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Construction of Agricultural Products Logistics Network in Hebei Province Based on Improved Gravity Mode

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Abstract

Solving the problems of "agriculture, rural areas" has always been the top priority of national development work and the focus of social attention. Logistics, as the "third source of income", can give full play to the role of logistics to enable agricultural products to obtain higher returns in the case of high production. In the context of the increasing demand for high-quality life, it is particularly important to reduce the consumption of agricultural products in the transportation process and ensure the quality of fresh agricultural products. A reasonable logistics network system can effectively reduce costs, save manpower and promote the increase of farmers' income.

Based on the research of factor analysis and gravity model, this paper adopts 11 prefecture-level cities in Hebei Province as research samples, and studies the economic development level of each city in Hebei Province, the scale and level of logistics industry development, the demand degree of agricultural products, and the supply degree of agricultural products as four indicators, and constructs a regional agricultural product logistics quality index system. The logistics quality and logistics gravity of agricultural products were calculated, the results of the model were graded, the regional logistics network of agricultural products was drawn and analyzed based on the logistics gravity strength, and some suggestions were put forward to improve the development of regional logistics network of agricultural products. Based on this, this paper believes that only by vigorously developing the construction of agricultural logistics network system can agriculture get better development, and in promoting the development of agriculture, it can optimize and upgrade the local logistics infrastructure and drive the regional economic development.

Keywords: factor analysis, gravity model, agricultural products logistics network, logistics gravity, logistics quality

1. Introduction

In December 2022, The General Office of the State Council issued the "14th Five-Year Plan" Notice on Modern Logistics Development Planning, which clearly mentioned that it is necessary to improve the rural logistics node network and effectively improve the basic

conditions for the circulation of agricultural products, which shows that the construction of agricultural product logistics network system has been attached great importance by the national government departments. It is of great practical significance to comprehensively promote the rural revitalization strategy.

Agricultural product logistics refers to the object flow for agricultural product producers to deliver agricultural products and other related information to consumers (Shi YaoXiong, Jiang Valve & WANG Xu, 2012). With a large rural population and abundant agricultural resources, Hebei Province is one of the major producing areas of grain, green vegetables and high-quality fruits in northern China. However, the logistics network of agricultural products in Hebei Province covers 11 prefecture-level cities in Hebei Province. Due to the geographical dispersion among cities, the spatial distribution of supply and demand of agricultural products resources is unbalanced, and the development level of agricultural products logistics in each city is uneven. Therefore, by studying the construction of logistics network system in Hebei Province, we can scientifically and rationally plan the transportation network of agricultural products logistics in Hebei Province. On the one hand, it can rationally allocate agricultural logistics resources, on the other hand, it can optimize agricultural structure and reduce the circulation cost of agricultural products, which has a positive effect on the development of regional agriculture. At the same time, in the context of Beijing-Tianjin-Hebei integration, Beijing and Tianjin, as important consumer cities, have relatively advanced logistics infrastructure and logistics network systems, so it is particularly important to improve the logistics network system and optimize and upgrade the logistics infrastructure in Hebei Province. In contrast to cities in Hebei Province, regional development is not coordinated, and network connections between other cities in the region are weak.

2. Literature Review

About the construction of logistics network, related scholars have carried out in-depth research. It mainly focuses on the construction and optimization of logistics network, the spatial connection of cities and the application of advanced technology of logistics network. In terms of construction and optimization of logistics network, Wang Xingzi et al. (Wang Xingzi & Ding Mingzhi, 2022) built a cold chain logistics network through factor analysis and gravity model based on data such as the economic development level and logistics demand of prefecture-level cities in Shandong Province in 2020, and put forward relevant suggestions for the optimization of logistics network in Shandong Province. Wu Fangyun (Wu Fangyun & Zhu Xiaolin, 2019) et al. established a network optimization model with the minimum transportation cost of cold chain logistics as the objective function, and concluded that hub-and-spoke logistics network is conducive to resource concentration. In terms of spatial linkages, Zhou Huan et al. (Zhou Huan, Jin Jin & Zou Xiao, 2022) described the characteristics of urban spatial linkages and logistics networks in Hunan Province based on the modified gravity model and social network analysis, and put forward relevant policy suggestions. In the application of advanced technologies, it is proposed that the application of technologies such as the Internet of Things and blockchain can significantly improve the informatization level of logistics networks. Qu Qiang et al. (Qu Qiang, Su Lijie, Li Flag, et al, 2023) studied the evolution pattern of logistics networks in the three major urban agglomerations in China based on the gravity model, and pointed out that the Beijing-Tianjin-Hebei urban agglomerations should seize the opportunity of the decentralization of Beijing's non-capital functions and the adjustment of regional logistics division of labor, accelerate the process of regional logistics integration, and improve the resilience of logistics networks.

To sum up, the existing literature on logistics network research is more in-depth, but there is a lack of agricultural products logistics network. In addition, most of the domestic literature focuses on the study of the three major urban agglomerations, but there are relatively few studies on Hebei Province, an increasingly important economic region. According to the research results of domestic scholars, the Beijing-Tianjin-Hebei city cluster is of great research significance in the national logistics network, and its geographical location, capital and other factors are particularly important. However, for most cities in Hebei Province, it is obviously disadvantaged in the Beijing-Tianjin-Hebei region, with backward logistics infrastructure and logistics network

that cannot match the more advanced Beijing-Tianjin region. In particular, it is more prominent in the livelihood issue of income generation of agricultural products. Therefore, this paper first analyzes the spatial distribution of supply and demand of agricultural products in Hebei Province, constructs an index evaluation system of agricultural products logistics, and determines the status and influence relationship of agricultural products logistics network in each city in the region, so as to effectively allocate resources and improve logistics transportation capacity. Secondly, based on factor analysis and improved gravity model, the comprehensive development level and gravity intensity of agricultural products logistics in 11 prefecture-level cities in Hebei Province were measured. Therefore, the logistics network of Hebei Province was built with more accuracy, aiming to provide reference for optimizing the logistics network structure and spatial layout among node cities in Hebei Province.

3. Overview of Agricultural Products Logistics Network in Hebei Province

As a member of the Beijing-Tianjin-Hebei city cluster, Hebei Province plays an important role in production and supply, especially in the agricultural product market, transporting fresh and abundant agricultural products to Beijing and Tianjin. At the same time, the development of logistics network system in Hebei Province is obviously lagging behind that in Beijing and Tianjin, and the unbalanced level of logistics development restricts its trade connection. Logistics activities in the Beijing-Tianjin-Hebei region have a profound impact on agricultural products. The reasonable allocation of logistics resources is the premise of ensuring the stable supply and demand of agricultural products. In this regard, we need to conduct a preliminary research and analysis on the spatial distribution characteristics of supply and demand of agricultural products in 11 prefecture-level cities in Hebei Province in order to better solve the development problems of agricultural products logistics network in Hebei Province.

There are eleven prefecture-level cities in Hebei Province, namely Shijiazhuang, Chengde, Zhangjiakou, Qinhuangdao, Tangshan, Langfang, Baoding, Cangzhou, Hengshui, Xingtai and Handan. The gravity level of the production and marketing of agricultural products in Hebei Province was analyzed through the gravity model. From the perspective of space, the output of main agricultural products in 11 prefecture-level cities in Hebei Province in 2021 was selected to reflect the supply capacity of agricultural products in each prefecture, and the total retail sales of consumer goods in 2021 was selected to reflect the consumption capacity of agricultural products, as shown in Figure 1 and Figure 2.

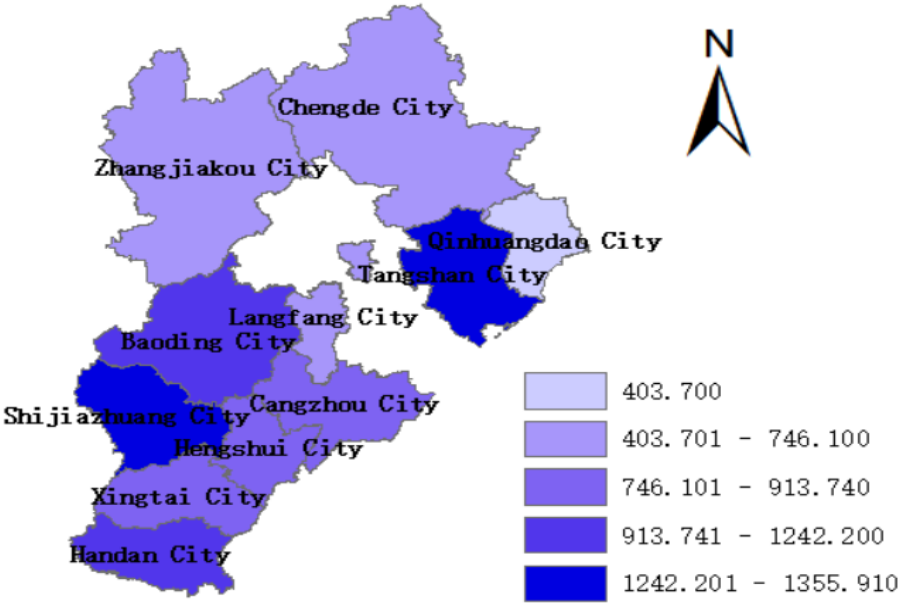

Figure 1. Spatial distribution of agricultural product output in Hebei Province

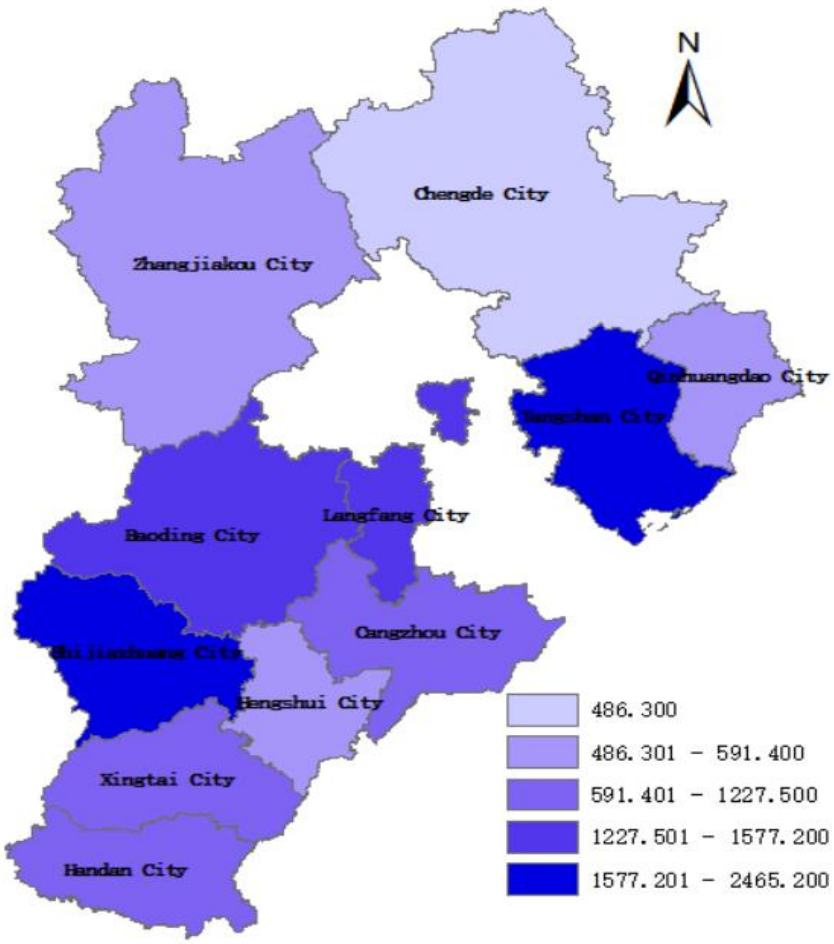

Figure 2. Schematic diagram of the spatial distribution of total retail sales of social consumer goods in Hebei Province

As can be seen from Figure 1, the spatial distribution of agricultural product output in Hebei Province is unbalanced. The overall output in northern Hebei Province is significantly lower than that in southern Hebei Province, and the spatial distribution characteristics of northern marginal cities are particularly obvious, which are strong in the south and weak in the north. The output of agricultural products in Shijiazhuang, Tangshan and Handan is larger. Taking Baoding as the line, Baoding and its south areas have abundant agricultural products, except Langfang, the agricultural products of other cities are at the medium level or above in Hebei Province. Although Chengde and Zhangjiakou in the north occupy a large area, the output of agricultural products is far less than that of Shijiazhuang Handan in the south, and the lowest output is the Qinhuangdao area in the northeast, which is far away from the output of Tangshan.

As can be seen from Figure 2, the consumption power of prefecture-level cities in Hebei Province also presents a phenomenon of strong consumption power in the south and weak consumption power in the north, while the consumption power in the northern marginal areas is relatively weak, and there is an obvious unbalanced spatial distribution. Among them, the economically developed Shijiazhuang and Tangshan have greater advantages, and the difference between Shijia, which ranks first, and Chengde, which ranks last, is about 5 times. Among them, Shijiazhuang, Tangshan and Langfang account for about 57% of the total retail sales of consumer goods in Hebei Province, while Chengde, Zhangjiakou and Qinhuangdao, the three cities on the northern edge, only account for about 12.5% of the total retail sales of consumer goods in Hebei Province, indicating that the spatial distribution of Hebei Province is not balanced.

In summary, from the perspective of spatial distribution, the supply and demand capacity of agricultural products in prefecture-level cities in Hebei Province is strong in the south and weak in the north, and the weaker cities are mostly concentrated in the northern fringe cities, which are far away from each other. The central and southern regions have high consumption power and are closely connected with each other. This may be related to geographical location, natural conditions and economic strength. There may be unbalanced development in logistics infrastructure, backward and different logistics networks, and the northern fringe cities are not closely connected with the central and southern regions. Therefore, in order to increase farmers' income, reduce the loss of agricultural products and promote mutual cooperation, it is necessary to establish a good logistics network to solve the problem of loss in the process of agricultural products transportation and unnecessary waste of resources caused by high cost.

4. Index System Construction and Research Methods

4.1 Index System Construction

Based on the analysis of the development status of agriculture and logistics industry in Hebei Province, the index system selected by the logistics network was studied by referring to relevant literature. On the basis of scientific and representative data, four first-level indicators were selected: regional economic development level (Li H Z, 2023), logistics development level (Li Flag, Jin Fengjun, Chen Yu, et al, 2015), supply level of agricultural products and demand level of agricultural products. The agricultural product logistics network of Hebei Province was constructed based on 12 secondary index systems such as gross regional product and freight volume (Cao Bingru, Yin Di & WANG Jingfang, 2015), as shown in Table 1.

Table 1. Logistics network indicators

Primary index	Secondary index
Regional economic development level	GDP, per capita disposable income
Logistics development level	Freight volume, freight turnover
Supply level of agricultural products	Total output value of agriculture, forestry, animal husbandry and fishery, output of agricultural products
Demand level of agricultural products	Total retail sales of consumer goods, per capital consumption expenditure

4.2 Research Methods

4.2.1 Factor Analysis Method

Factor analysis is to use a small number of factors to describe the relationship between many indicators or factors. Factor analysis can clearly identify the impact factors and transform many factors into potential common factors through dimensionality reduction, so as to reduce the number of indicators and make the relationship between data more intuitive (Liu Yuan, YAO Yukang, LI Ruiting et al, 2014).

4.2.2 Improved Gravity Model

In this paper, the gravity model is used to study the gravity analysis of regional agricultural products logistics in Hebei Province to analyze the connection strength between the two cities. The strength of logistics gravity is directly proportional to the logistics quality of the two places, and inversely proportional to the logistics quality between the two places (Shi Xianguang, 2007). Then the Fij of logistics gravity strength between the two cities is expressed as follows:

$$F_{ij} = GM_i M_j D_{ij}^{-r}$$

Where: Fij represents the gravitational force between the i object and the j object; G is the coefficient constant of inter-city logistics gravity. In practical application, since G has no effect on the measurement result, it is often valued as 1. Mi and Mj represent the logistics quality of city i and city j respectively. Dij represents the distance between city i and city j. r is the gravitational attenuation coefficient, usually taken as 2.

In this paper, the comprehensive score of agricultural products logistics in Hebei Province is taken as Mi and Mj of agricultural products logistics quality. In the description of the distance between different cities, we should not only use spatial distance to express, but also consider the particularity of logistics — economy and time cost. Therefore, the economic distance of agricultural products logistics

includes three dimensions: time, space and cost. The calculation formula is as follows:

$$D_{ij} = (d_{ij} \times c_{ij} \times t_{ij})^{\frac{1}{3}}$$

Where Dij is the economic distance of agricultural products logistics between region i and region j; dij is the mileage of road transport between Region i and Region j; cij is the road freight rate between Area i and Area j; tij is the road transit time between Area i and Area j. The comprehensive gravity model of agricultural products logistics is as follows:

$$F_{ij} = \frac{GM_i M_j}{(d_{ij} \times c_{ij} \times t_{ij})^{\frac{2}{3}}}$$

5. Empirical Analysis

5.1 Analysis of the Development Level of Regional Agricultural Products Logistics in Hebei Province

First, SPSS19.0 was applied for correlation coefficient test, KMO test and Bartlett test. The test results showed that the KMO test was 0.640, which was greater than the test value 0.6, indicating that the correlation of variables was strong, and the significance of Bartlett sphericity test P=0.000, P value & lt. 0.01, indicating that this group of data can be subjected to principal component analysis. Secondly, factor analysis is used to process the basic data of 11 prefecture-level cities in Hebei Province. As shown in Table 1, the extracted two common factors represent 81.233% of the original eight indicators measuring the development of regional agricultural products logistics in Hebei Province, indicating that the data loss is less and the initial data can be well interpreted.

Table 2. Initial eigenvalues and variance percentage of each principal factor

Ingredient	Initial eigenvalue		
	total	Percent variance%	total%
1	3.386	42.324	42.324
2	3.113	38.908	81.233

The maximum variance method is used to carry out orthogonal rotation of the factor load matrix, and the factor load matrix obtained after rotation is shown in Table 2. From Table 3, it can be concluded that the first principal component represents the supply level of agricultural products and the development level of logistics. The second principal component can represent the level of urban economic development and the demand level of agricultural products.

Table 3. Factor load matrix after rotation

Primary index	Secondary index	component		Primary index	secondary index component	component	
		1	2			1	2
Level of economic development	Gross regional product	0.719	0.682	Supply level of agricultural products	Total output value of agriculture, forestry, animal husbandry and fishery	0.822	0.308
	Per capita disposable income	0.113	0.949		Output of agricultural products	0.868	-0.037
Logistics development level	Volume of freight traffic	0.631	0.515	Demand level of agricultural products	Total retail sales of consumer goods	0.732	0.621

	Freight turnover	0.692	0.294	Per capita consumption expenditure	-0.114	0.956

By comparing the score coefficient matrix with the data of the original standardized values, we obtained the main factor scores F1 and F2 of 11 cities in Hebei Province. Using the variance contribution of 42.324% and 38.908% as weights, we constructed a comprehensive score function, where F=0.42324F1+0.38908F2. Through this function, we get the comprehensive score F of 11 cities in Hebei Province and their rankings.

According to the table, the scores of the comprehensive development level of agricultural products logistics in 11 cities in Hebei Province are analyzed. Among them, the scores of Shijiazhuang and Tangshan are 3.0006 and 2.9652, respectively. The scores of Shijiazhuang are slightly higher than those of Tangshan, and the scores of the comprehensive development level of logistics in these two cities are far higher than those of other 9 cities. Shijiazhuang scores 3.897 in factor F1, which reflects the supply level of agricultural products and the development level of logistics, ranking first. As the capital city of Hebei Province, Shijiazhuang has a strong economic driving ability, perfect transportation infrastructure and strong consumption demand for agricultural products, and is positioned as a consumption-oriented city in the logistics network of agricultural products. It plays a great driving role in the regional economic development of Hebei Province. On the one hand, Tangshan has a high level of industrialization development, so the logistics infrastructure is relatively perfect. On the other hand, Tangshan is the advantageous producing area of agricultural products in Hebei Province, and plays an important role in the supply of agricultural products in Hebei Province.

The comprehensive development level of agricultural product logistics in HanDan, CangZhou, BaoDing, LangFang, XingTai, ZhangJiaKou, QinHuangDao, HengShui and ChengDe is lower than that in ShiJiaZhuang and TangShan. Although the comprehensive strength of agricultural product logistics in the nine cities is insufficient, it indicates that their economic development and logistics level still need to be improved. These nine cities have different degrees of development in resource endowment and can therefore play a supporting role in the development of major core cities.

Therefore, ShiJiaZhuang and TangShan, as the axis cities of HeBei Province, have rich economic resources and high-tech support as well as solid urban logistics infrastructure construction level, which provides favorable conditions for the development of agricultural products logistics in Hebei Province.

Table 4. Main factor scores

city	F1		F2		Comprehensive development level of agricultural products logistics	Ranking
ShijiaZhuang	3.8794	1	3.5068	2	3.0006	1
TangShan	3.4930	2	3.8215	1	2.9652	2
HanDan	2.3967	3	1.5585	5	1.6208	3
CangZhou	2.2406	4	1.7180	4	1.6167	4
BaoDing	2.1633	5	1.4364	6	1.4744	5
LangFang	1.0974	7	2.4370	3	1.4127	6
XingTai	1.8153	6	0.6800	9	1.0329	7
ZhangJiaKou	0.6967	9	0.9010	8	0.6455	8
QinHuangDao	0.2046	11	1.2023	7	0.5544	9
HengShui	0.7529	8	0.3726	10	0.4637	10
ChenDe	0.3306	10	0.3052	11	0.2586	11

5.2 Gravity Analysis of Regional Agricultural Products Logistics in Hebei Province

Firstly, the road transportation mileage and road transportation time between cities in Hebei Province, and the road freight rate of 1.5 (Li Jiangsu, Luo Huasong & Wang Xiaorui, 2009) are substituted into the formula to calculate the comprehensive "economic distance" between 11 cities. Secondly, the "logistics quality M" and "economic distance D" of agricultural products in Hebei Province were substituted into the formula to obtain the gravitational strength of agricultural products logistics among cities.

Table 5. Gravity of regional agricultural products logistics in Hebei Province

F	ShiJia Zhuang	Tang Shan	Han Dan	Cang Zhou	Bao Ding	Lang Fang	Xing Tai	Zhang JiaKou	Qin Huang DAO	Heng Shui
TangShan	4.844									
HanDan	16.034	1.454								
CangZhou	9.268	8.186	2.151							
BaoDing	11.510	4.520	2.655	10.883						
LangFang	10.229	14.842	1.167	7.631	9.135					
XingTai	18.953	1.099	22.293	1.807	2.437	0.926				
Zhang JiaKou	1.316	0.916	0.343	6.230	1.214	1.062	0.260			
Qin HuangDao	0.539	6.112	1.753	6.691	4.281	9.061	1.264	1.007		
HengShui	7.536	1.021	1.943	3.666	2.883	1.040	1.943	1.511	0.981	
ChenDe	0.230	1.880	0.092	2.464	0.257	4.033	0.067	1.206	2.619	0.380

For the development level and logistics gravity value of each urban area in Hebei Province, the logistics gravity value of each community is divided into four levels, which are: F_{ij}>15Stands for super gravity, 10<F_{ij}<=15Stands for strong gravity, 5<F_{ij}<=10 represents gravity in general, 1<F_{ij}<=5It represents weak gravity, and the gravity value less than 1 is not considered, so the logistics gravity level between regions in Hebei Province can be obtained.

Table 6. Logistics gravity level of Hebei Province

Gravitational range	City-City
stronger attraction>15	Shijiazhuang - Handan, Shijiazhuang - Xingtai, Handan - Xingtai
10<Relatively strong attraction<=15	Shijiazhuang - Langfang, Shijiazhuang - Baoding, Baoding - Cangzhou City, Langfang - Tangshan
5<Weak attraction<=10	Shijiazhuang - Cangzhou, Shijiazhuang - Hengshui, Tangshan - Cangzhou, Tangshan - Qinhuangdao, Cangzhou-Langfang, Cangzhou-Zhangjiakou, Cangzhou-Qinhuangdao, Baoding - Langfang, Langfang - Qinhuangdao
1<Weaker attraction<=5	Shijiazhuang - Tangshan, Shijiazhuang - Zhangjiakou, Tangshan - Baoding, Tangshan - Xingtai, Tangshan - Hengshui, Tangshan - Chengde, Handan - Cangzhou, Handan - Qinhuangdao, Handan - Hengshui, Cangzhou - Xingtai, Cangzhou - Hengshui, Cangzhou - Chengde, etc

ShiJiaZhuang - HanDan, ShiJiaZhuang - XingTai, and HanDan - XingTai have strong gravitational

attraction, with the values reaching 16.034, 18.953 and 22.293. As can be seen from the figure, the three cities are geographically close, have close economic exchanges and high logistics quality of agricultural products, forming the highest value of urban logistics gravitational attraction. Shijiazhuang is the first place in the comprehensive score of regional agricultural products logistics development in Hebei Province. It has perfect logistics infrastructure and strong demand and supply capacity of agricultural products, so it can build an agricultural products logistics network with Shijiazhuang as the center and radiating the surrounding cities.

The network layout of strong gravity and strong gravity is basically based on Shijiazhuang city and spreads around. Shijiazhuang has a high level of economic development, a large population base and a large demand for agricultural products. Due to its convenient transportation and developed commercial and trade transportation, Shijiazhuang has the advantage of agricultural products logistics gathering. Strong gravitation and strong gravitation are distributed in a divergent manner from Shijiazhuang to all directions. The logistics quality of HanDan and ShiJiaZhuang is in the middle and upper reaches, although the score is not high, but because of the advantageous geographical position of HanDan and the relatively small transportation mileage of ShiJiaZhuang, HanDan successfully improves its logistics level and forms a strong logistics attraction among cities with the advantage of close location and high-quality logistics conditions near ShiJiaZhuang.

Weak gravity analysis shows that BaoDing is generally located between ShiJiaZhuang and CangZhou. With the advantage of transportation distance, BaoDing City forms a stable triangular network distribution, which can integrate agricultural resources of the three regions and make up for each other's shortcomings at all times. Meanwhile, due to the relatively developed port conditions of CangZhou City, the efficient circulation of commodities promotes the development of Baoding City. Secondly, the logistics network from CangZhou to ZhangJiaKou, QinHuangDao and other places has a long road transportation process, but because CangZhou has a strong logistics gravity, it makes up for the disadvantages brought by the road distance, thus forming a weak logistics gravity. However, the situation of TangShan and ZhangJiaKou city is on the contrary. TangShan is located in the northern part of HeBei Province, with good location conditions and a short road mileage with ZhangJiaKou. However, due to the low level of economic development of ZhangJiaKou and other places, the strong logistics attraction of TangShan is weakened, so a weak logistics attraction is eventually formed.

The weak logistics gravity analysis found that the logistics network covers several prefecture-level cities in HeBei Province, and a small number of prefecture-level cities are distributed in a triangular structure network, while most prefecture-level cities are distributed in a straight line network, indicating that the transportation network of agricultural products is simple and does not form multi-directional or two-way circulation. One-way circulation of agricultural products can not make the strength of low-quality logistics city grow up, one-sided agricultural products transportation situation is impossible to change, low-quality agricultural products logistics city will only passively accept low-quality agricultural products logistics quality of high city, but can not ship goods out. Most cities have frequent exchanges with big cities such as Shijiazhuang and Tangshan, but there are few exchanges between other cities, which is not conducive to the establishment of smooth and efficient agricultural products logistics network. Because some cities in the northern region are remote and have a low level of economic development, the logistics gravity value of Shijiazhuang and other cities is low, so they cannot be included in the network.

6. Suggestions on the Construction of Regional Agricultural Products Logistics Network

(1) Optimize the industrial layout of agricultural products in combination with the development status of agricultural products in Hebei Province and the range of gravitational radiation

The existing agricultural products consumption cities are mainly in the northern region, but the supply capacity of the northern fringe cities is weak, and the supply of agricultural products mainly comes from various cities in the south, which increases the circulation cost of agricultural products. It is necessary to further improve the supply capacity and efficiency of agricultural products in northern cities to alleviate the circulation pressure of agricultural

products in Shijiazhuang and Tangshan. At the same time, the 11 prefecture-level cities in Hebei Province are classified, the first and second central cities and the third node cities are clearly defined, the resource allocation and agricultural product industry layout of the cities at different levels are rationally planned, and the advantages of different cities are expanded.

(2) Adapt to local conditions and develop industrial advantages

By taking advantage of the unique geographical position and unique resource advantages of Hebei Province, the development level of agricultural products logistics in the southern cities of Hebei Province is accelerated. Although Shijiazhuang is also positioned as a core city, it is difficult to be affected by the radiation of major cities in northern Hebei Province due to the distance limitation. However, as an important producing area of agricultural products in this region, Shijiazhuang should actively make use of its industrial advantages, start from the extension of the industrial chain, combine with the characteristics of surrounding cities, carry out intensive processing of agricultural products and other industrial cooperation, and strengthen the transportation of agricultural products with surrounding cities, so as to better exert its core city's radiating and driving ability.

(3) Further clarify the functional positioning of each city in the agricultural product logistics network, coordinate regional development, and avoid homogeneous competition

The cities in Hebei are the main nodes of agricultural products supply, and there are significant differences in the output and output value of agricultural products. It is necessary to closely combine the trend of regional integration, coordinate and optimize the variety structure of agricultural products and vigorously develop the characteristic agricultural products industry. Shijiazhuang City is the capital of Hebei Province, the level of economic development is relatively high, but there are many universities and research institutes as scientific research advantages to actively use the advantages of scientific research and education to promote the development of new agriculture.

(4) Integrate resources and promote agricultural industrialization

The logistics of agricultural products belongs to a disorderly and disorderly pattern, and the producing areas of agricultural products are scattered. Farmers in different regions have different planting time and limited resources in local villages. For example, irrigation facilities are relatively backward. Due to problems such as insufficient facilities and equipment and insufficient resources, the planting time in rural areas varies greatly in terms of planting sequence time, and the time to enter the market will also vary greatly. For medium and long distances, the effect is more significant, resulting in weak gravity between many regions and higher transport costs. Therefore, the integration of resources and the promotion of agricultural industrialization are conducive to the rational use of limited resources, the increase of transportation batch while reducing transportation batches, saving transportation and labor costs, and the improvement and upgrading of local agricultural products logistics network.

(5) Improve logistics infrastructure construction

A good logistics network is based on a good basic logistics facilities. Agricultural products are perishable and not easy to preserve, and the water easily evaporates during transportation, resulting in loss. Therefore, improving logistics cold chain facilities is conducive to reducing the loss of agricultural products, increasing and expanding the market of agricultural products, and helping to adapt to a more perfect logistics network.

References

Cao Bingru, Yin Di, WANG Jingfang. (2015). Research on the construction of regional agricultural products logistics network based on gravity model: A case study of the Yangtze River Delta region. *Journal of Subtropical Resources and Environment, 10*(04), 42-49.

Li Flag, Jin Fengjun, Chen Yu, et al. (2015). Spatial pattern of China's logistics industry based on logistics popularity. *Progress in Geography, 34*(05), 629-637.

Li H Z. (2023). Research on evaluation of agricultural product logistics capability in Jiangsu Province based on factor analysis and cluster analysis. *Logistics Engineering and Management, 45*(06), 63-66.

Li Jiangsu, Luo Huasong, Wang Xiaorui. (2009). Application of gravity model reconstruction in the interaction between urban and suburban areas: A case study of Kunming

City. *World geographic Studies, 18*(02), 76-84.

Liu Yuan, YAO Yukang, LI Ruiting et al. (2014). Research on sustainable development ability of grain production in Jiangsu Province based on Principal Component Analysis. *Jiangsu Agricultural Sciences, 42*(03), 410-412.

Qu Qiang, Su Lijie, Li Flag, et al. (2023). Research on Evolution pattern of logistics network of three major urban agglomerations in China based on Gravity model. *Railway Transportation and Economy, 45*(05), 45-52.

Shi Xianguang. (2007). Spatial scope definition of Central Plains Urban Agglomeration based on Gravity Model. *Modern Economy (Modern Property Management), 6*(06), 16-17.

Shi YaoXiong, Jiang Valve, WANG Xu. (2012). Current situation and countermeasures of Hebei agricultural products logistics docking with Beijing and Tianjin.*Journal of Economic Research*, (09), 171-172.

Wang Xingzi, Ding Mingzhi. (2022). Research on construction of hub-and-spoke cold chain logistics network based on gravity model: A case study of cold chain logistics in Shandong Province. *Journal of Zhejiang Vocational and Technical College of Communications, 23*(02), 18-24.

Wu Fangyun, Zhu Xiaolin. (2019). Optimization model of cold chain logistics network based on hub-and-spoke Theory. *Highway Traffic Science and Technology, 36*(06), 144-150.

Zhou Huan, Jin Jin, Zou Xiao. (2022). Study on Spatial Connection and Network Structure of Logistics in Hunan Province. *Journal of Hunan City University (Natural Science Edition)*, 31(03), 51-58.