Research on the Synergetic Development Strategy of Regional Logistics Economic Environment in Jilin Province

Ziyu Liu\textsuperscript{1, a}, Jing Xiao\textsuperscript{2, *}, and Yang Yang\textsuperscript{1, b}

\textsuperscript{1}School of Economics and Trade, Jilin Engineering Normal University, Changchun 130000, China
\textsuperscript{2}School of management of Changchun University, Changchun 130022, China

*Corresponding author e-mail: 414283822@qq.com, 281081278@qq.com, 1026349353@qq.com

Abstract. Under the policy of the Belt and Road Initiative, the logistics industry as a new service industry is booming, occupying a huge role and status in the economy and society, and the impact on the ecological environment is gradually emerging. Through qualitative analysis of the interaction of logistics, economy and ecological environment in Jilin Province, this paper summarizes the problems existing in the current logistics economy of Jilin Province, and adopts the grey correlation method to conduct an in-depth analysis of the relationship between logistics, economy and ecology in Jilin Province. And according to the relevance value, the influencing factors are ranked, which provides a basis for studying the synergy between regional logistics and economic development and environmental impact in Jilin Province. Finally, based on the research results, it provides guiding opinions for promoting the coordinated development of regional logistics, economy and ecological environment in Jilin Province.

1. Research background

As an emerging complex industry, modern logistics can effectively reduce logistics costs, regulate the balance of supply and demand in the market, and promote rapid economic development. It is known as the “third-party profit source” and is a new growth point for the development of the national economy. In this context, regional logistics, which is an important component of the modern logistics industry, has received extensive attention and in-depth research by experts and scholars from all over the world. In recent years, in the context of the remarkable improvement of the national economic development level and the increasingly frequent circulation of goods, the logistics industry in Jilin Province has also developed rapidly, and the promotion of Jilin Province's economic development has become more and more obvious. It is a new type of economic growth that drives the province. Leading force. However, compared with the developed regions of the domestic and international logistics industry, there are still many problems: (1) the operational efficiency of the regional logistics industry is low, and the logistics cost is still high. Although the proportion of social logistics expenses in the province's GDP in recent years has dropped from 18.46% in 2006 to 16.53% in 2015, the comprehensive operational efficiency of the province's logistics industry has improved, but it is still higher than the national level. 1%, logistics costs are still high in economic operations [1-2]. (2) The distribution of logistics parks is
uneven and the level of informatization is low. More than half of the existing logistics parks in Jilin Province are located in Changchun City. Most of them are small in scale, and only one-third of the total logistics information platform is available. It is difficult to achieve effective resource sharing. (3) The logistics and transportation infrastructure have poor coupling. Although the province has continuously given policy support and increased investment in the construction of logistics infrastructure in recent years, the infrastructure is still scarce, and there is a lack of scientific planning and rational layout in accordance with local conditions, resulting in the inability to achieve various modes of transportation. Effectively connected, it is difficult to maximize the overall efficiency of regional logistics and regional economy in the province. (4) Unbalanced supply and demand of logistics. At present, the market concentration in Jilin Province is relatively low, and small and medium-sized logistics enterprises account for more than half of the total. These enterprises are generally small in scale, providing relatively simple logistics services and low level of product differentiation, which cannot meet the needs of diversified services, resulting in regional Logistics and regional economies cannot achieve economies of scale. Therefore, promoting the transformation and upgrading of the logistics industry and developing green logistics are not only the urgent needs of modern logistics development, but also the need to improve the efficiency and quality of economic operations.

2. The Status Quo and Relationship of Regional Logistics and Economic Development in Jilin Province

2.1. Analysis of current situation

In recent years, the economy of Jilin Province has grown steadily, the regional logistics system has been gradually improved, and the overall trend of regional logistics operations is good. Based on the relevant data of Jilin Province in 2009-2018, this section analyzes the development history of regional logistics in Jilin Province from the changes of the three indicators of total social logistics, added value of logistics industry and total cost of social logistics in Jilin Province. It can be seen from Figure 1 that the total social logistics in Jilin Province has continued to grow. The total social logistics in 2009-2013 has increased from 837.91 billion yuan to 226.32 billion yuan, an increase of about 2.7 times. The total social logistics in 2013-2018 is 226.32 billion yuan. The growth rate reached 2,884.56 billion yuan, an increase of about 1.7 times; the added value of the logistics industry in Jilin Province is also growing, but the growth rate has changed a lot. From 2009 to 2010, the growth rate is large, and the growth rate in 2010-2012 has dropped significantly. Although the growth rate has increased in the period from 20012 to 2018, the overall growth rate is still declining. Although the regional logistics development in Jilin Province has been steadily slowing down, in the period of 2009-2018, the regional logistics operation efficiency of Jilin Province has increased, and the ratio of total social logistics expenditure to regional GDP has generally declined, as shown in the following figure. A chart for regional logistics and economic development in Jilin Province. From the above table, it fell by 1.93 percentage points from 2009 to 2009, which is 0.38 percentage points lower than the national average. This shows that the regional logistics infrastructure is gradually improved and the regional logistics system is continuously improved, but compared with the developed domestic logistics level. This value is still high [3].
Figure 1. Regional logistics development in Jilin Province from 2009 to 2018

Figure 2. Total share of social logistics and regional GDP in 2009-2018

2.2. Relationship Analysis

From the research results of experts and scholars in the related fields over the years, it can be seen that there is an interaction between regional logistics and regional economic development, and the two are interdependent entities. Regional logistics is an important part of the regional economy. It is the link to realize the circulation and diffusion of goods within and outside the region and create economic value for regional development. Perfect logistics system, reasonable layout of network lines and nodes, and sound logistics infrastructure can effectively reduce the time cost and transaction cost of production factors in the circulation process, and make the regional industrial structure gradually become labor-
3. Grey Correlation Analysis of Regional Logistics Economy and Ecological Environment in Jilin Province

3.1. Factor determination
Through literature search and related data query, the seven main economic factors affecting the regional logistics and ecological environment of Jilin Province were obtained, namely: (1) regional GDP, and (2) total social fixed assets investment, (3) The total retail sales of social consumer goods, (4) the proportion of the tertiary industry to the regional GDP, (5) the total import and export volume, (6) the regional fiscal revenue, (7) the per capita savings balance of urban and rural residents; and the impact on the regional economic development of Jilin Province. The main logistics factors are: (1) freight volume, (2) cargo turnover, (3) highway mileage, (4) railway mileage, (5) number of employees in the logistics industry, and (6) total number of employees in the logistics industry. The proportion of the number of employees, (7) the added value of transportation, warehousing and postal industry [5].

3.2. Grey correlation analysis

3.2.1. Selecting a reference series. Let i be the serial number of the i-th evaluation unit, \(i=1,2,...,m\), and k be the serial number of the kth evaluation index, \(k=1,2,...,n\); \(V_{ik}\) is the evaluation value of the \(k\)-th index of the \(i\)-th evaluation unit.

Take the \(V_{0k}\) value of the best value of each indicator for the entity of the \(V_0\), then have:

\[
V_{0} = V_{01}, V_{02}, ..., V_{0n}
\]  

(1)

In the formula, there are \(V_{0k} = \text{Optimum}(V_{ik}) \ i=1,2,...,m \ ; \ k=1,2,...,n\).

For a system with \(m\) evaluation units and \(n\) evaluation indicators, the following matrix is available:

\[
V = V_{ik}m \times n = \begin{bmatrix} V_{11} & V_{12} & \cdots & V_{1n} \\ V_{21} & V_{22} & \cdots & V_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ V_{m1} & V_{m2} & \cdots & V_{mn} \end{bmatrix}
\]  

(2)

The selected reference sequence is \(V_{0} = V_{01}, V_{02}, ..., V_{0n}\).

3.2.2. Standardization of indicator values. In order to make the indicators comparable, it is necessary to standardize the indicators. The normalized formula is as follows:

\[
X_{ik} = \frac{V_{ik} - \min_i V_{ik}}{\max_i V_{ik} - \min_i V_{ik}}
\]  

(3)

After normalization, you can get:
3.2.3. Calculating the correlation coefficient. The normalized series \( X_0 = x_{01}, x_{02}, \ldots, x_{0m} \) is used as the reference sequence, \( X_i = x_{i1}, x_{i2}, \ldots, x_{in} \) \( (i=1,2,\ldots,m) \) is used as the comparison series, and the correlation coefficient is calculated as:

\[
\rho_{ik} = \frac{\min_{i} \min_{k} |X_{ik} - X_{ik}| + \rho \max_{i} \max_{k} |X_{ik} - X_{ik}|}{|X_{ik} - X_{ik}| + \rho \max_{i} \max_{k} |X_{ik} - X_{ik}|}
\]

(5)

Among them, there are \( i=1,2,\ldots,m \), \( k=1,2,\ldots,n \).

Using the formula to calculate the correlation coefficient \( \rho \), the following correlation coefficient matrix is obtained:

\[
E = (\rho_{ik})_{m \times n} = \begin{bmatrix}
\rho_{11} & \rho_{12} & \cdots & \rho_{1n} \\
\rho_{21} & \rho_{22} & \cdots & \rho_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\rho_{m1} & \rho_{m2} & \cdots & \rho_{mn}
\end{bmatrix}
\]

(6)

3.2.4. Calculating the degree of association of a single level. Considering that the importance of each indicator is different, the correlation calculation method takes the weight multiplied by the correlation coefficient. According to the expert law, the priority of each index of a certain layer relative to the upper target is:

\[
W = w_1, w_2, \ldots, w_n
\]

(7)

Where: \( \sum_{k=1}^{t} w_k = l \), \( t \) represents the number of indicators in the layer. Then the formula for calculating the degree of association is:

\[
R = (r_i)_{i \times m} = (r_1, r_2, \ldots, r_m) = WE^T
\]

(8)

3.2.5. Calculate the final relevance of the multi-level evaluation system. For a multi-layer evaluation system with \( L \) layer composition, the final correlation degree is calculated as follows: the correlation coefficient of each index of the \( K \) layer is synthesized, and the correlation degree of each layer of the upper layer, the \( K-1 \) layer, to which they belong is obtained [6]; Then, the correlation degree obtained by this layer is taken as the original data, and the correlation degree of each index of the \( K-2 \) layer is continuously synthesized, and so on, until the correlation degree of the highest-level index is obtained.

3.2.6. Sorting of regional logistics economy and ecological environment prediction impact factors. According to the degree of relevance \( r_i (i=1,2,\ldots,m) \), the order of the degree of relevance is the ranking of regional logistics economy and ecological environment prediction impact factors.
3.3. Result of operation
This paper uses Lingo12.0 software to use the regional logistics system and the regional economic system as the input decision-making unit, and solves the problems studied by the $C^2 R$ model and the $C^2 GS^2$ model respectively, and calculates the DEA validity of the regional logistics and regional economic synergy in Jilin Province. To ensure the comprehensiveness and accuracy of the evaluation results. The running results of Lingo12.0 are organized as shown in Table 1:

Table 1. DEA evaluation model operation results

| years | $\theta_1 C^2 R$ | $\theta_2 C^2 R$ | $\theta_1 C^2 GS^2$ | $\theta_2 C^2 GS^2$ |
|-------|-----------------|-----------------|-----------------|-----------------|
| 2009  | 0.9489          | 0.9597          | 0.9689          | 0.8456          |
| 2010  | 0.7379          | 1.0000          | 0.9984          | 0.9644          |
| 2011  | 0.9396          | 0.8820          | 0.8029          | 0.9924          |
| 2012  | 1.0000          | 0.9677          | 0.8380          | 1.0000          |
| 2013  | 0.8263          | 0.8430          | 0.8577          | 0.8861          |
| 2014  | 0.8295          | 0.9353          | 0.8604          | 0.8846          |
| 2015  | 1.0000          | 1.0000          | 0.9549          | 1.0000          |
| 2016  | 0.8729          | 0.7554          | 0.8843          | 1.0000          |
| 2017  | 0.8774          | 0.9895          | 0.8495          | 0.8762          |
| 2018  | 0.8364          | 1.0000          | 0.8700          | 0.7759          |
| average value | 0.8869 | 0.9333 | 0.8885 | 0.9225 |

4. Strategic Suggestions for Enhancing the Coordinated Development of Regional Logistics, Economy and Environment in Jilin Province

4.1. Strengthening government guidance
The government needs to solve the current problem of coordinated development of logistics, economy and environment in Jilin Province from two aspects: regional logistics development planning and policy support. On the one hand, the relevant departments of the government must first improve the management functions, deeply understand the status quo of regional logistics development in Jilin Province and the development of logistics industry in developed regions at home and abroad, and scientifically predict the future development trend, and the medium and long-term planning for the development of logistics industry promulgated by the State Council (2014) -2020) based on the development plan of the logistics industry suitable for the provincial conditions and market in Jilin Province, and supporting the construction of infrastructure to ensure the simultaneous development of logistics and economy. On the other hand, most logistics enterprises in Jilin Province are relatively backward in modern technology and scientific management. The Jilin provincial government and logistics management departments should vigorously support enterprise technology introduction and innovation, and increase policy support. For modern logistics enterprises and third-party logistics enterprises to implement tax preferential policies, at the same time, improve the taxation policy for agricultural products circulation, carry out the pilot program of agricultural product value-added tax deduction, actively promote the “going out” of the province's featured products, and promote the popularity of the province's brands in China and even internationally. To create market demand for logistics development, and also provide assistance for the province's economic development [7].

4.2. Improve traffic organization efficiency, reduce logistics costs, and reduce energy consumption
In the "Opinions on Promoting Supply-side Structural Reform and Promoting the Logistics Industry to Reduce Costs and Increase Efficiency", He Deng proposed that "the efficiency of logistics is the essence of the real economy. The direct reflection of the promotion of logistics industry's cost reduction and efficiency" lies in Lower the cost, but the key is to increase efficiency." Logistics costs
have remained high and the ecological environment is seriously polluted. One of the important reasons is the unreasonable transportation structure, low level of equipment technology and information sharing. In China, the cost of road transportation is the highest, and the cost of railway transportation is the lowest. However, China's railway transportation only accounts for 10% of the total transportation, and nearly 80% of it is road transportation. Therefore, the reform of the road and railway management system should be accelerated, and the hub node should be smoothed. "Strengthen the construction of railways, highways and aviation in key ports and large-scale integrated logistics parks to achieve seamless connection of infrastructure."

4.3. Encourage mergers and acquisitions and increase market concentration

At present, small and medium-sized logistics enterprises in Jilin Province account for the vast majority, small scale, unable to achieve economies of scale and large-scale informational, information cannot be shared in time, market concentration is low, logistics costs are high, so the economic situation is slightly improved, logistics After the market is slightly mature, it should promote market-based mergers and acquisitions, increase market concentration, and encourage logistics companies to become bigger and stronger.

5. Conclusion

With the sustained and rapid development of Jilin Province's economy and the increasing regional integration, the regional logistics industry, as an important part of the modern economy of Jilin Province and the most economical and comprehensive service model in the process of industrialization, will become the regional integration of Jilin Province. One of the most important components. In order to maintain a competitive advantage and to ensure comprehensive, coordinated and sustainable development of the economy and society, Jilin Province should adhere to the scientific development concept as a guide, market-oriented, and supported by information technology to build a modern logistics system.

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