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Evaluation of Agricultural Product Logistics Capability in Hubei Province Based on Factor Analysis and Cluster Analysis

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Abstract

This paper focuses on the current situation of agricultural product logistics in Hubei Province. Using factor analysis, it identifies the main factors that influence the logistics capability of agricultural products across the province. Based on these factors, the study evaluates and calculates the logistics capability scores for different regions, providing a quantitative basis for comparison. Furthermore, cluster analysis is applied to classify the logistics capability of each city, revealing significant regional differences and patterns. The results indicate that logistics capability is closely linked to regional economic development, the scale of agricultural production, and the completeness and efficiency of logistics infrastructure. Accordingly, this paper proposes a series of targeted measures and policy recommendations to optimize infrastructure, improve transportation networks, and enhance coordination among cities, which can help maintain balance and promote the sustainable development of agricultural product logistics across Hubei Province.

Keywords

Factor Analysis, SPSS, Agricultural Products, Cluster Analysis

1. Introduction

In 2017, the 19th National Congress of the Communist Party of China made an important political statement that "Socialism with Chinese Characteristics has entered a new era." Under this background, the implementation of the Rural Revitalization Strategy has become the main focus of work related to agriculture, rural areas, and farmers. This strategy, proposed by General Secretary Xi Jinping, was officially confirmed in the report of the 19th National Congress and has been continuously promoted over the past six years [1].

At present, rural revitalization is mainly reflected in the significant improvement of informatization and technology, which has increased people's demand for high-quality agricultural products. Meanwhile, the rapid development and popularization of the Internet have greatly promoted the growth of rural e-commerce, improving the current situation of rural logistics to some extent [2]. However, in 2023, the total value of agricultural product logistics in China reached 5.3 trillion yuan, accounting for only 1.5% of the total social logistics volume [3].

Hubei Province, historically known as the "crossroads of nine provinces," enjoys a favorable geographical and transportation advantage. Although the agricultural product logistics industry in Hubei is gradually developing, its growth rate remains unsatisfactory. The main challenges include insufficient rural infrastructure and the complexity of agricultural product transportation. These factors have limited the potential and market expansion ability of Hubei's agricultural industry to a certain degree.

2. Literature Review

Through a review of relevant studies, it is found that domestic scholars have placed different emphases when constructing comprehensive evaluation systems for rural agricultural logistics. Wang Yiyuan used factor analysis to evaluate the development level of rural logistics in Xuzhou and found that rural economic development was the main influencing factor. The study suggested increasing farmers' income and education levels, cultivating logistics talents, and strengthening informatization and infrastructure to promote logistics development [4].

Chen Liangyun used the grey relational analysis method and evaluated data from 2008 to 2017 to study the factors affecting the development of rural logistics in Fujian Province. The results showed that rural consumption level, economic development, and informatization were the main influencing factors. The study suggested increasing farmers' income to stimulate consumption, strengthening rural economic and information construction, and training logistics professionals to promote development [5].

Liu Yan conducted research on the logistics system in Jiangsu Province using the SWOT-AHP model [6]. Zhang Jiaqi evaluated the regional logistics capability of Hunan Province from 2011 to 2020 using the CRITIC-entropy method. The study emphasized that logistics volume and transportation facilities were key factors and suggested improving infrastructure and attracting logistics talents to enhance overall capacity [7].

In contrast to previous studies that mainly used single evaluation methods, this study comprehensively considers factors related to agricultural product logistics capability and builds an evaluation framework for Hubei Province. By applying factor analysis, multiple original variables are simplified into several comprehensive indicators, which are then used for scoring. Furthermore, cluster analysis is applied to provide a more accurate and fair evaluation result.

3. Empirical Analysis of Agricultural Product Logistics Capability in Hubei Province

3.1 Data Sources and Indicator System

Based on an extensive review and analysis of existing literature and previous studies on agricultural product logistics evaluation systems, this research carefully selected nine key indicators to build a comprehensive evaluation framework. These indicators cover several aspects, including the basic level of logistics, logistics supply capacity, logistics transportation capacity, logistics informatization level, and the current situation of rural agricultural products [8-10].

All data used in this study come from the *Hubei Statistical Yearbook 2023*. The selected indicators aim to provide a systematic and quantitative understanding of the logistics capability of agricultural products in Hubei Province. The details of the indicators are shown in the following table1.

Table 1. Indicator system framework.

Evaluation Dimension	Evaluation Indicator	Code	Unit
Logistics Basic Level	Highway mileage	x_1	km
	Railway mileage	x_2	km
Logistics Supply Capacity	Fixed asset investment in logistics industry	x_3	100 million yuan
	Number of employees in the logistics industry	x_4	persons
Logistics Transportation Capacity	Highway freight volume	x_5	10,000 tons
	Railway freight volume	x_6	10,000 tons
Logistics Informatization Level	Number of broadband access users	x_7	10,000 households
	E-commerce sales	x_8	100 million yuan
Rural Agricultural Product Status	Main agricultural product output	x_9	10,000 tons

3.2 Factor Analysis

In this study, the SPSS software was used to conduct the Kaiser-Meyer-Olkin (KMO) test and Bartlett’s test of sphericity on the nine selected key indicators. According to the test results shown in Table 2, the KMO value reached 0.65, which is higher than the critical value of 0.5. This indicates that the data are suitable for factor analysis.

At the same time, the significance level of Bartlett’s test was 0.000, which is much lower than the threshold of 0.050. This further confirms that there is a significant correlation among the selected indicators. Therefore, it can be concluded that applying factor analysis to these indicators is both reasonable and effective.

Table 2. KMO and Bartlett’s test.

Test	Indicator	Value
KMO Measure of Sampling Adequacy	KMO Value	0.65
Bartlett’s Test of Sphericity	Approx. Chi-Square	128.476
	df	36
	Sig. (p-value)	0.000

3.3 Extraction of Common Factors

According to the data shown in Table 3, the first two factors were identified as common factors, both having eigenvalues greater than 1, which indicates that they have significant explanatory power in the dataset. Before factor rotation, the variance contribution rates of the first and second factors were 55.432% and 15.994%, respectively. The cumulative variance contribution rate reached 71.426%, meaning that these two factors together capture most of the variation contained in the original nine indicators.

Furthermore, as shown in the scree plot (Figure 1), the curve for the first two factors drops sharply, while the subsequent lines become relatively flat. This pattern further confirms that the first two common factors have strong explanatory and representative power in reflecting and summarizing the regional logistics capability.

Explanation of Total Variance in Table 3

Explanation of Total Variance in Table3

Factor Number	Eigenvalue			Variance Explained Before Rotation			Variance Explained After Rotation		
	Eigen value	Variance Explained Before Rotation %	Cumulative %	Eigenvalue	Variance Explained%	Cumulative%	Eigenvalue	Variance Explained %	Cumulative%
1	4.989	55.432	55.432	4.989	55.432	55.432	4.158	46.205	46.205
2	1.439	15.994	71.426	1.439	15.994	71.426	2.27	25.221	71.426
3	1.077	11.963	83.389	-	-	-	-	-	-
4	0.843	9.369	92.758	-	-	-	-	-	-
5	0.268	2.975	95.733	-	-	-	-	-	-
6	0.201	2.233	97.966	-	-	-	-	-	-
7	0.133	1.481	99.447	-	-	-	-	-	-
8	0.033	0.366	99.813	-	-	-	-	-	-
9	0.017	0.187	100	-	-	-	-	-	-

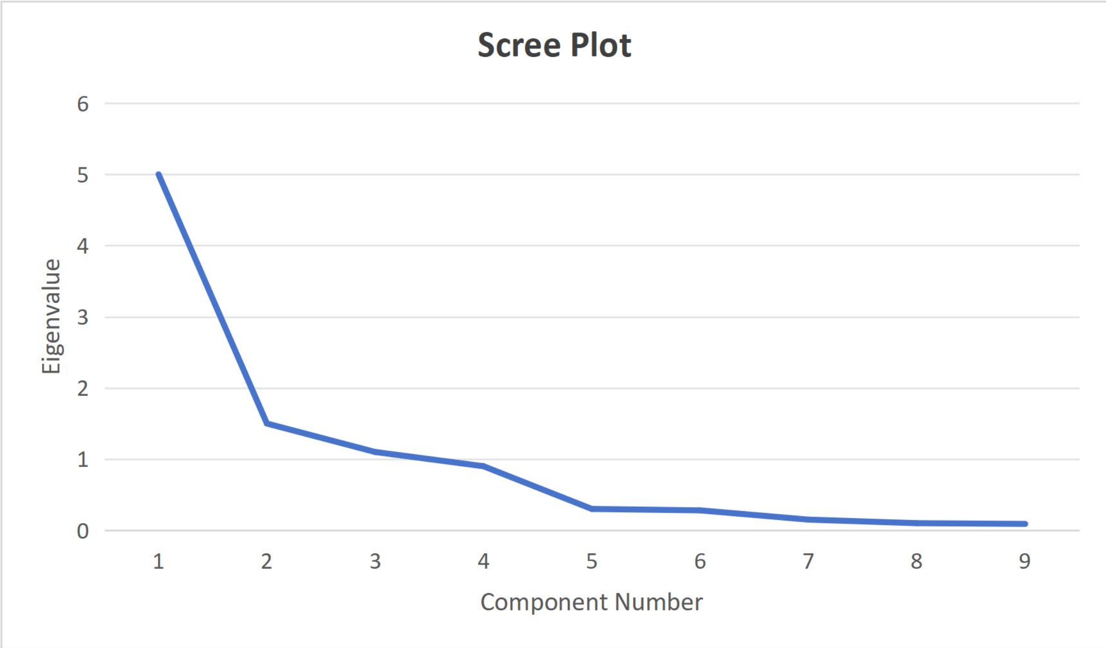

Figure 1. Scree plot.

3.4 Factor Rotation and Factor Score Calculation

Based on a review and summary of relevant literature, Based on Table 4,this study applies the varimax method to rotate the factors. The results after rotation are shown in the component matrix and the score coefficient matrix. Using these, a factor scoring model is established. Among the factors, X2 (railway mileage), X3 (fixed asset investment in the logistics industry), X4 (number of employees in the logistics industry), X5 (highway freight volume), and X7 (fixed broadband access users) have high loadings on Component 1, so it is named the Logistics Development Infrastructure Factor. Component 2 has high loadings on X1 (highway mileage), X2 (railway mileage), X6 (railway freight volume), and X8 (e-commerce sales), so it is named the Agricultural Product Demand Factor.

After extracting these factors, a factor score evaluation model is established based on the rotated score matrix.

$$F1=-0.168* X1+0.018* X2+0.248* X3+0.305* X4+0.261* X5-0.01* X6+0.261* X7-0.035X8+0.059* X9$$

$$F2=0.52* X1+0.156* X2-0.068* X3-0.241* X4-0.087* X5+0.207* X6-0.011* X7+0.385* X8-0.153* X9$$

The comprehensive score is calculated by multiplying the normalized variance explained after rotation by the factor scores and then summing them. The calculation formula for the current dataset is as follows:$(55.432* F1+* 15.994F2)/71.426$

The final formula is:$F=0.776* F1+0.223* F2$

Table 4. Factor loadings and component score matrix.

	Factor Loadings and Component Score Matrix			
Indicator	Rotated Component Matrix		Component Score Coefficient Matrix	
	F1	F2	F1	F2
x1	0.081	0.926	-0.168	0.52
x2	0.723	0.53	0.118	0.156
x3	0.929	0.219	0.248	-0.068
x4	0.906	-0.089	0.305	-0.241
x5	0.953	0.194	0.261	-0.087
x6	0.269	0.455	-0.01	0.207
x7	0.882	0.299	0.216	-0.011
x8	0.432	0.821	-0.035	0.385
x9	0.014	-0.259	0.059	-0.153

4. Score Evaluation

Based on the factor analysis results of 17 cities in Hubei Province (as shown in Table 5), the agricultural product logistics capability in Hubei exhibits significant regional differentiation. Wuhan, Xiangyang, Yichang, Huanggang, Xiaogan, Huanggang, and Jingmen rank among the top in terms of agricultural product logistics capability. Wuhan, as the provincial capital, ranks first due to its dual role as the economic and political center of the province and its strategic position on key transportation routes, including major highways, railways, and waterways. The city's advanced transportation network and abundant logistics infrastructure provide strong support for the efficient movement of agricultural products, contributing to both domestic and regional trade. In addition, cities such as Xiangyang, Yichang, and Xiaogan benefit from the radiation effect of neighboring provincial capitals, dense transportation networks, and the hub status of the Yangtze River waterway. These factors collectively enhance their logistics performance, allowing them to efficiently distribute agricultural products to surrounding areas and maintain a competitive advantage in the regional supply chain.

Table 5. City scores and rankings.

City	F1	Rank	F2	Rank	Composite Score	Rank
Wuhan	3.530	1	-0.306	9	2.175	1
Huangshi	0.013	4	-1.035	16	-0.357	11
Shiyan	-0.465	14	0.793	4	-0.021	6
Yichang	-0.129	6	2.330	1	0.739	3
Xiangyang	1.190	2	0.980	3	1.116	2
Ezhou	-0.404	10	-0.733	13	-0.520	14
Jingmen	0.124	3	-0.659	12	-0.152	7
Xiaogan	0.012	5	0.283	6	0.108	5
Jingzhou	-0.406	11	0.273	7	-0.166	9
Huanggang	-0.500	15	1.628	2	0.251	4
Xianning	-0.515	16	0.082	8	-0.304	10
Suizhou	-0.325	7	-0.527	10	-0.396	12
Enshi	-0.538	17	0.529	5	-0.161	8
Xiantao	-0.326	8	-0.629	11	-0.433	13
Qianjiang	-0.438	12	-1.034	15	-0.648	16
Tianmen	-0.386	9	-1.156	17	-0.658	17
Shenlongjia	-0.438	13	-0.820	14	-0.573	15

Shiyan, Enshi Prefecture, Jingzhou, and Huangshi exhibit medium-level agricultural product logistics capability. These cities, while not leading in logistics infrastructure, maintain a relatively stable logistics system supported by industrial and agricultural development. Their medium-level capability is due in part to moderate transportation connectivity, sufficient but not extensive storage and processing facilities, and regional agricultural output that is neither minimal nor abundant. Despite having certain advantages, such as natural resources and moderate industrial bases, these cities face limitations that prevent them from achieving top-tier logistics performance.

The remaining cities-Suizhou, Xianning, Xiantao, Ezhou, Shennongjia Forest District, Tianmen, and Qianjiang-have relatively weaker agricultural product logistics capability. In these cities, several factors constrain logistics development. Geographic challenges, such as mountainous terrain or dispersed urban layouts, hinder the construction and efficiency of transportation networks. Limited storage and cold chain infrastructure restrict the ability to maintain product quality during transport, while smaller agricultural production scales reduce overall throughput. These combined factors contribute to lower logistics efficiency and reduced market competitiveness for agricultural products originating from these regions.

Regarding the main factor F1, which represents logistics development infrastructure, Wuhan, Xiangyang, Jingmen, Huangshi, and Xiaogan score higher, reflecting a strong correlation between infrastructure quality and overall logistics capability. Xiangyang, in particular, has experienced rapid GDP growth in recent years, benefiting from its geographical advantage, proximity to Wuhan, and increasing investment in infrastructure. This development has helped the city improve logistics efficiency and strengthen its role as a regional distribution hub.

As for the F2 factor, representing agricultural product demand status, Yichang, Huanggang, Xiangyang, and Shiyan score the highest. This indicates that agricultural production volume and market demand play a crucial role in shaping logistics capability. Yichang, for instance, despite its moderate economic development level, leverages abundant agricultural output and the strategic advantage of the Yangtze River to develop efficient waterway transport, thereby enhancing logistics performance. In contrast, Qianjiang and Tianmen have lower agricultural output and face geographic constraints, resulting in reduced logistics capability.

In conclusion, the agricultural product logistics capability in Hubei Province is influenced by a combination of geographic location, economic development, infrastructure quality, and agricultural output. Regional disparities highlight the need for tailored strategies to improve logistics efficiency. By optimizing infrastructure, enhancing transportation networks, and leveraging both production capacity and technological innovations, Hubei can strengthen the competitiveness of its agricultural logistics system and promote more balanced regional development.

5. Cluster Analysis

To better analyze the agricultural product logistics capability of cities in Hubei Province, a hierarchical clustering method was applied to classify the 17 cities. Based on the clustering dendrogram (Figure 2), these cities can be broadly divided into three categories according to their logistics capability levels. The first category, representing high agricultural product logistics capability, includes Wuhan, Xiangyang, Yichang, Xiaogan, Jingmen, and Huanggang. The second category, with medium logistics capability, includes Shiyan, Huangshi, Jingzhou, and Enshi Prefecture. The third category, representing low logistics capability, includes Suizhou, Xianning, Xiantao, Ezhou, Shennongjia Forest District, Tianmen, and Qianjiang. This classification highlights the significant regional disparities in agricultural product logistics across Hubei Province and indicates that both geographic location and economic conditions play important roles in shaping logistics performance.

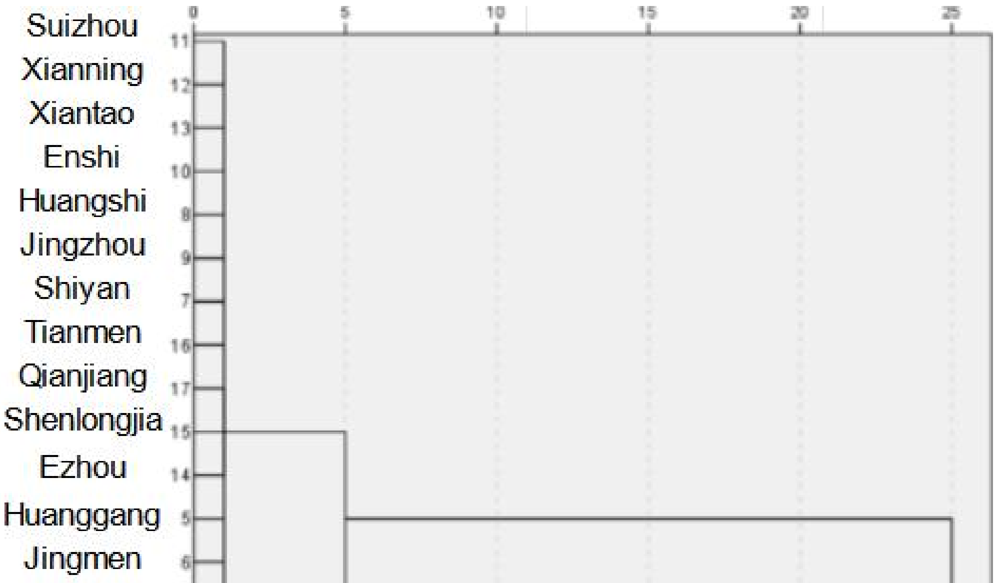

Figure 2. Cluster dendrogram of agricultural product logistics capability in cities of hubei province.

Cities with high agricultural product logistics capability. Wuhan, as the provincial capital, scores the highest in agricultural product logistics capability. Its top position is largely due to its strategic geographic location at the confluence of the Yangtze River and Han River, combined with a highly developed transportation network. Wuhan hosts the largest inland port in the middle reaches of the Yangtze River and serves as a major transportation hub in central China, with extensive railway, highway, and air transport systems. These advantages enable efficient movement of agricultural products both within the province and to external markets. Furthermore, Wuhan’s strong economic base supports the development of logistics infrastructure, such as warehouses, cold chain facilities, and distribution centers, ensuring high operational efficiency. Xiangyang, Yichang, and Jingmen also demonstrate strong logistics capability. Xiangyang, located in the middle reaches of the Han River, functions as a secondary central city in Hubei, benefiting from a solid industrial base, well-established road networks, and expanding logistics facilities. Yichang, Jingmen, and Huanggang leverage abundant agricultural resources and relatively developed waterway conditions to form key nodes in the province’s agricultural product logistics network. These cities are capable of handling high volumes of agricultural goods and ensuring timely delivery, which is crucial for maintaining product quality and market competitiveness.

Cities with medium agricultural product logistics capability. Shiyan, Huangshi, Jingzhou, and Enshi Prefecture have moderate logistics scores, reflecting a balance of strengths and limitations. Shiyan and Huangshi benefit from their status as regional transportation hubs. Shiyan, located in the Qinba Mountains, forms the Northwest Hubei economic zone and has considerable agricultural production, yet its logistics capacity is restricted by limited transport methods, such as the scarcity of high-capacity roads and rail links. Huangshi, while adjacent to Wuhan and benefiting from its proximity, has limited regional area and agricultural production, which constrains its overall logistics capability. Enshi Prefecture, despite its large area and substantial agricultural output, faces challenges due to mountainous terrain and restricted transport modes. These cities, while not at the top, maintain a stable logistics system capable of supporting local agricultural distribution but still require improvements to reach higher levels of efficiency.

Cities with low agricultural product logistics capability. Suizhou, Xianning, Xiantao, Ezhou, Shennongjia Forest District, Tianmen, and Qianjiang score relatively low in logistics performance. Suizhou and Xianning possess agricultural industries but rely on limited transportation methods, and cold chain infrastructure is often insufficient, which hinders the efficiency of perishable goods distribution. Ezhou, though near Wuhan, experiences a “shadow effect,” where Wuhan dominates regional logistics, and Ezhou’s agricultural production and output are relatively low, limiting its logistics potential. Shennongjia Forest District, Tianmen, and Qianjiang face even more pronounced limitations. Shennongjia, despite a large area and abundant agricultural production, is constrained by mountainous terrain and geographic isolation, making it difficult to form an integrated economic zone. Tianmen and Qianjiang, situated in the Jianghan Plain, are hindered by fragmented administrative divisions and dispersed resources, resulting in scattered logistics infrastructure. Additionally, inadequate cold chain facilities further limit their capacity to handle perishable agricultural products. These limitations collectively contribute to weaker logistics capability, highlighting the need for targeted infrastructure investment, improved connectivity, and modernized logistics systems to support agricultural product distribution in these areas.

6. Conclusion

6.1 Overall Evaluation of Agricultural Product Logistics Capability

The analysis of 17 cities in Hubei Province shows significant regional differences in agricultural product logistics capability. Cities such as Wuhan, Xiangyang, Yichang, Xiaogan, Jingmen, and Huanggang demonstrate high capability due to their advantageous geographic location, well-developed transportation networks, and economic strength. Medium-level capability is observed in Shiyan, Huangshi, Jingzhou, and Enshi Prefecture, while Suizhou, Xianning, Xiantao, Ezhou, Shennongjia Forest District, Tianmen, and Qianjiang exhibit relatively low capability, mainly due to geographic constraints, limited infrastructure, and dispersed resources. This differentiation highlights the need for targeted strategies to improve logistics capability across the province.

6.2 Importance of Infrastructure Improvement

Infrastructure remains the foundation of logistics efficiency. Enhancing road networks, expanding storage and distribution facilities, and developing cold chain systems are essential, particularly for mountainous and remote areas. Such improvements can increase transportation efficiency, reduce post-harvest losses, and ensure product quality, thereby raising market competitiveness. Additionally, modernized infrastructure can facilitate better integration of regional supply chains, enabling efficient flow of agricultural products between production areas and urban markets.

6.3 Role of Information Technology

Information technology plays a pivotal role in modern agricultural logistics. The adoption of big data, cloud computing, and intelligent logistics platforms can optimize transportation routes, monitor product conditions, and provide real-time data for decision-making. By sharing information among producers, distributors, and retailers, logistics operations become more coordinated, cost-effective, and responsive to market demand. The promotion of digital logistics systems in Hubei Province can enhance overall efficiency and contribute to higher product quality and consumer satisfaction.

6.4 Significance of Government Support

Government policies and regulations are crucial in shaping the development of agricultural product logistics. Fiscal incentives, regulatory oversight, and the establishment of industry standards can encourage investment, ensure fair competition, and protect the interests of rural producers. Moreover, support for talent training and professional development ensures the availability of skilled personnel to manage and operate logistics systems efficiently. Coordinated government intervention can stimulate sustainable growth and strengthen Hubei’s position as a regional logistics hub.

6.5 Comprehensive Strategies for Enhancement

Improving agricultural product logistics capability requires a comprehensive approach that integrates infrastructure, technology, and policy support. Tailored strategies should address regional disparities, leveraging the advantages of high-capability cities to support weaker regions through better connectivity and resource sharing. The combination of modern infrastructure, advanced logistics technology, and effective government policies will create a resilient and competitive logistics network. This not only promotes the economic development of Hubei Province but also contributes to the broader goals of rural revitalization and agricultural modernization.

References

[1] Deng M., Chen T., Yang M. A brief discussion on land value under the rural revitalization strategy of the 19th National Congress: A case study of the "Enterprise + Cooperative + Farmer" model [J]. China Collective Economy, 2019, (02): 1–2. https://portal.sclib.cn/interlibSSO/goto/11/+jmr9bmjh9mds/kcms2/article/abstract?v=NitQnVYDOcpDFn5juhxM65tPR4BAu4nZ3hTIIsllLYdNKcQM9hP880A_wwTIyRGPpwJ9I7Z8KBPPvrJMXhUAZXcqjajmf7YCPmIh1V799-UO2EcAzpWyaoRopI4ob7RWD9PNQpRfbV8BBOqqCwJVZxHlC5uZc6JOWh2vs7nMxLg1R0WcXxujOA==&uniplatform=NZKPT&language=CHS

[2] Liu L. Research on the development of rural e-commerce in China under the background of digital commerce promoting agriculture [J]. Logistics Engineering and Management, 2024, 46(05): 56–59. https://portal.sclib.cn/interlibSSO/goto/11/+jmr9bmjh9mds/kcms2/article/abstract?v=NitQnVYDOcqxGwk_DCfy5HGIeELlBUTgtFEd3fmJ1Rb0I11Naa0dv1vBcKgVBv8G-aV5pV5KVFY21_O1d44T9LpPujVXyH3Lc-vDnuVUBKI1-U1rbwEQZGHTu_UaqkMK-AdYYwoq_pYZLekCmyXBQIPJttipE8eZoI6ZkFQsxQC_ytJ9iCqfvA==&uniplatform=NZKPT&language=CHS

[3] Hou J. Research on problems and suggestions of agricultural logistics in the development of agricultural economy [J]. China Storage and Transportation, 2023, (09): 142–144. https://link.cnki.net/doi/10.16301/j.cnki.cn12-1204/f.2023.09.081

[4] Wang Y. Research on rural logistics development level in Xuzhou based on factor analysis [J]. Logistics Technology, 2023, 46(23): https://link.cnki.net/doi/10.13714/j.cnki.1002-3100.2023.23.030

[5] Chen L. Analysis of influencing factors of rural logistics development in Fujian Province [J]. Logistics Engineering and Management, 2019, 41(08): 26–28+3. https://portal.sclib.cn/interlibSSO/goto/11/+jmr9bmjh9mds/kcms2/article/abstract?v=NitQnVYDOcqR1cbVyVzR6x5nI-wgwK3t6Wzrvk5lxak6Jut75kue5szxUCSmCA5cx-a99nrI6ORY-PowLghjnAgLfVgy_OshWI9TWEag4oy0RIPnG2cGQ6Jw9hrjXzbh4v1lfohLLj9I5_iepwTmy9ijV43K6W0IuInIKvnySsJ5c3lqgXZelA==&uniplatform=NZKPT&language=CHS

[6] Liu Y. Research on the development of agricultural product logistics system in Jiangsu based on SWOT-AHP [J]. Logistics Engineering and Management, 2022, 44(01): 97–100. https://portal.sclib.cn/interlibSSO/goto/11/+jmr9bmjh9mds/kcms2/article/abstract?v=NitQnVYDOcpI8hfl0j9pvt_g8gFs_fiCBpSpRVH7uouh_3xqWTTFKY6zf_cL7mDQJMfoWquHtYdnXbD9083hupJxek3NecXHsZ1wVCOAZuV3kArX_PRg9ZLpY72EjcPai6g5qO-s7ZkTEGrNDsSWIg7j4pLCa-P0XEg1vC81xOZa5tQMSNp2wg==&uniplatform=NZKPT&language=CHS

[7] Zhang J., Cai R., Xiang X., et al. Evaluation and improvement strategies of regional logistics capability in Hunan Province: Based on CRITIC-entropy weight combination method [J]. China Logistics & Purchasing, 2023, (05): 44–45. https://link.cnki.net/doi/10.16079/j.cnki.issn1671-6663.2023.05.010

[8] Guo Yuexian, Li Mingkun. Evaluation of Cold Chain Logistics Capability for Agricultural Products in Hebei Province Based on Factor Analysis and Entropy Weight-TOPSIS [J]. Journal of Hebei University of Science and Technology (Social Science Edition), 2025, 24(03): 33-40+61. https://portal.sclib.cn/interlibSSO/goto/11/+jmr9bmjh9mds/kcms2/article/abstract?v=NitQnVYDOco9RAPdsNq-FGVTHK8RwRlknUazb4psvehnArXvudE7H1pvr1JA_eYfwxt-pugAYF-fyCuDk-HyhXPOE4Fyj4t-HMLK26ekwAcj-dxuAgVW2eb4CnN6pje9xWzOXvEI9ylZe66f9ZLIl90VM0ZSx57lgSwE5yiUPwNxhANOh4Iqaw==&uniplatform=NZKPT&language=CHS

[9] Chu Hanfang, Hao Yubin, Liu Xinyan, et al. Evaluation of Emergency Logistics Capability Based on Factor Cluster Analysis: A Case Study of the Pearl River Delta Region [J]. Logistics Technology, 2025, 48(10): 8-12. https://link.cnki.net/doi/10.13714/j.cnki.1002-3100.2025.10.002

[10] Wu Hongxia, Li Jiaxin, Cui Boyu. Assessment of Logistics Capability Development Level in Hebei Province Based on the Entropy Weight-TOPSIS Model [J]. China Storage & Transportation, 2025, (04): 154-155. https://link.cnki.net/doi/10.16301/j.cnki.cn12-1204/f.2025.04.03