An Empirical Study on the Linkage Development of Logistics Industry and Manufacturing Industry in Guangzhou——Analysis of Grey Relation Model Based on Entropy Weight Method

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Abstract: Modern logistics industry, like the "blood vessel" of economic society, has the attributes of "black continent" of economy and "the third profit source" of enterprises. With the trend of globalization and the development of international division of labor, the logistics industry has received unprecedented attention. The relationship between logistics industry and manufacturing industry is very close. They promote each other and develop together; The manufacturing industry needs the support of the logistics industry, and the huge demand of the manufacturing industry drives the development of the logistics industry. Guangzhou is an important national economic center and an important logistics node. Taking Guangzhou as an example, this paper uses entropy weight method and grey relation model to discuss the linkage development of Guangzhou manufacturing industry and logistics industry, and further provides decision-making basis for the development of Guangzhou logistics.

1. Introduction

The modern logistics industry is like the "blood vessel" of the economy and society, with the attributes of the economic "black continent" and the "third source of profits" of the enterprise. With the trend of globalization and the development of international division of labor, the logistics industry has received unprecedented attention and attention. Regardless of national strategies such as "supply-side structural reform", "the Belt and Road Initiative", "Internet +", or the emerging e-commerce economy, the construction of free trade zones, market transformation and upgrading, new town layouts, and commercial real estate development, all directly or indirectly Constrained by logistics factors. Economic development and logistics have become a consensus. Guangzhou is an important national economic center and an important logistics node. According to Guangzhou's 13th Five-Year Plan, Guangzhou is driven by innovation to form a two-wheel drive industrial structure of modern service industry and advanced manufacturing industry. Under the strategic layout, it is committed to building an international comprehensive transportation hub. The construction and development of the logistics industry has become an accelerator of Guangzhou's economic development.

The relationship between logistics industry and industry, especially manufacturing industry, is very close. The two promote each other and develop together. Manufacturing industry needs the support of logistics industry. At the same time, the huge demand of manufacturing industry is driving the development of animal flow industry. China has entered the middle and late stages of industrialization. Strong production and manufacturing capabilities must be matched by strong logistics capabilities in order to exert better efficiency. Logistics has become one of the key factors restricting the economy. Since 2007, the National Manufacturing and Logistics Industry Joint Development Conference organized by the National Development and Reform Commission has been held for thirteen sessions. The joint development of logistics and manufacturing has become an important project in the national key industry revitalization plan.

For the joint development of manufacturing and logistics industry, many experts and scholars have carried out research in different aspects. Hou Hongchang used the co-integration analysis

method to study the coordinated development of Henan's manufacturing and logistics industries; Tian Xue, Wang Dandan, and others analyzed the coordinated development of Beijing's logistics and manufacturing industries by constructing a gray correlation model; Sun Fangfang explained the gray from the perspective of method application Correlation analysis method and its application; Lu Tao and Nie Rui studied the theoretical basis and manifestation of the connotation of industrial linkage from the theory of industrial linkage; Tan Xuerui and Deng Julong expounded the multi-factor statistical analysis method of grey correlation from the perspective of model application. Scholars have provided a large number of methods and research conclusions on the relationship between logistics industry and manufacturing industry, but there is still a lack of analysis and research on the coordinated development between Guangzhou logistics industry and manufacturing industry under the current environment. Therefore, this article takes Guangzhou as an example, and uses the gray correlation model to try to explore the coordinated development of Guangzhou's manufacturing industry and logistics industry, to further provide decision-making basis for the development of Guangzhou logistics.

2. Selection of research methods and indicators

The grey system theory puts forward the concept of grey relational analysis of each subsystem. The intention is to seek the numerical relationship between the subsystems (or factors) in the system through a certain method. The gray correlation analysis method is based on the similarity or dissimilarity of the development trends between factors, that is, the "gray correlation degree" as a method of measuring the degree of correlation between factors. Therefore, the gray correlation analysis provides a quantitative measure for the development and change of a system, which is very suitable for dynamic history analysis.

2.1 Initial establishment of evaluation index matrix

Determine the evaluation index system according to the evaluation purpose and collect relevant evaluation data.

2.1.1 Form the data series into an evaluation index matrix:

Where m is the number of indicators.

2.1.2 Determine the reference sequence according to the actual situation and record it as:

The comparison sequence is recorded as.

2.2 Dimensionlessness of indicator data

2.2.1 This paper uses the mean method to dimensionlessly obtain the data;

2.2.2 Calculate one by one the absolute difference between the corresponding elements of the index series of the evaluated object and the reference element.

2.2.3 Determine the maximum and minimum absolute differences:

2.3 Calculation of correlation coefficient

Decompose and calculate the correlation coefficient between each comparison sequence and the corresponding element of the reference sequence, as follows:

Among them, is the resolution coefficient; the smaller the difference, the greater the difference between the correlation coefficients, and the stronger the discrimination ability. Take this article.

2.4 Calculation of entropy weight

The concept of entropy is derived from thermodynamics, which is a measure of the uncertainty of the system state. When making multi-objective decision-making, the relative importance of each evaluation index needs to be considered. Weighting each indicator is the most direct and easy way to indicate importance. The information entropy of each indicator is obtained by the entropy method. The smaller the information entropy, the lower the disorder degree of the information, the larger the utility value of the information, and the larger the indicator weight.

2.4.1 Calculating the proportion of the evaluation factor value

2.4.2 Calculate the information entropy of the j-th index
Where c is a constant,
2.4.3 Calculate the coefficient of variance and weight of the j-th index

2.5 Calculation of grey correlation based on entropy weight

3. Model construction and analysis

3.1 Index data selection

The linkage relationship between the logistics industry and the manufacturing industry is very complicated. The two interact with each other and promote together, and there are other factors. According to the market situation in Guangzhou, this article selects several representative indicators for research, which may exist. Certain deviation. In this paper, freight volume is selected as an indicator to measure the level of development of the logistics industry. Regional GDP, total industrial output value, total fixed asset investment in manufacturing, total industrial output value above designated size, and added value of industrial enterprises above designated size are selected The indicator of the level of development of the manufacturing industry. Considering the symbiosis of the industry, the total retail sales of consumer goods are also included in the research data as an indicator of the level of commercial development. The article selects data from 2010 to 2018, determines the original data sequence, and constructs a comprehensive evaluation index system. The data in this article comes from the data released by the Guangzhou Statistical Bureau's online platform.

Table 1. Raw data table

year	Freight volume	Regional GDP	Industrial output value	Industrial output value of enterprises above designates size	Value added of industrial enterprises above designated size	Investment in fixed assets throughout the society	Total retail sales of consumer goods
2010	57368.75	10859.29	14438.99	13831.25	3573.32	3263.57	4476.38
2011	64929	12562.12	16624.18	15712.72	4008.38	3412.2	5243.02
2012	76100	13697.91	17090.18	16066.43	4090.62	3758.39	5977.27
2013	89098.66	15663.48	18335.76	17310.24	4430.88	4454.55	6882.85
2014	96553	16896.62	19389.88	18193.55	4722.92	4889.5	7144.45
2015	100124	18313.8	19892.51	18684.22	4868.93	5405.95	7987.96
2016	112506.64	19782.19	21125.06	19570.43	4897.61	5703.59	8706.49
2017	120736.85	21503.15	22691.06	20929.65	5172.61	5919.83	9402.59
2018	127752.06	22859.35	23939.07	18234.91	4451.11	5938.4	9256.19

(Data source: Guangzhou Municipal Statistics Bureau)

3.2 Data processing

Using the ② method, the data is dimensionlessly processed as described above. Data processing results are shown in Table 2 below.

Table 2. Dimensionless data processing

year	Freight volume	Regional GDP	Industrial output value	Industrial output value of enterprises above designates size	Value added of industrial enterprises above designated size	Investment in fixed assets throughout the society	Total retail sales of consumer goods
2010	0.61091	0.6424	0.74888	0.78521	0.7997	0.68713	0.61907
2011	0.69141	0.74314	0.86222	0.89202	0.897	0.71843	0.7251
2012	0.81037	0.81033	0.88639	0.9121	0.9154	0.79131	0.82664
2013	0.94879	0.9266	0.95099	0.98271	0.9916	0.93789	0.95188
2014	1.02817	0.99955	1.00566	1.03285	1.0569	1.02947	0.98806
2015	1.0662	1.08339	1.03173	1.06071	1.0896	1.1382	1.10471
2016	1.19806	1.17025	1.09566	1.11102	1.096	1.20087	1.20408
2017	1.2857	1.27206	1.17688	1.18818	1.1576	1.2464	1.30035
2018	1.3604	1.35229	1.24161	1.0352	0.9961	1.25031	1.28011

3.3 Calculation of correlation coefficient

According to the grey system theory, using the above formula, we can get the grey correlation coefficient between 2010-2018 Guangzhou freight volume and influencing factors. The conclusion is shown in Table 3.

Table 3. Grey correlation coefficient of logistics and manufacturing in Guangzhou, 2010-2018

2018	0.9576	0.6054	0.3591	0.3334	0.62343	0.6942

3.4 entropy weight calculation

According to the entropy weight theory, the formula is used to calculate the annual entropy weight.

Table 4. Entropy weights based on year

year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Entropy weight	0.1181	0.1227	0.1153	0.1084	0.1073	0.1015	0.1035	0.1061	0.1171

3.5 Grey relational degree and analysis based on entropy weight

Finally, the correlation and ranking of Guangzhou logistics industry and manufacturing industry based on entropy weight are obtained, as shown in Table 5.

Table 5. Relevance and ranking of Guangzhou logistics industry and manufacturing industry based on entropy weight

index	Regional GDP	Total retail sales of consumer goods	Investment in fixed assets throughout the society	Industrial output value	Industrial output value of enterprises above designates size	Value added of industrial enterprises above designated size
Correlation degree based on entropy weight	0.89447	0.88061	0.83844	0.70355	0.668597	0.62695
Sort	1	2	3	4	5	6

It can be seen from Table 5 that the correlation coefficient between the logistics industry and regional GDP, total social consumer goods, and the total investment in fixed assets of the whole society exceeds 8, which is close to 9. These three factors have a strong correlation with the volume of freight; while the total industrial output value is correlated. The degree also reached 7, with a strong degree of correlation, and the linkage relationship was weaker than the first three. According to the correlation degree of the four indicators, Guangzhou's rapid development of the economy, its manufacturing and logistics are also more coordinated, and the linkage effect is also relatively Well, investment measures and investment directions have played a positive role in promoting the development of the logistics industry and have a significant impact. The relationship between the gross industrial output value of industrial enterprises above designated size and the added value of industrial enterprises above designated size is relatively weak, and both are less than 7, which indicates that the linkage between the industries above designated size and the logistics industry has been weak over the years and the development coordination between the two is insufficient .

3.6 Entropy weight result analysis

According to the entropy weight theory, formulas are used to calculate the entropy weight of each freight volume impact indicator.

Table 6. Entropy weight and ranking of impact indicators of Guangzhou freight volume

index	Total retail sales of consumer goods	Regional GDP	Investment in fixed assets throughout the society	Industrial output value	Industrial output value of enterprises above designates size	Value added of industrial enterprises above designated size
Information entropy	0.987604	0.987936	0.989375	0.994979	0.996931	0.997343
Coefficient of difference	0.012396	0.012064	0.010625	0.005021	0.003069	0.002657
Entropy weight	0.270458	0.263213	0.231831	0.109547	0.066972	0.057979
Entropy weighting	1	2	3	4	5	6

According to the entropy weight theory, it can be seen from the data in Table 6 that among the many influencing factors, Guangzhou 's total retail sales of consumer goods, Guangzhou 's gross domestic product and investment in fixed assets of the whole society have the largest impact on freight volume, reaching 27%, 26 respectively. % And 23%; regional economic growth and commercial development have the greatest impact on Guangzhou's logistics industry; increased investment in fixed assets has also greatly promoted the development of the logistics industry. The impact of total industrial output value and logistics freight volume has reached about 11%, indicating that the industry has a greater degree of impact on the logistics industry, but it cannot be compared with the impact of economic development, commercial development, and fixed asset investment on the logistics industry; especially above the scale The importance of industrial, total industrial output value above designated size and value added of industrial enterprises above designated size are less than 7% and 6%, respectively, indicating that the relative influence is minimal. This data is also consistent with the data presented in Table 5. It further illustrates that Guangzhou's rapid economic development and commercial development have greatly promoted the development of the logistics industry; its manufacturing and logistics have also developed more coordinated, and the linkage effect is also better. The linkage between industrial enterprises above designated size and the logistics industry is weak, and the degree of coordination between the two is insufficient.

4. Conclusion

The total retail sales of consumer goods, the GDP of Guangzhou, and the investment in fixed assets of the whole society have the greatest impact on freight volume, with correlation coefficients exceeding 8; the entropy weights reached 27%, 26%, and 23%, respectively; indicating that the logistics industry in Guangzhou There is a good linkage with the manufacturing industry; the development of commerce in Guangzhou and the growth of the regional economy have a great impact on the logistics industry in Guangzhou; it indicates that Guangzhou has a vibrant business, strong public demand, and an economic boom; investment measures and investment directions have played a role in promoting the development of the logistics industry To the positive effect, the impact is significant. This is in line with the strategic goal of Guangzhou's vigorous investment in building an "international logistics center", and also shows that Guangzhou and Guangzhou's economic operation is improving, and the 13th Five-Year Plan construction effect has appeared.

The correlation between the total industrial output value and the logistics freight volume reaches 7, which is strong; the entropy weight indicates that the impact has reached about 11%, which indicates that the industrial linkage to the logistics industry is relatively large and the degree of impact is large, but it cannot be related to economic development, The impact of commercial development and fixed asset investment on the logistics industry is relatively similar; especially for industries above designated size, the correlation between the total output value of industrial enterprises above designated size and the added value of industrial enterprises above designated size reached 0.67 and 0.63, both of which are less than 7, and the proportions of importance are less than 7% and 6%; indicating that the linkage between the industries above designated size and the logistics industry has been weak over the years, and the development coordination between the two is insufficient. The reasons may be related to the status quo of the industry in Guangzhou. First, the level of industrial clusters in Guangzhou is not high, there are not many new growth points in advanced manufacturing, and there is a lack of innovative leaders. The ability to integrate global high-end resource elements is not strong, and the level of open economy Not high; the large transportation system is incomplete, the transportation network needs to be improved urgently, and the problem of traffic congestion is still relatively serious. These shortcomings and problems will hinder the development of Guangzhou's logistics industry. Secondly, there are obstacles in information transmission between the industries above designated size and the logistics industry. The scattered logistics needs of industrial enterprises above designated size have not been transformed into socialized requirements, resulting in low and efficient logistics operation costs. It is also difficult for the industry to achieve coordination and cooperation, and share. . Finally, the overall level of the logistics industry in Guangzhou is relatively low, and the existing logistics companies have weak service capabilities, which are difficult to meet the logistics needs of manufacturing companies. The lack of socialized requirements also restricts the development of specialized logistics.

5. Suggestion

Guangzhou's "Thirteenth Five-Year Plan" proposes to implement the Guangzhou Manufacturing 2025 strategic plan and industrial transformation and upgrading action plan, strengthen industrial basic capabilities, improve the level of comprehensive integration, and promote the manufacturing industry to the high-end development of the industrial chain value chain innovation chain. Focus on the construction of three centers and one system. Efforts will be made to build international shipping centers, logistics centers, trade centers, and modern financial service systems, enhance Guangzhou's role as the core city of the Pearl River Delta urban agglomeration, and strive to strengthen provincial capitals, southern China regional centers, and international and domestic influence. The coordinated development of logistics and manufacturing has become the main driving force for the transformation and upgrading of manufacturing. Speeding up the development of the logistics industry and achieving a win-win situation for the linkage between the manufacturing industry and the logistics industry is an urgent task for industrial development and

structural adjustment in Guangzhou.

For future development, this article gives corresponding suggestions from the following aspects:

5.1 Determine the core of the two industries' interaction

The core of the two industries' interaction is to break through the boundary, two-way interaction, integration and penetration, mutual benefit and win-win!

The linkage between the two industries lies in the breakthrough. Traditionally, the manufacturing industry outsources some services such as transportation and storage to logistics companies. The linkage between the two industries is not a simple outsourcing. To base on "supply to create demand", the connotation lies in the fact that the development of "supply" helps to tap "demand", especially the logistics demand of potential manufacturing industries. Encourage production and trading companies to divest or outsource logistics functions. In recent years, there has been a continuous outsourcing of manufacturing operations to logistics companies, which has not only heated up the logistics supply, but also the logistics demand.

5.2 Exploiting multiple forms of joint development

Flexible implementation of linkage methods, for example, the integration of logistics systems within the manufacturing industry to establish a logistics company; manufacturing holdings or holding logistics companies; several manufacturing companies jointly invest to establish a logistics company; manufacturing and logistics industry to establish a supply chain management system; manufacturing and logistics The logistics industry implements strategic alliances. The content of linkage should be carried out from the perspective of supply chain integration and mutual benefit.

5.3 Use "Internet +" to break through boundaries and achieve two-way interaction

Use "Internet +" to break through boundaries and achieve two-way interaction. Accelerate the deep integration of the new generation of information technology with the logistics industry and manufacturing industry, optimize and upgrade the industry, build a professional logistics information platform, and realize the interconnection and sharing of information between the logistics industry and the manufacturing industry.

5.4 Improve the service level of the logistics industry

Cultivate and strengthen a group of backbone logistics enterprises; plan and build third-party and fourth-party logistics service centers with strong comprehensive service functions; optimize the layout of logistics parks and professional logistics bases, improve the layout of integrated transportation corridors and transportation hub nodes, and coordinate the construction of logistics warehouses Base, build a batch of modern logistics distribution centers, and form a network-based logistics infrastructure system. Establish and improve a modern logistics service system; improve supply chain management and logistics service levels, improve distribution efficiency, and reduce logistics costs.

5.5 Establishing Macro Promotion Mechanism

The joint development of the two industries must not only play an effective role in promoting the market mechanism, but also play the role of the government's planning and coordination; promote the development of factor markets such as people and materials, and break the barriers that block the flow of various factors. Make use of the positive role of related industry associations in promoting the coordinated development of industries, increase the intensity of inter-industry exchanges, and promote interactive docking between industries.

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