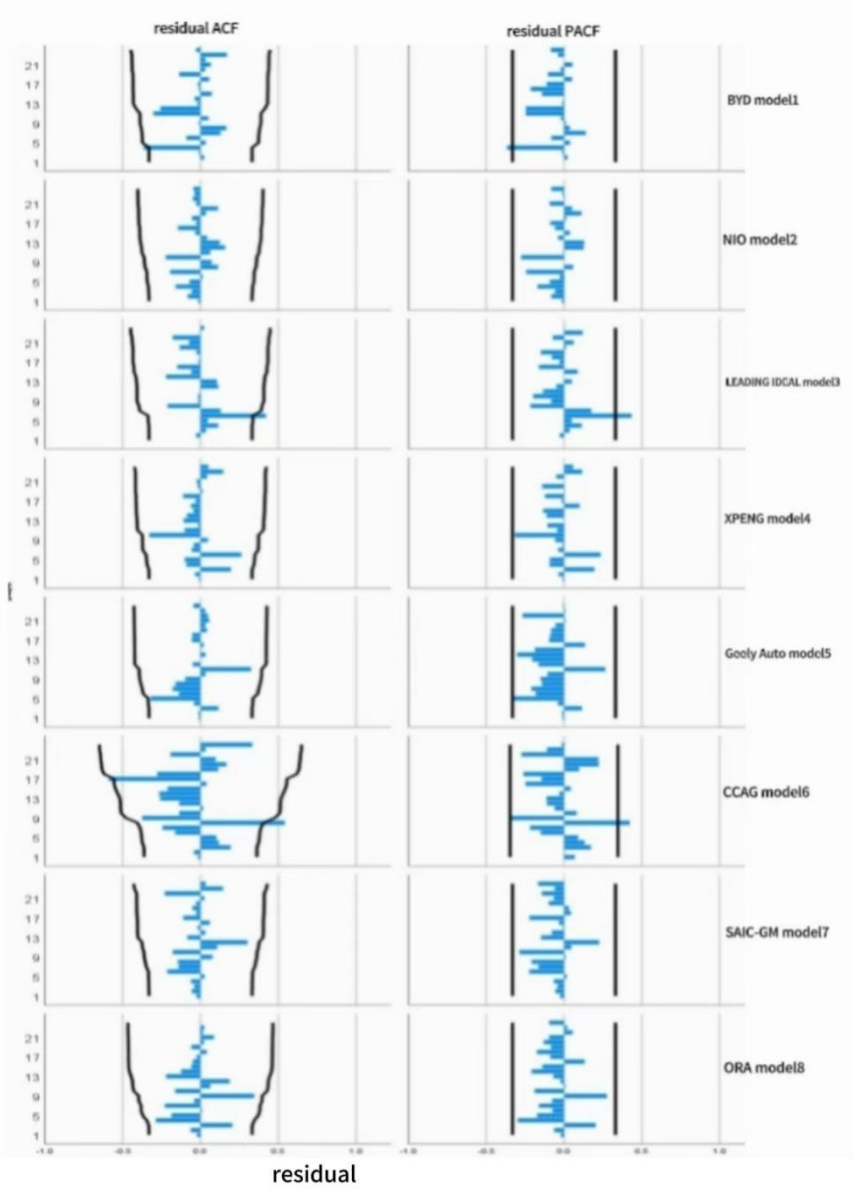

Fig 27. sales Ananlysis

As can be seen from the residual auto/partial autocorrelation diagram, most of the coefficients of autocorrelation and partial autocorrelation of each brand basically fall within the confidence interval, and there are few cases exceeding the interval, according to which it can be inferred that the sequence in the diagram is a white noise sequence. As can be seen from Table X, the trend of the fitted series of each brand has good similarity with the trend of the real series, i.e., the data results are more satisfactory, indicating that new energy vehicles in the sales part of the fitting effect is good.

2.4 Principal Component Analysis

This study uses principal component analysis followed by linear regression to explore the relationship between the independent and dependent variables under several dimensions.

The principal component analysis successfully grouped the independent variables into four main categories, as shown in the table below, listing favorites and retweets as the first category, called: brand identity behavior, quality control1 and complaint-to-sales ratio as the second category, called: product power perception; like-view ratio and comments as the third category, called: brand identity; and personalized production (the number of branded option packages) as the fourth category, called: personalized products, which are the four main categories. components contain the core of multiple primitive variables.

	element			
	Brand identity behaviour	Perceived brand power	brand identity	Personalised products
bookmark (Internet)	0.949			
reprint	0.942			
Quality Control 1 (Complaints Volume) from 1 July 2019		0.931		
Complaints Sales Ratio (per cent)		0.922		
Zanabi (name)			0.981	
commentaries			0.808	
dividualised production (number of branded option packages)				0.932

Fig 28. Table Principal component analysis

2.5 Linear regression analysis

After the first regression analysis, the four types of principal components as independent variables, and the dependent variable "brand value increase" to do linear regression analysis can be seen that the brand identity behavior has a greater impact on the brand value increase. The user's collection and forwarding behavior has a direct link to the brand value increase, the higher the collection and forwarding volume, the greater the brand value increase.

mould	Unstandardised coefficient	Standardised coefficient	t	significance		
	B	standard error	Beta			
1	(common metric)	-0.009	0.028		-0.328	0.747
	Brand identity behaviour	0.088	0.029	0.613	3.039	0.008
	Perceived Brand Power	0.013	0.029	0.094	0.467	0.647
	Brand Power Identity	0.005	0.029	0.035	0.173	0.865
	Personalised products	-0.009	0.029	-0.064	-0.319	0.754
a:implicit variable:Increase in brand value						

Fig 29. Table First regression Analysis

According to the second regression analysis, the independent variable remains unchanged, with "sales of new energy vehicles (cumulative over the past 4 years)" of the 20 brands as the dependent variable, and again it is the brand identification behavior that has the greatest impact. Users need to take concrete actions to identify with a brand, such as favorites and retweets, which are more convincing than viewing and liking, and comments are multi-faceted, so the higher the favorites and retweets, the higher the brand sales.

mould	Unstandardised coefficient	Standardised coefficient	t	significance		
	B	standard error	Beta			
1	(common metric)	1511860.85	290884.371		5.197	0
	Brand identity behaviour	1001982.442	298441.068	0.65	3.357	0.004
	Perceived Brand Power	-125648.907	298441.068	-0.081	-0.421	0.68
	Brand Power Identity	-93913.867	298441.068	-0.061	-0.315	0.757
	Personalised products	-115835.653	298441.068	-0.075	-0.388	0.703
a:implicit variable:sales volume						

Fig 30. Table Second regression analysis

According to the third regression analysis, the independent variable remains unchanged, "user satisfaction" as the dependent variable, personalized products "personalized production (number of brand option packages)" has the greatest impact on it. Its significance reaches 0.002, indicating that there is a strong correlation between the two, as shown in the table below, customers are more inclined to choose new energy vehicles that can be self-personalized and customized to better meet customer needs, thus enhancing customer satisfaction.

mould	Unstandardised coefficient	Standardised coefficient	t	significance		
	B	standard error	Beta			
1	(common metric)	79.3	0.425		186.549	0
	Brand identity behaviour	-0.514	0.436	-0.206	-1.178	0.257
	Perceived Brand Power	0.532	0.436	0.213	1.219	0.242
	Brand Power Identity	0.481	0.436	0.193	1.103	0.287
	Personalised products	1.609	0.436	0.645	3.69	0.002
a:implicit variable:customer satisfaction						

Fig 31. Table Third regression analysis

According to the fourth regression analysis, the independent variable is unchanged with "market share" as the dependent variable, and brand identity behavior has the greatest impact on it. The user's brand identity behavior shows the user's desire to buy, and the higher the user's brand identity behavior, the higher the enterprise's product sales can be greatly enhanced, which makes the enterprise's market share share increase, and increase the sales.

mould	Unstandardised coefficient	Standardised coefficient	t	significance		
	B	standard error	Beta			
1	(common metric)	0.045	0.008		5.667	0
	Brand identity behaviour	0.057	0.008	0.872	7.006	0
	Perceived Brand Power	0.009	0.008	0.143	1.156	0.267
	Brand Power Identity	0.008	0.008	0.128	1.039	0.316
	Personalised products	0.003	0.009	0.043	0.345	0.735
a:implicit variable:market share						

''

Fig 32. Table Fourth regression analysis

2.6 Neural Networks

The future sales of new energy vehicles can be reflected by brand value, so this post explores 20 brand perspectives on the metrics that influence brand value.

This paper selects brand value increase, sales volume, user satisfaction, market share as indicators, through the entropy weighting method to analyze the dependent variable weighting into "brand value". That is, the prediction index of neural network analysis, on behalf of the prediction of new energy automobile sales influence factors, this paper selects four variables: brand identity, product power perception, brand interaction, policy in the nine dimensions of the prediction index system.

As the outline of each indicator is different, it should be standardized first, and the result of the standardization process is shown in Fig.

Applying the SPSS neural network model, we get the neural network system as shown in Fig. When there are 4 hidden neurons, the accuracy of the prediction of this neural network model can be guaranteed, so in the article, there are 11 neurons in the input layer, 4 neurons in the hidden layer and 2 neurons in the output layer.

As can be seen from arima, the sales prediction error changes with strong stability, so it can be considered that this paper adopts the neural network model to study the influence factors of the sales of new energy vehicles is more ideal, and the accuracy is also higher.

The importance of the independent variables to the brand value is finally obtained as shown in the table.

Table 2. Neural Network Predictors and Normalized Processing Results

branding	Zankambi (name)	commentaries	favorite	forwarding (mail, SMS, packets of data)	Quality Control 1 (Complaint Volume) Beginning July 1, 2019	Complaint-to-sales ratio (in 10,000s)	Quality Control 2 (Crash Test Structural Safety)	Individualized production (number of branded option packages)	Personalization (downloads) 10,000	(Baidu search index, cumulative daily average for the past 4 years)	Frequency of buzzwords (official media, cumulative data for the last 4 years)	brand value
BYD BYD	-0.28648	1.67832	3.32406	3.46624	0.36385	-0.50204	0.31543	-0.11407	1.51168	3.20858	3.29548	3.33883
Geel	-	1.042	0.3889	0.850	0.053	-	0.2402	-	-	1.196	2.05883	0.5985

y	0.25952	61	3	45	35	0.54978	9	0.03715	0.61105	93		
Haval Haval	-0.29181	-0.58775	-0.55487	-0.63623	0.90669	-0.24924	0.59094	-0.19099	0.08462	-0.48246	-0.28435	-0.20206
NIO Azure	-0.26086	-0.6727	-0.15039	-0.69268	-0.88495	-0.5701	0.27536	3.039 56	0.20337	0.68165	0.22668	-0.27462
Great Wall	-0.22435	-0.11919	0.1089	0.26393	-0.37412	-0.42132	-4.12272	0.11668	0.08462	0.05157	0.10367	-0.61082
LI AUTO Ideal	-0.21254	-0.51103	-0.50302	-0.52018	-0.77158	-0.40959	0.47572	0.80894	-0.70965	1.30517	-0.46596	-0.64023
Xpeng.	-0.27631	0.02329	-0.70008	-0.64877	-0.85828	-0.49324	0.49576	0.57819	-0.54512	0.23924	0.2309	-0.51181
Song	-0.02349	0.75216	0.20224	0.24511	1.68988	0.70681	0.29038	-0.42174	1.51168	-0.46855	-0.72965	0.45022
Han Han	-0.26462	-0.54665	-0.48227	-0.40099	3.04832	3.70942	0.4607	0.1936	1.51168	0.11593	-0.70933	-0.25593
Dongfeng	-0.23555	-0.41239	-0.23336	-0.52018	-0.2134	-0.2066	0.04994	-1.96009	-1.15043	-0.74319	-0.15897	-0.42018
Changan	-0.27766	-0.45349	-0.28522	-0.29122	-0.03921	-0.54171	0.14211	0.34744	-0.62051	0.42981	0.36737	0.57059
GAC Guangzhou Automobile Chuanqi	-0.22631	-0.31374	0.19187	-0.15635	1.00633	0.21954	0.27886	-0.11407	-0.24444	-0.71324	-0.37859	0.11045
FAW Jiefang	-0.14349	-0.68092	-0.66896	-0.68641	-0.57085	-0.52534	0.36302	-0.34482	-0.8	-0.97068	-0.42214	-0.64147
Wuling SAIC-GM-Wuli	-0.27156	0.36855	1.923 91	0.75949	-0.36612	-0.6273	0.00486	-0.0633	0.52266	-0.35065	-0.18563	1.68964

ng											
Tang	-0.23433	-0.46445	0.14002	-0.22535	-0.00734	1.02999	0.19521	0.34744	1.51168	-0.53329	-0.72015	-0.40239
Sokon Sellis/Inquirer	0.05422	-0.76312	-0.72082	-0.73346	-0.92723	-0.51742	0.22526	0.03977	-1.03395	-0.75692	-0.67554	-0.49684
BAIC Biue park BAIC	-0.25685	-0.73572	-0.77268	-0.73973	-0.74624	0.75973	-0.11035	-1.96009	-1.05336	-0.8379	0.00812	-0.93868
Roewe SAIC Rongwei	-0.28821	-0.70832	-0.72082	-0.70209	-0.3141	-0.41478	0.22526	-0.42174	-0.66325	-0.2857	-0.20543	-0.6823
Qin	4.23161	3.19908	0.17113	0.2357	-0.26342	-0.20728	0.11005	-0.2679	1.51168	-0.67845	-0.68795	0.04476
Ora Ora	-0.25189	-0.09453	-0.65859	1.13273	-0.73157	-0.18975	-0.50608	0.42435	-1.02192	-0.40786	-0.66736	-0.72564

Table 3. neural network system

input layer	covariate	1	Kazembe
		2	commentaries
		3	favorite
		4	forwarding (mail, SMS, packets of data)
		5	complaint volume
		6	x6 Complaints Sales Ratio
		7	crashworthiness
		8	Individualized production
		9	Personalization
		10	search index
		11	frequency of buzzwords
	Number of units		11
	Rescaling methods for covariates		standardization

hidden layer	Number of units		4a
	activation function		Softmax
output layer	implicit variable	1	y
	Number of units		1
	Rescaling Methods for Scaled Dependent Variables		standardization
	activation function		identity (math.)
	error function		square sum (e.g. equation of squares)

Table 4. importance of independent variables

independent variable	significance	Importance of normalization
Kazembe	0.073	46.10%
commentaries	0.079	50.20%
favorite	0.132	84.00%
forwarding (mail, SMS, packets of data)	0.116	73.70%
complaint volume	0.076	48.30%
Complaints to Sales Ratio	0.064	40.60%
crashworthiness	0.157	100.00%
Individualized production	0.088	56.20%
Personalization	0.068	43.20%
search index	0.087	55.40%
frequency of buzzwords	0.059	37.60%

As can be seen from the figure, the importance of the crashworthiness experiment on the brand value of the factors ranked first, 100%, indicating that consumers are particularly concerned about and sensitive to the safety of new energy vehicles, with the gradual expansion of the new energy vehicle market, product safety has not only turned into a basic need, but also become an important indicator of the brand differentiation

competition and the core competition, for the brand with excellent results in the collision test, consumer For brands with excellent crash test results, consumers' trust in them is also significant, and this trust will directly affect the purchase decision, thus increasing the brand value.

The importance of the behavior of collection is 84%, indicating that the user's interest level also has a strong impact on the brand value, the collection behavior reflects the potential consumer's desire to buy as well as the brand identity, the collection and the user's sustained goodwill into a positive correlation, in the era of digital media, the collection of both personal behavior, but also the representation and transmission of the brand's word-of-mouth, when a product has a large number of collections, the brand awareness and market When a product has a large number of favorites, brand awareness and market recognition will be enhanced to a certain extent, thus affecting the brand value.

Forwarding is also an important behavior of users, with an importance level of 73.7%, which represents users' willingness to actively share brand information. The behavior of sharing is essentially an endorsement of the brand, and extensive forwarding implies that users take the initiative to expose the brand to the social circle, and brand awareness expands in the process, which represents positive word-of-mouth for the brand, and the user's brand identity deepens through cumulative sharing, which has a positive impact on brand value.

Personalized production and customization each accounted for 56.2% and 43.2%, nowadays consumers are more and more chasing the unique experience of individuality, especially in the fast-developing industry such as new energy vehicles, personalized service is the key to differentiate the competition, and the percentage of the importance of these two also reflects the core needs of specific consumer groups, especially in the customization of high-end models, personalization can directly enhance the brand's premium ability.

The search index and buzzword frequency account for 55.4% and 37.6%, indicating that online heat has a moderate influence on brand value, and that in a digitally developed world, the act of searching is a prelude to purchasing decisions, while the importance of the search index, which accounts for 55.4%, reflects to a certain extent that user-initiated search behavior for a brand is better at increasing brand exposure and awareness. However, the relatively low frequency of hot words shows that certain specific topics and popular words of a brand cannot significantly promote the growth of brand value in the long term.

The importance of the ratio of comments and likes on social media is close to 50%, which indicates that consumers' interactive behavior on social media platforms has a moderate impact on brand value. Positive comments and high number of likes correspond to users' satisfaction and support for the brand, and this positive feedback further expands the brand's influence, while the relative importance of the number of complaints (48.3%) and the ratio of complaints to sales (40.6%) is low, which means that although the negative feedback has a certain negative impact on brand value, as an automotive market, consumers are more concerned about product performance and safety, so unilateral complaints do not have too serious a blow to the brand value. Negative feedback has a certain negative impact on brand value, but as an automotive market, consumers pay more attention to product performance, safety, and user experience, so one-sided complaints do not have an overly serious impact on brand value.

3. Result and Discussion

3.1 Findings

The results of the study show that the brand sales of new energy vehicles are generally on a gradual upward trend, and it can be seen that under the background of the development of the green economy, many automobile brands continue to optimize their development strategies and innovate their marketing paths, which shows that the brand of new energy vehicles is keeping abreast of the times as well as the great potential of the market; after the ARIMA time series prediction, whether it's a linear or non-linear regression analysis, the brand and personalized products are the four dimensions that have the most significant effect on the sales and development of the independent variables. After the ARIMA time series prediction, both linear and linear regression analysis, the brand identity behavior and personalized products among the independent variables, i.e., the four dimensions of favorites, retweets, personalized production, and quality control2 (structural safety of the crash test), have the most significant impact on the sales and development of new energy vehicles. The main reason may be that collection and forwarding, as a kind of brand identity behavior, play a role in big data marketing, which not only reflects the importance of consumers to the brand, but also promotes to a certain extent the effect of the whole chain marketing of new energy vehicles, and strengthens the dynamic correlation of consumer psychology; personalized production is conducive to the testing and development of new target markets, and meets the diversified demand while at the same time

Finding new consumption potential points, profoundly promoting the brand's unique image and personality characteristics, thus improving brand attractiveness; With regard to the quality control of the structural safety of the collision test, which can be said to be the principle of production for all brands, as mentioned earlier, new energy vehicles are highly dependent on technological progress, and new energy vehicle technology is rapidly updated, and faces many safety hidden dangers and challenges in technological innovation, production and manufacturing, and daily use [Ma, J]. There are many safety hazards and challenges , all of which directly affect the final choice of consumers.

3.2 Problem identification

According to the empirical results, both brand power perception and brand identity have no significant impact on the development effectiveness of new energy vehicles, which will be analyzed below.

In terms of brand perception, it is mainly categorized into two aspects, namely, view-to-like ratio and poor comment construction. For the former, the gap between the ratio of exposure and the number of likes is obvious, and this disorder is typified by the phenomena of insufficient interaction, low attractiveness and reach bias, which may cause consumers to consume a more blurred vision and then maintain a long time wait-and-see attitude towards a certain automobile brand, which hinders the transaction process of new energy vehicles while increasing the marketing cost of the brand; for the latter, people, when considering whether or not a product should be For the latter, when people consider whether to buy a product, they tend to pay more attention to negative comments than positive ones. However, many brands pay more attention to publicity and give less consideration to consumers' feelings, which leads to the fact that there is no emotional connection between certain new energy vehicles and consumers, and on the contrary, people will subconsciously develop a negative attitude towards the whole new energy vehicle brand because of such comment-oriented.

In terms of brand identity, it is mainly reflected in the two aspects of quality control (complaint volume) and the negative tendency of complaint-to-sales ratio. For example, an increase in the number of complaints will inevitably affect people's consumer confidence, which is at the same time linked to the comprehensive indicators of new energy vehicles, thus making it easy to form a vicious circle, which, if not adjusted in a timely manner, will impede the path of market expansion of its brand in the long run. However, it is worth noting that a brand's sales volume is often accompanied by an increase in the number of complaints, this phenomenon is generated by a larger trading base, and is therefore unavoidable.

3.3 Research recommendations

Based on the research results and problem findings, this paper puts forward the following suggestions related to the future development of new energy vehicles to better adapt to the macro trends of China's automobile industry and market.

First of all, for brand identity behavior and personalized products, it is recommended that brands provide a variety of customization options, including but not limited to the appearance, interior, technology configuration, etc., through more in-depth interaction with consumers to strengthen the user's sense of participation and sense of exclusivity, and innovation is the key to the new energy automobile market, the launch of limited edition, cooperation models to stimulate the user to the brand uniqueness of identity.

Secondly, for brand perception and brand identity, on the one hand, it is recommended that each new energy automobile brand clarify its own brand characteristics and image style, consolidate and extend the user image, and on this basis, accelerate the technological upgrading and iteration, so as to improve the performance of the automobile and optimize the marketing of big data; on the other hand, it is necessary to strengthen the monitoring and control of negative public opinion, and deal with the marketing risk in a timely and appropriate manner, and at the same time it can respond to the negative complaint in a positive respond to negative complaints in a positive way to maintain its brand image.

To improve competitiveness in the new energy vehicle market, brands need a detailed strategy. This includes enhancing brand and user communication for better awareness and preference, and utilizing digital marketing to connect with consumers. Emphasis should be on technology and innovation by raising R&D investments and introducing advanced features like automated driving. Ensuring high product quality and actively gathering user feedback will boost satisfaction and limit negative perceptions. Brands should offer personalized customization options to meet diverse consumer needs. Monitoring market influence, adjusting marketing strategies based on consumer evaluations, and staying updated with national policies are essential. Finally, collaborating with charging operators will help ease user charging concerns.

4. Conclusions

Starting from the perspective of macro forecasting, this study focuses on the future trend direction and comprehensive assessment of new energy vehicles, identifies the key factors affecting the sales of new energy vehicles, reveals the importance of brand identity behavior, personalized products and product safety in the market of new energy vehicles, and puts forward targeted development suggestions. Compared with the existing literature, this paper not only enriches the research perspective of new energy vehicle market theoretically, but also provides empirical support for the marketing strategy of new energy vehicle brands practically.

However, despite the exploration of research methodology and data analysis in this paper, there are still some limitations. In future research, it is necessary to further explore the specific performance of new energy vehicles in different regional markets and how emerging technologies reshape consumer purchasing behavior. In addition, as the global economic situation and policy environment continue to change, the new energy vehicle market will also face new challenges and opportunities, which requires us to continue tracking the research in order to provide more accurate forecasts and recommendations.

In conclusion, this study provides some reference and guidance for the future development of the new energy vehicle industry, and we expect that new energy vehicles will achieve wider popularization worldwide and make greater contributions to the promotion of green mobility and sustainable development.

5.References

Deng, Q. (2024). Research on digital marketing strategy of new energy vehicles. *Times Automobile*, (15), 148–150.

Huang, D., & Xu, X. (2017). Textual analysis of China's new energy vehicle policy based on sustainable transformation. *Science and Technology Management Research*, 37(13), 36–41.

Jiang, H. (2022). An empirical study of urban differences in new energy vehicle sales and its influencing factors [Doctoral dissertation, Shanghai University of Finance and Economics]. https://doi.org/10.27296/d.cnki.gshcu.2022.001517

Li, C. (2024). Analysis of the current situation and development trend of new energy vehicle ownership in China. *Automobile Practical Technology*, 49(04), 8–12. https://doi.org/10.16638/j.cnki.1671-7988.2024.004.002

Li, X. (2023). Exploration of new energy vehicle development issues and countermeasures in the context of low-carbon economy. *Automotive Test Report*, (18), 62–64.

Long, D. (2024). Analysis of market positioning, target customers and marketing strategy of new energy vehicles under the background of "double carbon". *Specialized Vehicles*, (08), 11–13. https://doi.org/10.19999/j.cnki.1004-0226.2024.08.004

Ma, J. (2024). Discussion on safety performance and intelligent driving mode of new energy vehicles. *Times Automobile*, (07), 82–84.

Mao, J. (2022). Exploration of major obstacles and countermeasures for the development of new energy vehicles. *Times Automobile*, (21), 99–101.

Mou, L., Zou, Y., & Jiang, H. (2024). Research status, existing problems and future development trend of new energy vehicles. *Automobile Maintenance Technician*, (16), 81–82.

Wang, S. (2019). Preliminary analysis of economic benefits of new energy vehicles. *Automobile and Driving Maintenance (Maintenance Edition)*, (03), 70–71.

Xu, M. (2023). Research on sales forecast and development path of new energy vehicles in China [Doctoral dissertation, Shandong Institute of Commerce and Industry]. https://doi.org/10.27903/d.cnki.gsdsg.2023.000123