Collaboration Between Xi’an Inland Port Logistics and Regional Economy Under the Background of Free Trade Zone

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Abstract. Based on the theory of collaboration, this paper explores the necessity of collaboration between Xi’an inland port logistics and regional economy under the background of constructing Shaanxi free trade zone. Grey relation method is used to make an empirical study on the relationship between the Xi’an inland port logistics and Shaanxi regional economy. Study results show that there is a clear correlation between them. In the end, this paper puts forward some countermeasures to further promote the linkages, positively respond to the free trade zone construction and new reform and opening platform. The mostly first method is to fully make use of the policy stimulation to explore more collaboration path and mode. The second is to improve the transfer function of the international inland port hub and promote the healthy and orderly development of the China Railway Express. The last is to carry out multi-modal transport and improve the competitiveness of inland port logistics.

Introduction

In the context of the new economic development that Shaanxi province has been granted as the Free Trade Zone, inland logistics will have more important development opportunities and favorable conditions. Construction of Free Trade Zone means the development model of new inland port logistics. With the Free Trade Zone as the important area of economic and trade cooperation, the open opportunity will be intensified. Thus, the center function of Shaanxi province as the B&R will be highlighted by improving the logistics service level to build up regional logistics channel and network. On the other hand, Free Trade Zone is consisted with B&R and is helpful to optimize the industrial spatial layout and regional development strategies. The industry will be further activated to radiate the regional economy. So, it’s necessary to discuss the joint development path and countermeasures between inland port logistics and regional economy.

Literature Review

With the development of modern manufacturing industry, the interaction and coordination between them has been valued by more and more scholars and government departments. Early in September 2007, the first national conference on manufacturing and logistics industry linkage development was held by National Development and Reform Commission (NDRC). Later in March 2009, China issued the planning of logistics industry adjustment and revitalization. Among which, “manufacturing and logistics industry linkage development project is listed as one of the nine key projects. In the research area, the focus was firstly on the connotation level. YAN Wei, HUANG You-fang[1] put forward the concept and stated the necessity and six main linkage trend of the linkage based on the late start of logistics industry and weak support for the manufacture in China. In terms of linkage concept between these two industries, researchers have different points. ZHAO Man(2010)[2] emphasized the overall optimal and sustainable development from the view of system theory. While Wang Ning(2011)[3] held the idea that the goal of symbiosis development should be established around their respective core interests. Secondly, the subsequent research focuses on the linkage path and pattern. Wang Zhenzhen(2012)[4] built the evolutionary game model of linkage development between manufacturing and logistics enterprises from the premise of

To sum up, relevant scholars have made certain qualitative and quantitative analysis on the linkage between logistics industry and manufacturing industry. However, in terms of new developed inland port logistics, few study has focused on its role on local economy development and how to quickly guide the strategy. This paper will take Xi’an inland port logistics as the research object, apply the grey association method to find out the linkage effect of the inland port logistics and regional economic.

An Empirical Analysis of the Grey Relation between the Logistics and Regional Economy in Xi’an

Grey System Theory [19] is suitable for the study of uncertainty in the case of low data and poor information. The basic idea is to judge the degree of correlation between factors according to the similarity degree between curves. Grey correlation analysis is used to reflect the correlation by measuring the data series, which can be obtained by comparing the correlation curves between different factors.

Given the randomness and uncertainty interaction between inland port logistics and regional economy, as well as the background of different economic basis, the relationship between them is not precise. So, this paper selects grey correlation model to measure the correlation degree.

Determine the Evaluation Index System

The sequence of dependent variables that is to be analyzed is considered as the reference sequence $Y_j$, the sequence of independent variables is regarded as the comparison sequence $X_1, X_2, \ldots, X_m$, $m$ is the number of independent variables. The reference number is listed as $Y_j = \{Y_j(k)/k = 1, 2, \ldots, n\}$, $n$ is the length of the sequence; The comparison number is listed as $X_i = \{x_i(k)/k = 1, 2, \ldots, n\}$, $x_i$ is the value of variable $i$ at the moment of $k$. in this paper, the regional economy is the reference sequence $Y_j$, inland port logistics value is the comparison sequence $X_i$.

Regional economic evaluation indicators include: GDP $Y_1$ (RMB one hundred million), Primary industry output value $Y_2$ (RMB one hundred million), the second industry output value $Y_3$ (RMB one hundred million), the third industry output value $Y_4$ (RMB one hundred million), total retail sales of social consumer goods $Y_5$ (RMB one hundred million) and the total import and export $Y_6$ (one million dollars).

The evaluation indexes of inland port logistics include: road miles $X_1$ (km), railway shipments $X_2$ (ten thousand tons) and railway arrivals $X_3$ (ten thousand tons).

The index data source is the Shaanxi Regional Yearbook (2016) and the container operation data from XINZHU station in Xi’an International Inland Port.
Dimensionless Treatment of Index Data

Because each factor has different units of measurement, different dimensions and orders of magnitude are not easy to compare, or difficult to draw the correct conclusions. By eliminating the dimensions of the original data, the data sequence can be compared. This paper adopts the initial value method.

\[ X_i(k) = \frac{X_i(k)}{X_i(1)}, \quad \text{among which} \quad i = 1, 2, ..., n; k = 1, 2, ..., t; \]

Calculate the Correlation Coefficient

From the geometrical point of view, the correlation degree is essentially the similarity between the curve shape of the reference and comparison sequence. The relative degree is larger if the curve shape is close, vice versa. Therefore, the difference between the available curves is the measure of the correlation degree.

Then \[ \Delta_i(k) = |Y_i(k) - X_i(k)|, k = 1, 2, ..., t; \] (2)
The difference sequence is \[ \Delta_i = \{\Delta_i(1), \Delta_i(2), ..., \Delta_i(n)\} \] (3)
The minimum difference of two level is \[ \Delta(\text{min}) = \min_{i \neq k} \Delta_i(k); \] (4)
The maximum difference of two level is \[ \Delta(\text{max}) = \max_{i \neq k} \Delta_i(k); \] (5)
Correlation coefficient is \[ \xi_i(k) = \frac{\min_{i \neq k} \Delta_i(k) + \rho \max_{i \neq k} \Delta_i(k)}{\Delta_i(k) + \rho \max_{i \neq k} \Delta_i(k)}; \] (6)

Among which \( k = 1, 2, ..., n; i = 1, 2, ..., m \); \( \rho \) is the distinguishing coefficient used to weaken the influence of excessive \( \max_{i \neq k} \Delta_i(k) \) on the coefficient distortion. This coefficient is artificially introduced to improve the significance of the difference between the correlation coefficients. \( \rho \in (0, 1) \), this paper takes \( \rho = 0.5 \) as convention.

Correlation Analysis

Since the correlation between each comparison sequence and reference sequence is reflected by the correlation coefficient, besides, the correlation information is dispersed and it is not convenient to compare the whole, so, it is necessary to centralize the related information. And the common way is to consider the average. The correlation between the two sequences is quantitatively reflected by the mean value of the correlation coefficients of the comparison sequence and reference sequence. Or when there are multiple levels of influence factors, one of them can be taken as a reference sequence, which can be calculated with the comparison sequence, and finally put together to form an associative matrix. The calculation formula of correlation degree \( r_{ij} \) is in the follow

\[ r_{ij} = \frac{1}{n} \sum_{k=1}^{n} \xi_i(k), k = 1, 2, ..., n \] (7)

The size of \( r_{ij} \) can show what factors in the logistics have close relation with regional economic development and what factors don’t. If \( 0 \leq r_{ij} \leq 1 \), that means \( X_i \) and \( Y_j \) is related. The greater the value of \( r_{ij} \), the greater the relevance is and vice versa. When \( 0 \leq r_{ij} \leq 0.35 \), the correlation degree is weak, when \( 0.35 \leq r_{ij} \leq 0.65 \), the correlation degree is medium, when \( 0.85 \leq r_{ij} \leq 1 \), the correlation degree is extremely strong. Using MATLAB program, the following correlation degree can be achieved, as shown in Table 1.
Table 1. Values of Grey Relation Degree between Inland Port Logistics and Regional Economy.

<table>
<thead>
<tr>
<th></th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
<th>Y5</th>
<th>Y6</th>
<th>Average</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>0.6532</td>
<td>0.7521</td>
<td>0.6865</td>
<td>0.6084</td>
<td>0.5984</td>
<td>1.0000</td>
<td>0.7164</td>
<td>3</td>
</tr>
<tr>
<td>X2</td>
<td>0.8278</td>
<td>0.8076</td>
<td>0.8088</td>
<td>0.8577</td>
<td>0.8402</td>
<td>0.6461</td>
<td>0.7980</td>
<td>2</td>
</tr>
<tr>
<td>X3</td>
<td>0.8432</td>
<td>0.7662</td>
<td>0.8143</td>
<td>0.8627</td>
<td>0.8493</td>
<td>0.6912</td>
<td>0.8045</td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td>0.7747</td>
<td>0.7753</td>
<td>0.7699</td>
<td>0.7763</td>
<td>0.7626</td>
<td>0.7791</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order</td>
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<td>3</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions and Discussion

Analysis of the Overall Correlation Degree between Inland Port Logistics and Regional Economy

Conclusion 1: The mean correlation degree of inland port logistics and Shaanxi regional economic is high as a whole (from 0.7627 to 0.7791), which is moderately correlated. It reflects the overall strong correlation. And the gap is not obvious, only 0.0064. The total amount of social consumer retail, the primary industry and the third industry are slightly more dependent on the inland port logistics than the second industry and total import and export.

Secondly, in terms of the overall level of correlation between the inland port logistics indexes and regional economic indicators, the correlation degree of railway arrival volume (0.8045) is higher than that of rail shipments (0.7980), followed by highway mileage (0.7164). Whether railway arrival or shipment, it shows the strong correlation with the Shaanxi regional economic development. So the following conclusion can be drawn.

Conclusion 2: The inland port railway logistics play an important role in regional economic development.

Partial Correlation Degree Analysis

Strong Correlation Point. The Table 2 shows that the highest correlation is between highway mileage and total retail sales of social consumer value (1), followed by the degree between railway arrival and the third industry. The degree between railway shipment and the third industry come after it. And the degree between railway arrival and import and export amount is ranked the fourth. These correlations are all above or extremely close to 0.85, which correspond to the characteristics of strongly related degrees. Thus, the following conclusions can be drawn.

Conclusion 3: The important way to promote the total retail sales of social consumer is to improve the highway mileage to be accessible from all directions.

Conclusion 4: The improvement of import and export volume in the context of Free Trade Zone relies on inland port railway transport. The China Railway Express Europe block Train of Chang’an has greatly and will help to promote the international trade.

Weak Correlation Point. In Table 2, there are 3 correlation degree are lower than 0.65. The correlation degree of highway mileage and import and export volume is the lowest (0.5984), the next lower value is the degree of highway mileage and the third industry (0.6084),followed by the degree of railway shipment and total retail sales of social consumer (0.6461).The following conclusion can be drawn.

Conclusion 5: In order to increase the contribution of road freight to import and export trade, we need to actively promote the multiple transportation between road and railway to take advantage of each mode.

Measures to Promote the Joint Development of Xi’an Inland Port and Regional Economy

Since the establishment of Xi’an international inland port, the first inland port logistics park in China, Shaanxi province has further promoted its leading position in the development process of the west. Correlation between Xi’an inland port logistics and regional economic development has been validated by the data. But the challenge now is how to extend the effect to develop Shaanxi economy under the new background of Free Trade Zone construction. The following development
strategies are proposed according to the analysis of inland port logistics and the regional economy of Shaanxi province.

**Fully Rely on the Policy Advantages and Strengthen the Joint Development of Inland Port Logistics and Regional Economy**

According to the conclusion 1, we can see that the development of regional economy in Shaanxi has a strong correlation with the logistics in inland port. The development of regional economy not only has a high viscosity dependence on inland port Logistics, but also promotes the positive transformation and upgrading of inland port Logistics. Under the new economic situation, it is the first priority of Shaanxi's economic development to build a new highland for reform and opening up to the outside world and create a new pattern of opening up in an all-round way. Inland port Logistics should stand at a higher strategic level, improve its positioning target, further improve its functional system, absorb and introduce high-end intelligent logistics technologies and models to serve regional economic agglomeration services.

**Enhance the Transit Function of International Inland Port Hubs and Promote the Healthy and Orderly Development of China Railway Express**

From Conclusion 2, it can be seen that the inland port railway logistics has a more obvious driving effect on the development of regional economy, especially in terms of import and export trade. Therefore, in order to expand and enhance its driving force in economic development, rail logistics should be vigorously developed to give full play to the advantages of large-scale, low-cost and time-efficient transport by rail. the potential of "Chang'an" international trains in China's with European trade has not yet been fully tapped. We should re-examine the positioning of Xi'an International inland Port as the hub of the national pivot so that it can bear the heavy responsibility of domestic transit by virtue of its favorable geographical position and at the same time, expand more participants in Shaanxi's economic development.

**In-depth Multimodal Transport to Enhance Inland Port Logistics Competitiveness**

According to Conclusion 2, although road transport has made some contribution to the regional economic development, due to its own economic and technological characteristics, there is still room for improvement in the linkage of regional economy. In order to overcome their own shortcomings, multimodal transport should be actively carried out. By establishing effective organization of multimodal transport hubs, speeding up the standardization of logistics facilities, increasing port functions and establishing multimodal transport hubs, etc., giving full play to each advantage of highways and rail transport, complementing each other's strengths and making up weaknesses, activating and sharing logistics resources, ultimately, the overall competitiveness of Xi'an International inland port Logistics will be enhanced.

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**Reference**


