The Development Jilin Province's Automobile Industry
Artificial Intelligence and LC Economy

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Abstract. With the rapid increase in the number of traditional cars, coupled with the non-renewability of petroleum fuels, the traditional automotive industry is facing severe energy challenges; traditional cars emit a large amount of greenhouse gases and toxic gases during the driving process, which brings serious Environmental Pollution. As a major manufacturing province of China's traditional automobile industry, the development of the automobile industry in Jilin Province is very important. Making the most of one's own advantages, strengthening the core component support system, and realizing the process of industrialization of intelligent and environmentally friendly new energy vehicles is the focus of the automobile industry in Jilin Province. Low Carbon(LC) economy has become the main direction of world economic development, and the development of China's automobile industry is facing energy, environmental protection and transportation issues. This article comprehensively elaborates the theoretical basis for supporting the development of a LC economy in the automobile industry in Jilin Province from the theoretical basis of artificial intelligence and LC economy, related sustainability, and circular economy, and puts pressure on the current environmental pressure requirements and energy consumption requirements. Next, the inevitability of the intelligent LC development model of the automobile industry is comprehensively analyzed, and then based on the analysis of the current energy consumption and carbon emissions of the automobile industry in Jilin Province, the development path of the automobile industry in Jilin Province under the background of artificial intelligence and LC economy is proposed.

Key words: Artificial Intelligence, Low Carbon Economy, Jilin Province Automobile Industry, Environmental Pollution

1. Introduction

According to the world population statistics, with the gradual growth of economic strength, the population of China and even the world is growing rapidly, and this destructive impact on the ecological environment is increasing. Relevant concepts and theories of LC economy have emerged [1]. Intelligent technology promotes economic and social development, promotes the modernization of
national governance system, and meets people's growing demand for improving life, and plays an increasingly important role [2]. LC economy was first found in a government document in the paper "our energy future: creating a LC economy" published in British energy self in 2003. On September 8, 2007, Chinese President Hu Jintao explicitly supported "LC economic development" at the 15th APEC summit [3]. Its essence is energy efficiency and clean energy structure. The core is energy technology innovation and system innovation. The purpose is to reduce climate change and promote sustainable development of human beings [4]. Energy consumption and environmental damage not only have an important impact on the world economy, but also bring great changes to the automotive industry.

Affected by artificial intelligence and LC economy, Jilin province's automobile industry is facing new challenges [5]. Intelligent manufacturing reform is the core of the new industrial revolution, and also the main direction of national competitiveness reorganization [6]. The overall informatization and automation level of China's automobile manufacturing industry is high, and some automobile companies have made some progress in the construction of intelligent factories for automobile parts and automobile manufacturing [7]. The reasonable and scientific application of new materials can reduce the weight and energy consumption of automobile itself. This operation can reduce energy consumption and greatly improve the efficiency of the whole fuel body [8].

In order to comply with the LC development trend of energy saving and environmental protection in the future, and promote the technological innovation of energy saving, emission reduction and key technologies of new energy vehicles, it is urgent to promote the transformation of vehicles. Industry has developed from "high carbon" economy to "LC" economy [9]. After fierce market competition, Jilin Automobile industry has formed a relatively complete industrial chain and independent brand advantage. It plays a very important role in the development of sex economy and becomes the main industry of Jilin Province. In Jilin Province, the development of new energy vehicles is of great significance to the entire automotive industry, resource conservation and the establishment of an environment-friendly society [10]. At the same time, to fundamentally solve the huge contradiction between energy supply and demand, to ensure the energy and environmental safety of Jilin Province, the development of new energy vehicle technology has become an inevitable choice for China's sustainable development strategy. It focuses on the analysis of the automobile industry and puts forward targeted countermeasures and suggestions. This has certain reference value for guiding the LC and sustainable development of various industries in Anhui Province; secondly, it has a certain reference value for promoting the development and consumption of the automobile industry in Jilin Province. More far-reaching significance.

2. Method

2.1 Gradient correction parameter estimation

Recursive gradient correction (RGC) and recursive least squares algorithm have the same structure, but the basic principle is completely different. The specific derivation process is as follows:

Consider determining the system as follows

\[ A(z^{-1})y(k) = B(z^{-1})u(k - d) \]  

(1)

Where

\[ A(z^{-1}) = a_0 + a_1z^{-1} + a_2z^{-2} + \ldots + a_nz^{-n} \]

\[ B(z^{-1}) = b_0 + b_1z^{-1} + b_2z^{-2} + \ldots + b_nz^{-n} \]  

(2)

Write (1) in least square format:

\[ y(k) = \varphi^T(k)\theta \]  

(3)

Where:

\[ \varphi(k) = [-y(k-1), \ldots, -y(k-n), u(k-d), \ldots, u(k-d-n)]^T \in R^{(n_a+n_b+1) \times 1} \]

\[ \theta = [a_1, \ldots, a_n, b_0, \ldots, b_n]^T \in R^{(n_a+n_b+1) \times 1} \]  

(4)

According to the principle of gradient search, the model parameter estimate \( \hat{\theta}(k) \) can be gradually
corrected along the negative gradient direction of the output residual square, namely:

$$\hat{\theta}(k) = \hat{\theta}(k - 1) - R(k)grad(f(\theta))|\hat{\theta}(k - 1)$$

(5)

Equation (5) can be further written as:

$$\hat{\theta}(k) = \hat{\theta}(k - 1) - R(k)\phi(k)[y(k) - \phi^{T}(k)]\hat{\theta}(k - 1)$$

(6)

This formula is to determine the model gradient correction identification algorithm, in which the selection of the weight matrix R(k) is very important.

2.2 Carry out technological innovation in the automotive industry

In the research and development of automobile LC technology, the goal of Jilin Automobile industry is to develop cheap, clean and efficient core technology. Automobile design plays a decisive role in the management of automobile pollutants. The LC design of automobile is based on the selection of raw materials and fuels, the adoption of automobile technology, automobile manufacturing, the use and reuse of product tailoring. The whole automobile life cycle is strictly based on the principle of LC economy. The use of new materials and fuels that are good, useful, and ecologically coordinated can improve energy efficiency, reduce urban space occupation, and improve the efficiency of component reuse. At the same time, Jilin Province combines its own advantages, integrates scientific and technological resources, and actively learns the practical experience of foreign new energy vehicle development. Automobile manufacturing companies are responsible for the construction of specific product development platforms, universities are responsible for basic theoretical innovations, and scientific research units develop common technology research and development platforms to form an effective technological innovation system for industry, universities and research.

2.3 Adjust and optimize the internal structure of the automobile industry in Jilin Province

The development focus should be shifted to the development of small-displacement vehicles, new energy vehicles and auto parts industry as a key link in the leap-forward development of the automobile industry in Jilin Province. In the demand for LC economic development. The automobile industry in Jilin Province should optimize the internal structure of the industry, focus on integrating the current industrial scale, and improve the efficiency of resource allocation in the automobile industry. In order to make use of China's inherent resource advantages, China hopes to establish six systems and platforms at a strategic level. To establish a comprehensive intelligent network transportation system, it is necessary to establish an open intelligent ecological cooperation platform required by all parties. Jilin Province has a good foundation and strong scientific research capabilities for the development of the automobile industry. The combination of these two forms a breakthrough in the field of new energy vehicles. Therefore, Jilin Province should play the leading role of the government, innovate a variety of business models, adopt inter-governmental cooperation, government-enterprise cooperation, or enterprise-led purely commercial operations, conduct feasibility development studies, and implement infrastructure operations.

3. Experiment

3.1 Subject

Based on the development experience of automobile industry in developed countries and the actual situation of automobile industry in our province, the development mode of LC economy based on artificial intelligence is decided. This is the future development direction of automobile industry in Jilin Province. Whether it is suitable or not is related to the future development direction and speed of LC economy of automobile industry. Jilin Province should take the actual local conditions as the basis, comprehensively consider the industrial foundation, constraints, policy opportunities and other conditions of Jilin Automobile Industry, and choose the LC economic development mode suitable for Jilin Automobile Industry.
3.2 Experimental method

The main research methods used in this experiment are as follows:

The first is comparative analysis. On the one hand, compared with the level of developed countries, through the comparison of the level, we can clearly know the gap and shortcomings between the current LC economic development and the international level of automobile industry in China and Jilin Province. On the one hand, through the vertical comparison, that is, the surface heat comparison, the development process and current situation of LC economy of automobile industry are clarified.

The second method is case analysis. When studying the LC development mode of foreign automobile industry, taking the representative examples of Europe, the United States, Japan and other developed countries as examples, it provides valuable experience and useful enlightenment for the development of LC economy. Automobile industry in Jilin Province.

The third is model analysis. Through the analysis of the characteristics of energy consumption and carbon emission in Jilin Province, the relationship between energy consumption, carbon emission data and GDP data in Jilin Province is decoupled and analyzed. The conclusion is that Jilin Province is a pillar industry, and it is also a three major industries. The automobile industry needs to develop LC economy.

4. Results

The endowment of “rich coal, less gas, and lack of oil” determines that Jilin Province must continue to maintain a coal-based energy structure for a long time in the future. Jilin Province’s industries are mainly composed of automobiles, electricity, metallurgy, chemistry, steel and petroleum processing, etc. The heavy chemical industry is dominated and coal demand is high. In 2019, coal consumption in Jilin Province accounted for 94.39% of total emissions, oil accounted for 5.08%, and natural gas accounted for 0.53%. The coal-based energy structure will also increase carbon emissions. From 2010 to 2019, the carbon emissions generated by energy activities in Jilin Province have increased from 56 million tons in 2010 to 111.85 million tons in 2019, increasing every year, almost doubled in the past few years.

![Figure 1. Carbon emissions, energy consumption and GDP changes in Jilin Province from 2010 to 2019](image)

According to the economic development needs of Jilin Province, the total energy demand of Jilin Province by 2018 will be around 300 million tons of standard coal. According to the calculation of 2.6 tons of carbon dioxide per unit of coal per ton of standard coal and 2.4 tons of carbon dioxide per unit of petroleum per ton of standard coal, the province’s carbon dioxide emissions in 2018 will exceed 900 million tons. Combined with Figure 1, it can be found that with economic development, energy consumption and carbon emissions in Jilin Province are gradually increasing, and Jilin Province will
face severe forms and demands for energy conservation and emission reduction in the future.

With the introduction of various innovation policies of the government, it has effectively promoted the technological innovation of new energy automobile companies, and at the same time greatly improved the public's awareness of new energy vehicles and increased the public's enthusiasm for purchasing new energy vehicles. The emergence, promotion and use of new energy vehicles have also effectively improved the local urban environment to a certain extent, reduced pollutant emissions, reduced urban vehicle noise pollution, and improved clean energy use efficiency.

![Proportion of new energy vehicle sales to annual vehicle sales from 2015 to 2019](image)

**Figure 2.** Proportion of new energy vehicle sales to annual vehicle sales from 2015 to 2019

Next, we will use some time series data and cross-sectional data indicators to compare and analyze the achievements of Jilin Province's auto industry in recent years. Let us have a more comprehensive understanding of the development process of Jilin Province's auto industry. First of all, let's first look at the automobile production level of Jilin Province in recent years and its proportion in the national automobile production.

**Table 1.** Comparison table of automobile production in Jilin Province from 2015 to 2020

| years          | 2015     | 2016     | 2017     | 2018     | 2019     | 2020     |
|---------------|----------|----------|----------|----------|----------|----------|
| National production (10,000 vehicles) | 570.49   | 727.89   | 888.89   | 929.9    | 1379.1   | 1826.47  |
| Output in Jilin Province (10,000 vehicles) | 34.25    | 48.95    | 61.06    | 61.45    | 91.6     | 124.64   |
| % Increase in output in Jilin Province | 57.11    | 42.92    | 24.74    | 0.64     | 49.06    | 35.99    |
| % Of national proportion | 6.00     | 6.72     | 6.87     | 6.61     | 6.64     | 6.82     |

From Table 1, the overall development momentum of the automobile industry in Jilin Province is good, with output increasing year by year, and the growth rate is rapid. Among them, 2018 is a special period. As the automobile industry was greatly impacted by the international financial crisis, it caused a serious decline in exports and domestic demand. With the recovery of the financial crisis, the auto industry has shown an improvement. In 2019, the auto market demand is strong, and the output has increased substantially. In addition, the proportion of automobile production in Jilin Province in the national automobile production is relatively low and relatively stable. Since 2016, this proportion has always remained between 6.6% and 6.9%. Although it is higher than before 2020, there is still a certain gap compared with other auto provinces. This also shows that the growth rate of automobile production in Jilin Province is basically consistent with the growth rate of automobile production in the country.

Combined with the comprehensive analysis of Table 1 and Figure 2, it can be clearly seen that the automobile production in Jilin Province continues to grow, and the sales of new energy vehicles have increased in recent years. Therefore, the comprehensive experimental survey data above can be preliminarily determined in artificial intelligence and Under the LC economy, new energy vehicles are
a production direction that meets the current LC economy requirements.

5. Conclusion

To sum up, the automobile industry in Jilin Province should reduce the cost of technological innovation of enterprises, gradually reduce the cost of consumers' consumption of new energy vehicles, increase the output rate of technological innovation efficiency of enterprises, and increase the output ratio of consumers' new energy vehicles. Through practical ways to improve the psychological benefits of consumers' consumption of new energy vehicles, and continuously expand the environmental benefits of enterprises' participation in technological innovation, the system evolves to a good state. In addition, the relevant departments of the Jilin Provincial Government should pay attention to the automobile industry as one of the traditional pillar industries in Jilin Province, not only to contribute to the rapid development of the automobile industry, but also to pay attention to new energy vehicles that are helpful to the current artificial intelligence and LC economy. Technical construction of the product. The development of the new energy automobile industry is an important part of the strategic emerging industry. Under the combined pressure of artificial intelligence, environmental pollution, and energy crisis, the development of new energy automobiles has become a decompression in Jilin Province, accelerating the heightening of the automobile industry structure, and increasing market competition. The main measures to maintain sustainable economic and social development.

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