

Trend Research on China's Pet Industry and Global Pet Food Demand Based on Multiple Forecasting Models

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Abstract. This article analyzes the current state and future trends of the Chinese pet industry, along with the global pet food market, to inform strategic planning. It reviews the industry's development over the past five years using core data and predicts future trends for the next three years with a multi-factor forecasting model. Additionally, it assesses the global pet industry using data from European and American countries and forecasts global pet food demand. The study finds that the Chinese pet industry will continue to grow steadily, with notable growth in the cat market and slower growth in the dog market. Global pet food demand is expected to decline, with the US market significantly impacting the global trend. Based on these findings, the article suggests optimizing export product structure, exploring new markets, and increasing domestic market share, providing data-driven support for strategic planning in the pet industry.

Keywords: Chinese Pet Industry, Global Pet Food Demand, Multiple Forecasting Models, ARIMA Model.

1. Introduction

With the continuous change and upgrading of consumption concept, the pet industry has quietly risen and become a new highlight of economic growth worldwide. Through in-depth literature research, it is found that with the sustained economic growth and the steady improvement of residents' income, China's pet industry market is expanding at an alarming rate, and its related fields are also growing rapidly. At the same time, as an important part of the global pet industry, the influence of the European and American markets on the entire industry should not be underestimated[1].

In view of this, this paper aims to deeply study the current situation and future development trend of China's pet industry, as well as the overall trend of the international market. The specific research objectives include two aspects: first, based on the core data of China's pet industry, systematically review the development process of the past five years, analyze the main driving factors of industry changes, and scientifically predict the development trend in the next three years on this basis, so as to provide decision-making reference for Industry practitioners; The second is to use the rich data of the pet industry in Europe and the United States to comprehensively evaluate the overall development of the global pet industry, reveal the internal laws of the industry development, and then predict the global demand for pet food in the next three years, so as to provide strong support for relevant enterprises to seize market opportunities.

The innovation of this study is to conduct a cross regional comparative analysis based on domestic and foreign market data, and to examine the development of the pet industry from a more comprehensive perspective. This research not only has important theoretical significance, but also has practical value in guiding the practice of the pet industry and promoting the healthy development of the industry.

2. Materials and Methods

2.1. Data Acquisition and Preprocessing

Firstly, this article has collected core data such as the market size of the pet industry, the number of pets, and consumption levels. These data are sourced from the "China Pet Industry White Paper

2023-2024" as well as from iResearch and the China Pet Food Industry Development Report[2], Pet Industry Data Network and other open-source websites.

2.2. Method Introduction

2.2.1 Analysis of the Development of China's Pet Industry

To deeply analyze industry development, focus on:

Data Analysis: Collect key indicators like market size, pet numbers, and consumption levels to assess growth and trends over the past five years[3].

Influencing Factors: Examine correlations between external factors (e.g., economic development, demographic changes) and their potential impact on industry direction.

Development Forecast: Construct a scientific forecasting model to estimate industry trends over the next three years, supporting strategic planning with rigorous data.

2.2.2 Analysis of the Development of Global Pet Food Demand

Key analysis elements include:

Current market status: Thorough analysis of core data (pet numbers, market size, food consumption) in European and American countries to reveal industry context and characteristics.

Global Demand Analysis: Comprehensive assessment of current and future pet food demand trends based on European and American data.

Demand Forecasting: Mathematical model to predict global pet food demand over the next three years, offering strategic guidance to industry players.

3. Model Establishment and Solution

3.1. Development Forecast Model of China's Pet Industry

3.1.1 Analysis of Development Conditions

Pet cat development has seen significant growth, with numbers increasing by 58.2% from 2019 to 2023, reaching 69.80 million cats (an annual growth rate of 11.8%). The market size has expanded from 118.1 billion yuan in 2020 to 148.8 billion yuan in 2023. However, average spending per cat has risen only slightly, from 1818 yuan to 1870 yuan.

In contrast, the pet dog market has experienced a slight decline in numbers, from 55.03 million in 2019 to 51.75 million in 2023. Despite this, the market size has grown significantly, from 88.4 billion yuan in 2020 to 130.5 billion yuan in 2023. Average spending per dog has increased markedly, from 2262 yuan to 2875 yuan (an annual growth rate of 8.3%).

Developmental differences between the two markets are notable. The cat market's growth is primarily driven by quantity, while the dog market has expanded despite a decline in numbers, thanks to higher per-dog consumption. Cat spending remains relatively stable with slow growth, whereas dog spending has shown significant increases, likely due to investments in high-quality food and care. In conclusion, the pet cat market needs higher per capita spending on premium products and personalized services, while the pet dog market should focus on offering high-quality products to attract high-spending households.

3.1.2 Analysis of Influencing Factors

(1) Descriptive Statistical Analysis

Prior to model establishment, the article analyzed descriptive statistics of pet industry indicators (2019-2023) to understand its development. This aimed to reveal pet and market trends via graphical representation, supporting model selection and parameter setting. This study has drawn the trend graphs for four sets of indicators, as shown in Figures 1-4.

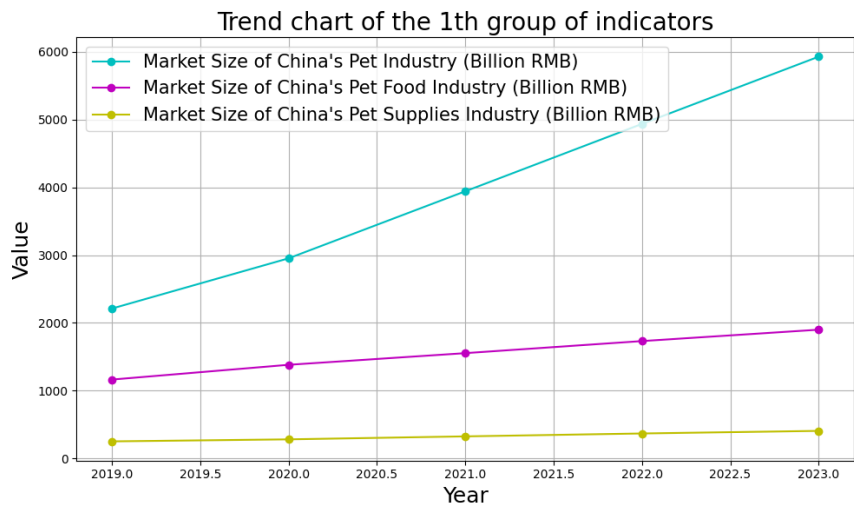


Figure 1. The first group of indicators

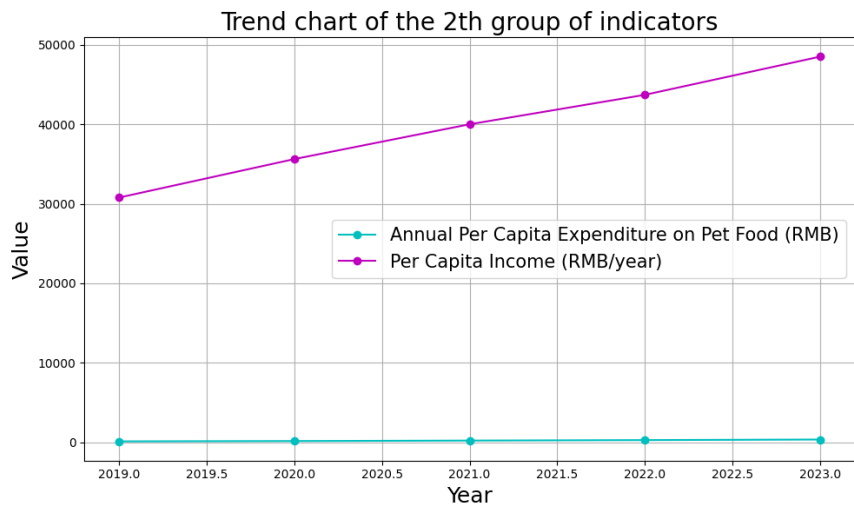


Figure 2. The second group of indicators

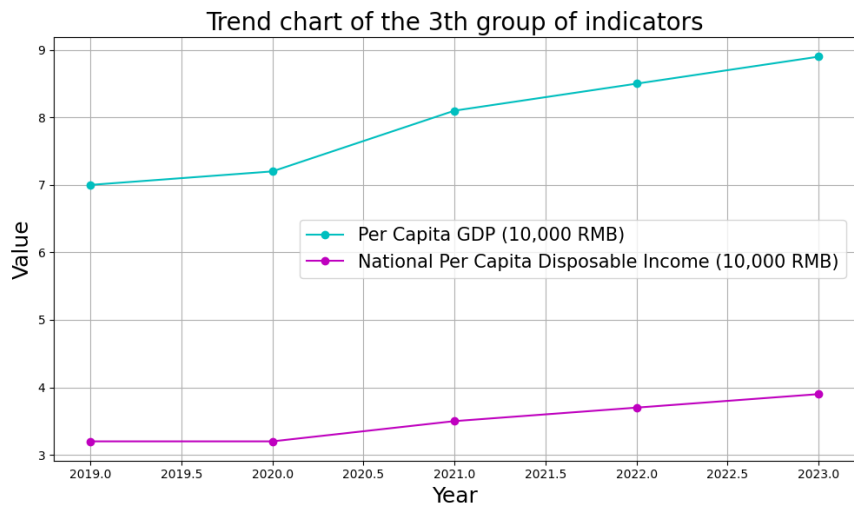


Figure 3. The third group of indicators

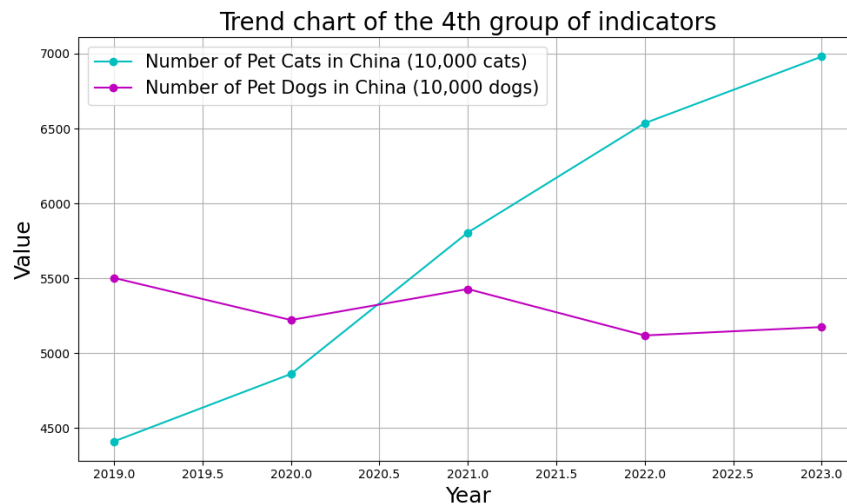


Figure 4. The fourth group of indicators

Trend analysis shows China's pet industry market size jumped from 200 to 600 billion yuan, with stable pet food/supplies growth. Per capita income rose, but pet food expenditure stayed flat. GDP per capita increased to 90,000 yuan. Cat ownership surged; dog ownership declined[4]. Overall, the pet industry grew rapidly, with segment variations.

(2) Correlation Analysis

To identify key factors influencing China's pet industry development, this article performed correlation analysis between potential impactors and five core indicators: pet industry market size, pet food market size, pet supplies market size, and the number of pet cats and dogs in China[5].

The correlation analysis uses Pearson's coefficient to measure linear relationships between core indicators (P_i) and influencing factors (Q_j). The coefficient ranges from 1 (positive) to -1 (negative), with 0 indicating no correlation. The formula is used to calculate it.

$$\rho_{P_i, Q_j} = \frac{Cov(P_i, Q_j)}{\sigma_{P_i} \sigma_{Q_j}} \quad (1)$$

Among them, $Cov(P_i, Q_j)$ represents the covariance between P_i and Q_j , while σ_{P_i} and σ_{Q_j} are the standard deviations of P_i and Q_j , respectively. This study solved and obtained the final correlation heatmap, as shown in Figure 5.

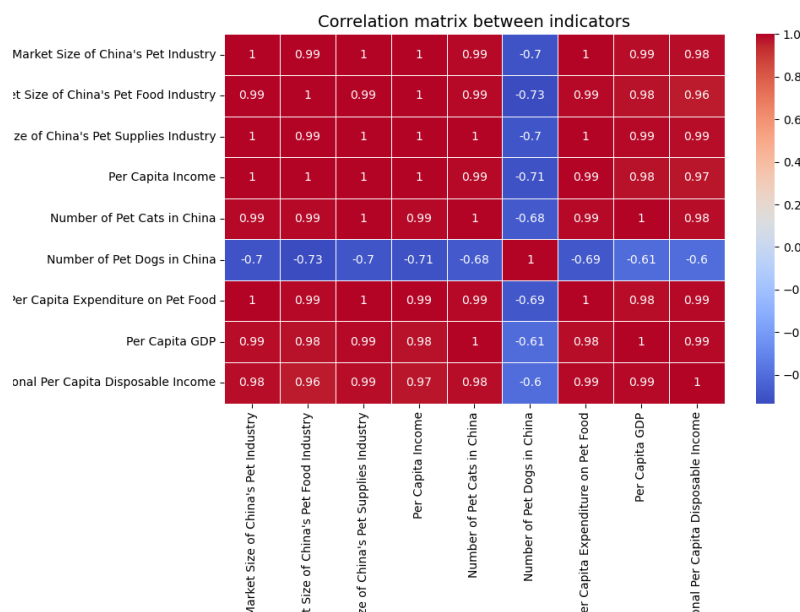


Figure 5. Heatmap of the correlation between various indicators

(3) Results Analysis

China's pet industry market size shows strong positive correlations with per capita pet food expenditure (0.999), urbanization (0.999), and income (0.996), highlighting the significant impact of economic growth. Conversely, birth (-0.998) and marriage rates (-0.993) negatively correlate, suggesting that lower rates may boost pet ownership. The pet food market is also heavily influenced by income (0.999), pet care attitude (0.995), and the elderly population's proportion (0.995), with a negative correlation with birth rate (-0.993)[6].

The pet supplies market correlates highly with urbanization (0.998), pet food expenditure (0.998), and income (0.995), and has a significant negative correlation with birth rate (-0.999). The number of pet cats correlates with GDP per capita (0.996), urbanization (0.990), and the elderly population (0.990), while dog ownership positively correlates with birth (0.723) and marriage rates (0.700) but negatively with income and GDP[7].

Overall, the pet industry is primarily driven by economic improvement and urbanization. Cat ownership is influenced by urbanization and aging, while dog ownership is more influenced by family structure.

3.1.3 Development Forecast

(1) Establishment and Comparative Analysis of Multiple Forecast Models

After completing the descriptive statistical analysis and correlation analysis of the data, this paper selects appropriate mathematical models to forecast the development of the pet industry over the next three years (2024-2026). Considering the characteristics of the time series data and the results of the correlation analysis, ARIMA model, linear regression model, nonlinear regression model[8], and exponential smoothing model[9] were established.

To select the optimal model, this article predicted core indicators separately using each model and calculated prediction errors based on Mean Absolute Error (MAE). MAE measures the average absolute deviation of predictions from actual values, widely used in statistics and machine learning to evaluate model prediction accuracy. The formula for calculation is:

$$MAE = \frac{1}{n} \sum_{i=1}^n |Y_i - \hat{Y}_i| \quad (2)$$

Where: Y_i is the true value, and $\hat{Y}_i$ is the predicted value.

Based on MAE values, this article selects the model with the lowest error as the optimal predictor for each core indicator and forecasts for the next three years, with models tailored to specific indicators.

(2) Actual prediction comparison

The results obtained after actual prediction are shown in Table 1.

Table 1. The optimal models for various indicators and their forecast results for the next three years

Indicator	Optimal model	2024 Forecast	2025 Forecast	2026 Forecast
China's pet industry market size (in billion RMB)	Exponential Smoothing	6818.63734156	7760.11251612	8701.58769069
China's pet food market size (in hundred million RMB)	Nonlinear Regression	2045.99998982	2181.19997967	2302.97139518
China's pet supplies market size (in billion RMB)	ARIMA	442.860158853	475.729138615	505.856440477
Number of pet cats in China (in ten thousand)	Nonlinear Regression	7649.20005451	8217.20010819	8752.91446281
Number of pet dogs in China (in ten thousand units)	Nonlinear Regression	5140.40001288	5143.00000690	5168.02856795

(3) Result Analysis

China's pet industry market size is projected to reach 870.159 billion RMB by 2026, with stable growth indicated by exponential smoothing. Pet food market size will continue to grow, albeit slower, with nonlinear regression revealing consumption upgrading. Pet supplies market size is expected to steadily increase by about 3 billion RMB annually, with ARIMA indicating maturity and reduced cyclical impact. Cat ownership is predicted to accelerate, reflected by nonlinear regression. Dog ownership is forecasted to slightly increase, maintaining around 50 million, with gentle growth shown by nonlinear regression due to urbanization and cost constraints.

Overall, China's pet industry has seen steady growth, with significant increases in food and overall market size. Cat ownership has surged, while dog ownership growth is slower, influenced by consumer preferences and urban living. Predictive models are selected based on market characteristics.

3.2. Global Pet Food Development Forecast Model

To forecast global pet food demand over the next three years, it is crucial to analyze country-specific demand trends and estimate overall global demand. Key prediction factors include: pet population changes by country and type, average annual food consumption per pet, and country market shares within the global pet market.

3.2.1 Description of Development Situation

Based on global market data, this article will analyze the development of the global pet industry from three aspects: the number of pets, pet food consumption, and market size.

From 2019 to 2023, global pet populations remained relatively stable. The US cat population notably surged to 94.2 million in 2021, while dog populations declined slightly in the US and France but remained stable in Germany. Cats slightly outnumber dogs, with significant growth trends in France and Germany. In terms of pet food consumption, dogs in the US consume an average of 320 units annually, higher than cats at 265 units, with similar trends in Germany and France. The US leads the global pet market with a 2022 size of 675-billion-yuan, accounting for 38%, followed by Western Europe at 26% and Japan at 3.2%. The US pet industry grows at a 14.2% annual compound rate, with the food market expanding from 20.06 billion RMB in 2017 to 28.70 billion RMB in 2022. Western Europe grows at 3.0% annually, with a stable food market of 15.65 billion RMB in 2022, while Japan grows at 1.0% annually. The cat market, driven by population growth and food consumption, is a key growth area, while dogs remain a significant industry pillar due to high consumption levels. Emerging markets like China are expected to grow rapidly and occupy a larger global market share in the future[10].

3.2.2 Food Demand Forecasting

(1) Establishment of Multiple Forecasting Models

In constructing a global pet food demand forecasting model, this paper deeply analyzes several key variables including the number of pets, annual average food consumption, and market size, with the aim of accurately grasping the dynamic trends of the global pet food market.

① National Demand Calculation:

For the calculation of pet food demand at the national level, this article integrates comprehensive pet population data with annual average food consumption information, ensuring the accuracy of the calculation results through meticulous data preprocessing. The total demand for country i is determined by its pet population and annual average food consumption, with the formula as follows.

$$E_t^{(i)} = \sum_j Q_t^{(i, j)} \cdot W^{(i, j)} \cdot 10^4 \quad (3)$$

Wherein:

$Q_t^{(i, j)}$: The number of pet type j in country i in year t (unit: ten thousand).

$W^{(i, j)}$: Annual average food consumption expenditure (USD per pet) of pet type j in country i.

$E_t^{(i)}$: Year t, total pet food demand in country i (in USD).

j represents the type of pet (cat or dog).

② Global Total Demand Calculation

To determine global pet food demand, a hierarchical estimation method was used. Using U.S. data on pet population and food consumption, a verified formula calculated the current U.S. demand. This was then scaled using the U.S.'s global market share to estimate overall global demand. Global demand is estimated through the U.S. demand and its market share.

$$R_t = \frac{E_t^{(US)}}{Y^{(US)}} \quad (4)$$

Wherein:

$E_t^{(i)}$: Year t, total pet food demand in country i (in USD).

R_t : Global total demand for pet food in year t (in dollars).

$Y^{(i)}$: Country i's share in the global market.

$Y^{(US)} = 0.38$: the proportion of the United States in the global market.

③ Time Series Forecasting

This paper adopts a diversified approach for time series forecasting, testing ARIMA, exponential smoothing, nonlinear regression, and linear regression. ARIMA emphasizes data stability and parameter optimization. Exponential smoothing balances historical and recent data via smoothing factors. Nonlinear regression accommodates nonlinear growth, and linear regression provides simplicity and performance. Model accuracy is validated using historical data, with MAE as the evaluation metric.

$$MAE = \frac{1}{n} \sum_{i=1}^n |Y_i - \hat{Y}_i| \quad (5)$$

Where: Y_i is the true value, and $\hat{Y}_i$ is the predicted value.

④ Model Selection

For each country and each type of pet, select the model with the smallest prediction error as the final predictive model.

$$\text{Optimal Model} = \arg \min_{\text{model}} (MAE) \quad (6)$$

(2) Actual Forecast Comparison

The results obtained after actual prediction are shown in Figure 6-7.

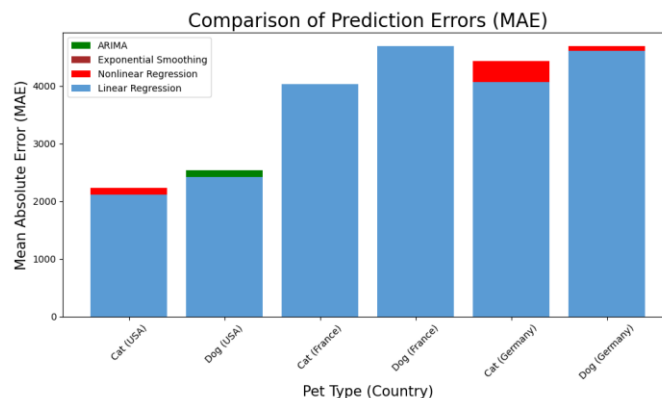


Figure 6. Comparison of prediction errors among various models

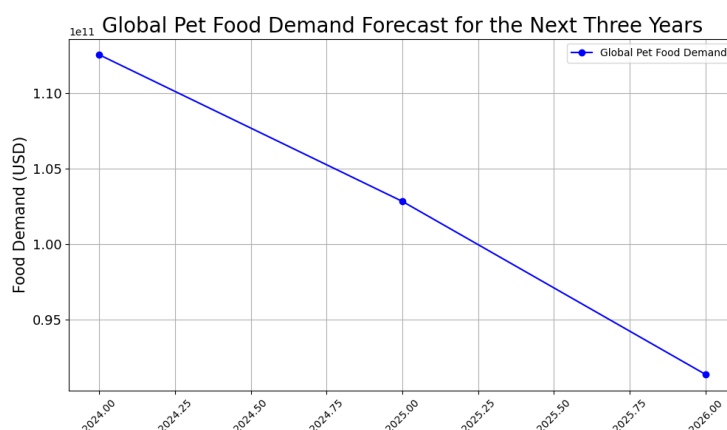


Figure 7. Global Pet Food Demand Forecast for the Next Three Years

Figure 6 indicates that ARIMA is best for cat predictions in the US (MAE: 2116.67) and France (MAE: 4011.83), while nonlinear regression performs better for dogs in these countries (US MAE: 1805.62, France MAE: 4296.90). In Germany, linear regression excels for both cats and dogs (MAE: 4063.33 and 4611.33, respectively). Figure 7 shows that US pet food demand is projected to decline, reaching 4.36×10^{10} dollars in 2025, and 3.74×10^{11} dollars in 2024, 1.07×10^{10} dollars in 2026, suggesting severe market challenges.

(3) Results Analysis

①Model Selection Analysis

For predicting pet numbers, the best models were selected for the US, France, and Germany based on MAE. In the US and France, the ARIMA model was chosen for cat predictions due to stable time series trends, while nonlinear regression was used for dogs because of nonlinear growth. In Germany, linear regression was effective for both cats and dogs, indicating linear growth trends.

②United States and Global Demand Forecast

The forecast shows a downward trend in pet food demand over the next three years in both the US and globally. In the US, this decline may be linked to a reduction in pets, especially dogs, and increased consumer discernment in a saturated market. Globally, the decline reflects US market influence, economic slowdown, and changes in consumer habits, with heightened sensitivity to pet food quality and price intensifying competition and demand decline.

4. Conclusion

In this study, a multi-predictive model was utilized to deeply analyze the trends of China's pet industry and global pet food demand, revealing that the Chinese pet market will continue to grow steadily, especially the cat market showing significant growth potential, while the dog market maintains a moderate growth. At the same time, the global pet food demand exhibits a declining trend, with fluctuations in the U.S. market having a significant impact on the global market.

These conclusions not only reflect the current dynamic changes in the market but also provide valuable market insights for related enterprises. In the future, efforts will be made to further optimize the predictive model, broaden the scope of research, deeply explore emerging markets and trends, such as pet intelligent devices and health management, while strengthening interdisciplinary cooperation, in the hope of providing more accurate and comprehensive strategic support for the sustained and healthy development of the pet industry in China and globally.

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