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A Study on Fresh Food Warehouse Location Selection Taking Hema Fresh as an Example

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Abstract: Over the past decade, e-commerce has achieved vigorous development, and the online demand for fresh food products has been growing continuously. As a self-operated fresh food supermarket under Alibaba Group, Hema Fresh holds a large market share in the fresh food industry. Its business is mainly concentrated in first- and second-tier cities, while third- and fourth-tier cities also boast potential market demand. As a vital link in e-commerce logistics management, warehouse location selection exerts a decisive impact on distribution efficiency, cost control and customer experience. To help Hema Fresh further expand its market share, strengthen its competitiveness in the online fresh food sector and reduce operating costs, it is essential for the enterprise to make scientific decisions on warehouse layout. Based on domestic and foreign theories concerning fresh food distribution center and warehouse location selection, this paper analyzes the current situation and existing problems of Hema Fresh's warehouses, and verifies the necessity and rationality for the enterprise to build new warehouses with relevant data collected. In accordance with the logistics demand characteristics of customers, the Analytic Hierarchy Process (AHP) is adopted to solve the problem of fresh food warehouse location selection. Furthermore, this paper constructs a hierarchical evaluation model for fresh food warehouse location selection, determines the weight of each indicator, and ranks the performance of alternative schemes against each indicator. Finally, the decision results of AHP are applied in practice to verify the implementation effect of the optimal alternative scheme.

Keywords: Warehouse Location Selection; Fresh Food Products; Analytic Hierarchy Process.

1. Introduction

1.1. Research Background

With the rapid advancement of the Internet and electronic payment technologies, the traditional brick-and-mortar retail model has been thoroughly transformed. Online shopping, free from geographical restrictions, has gradually become an indispensable part of people's daily lives. Nevertheless, fresh food products are perishable, impose high requirements on transportation and require substantial capital investment, leading to high operating costs and difficult product preservation in online sales. Therefore, warehouse location selection for fresh food products faces extremely strict requirements to address the above challenges.

Against the backdrop of deepening economic globalization and digital transformation, fresh food e-commerce has evolved into a mainstream consumption pattern for residents. In recent years, the Chinese government has attached great importance to the development of the digital economy and new retail formats, and successively issued a series of incentive policies to promote technological innovation and model upgrading in the fresh food e-commerce industry. Driven by national strategies such as the "Internet Plus" and digital economy, a complete industrial support system has been established, including supporting the development of rural fresh food e-commerce, improving the cold chain logistics system and optimizing the layout of front warehouses. These policies have profoundly shaped the development path and pace of the industry, boosted market vitality and facilitated coordinated urban-rural development.

China's fresh food e-commerce market has maintained steady growth in transaction scale and user penetration. Relevant statistics show that the market size reached 560.14 billion yuan in 2022, with a year-on-year growth rate of 20.25%; the total transaction volume hit 642.76 billion yuan in 2023, with the growth rate falling to 14.7%; and the market scale further rose to 736.79 billion yuan in 2024, maintaining a stable growth rate of 14.7%. The user base also saw remarkable growth: the market penetration rate increased from 10.28% in 2022 to 14.9% in 2024, and the number of active users grew from 460 million to 577 million, a net increase of over 100 million in three years. The data indicates that the industry still has strong potential for expanding into sinking markets and acquiring new users [1].

1.2. Research Status at Home and Abroad

In the context of big data, Lili and Weng [2] adopted the grey prediction model to forecast the demand for fresh agricultural products, and planned the layout of distribution centers based on the prediction results. The constructed framework fits practical scenarios well, and case studies have proven the effectiveness and feasibility of this method. Silva A [3] integrated warehouse location selection and order picking problems, and proposed a solution based on the variable neighborhood search heuristic algorithm to optimize the traditional warehouse location model. Musolino G [4] and other scholars focused on the layout of urban distribution nodes, and put forward solutions to balance multiple objectives including sustainable development and operational efficiency. Their research fully took transportation routes and energy consumption into account, and adopted quantitative evaluation methods to measure the operational performance and environmental friendliness of urban logistics systems. Considering the uncertainty and fuzziness in decision-making as well as potential market changes, Agrebi M et al. [5] proposed an improved multi-attribute and multi-criteria fuzzy decision-making method for distribution center location selection in logistics systems. Comparative analysis and sensitivity verification confirmed the superiority of this method.

Domestically, Wang and other scholars [6] optimized the traditional genetic algorithm by integrating greedy strategies and tabu search mechanisms, which greatly improved the efficiency of obtaining optimal solutions. Taking the fresh agricultural product logistics system in Beijing as an example, they verified the broad application potential of the improved model in commercial location selection. In view of the characteristics of various agricultural products and pre-cooling demands in rural areas, Li Ya et al. [7] constructed an improved genetic algorithm framework aiming to reduce the total system cost, which has high practical value for the layout planning of rural cold chain logistics infrastructure. Targeting the integrated distribution and pickup mode, Liu Dong et al. [8] established a mathematical programming model for location selection with the goal of minimizing operating costs, and optimized core modules of the hybrid immune algorithm, significantly enhancing the efficiency and accuracy of calculation, thus providing theoretical support and practical guidance for logistics enterprises.

1.3. Research Significance

As a core hub in the fresh food cold chain logistics network, warehouse location selection is closely linked to all upstream and downstream nodes of the supply chain. Any adjustment of decision parameters will generate a chain reaction on the overall performance of the system. A scientific warehouse layout is directly related to the long-term strategic development of enterprises. This research focuses on core factors such as warehouse construction costs and the spatial distribution of target customers, and establishes theoretical models and practical schemes for the optimization of warehousing and distribution collaboration of fresh food e-commerce enterprises, which possesses important theoretical research value and practical application significance.

Theoretical Significance：A reasonable warehouse layout shortens the distance between products and consumers, ensures product freshness by enabling timely delivery, and helps enhance customer loyalty. In addition, fresh food logistics requires far more investment in infrastructure than ordinary logistics industries due to the unique attributes of fresh products. Scientific location selection can effectively help enterprises cut operating costs.

Practical Significance：As a leading player in the fresh food e-commerce industry, Hema Fresh is taken as the research object for warehouse layout analysis. The research results can help similar enterprises maintain existing market shares and expand business in the fiercely competitive market, and also provide a reference for the sustainable development of the entire industry.

2. Overview of Existing Fresh Food Warehouses of Hema Fresh

2.1. Profile of Hema Fresh

Affiliated with Alibaba Group, Hema Fresh is a representative enterprise in the new retail sector. Founded by Hou Yi in 2015, it mainly engages in the sales of fresh food and daily necessities. Leveraging Alibaba’s big data resources accumulated over years, together with mobile Internet, intelligent Internet of Things, automation and other advanced technologies, Hema Fresh has created an innovative retail model that integrates people, goods and consumption scenarios. Different from the single operation mode of traditional supermarkets, Hema Fresh combines supermarket shopping, catering services and instant delivery.

On March 30, 2023, Hema officially launched the "1-hour delivery" service for customers within a radius of 3 to 5 kilometers around its stores, which greatly improved user experience and became a typical innovative practice in the new retail industry. By January 3, 2025, the total number of Hema stores had expanded to 429, including 8 newly opened Hema X Membership Stores. According to Alibaba’s financial report for the 2024 fiscal year, Hema achieved overall profitability for nine consecutive months with double-digit performance growth. Its annual active users increased by more than 50% year-on-year, and online business contributed 63% to the total GMV. The annual total GMV exceeded 59 billion yuan, up from 55 billion yuan in the previous fiscal year.

2.2. Overview of Current Locations of Hema Fresh's Fresh Food Warehouses

Hema Fresh has built a multi-level national warehousing and logistics network, consisting of central warehouses, regional distribution centers, urban front warehouses and other storage facilities, with functional units for normal temperature storage, refrigeration and freezing, fruit and vegetable processing, live fresh product temporary rearing and central kitchen. According to statistics as of February 2025, the enterprise has built 48 multi-temperature integrated warehouses in 15 major cities across China, including 33 warehouses for normal and low-temperature storage, 11 fresh food deep processing centers and 1 live fresh product cold chain transit hub, with a total storage area of over 1 million square meters. Supported by trunk transportation and terminal distribution networks, these facilities realize a seamless full cold chain operation system.

Hema’s warehousing network is divided into six major regions: East China, South China, North China, Central China, Southwest China and Northwest China, covering key cities such as Shanghai, Hangzhou, Nanjing, Beijing, Tianjin, Shenzhen, Guangzhou, Wuhan, Changsha, Chengdu, Chongqing and Xi’an. Among them, East China serves as the core hub of Hema’s logistics system with important strategic status.

In July 2023, Hema Shanghai Supply Chain Operation Center located in Hangtou Town, Pudong was put into operation. Covering an area of about 100,000 square meters, this project integrates agricultural product deep processing, food research and development, semi-finished product refrigeration, central kitchen and cold chain logistics. It is the largest, most technologically integrated and most heavily invested single facility within Hema’s system.

Since its establishment, Hema has attached great importance to the strategic layout of the fresh food supply chain, aiming to build a nationwide core logistics network. Seven supply chain centers in Northwest China, Southwest China, Central China and East China have been successively launched, forming one of the largest full-temperature cold chain logistics systems in China’s retail industry. This layout has enhanced Hema’s core competitiveness and service efficiency, and provided strong support for the enterprise to meet the diverse demands of Chinese consumers.

3. Basic Theories of Warehouse Location Selection

3.1. Purposes of Location Selection

3.1.1. Reduce Transportation Costs

Transportation costs account for a large proportion of total supply chain expenditure and are highly correlated with warehouse locations. Locating warehouses close to suppliers, manufacturers or major distribution networks can significantly cut total transportation mileage, thereby reducing expenses on fuel, tolls and vehicle maintenance. Meanwhile, rational planning of distribution routes helps further control operating costs and reduce greenhouse gas emissions, which conforms to the sustainable development strategy of modern enterprises.

3.1.2. Improve Service Quality

Warehouse location is critical to customer experience. Warehouses located in core consumption areas or near transportation hubs can shorten the delivery time of the "last mile" and meet customers' demand for fast delivery. In addition, warehouses built around target markets enable enterprises to respond quickly to dynamic changes in consumer demand. For fast-moving consumer goods characterized by frequent restocking, warehouses adjacent to large supermarkets and community retail outlets can adjust inventory structure flexibly and cope with demand fluctuations caused by promotional activities and seasonal changes.

3.1.3. Improve Operational Efficiency

The operational efficiency of warehouses depends on their connection with key supply chain nodes. Warehouses near ports, railway stations or expressway hubs can accelerate cargo inbound and outbound processes and reduce transit waiting time. The combination of reasonable internal warehouse layout and superior external transportation conditions further shortens loading and unloading time.

3.2. Influencing Factors of Location Selection

3.2.1. Time Efficiency

Fresh food products operated by Hema Fresh have extremely high requirements for timeliness, so the distance from distribution centers and overall distribution efficiency are key considerations for location selection. Hema tends to select areas near large logistics centers or equipped with complete cold chain facilities to ensure efficient supply chain operation. Priority is given to locations with convenient transportation such as subway stations and public transport hubs, which support both offline in-store consumption and online order delivery, and promote the coordinated development of online and offline businesses. From the perspective of user experience, complete supporting facilities such as parking lots are also important evaluation indicators, especially in business districts and high-end residential areas, to fully optimize consumption convenience and user satisfaction.

3.2.2. Warehousing Costs

Warehousing costs mainly include warehouse rental fees and infrastructure construction costs. Rental cost, calculated by the daily rent per square meter, is the primary factor in location evaluation. Areas with complete supporting facilities such as high-end residential and office clusters have large passenger flow and sound business conditions, but high rental costs push up overall operating expenses. Therefore, Hema needs to balance rental costs and potential sales volume to select locations with high cost performance. Besides rent, labor costs and logistics costs are also taken into account to optimize comprehensive operating costs. Infrastructure costs cover the procurement and installation of shelves, forklifts, pallets and other equipment, as well as the construction of network and security systems.

3.2.3. Business Environment

Warehouse construction is a commercial activity, so the overall business environment must be fully considered. Urban central areas shorten supply chain distance and cut transportation costs, but high land prices lead to huge construction investment; suburban areas have lower land costs, yet longer transportation distances may increase logistics expenses. Hence, it is necessary to strike a balance between construction costs and operational costs including transportation, energy consumption and goods damage.

As the core node of fresh food cold chain logistics, cold storage warehouses must match the scale of regional cold chain market, logistics service capacity and industrial development needs, so that infrastructure layout can adapt to regional consumption characteristics and industrial upgrading. Logistics service quality relies on both hardware such as cold storage buildings and refrigeration equipment, and software such as information management systems. Temperature control in warehousing and timeliness in distribution jointly determine product freshness, and it is essential to establish a full-chain quality management system to meet the high standards of customers sensitive to product freshness.

4. Warehouse Location Selection Based on Analytic Hierarchy Process

A variety of location selection methods are available, and no single method is universally optimal. The selection of methods should be adapted to specific practical demands. Combined with the actual situation of Hema Fresh's warehouse location selection in Yibin, this paper adopts the Analytic Hierarchy Process (AHP). AHP combines qualitative and quantitative analysis, which is suitable for solving multi-factor decision-making problems.

4.1. Construction of Indicator System

4.1.1. Principles for Indicator Selection

To avoid subjectivity in indicator selection, the evaluation indicator system is established following the principles below.

Scientificity: The system is built on mature academic theories. Rigorous scientific research and quantitative methods are adopted to select indicators and determine weights, ensuring that all indicators objectively reflect the core demands of warehouse location selection.

Targetedness: All indicators are closely related to warehouse location selection. Indicators are screened and adjusted according to regional economic characteristics and practical demands.

Consistency: Indicator selection follows unified standards, and there is no overlap or substitution between different indicators.

Systematicness: Warehouse location selection is a complex multi-objective and multi-constraint decision problem. A systematic indicator system is required to achieve optimal balance among economy, strategic development and sustainability.

4.1.2. Construction of Indicator System

Wang Lingyu [9] defined the site selection criteria as traffic conditions, economic conditions, environmental benefits and future development potential in his research on warehouse location selection for Dalian Lvchen Fruit and Vegetable Professional Cooperative.

Zhai Xiaohui [10] selected transportation time, transportation cost, distribution coverage and customs clearance environment as the top-level indicators for bonded warehouse location selection in the research on S Logistics Company.

In the study of B2C e-commerce warehouse location selection for Company N, Chen Qiwei [11] analyzed the issue from three dimensions: economy, environment and service, and further subdivided each dimension. The economic factors include warehousing cost, logistics cost and distribution cost; the environmental factors cover logistics infrastructure, urban agglomeration level and sustainability; the service factors consist of order volume, distribution timeliness and service scalability.

Zheng Xiaona [12] put forward the indicators for emergency warehouse location selection in the research on warehouse layout of emergency reserve systems for emergencies, namely natural conditions, the matching degree with the characteristics of local hazard sources, transportation conditions, as well as policy and legal factors.

Logistics center location selection has several key goals, which are embodied in cost reduction, service improvement, expanded coverage and higher social benefits. To be specific, "cost reduction" refers to minimizing the total expenditure including fixed investment and variable costs throughout the construction and operation of a logistics center. "Service improvement" emphasizes the capability to satisfy customer needs and ensure that goods are delivered to designated places efficiently, safely and on time. To realize strong radiation capacity and sound social benefits, relevant facilities should be integrated into the existing logistics network to achieve resource collaboration and keep in line with the development demands of regional economy.

For new retail formats such as Hema Fresh, the layout of stores and warehouses requires comprehensive consideration of various factors. On the one hand, it involves the cooperation intention and capacity of real estate developers; on the other hand, it takes into account the policy support from local governments. Combining traditional location selection theories with the operational features of Hema Fresh, this paper ultimately establishes an evaluation system with four core indicators: distribution efficiency, logistics cost, completeness of supporting facilities and policy support, which is adopted as the basis for location selection decisions.

4.2. Establishment of Hierarchical Structure

Objective Layer (Top Layer): The ultimate goal to be achieved through AHP decision-making.

Criterion Layer (Middle Layer): Decision criteria and influencing factors for location selection.

Scheme Layer (Bottom Layer): Alternative warehouse location schemes.

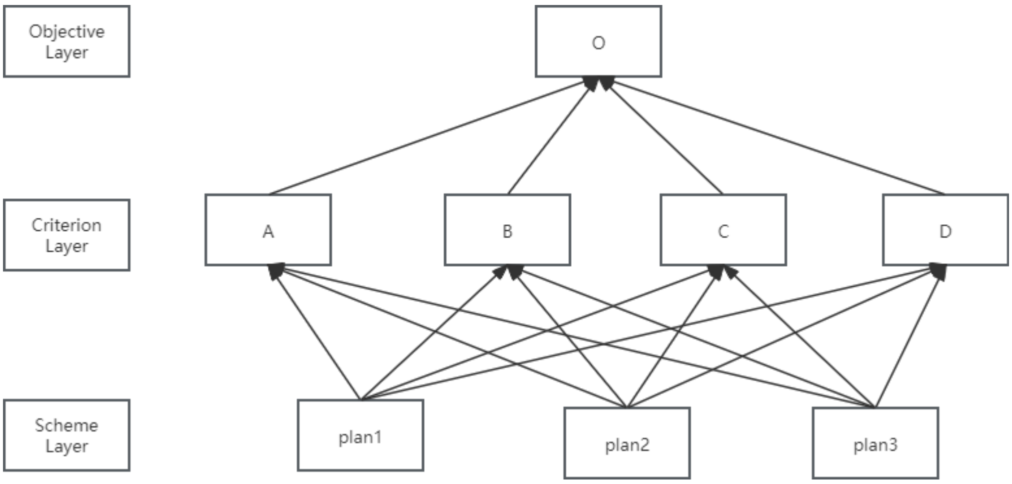

Figure 1. AHP Hierarchical Structure

4.3. Construction of Judgment Matrix

A judgment matrix is constructed by pairwise comparison of the importance of elements at the same layer under the criteria of a higher-layer element.

The constructed judgment matrix is generally shown as in the Table 1.

Table 1. Format of Judgment Matrix

C	B_1	B_2	⋯	B_j	⋯	B_n
B_1	b_{11}	b_{12}	⋯	B_{1j}	⋯	B_{1n}
B_2	b_{21}	b_{22}	⋯	b_{2j}	⋯	b_{2n}
⋮	⋮	⋮	⋮	⋮	⋮	⋮
B_i	b_{i1}	b_{i2}	⋯	b_{i3}	⋯	b_{in}
⋮	⋮	⋮	⋮	⋮	⋮	⋮
B_n	b_{n1}	b_{n2}	⋯	b_{n3}	⋯	b_{nn}

In this paper, data are generated by conducting pairwise comparisons of the relative importance of different elements and assigning corresponding scale values, followed by the construction of judgment matrices. Therefore, the criteria below are applied for data processing in this study.

This research adopts the 1–9 scale to measure the relative importance between indicators and factors. The meaning of each numeric value is specified in Table 2.

Table 2. Scale Table of Relative Importance Between Factors

Scale	Meaning
1	The two factors are equally important
3	One factor is slightly more important than the other
5	One factor is moderately more important than the other
7	One factor is strongly more important than the other
9	One factor is extremely more important than the other
2, 4, 6, 8	Intermediate values of adjacent judgments above
Reciprocal	The reciprocal value when comparing the two factors in reverse order

Since rankings are partially adopted to determine the degree of importance in the Analytic Hierarchy Process of this paper, scores are assigned to different ranks for the purpose of information quantification. The relationship between rankings and corresponding scores is shown in Table 3.

Table 3. Correspondence between Rank and Score

Rank	Score
1	3
2	2
3	1

During the comparative analysis, the scores of each factor are subtracted mutually. The correspondence between score differences and scales is shown as follows Table 4:

Table 4. Correspondence between Score Difference and Scale Value

Score Difference	Scale
1	3
2	6

4.4. Consistency Test of Judgment Matrix

Hierarchical single ranking calculates the weight of each element in the current layer relative to a certain element in the upper layer. This paper adopts the geometric mean method ($\overline{b_i}$) to calculate weights:

$$\overline{b_i} = \left(\prod_{j=1}^{n} b_{ij}\right)^{\frac{1}{n}} \quad (1)$$

Hierarchical single ranking is essentially the calculation of eigenvalues and eigenvectors of the judgment matrix. For judgment matrix B, we solve for the eigenvalues and eigenvectors that satisfy the following equation:

$$BW = \lambda_{max} W \quad (2)$$

Where λ_{max} stands for the maximum eigenvalue of matrix B; W is the normalized eigenvector corresponding to λ_{max}; Each component W_i of vector W represents the weight value of the corresponding element in the single ranking.

Subsequently, the Consistency Index (CI) is calculated to test the consistency of the judgment matrix:

$$CI = \frac{\lambda_{max} - n}{n-1} \quad (3)$$

If a judgment matrix has complete consistency, the value of CI equals 0.

Next, look up the corresponding Random Consistency Index (RI). The values of RI when $n = 1,2,\ldots,10$ are shown in Table 5.

Table 5. Average Random Consistency Indices

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.89	1.12	1.24	1.32	1.41	1.45	1.49

Calculate the Consistency Ratio (CR):

$$CR = \frac{CI}{RI} \quad (4)$$

If $CR < 0.10$, the judgment matrix is deemed to have satisfactory consistency. Otherwise, the judgment matrix needs to be revised appropriately.

4.5. Overall Ranking of Alternative Schemes

We calculate the weight vector of each element against a given element in its upper hierarchy, and eventually derive the ranking weights of all alternative schemes at the bottom hierarchy for the general objective, which are referred to as the overall ranking weights. The optimal alternative scheme can be selected accordingly. The calculation method for overall ranking is shown in Table 6.

Table 6. Calculation Method for Overall Ranking

Hierarchy A / Hierarchy B	A_1	A_2	…	A_m	Overall Ranking of Hierarchy B
	a_1	a_2	…	a_m	
B_1	b_{11}	b_{12}	…	b_{1m}	$\sum_{j=1}^{m} a_m b_{1m}$
B_2	b_{21}	b_{22}	…	b_{2m}	$\sum_{j=1}^{m} a_m b_{2m}$
⋮	⋮	⋮	…	⋮	⋮
B_n	b_{n1}	b_{n2}	…	b_{nm}	$\sum_{j=1}^{m} a_m b_{nm}$

5. Empirical Analysis

To verify that the above method is universally applicable to Hema Fresh's warehouse location selection in different regions, this paper takes the warehouse location selection of Hema Fresh in Yibin as a case to test the feasibility of the proposed method.

5.1. Preliminary Selection of Warehouse Locations

Warehouses in Yibin are mainly concentrated in the following three logistics parks:

(1) Xiangbi Logistics Park, Cuiping District

Yibin Jiudu Grain Logistics Center. Located in Xiangbi Logistics Park of Cuiping District, this project covers an area of 384 mu with a total investment of approximately 543 million yuan. It consists of three core functional areas: grain reserve and logistics, emergency processing support and comprehensive services. Supporting facilities include low-temperature horizontal warehouses, transit warehouses, edible vegetable oil storage tanks and low-temperature storage areas for finished grain. As the largest national-level grain depot in Southern Sichuan, this project is of vital strategic significance for stabilizing the supply of grain and agricultural products and improving the efficiency of grain transshipment.

Southern Sichuan Grain Warehousing and Distribution Center of Yibin. Centered on Yibin North Railway Station and extending along both sides of S206 Chuanyun Road, this project plans an industrial land area of 487 mu. It is mainly built as a grain warehousing, logistics and distribution center, equipped with a container terminal station, handling machinery such as gantry cranes, container yards, as well as low-temperature grain warehouses, auxiliary production buildings, management and living facilities.

(2) Xinlian Logistics Park, Sanjiang New Area

No.2 Warehouse of Ningde Borui. Ningde Borui stores raw materials for power batteries of Sichuan Times in advance and continuously optimizes its warehousing service capacity. At present, the enterprise is independently constructing a modern warehousing facility covering about 140 mu with a total floor area of 220,000 square meters, aiming to strengthen its supply chain support capability.

Xinlian Logistics. The total floor area of its warehousing facilities reaches 60,000 square meters, hosting 24 settled enterprises including well-known brands such as Ningde Borui, SF Express and Deqiang Express. Ningde Borui accounts for about 50% of the total business volume and takes a leading position in the park.

(3) Caiba Urban Logistics Park, Cuiping District

The Eternal Asia (Yibin) Supply Chain Integration Center covers a total area of 155 mu, with plans to construct Yitong World Zone A, Zone B and supporting commercial facilities. Zone A is built into an integrated new-type warehousing and retail model combining new retail, intelligent warehousing, commercial complex and cold chain logistics. Zone B centers on the construction of an intelligent warehousing operation center, with a total floor area of approximately 6,100 square meters and an additional office building. Upon completion, it will form a comprehensive logistics system connecting digital smart cloud warehouses and large-scale cold chain storage facilities.

The above three logistics parks are selected as alternative locations for Hema Fresh's warehouse.

5.2. Establishment of Hierarchical Structure

Objective Layer: Warehouse location selection for Hema Fresh in Yibin.

Criterion Layer: Transportation Time, Transportation Cost, Infrastructure, Government Policy.

Scheme Layer: Xiangbi Logistics Park (Cuiping District), Xinlian Logistics Park (Sanjiang New Area), Caiba Urban Logistics Park (Cuiping District).

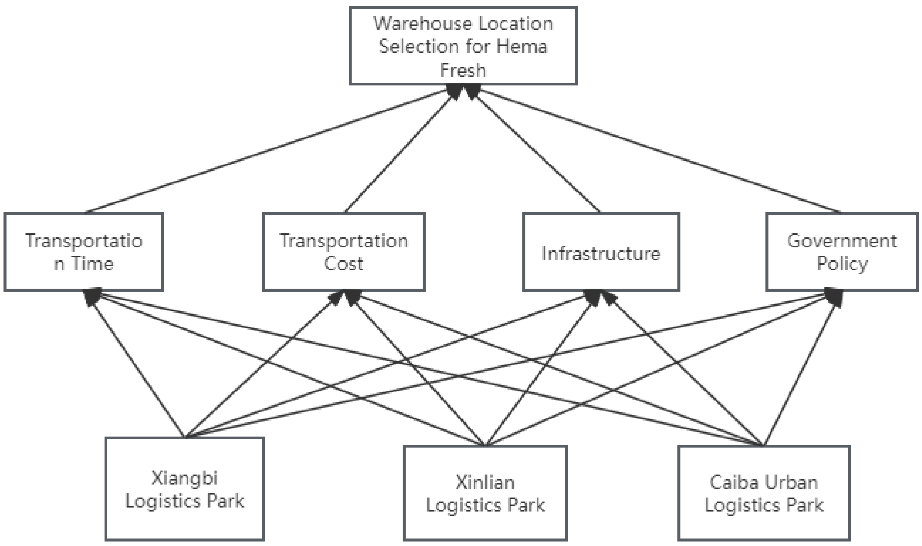

Figure 2. Hierarchical Structure Model for Hema Fresh Warehouse Location Selection

5.3. Construction of Judgment Matrices

Judgment matrices are established via pairwise comparison of selected elements in accordance with the above rules.

Referring to relevant literature and combining with the actual demands of Hema Fresh's warehouse location selection, the judgment matrix for the four indicators in the criterion layer is constructed as shown in Table 7.

Table 7. Judgment Matrix for Four Factors in the Criterion Layer

	Transportation Cost	Transportation Time	Infrastructure	Government Policy
Transportation Cost	1	2	5	8
Transportation Time	1/2	1	2	5
Infrastructure	1/5	1/2	1	2
Government Policy	1/8	1/5	1/2	1

Table 8. Judgment Matrix for Transportation Time of Three Alternative Schemes

	Xiangbi Logistics Park	Xinlian Logistics Park	Caiba Urban Logistics Park
Xiangbi Logistics Park	1	1/3	3
Xinlian Logistics Park	3	1	6
Caiba Urban Logistics Park	1/3	1/6	1

Table 9. Judgment Matrix for Transportation Cost of Three Alternative Schemes

	Xiangbi Logistics Park	Xinlian Logistics Park	Caiba Urban Logistics Park
Xiangbi Logistics Park	1	3	1/3
Xinlian Logistics Park	1/3	1	1/6
Caiba Urban Logistics Park	3	6	1

Table 10. Judgment Matrix for Infrastructure of Three Alternative Schemes

	Xiangbi Logistics Park	Xinlian Logistics Park	Caiba Urban Logistics Park
Xiangbi Logistics Park	1	1/3	3
Xinlian Logistics Park	3	1	6
Caiba Urban Logistics Park	1/3	1/6	1

Table 11. Judgment Matrix for Government Policy of Three Alternative Schemes

	Xiangbi Logistics Park	Xinlian Logistics Park	Caiba Urban Logistics Park
Xiangbi Logistics Park	1	1/3	3
Xinlian Logistics Park	3	1	6
Caiba Urban Logistics Park	1/3	1/6	1

5.4. Consistency Test

The consistency test procedures for the judgment matrix of the four factors in the criterion layer are presented as follows Table 12.

Table 12. Calculation of Geometric Means for Four Criteria

Criterion	Calculation Formula	Unnormalized Geometric Mean
Transportation Cost	(1×2×5×8)1/4	≈2.9907
Transportation Time	(0.5×1×2×5)1/4	≈1.4953
Infrastructure	(0.2×0.5×1×2)1/4	≈0.6687
Government Policy	(0.125×0.2×0.5×1)1/4	≈0.3347

Total sum of geometric means (Table 13):

2.9907+1.4953+0.6687+0.3347≈5.4894

Table 13. Calculation of Normalized Weights for Four Criteria

Criterion	Weight Calculation	Normalized Weight
Transportation Cost	2.9907/5.4894	0.5448
Transportation Time	1.4953/5.4894	0.2724
Infrastructure	0.6687/5.4894	0.1218
Government Policy	0.3347/5.4894	0.0610

Consistency Test

Calculate the maximum eigenvalue λ_{max}

$$BW=B\times W$$

$$1\times0.5448+2\times0.2724+5\times0.1218+8\times0.0610\approx2.2176$$

$$0.5\times0.5448+1\times0.2724+2\times0.1218+5\times0.0610\approx1.0890$$

$$0.2\times0.5448+0.5\times0.2724+1\times0.1218+2\times0.0610\approx0.4896$$

$$0.125\times0.5448+0.2\times0.2724+0.5\times0.1218+1\times0.0610\approx0.2448$$

$$\lambda_{max}=(2.2176/0.5448+1.0890/0.2724+0.4896/0.1218+0.2448/0.0610)/4$$

$$\approx(4.071+3.997+4.020+4.013)/4\approx4.025$$

Calculate the Consistency Index (CI) and Consistency Ratio (CR):

$$CI=\frac{\lambda_{max}-n}{n-1}=\frac{4.025-4}{3}=0.0083$$

Look up the table to obtain the Random Consistency Index (RI): (RI=0.89) when (n=4).

$$CR=\frac{CI}{RI}=\frac{0.0083}{0.89}\approx0.0093$$

The judgment matrix has full consistency, so no revision is required.

Similarly, the consistency test results and weight coefficients of the judgment matrices for the three alternative schemes are as follows:

Transportation Time: Consistency ratio (CR=0.0164<0.1),

(λ_{max} =3.019) Weights: Xiangbi Logistics Park = 0.2499; Xinlian Logistics Park = 0.6549; Caiba Urban Logistics Park = 0.0954

Transportation Cost: Consistency ratio (CR=0.0164<0.1), (λ_{max} =3.019) Weights: Xiangbi Logistics Park = 0.2499; Xinlian Logistics Park = 0.0954; Caiba Urban Logistics Park = 0.6549

Infrastructure Consistency: ratio (CR=0.0164<0.1), (λ_{max} =3.019) Weights: Xiangbi Logistics Park = 0.2499; Xinlian Logistics Park = 0.6549; Caiba Urban Logistics Park = 0.0954

Government Policy: Consistency ratio (CR=0.0164<0.1), (λ_{max} =3.019) Weights: Xiangbi Logistics Park = 0.2499; Xinlian Logistics Park = 0.6549; Caiba Urban Logistics Park = 0.0954

All judgment matrices have a CR value less than 0.1, which indicates satisfactory consistency. The analysis results are valid and reliable.

5.5. Final Warehouse Location Selection

Table 14. Calculation of Overall Weights for Four Criteria

Alternative Scheme	Transportation Cost (0.5448)	Transportation Time (0.2724)	Infrastructure (0.1218)	Government Policy (0.0610)	Total Score
Xinlian Logistics Park	0.0954×0.5448=0.0520	0.6549×0.2724=0.1846	0.6549×0.1218=0.0801	0.6549×0.0610=0.0390	0.5025
Xiangbi Logistics Park	0.2499×0.5448=0.1364	0.2583×0.2724=0.0704	0.2499×0.1218=0.0306	0.2499×0.0610=0.0149	0.2522
Caiba Urban Logistics Park	0.6549×0.5448=0.3574	0.0954×0.2724=0.0269	0.0954×0.1218=0.0117	0.0954×0.0610=0.0057	0.2478

Final Ranking Results

Xinlian Logistics Park, Sanjiang New Area: 0.5025 (50.25%)

Xiangbi Logistics Park, Cuiping District: 0.2522 (25.22%)

Caiba Urban Logistics Park, Cuiping District: 0.2478 (24.78%)

Based on the comprehensive analysis of the above results, Xinlian Logistics Park in Sanjiang New Area is selected as the warehouse location for Hema Fresh.

6 Conclusion

With the continuous advancement of Internet technologies and constant innovation of electronic payment methods, online shopping has gradually broken the limitations of traditional retail, which takes physical stores as its main sales channel, and has won wide public acceptance.

The fresh food market is huge in scale, and fresh products are characterized by high-frequency repeat purchases, which means the sector enjoys bright development prospects in the field of e-commerce. However, fresh goods are perishable in nature, posing a host of thorny problems and challenges for online businesses. To keep product quality stable and lower the risk of losses during long-distance transportation, it is crucial to carry out scientific planning for warehousing network layout.

In modern supply chain systems and the daily operation of related enterprises, logistics node location selection is a key strategic issue for optimizing overall operational efficiency, and also an essential part of realizing lean supply chain management. The logistics industry in China develops relatively slowly. When making location decisions, most enterprises either rely too much on empirical judgment or overemphasize short-term benefits. Such practices not only restrict the sustainable development of enterprises, but also may result in low efficiency and waste of resource allocation.

This paper takes the key factors influencing logistics center location selection as the research subject. It applies the Analytic Hierarchy Process to evaluate and screen alternative schemes, aiming to provide enterprises with more scientific and reasonable support for location decision-making.

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