Paradigm Academic Press
Innovation in Science and Technology
ISSN 2788-7030
NOV. 2023 VOL.2, NO.6

Analysis of Pharmaceutical Plant Location Design in Cities

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doi:10.56397/IST.2023.11.08

Abstract

In the contemporary era, heightened by China's advancing national prowess and improved living standards, health concerns have gained prominence in societal discourse. While medicine is instrumental in preserving health, the impact of pollution from pharmaceutical processes, particularly wastewater, poses health risks. Consequently, judiciously siting pharmaceutical plants assumes paramount importance. China is currently in the nascent stage of pharmaceutical plant location, lacking a comprehensive practice. Selecting an appropriate site efficiently remains a critical challenge. This paper advocates the Analytic Hierarchy Process (AHP) as a superior method for this purpose. Considering environmental and economic factors, it introduces indicators like environmental functional zoning, sensitivity, traffic, meteorological disasters, and local economic development. The AHP model quantitatively analyzes these factors, determining optimal locations through weight distribution and consistency indicators. This approach offers a systematic framework for pharmaceutical plant location planning.

Keywords: location of pharmaceutical plant, analytic hierarchy process, the hierarchical model, weight distribution, consistency indicator

1. Introduction

The pharmaceutical factory is a production department of antibiotics, chemical synthesis drugs, biochemical drugs, phytochemical drugs, traditional Chinese medicine, etc. With the improvement of people's understanding level, the problem of the location of pharmaceutical companies has increasingly aroused our general attention and reflection. The design and research of pharmaceutical factory construction is an important strategic goal in realizing the long-term health, sustainable, stable and prosperous development of the Chinese nation. Although the development of the domestic pharmaceutical industry is relatively backward compared to other countries, we are the largest microbial production base in Asia and the largest pharmaceutical resource pool in the world, which provides a good foundation for the development of China's pharmaceutical industry (Wu Jianwen, 2006).

In the first year of the 14th Five-Year Plan, the pharmaceutical industry has entered an era of reform and innovation and has given a series of supports to the whole life cycle of clinical trials and drug production. In terms of policies, in order to encourage the research and development of innovative new drugs, improve the quality of drug efficacy, and better meet the needs of the vast number of people, the state has issued relevant pharmaceutical policies. The release of these policies has played a leading role in the entire pharmaceutical industry, making the pharmaceutical industry move forward in the direction of standardization and rationalization.

With the rapid development of science and technology and industrial technology in today's world, and the acceleration of the combination of biopharmaceutical with energy, science and technology, information and communication and other related technologies, the return of outstanding overseas medical technicians has become the focus of continuous innovation in the pharmaceutical industry, playing an irreplaceable role in building a clean and beautiful world and building the destiny of mankind (Sun Zhengyang, Wei Lijun & Chen

Huan, 2022).

1.1 Background, Purpose, and Significance of the Topic

1.1.1 Background of the Topic

There is no doubt that drugs play a vital role in improving people's life and health. With the continuous development of the country, people's health awareness is constantly enhanced, and the safety and quality of drugs are particularly critical (Wang Chengfeng, 2008). In recent years, China has successively promulgated laws and regulations related to pharmaceuticals, which plays a good role in improving the rationality and standardization of pharmaceuticals, and pharmaceutical factories, as the main suppliers of pharmaceuticals, cannot make any mistakes in the whole process. In terms of plant construction and plant site selection, the state has also issued corresponding standards (Jiang Y., 2020) and clearly proposed the direction and objectives. In order to enable the large-scale development of drugs, pharmaceutical factories have begun to be built in various places, such as Beijing Great Wall Pharmaceutical Factory, Tianjin Important Pharmaceutical Factory and other large pharmaceutical factories, which have put forward clear requirements for the location of pharmaceutical factories. Before the construction of the site, an environmental impact assessment is required to determine the final location. At present, a more effective and accurate multi-objective integrated decision-making system is needed, while the current methods related to the location of pharmaceutical plants are mostly scattered, and a complete plan is required to solve the problem (Fu Xiaocheng, Huang Xiaodong & Du Fenglei, 2020).

1.1.2 Purpose of the Topic

The reasonableness of the site selection of the pharmaceutical plant will directly affect the environmental impact, construction, and operation cost of the plant. This paper attempts to identify the impact of pharmaceutical factories on the surrounding environment through engineering analysis, summarizes the content of factory location in relevant policies laws and regulations of pharmaceutical factories, and establishes an evaluation index system and the evaluation method of each index to guide factory location. Finally, the actual site selection case of a pharmaceutical factory can provide a technical reference for rational site selection of pharmaceutical factory projects.

Through the comprehensive evaluation of the economic benefits, social benefits, product efficiency and environmental benefits of the enterprise, the evaluation index that plays an important role in the overall benefits of the enterprise is determined, and the most suitable pharmaceutical factory is selected, which plays a good role in the construction of green and low-carbon cities in China. The site is in the fields of science and technology development, policy formulation and environmental protection. It has actively promoted the development and use of green resources (WU H., 2013).

This paper uses the analytic hierarchy process (AHP) model to carry out consistency analysis and weight comparison of factors affecting the location of pharmaceutical factories, combing with local urban development planning and relevant national standards, and finally conducting simulation analysis through actual cases to test whether it is reasonable and effective. It is hoped to provide a set of scientific, fast and effective location models for the location of pharmaceutical factories. Drive the entire pharmaceutical industry to develop positively.

1.1.3 Significance of the Topic

Site selection is of indispensable importance in life. Through the design and analysis of the site selection of pharmaceutical factories, a feasible scheme can be provided for the next site selection, thus providing a reference. Whether the location is reasonable, economic cost and route transportation are of great help. The topic of selecting a pharmaceutical factory is chosen according to China's economic development and yearning for a healthy and comfortable life (HU P P., 2015). At present, drug production is a very effective means for us to resist diseases. In the past ten years, the pharmaceutical industry has always adhered to the good development policy of linking economic policies and investment environment and coordinating and unifying, and has achieved remarkable results. Some pharmaceutical industries have made remarkable progress in the optimization of industrial structure, energy conservation and consumption reduction, and pollution prevention and control. Some pharmaceutical companies have strengthened their clean production concept and successively obtained various environmental protection certificates; At the same time, some pharmaceutical companies have strengthened their industrial structure and technological innovation, and the pharmaceutical industry has made outstanding contributions to the development of the national economy, but its environmental problems have also been exposed, and it has become one of the industries with high energy consumption and high emissions.

At the same time, although China's pharmaceutical industry has made some achievements in "energy conservation, consumption reduction, pollution reduction and efficiency improvement" (Lu Guisheng, 2021), there is still a certain gap compared with the world's advanced pharmaceutical enterprises. At the same time, the waste gas, waste water and waste residue produced by pharmaceutical factories affect our quality of life, which is an urgent matter for urban development. The location of the pharmaceutical factory, it points out the direction for the next development of the pharmaceutical industry, improves the quality of life of residents to a certain extent, and plays a great role in reducing environmental pollution. The state has put forward new plans and requirements for the construction of the pharmaceutical industry in the "14th Five-Year Plan". With the support and encouragement of the Chinese government, the pharmaceutical industry is slowly getting better. The trend of the industry can be said to be irresistible, and the relevant research on the location of pharmaceutical plants in China is relatively scarce. It is hoped that the selection of this related topic design can provide a new idea and a convenient and efficient method for the location of pharmaceutical plants. The results of the application of the analytic hierarchy process can be used to conduct new thinking and research on the existing or currently under construction of pharmaceutical plant construction projects, judge whether the site of the facility construction is reasonable, and summarize the rules and experience accordingly, and provide certain suggestions for improving the site selection requirements of pharmaceutical plant projects and relevant laws and regulations.

1.1.4 Technical Route

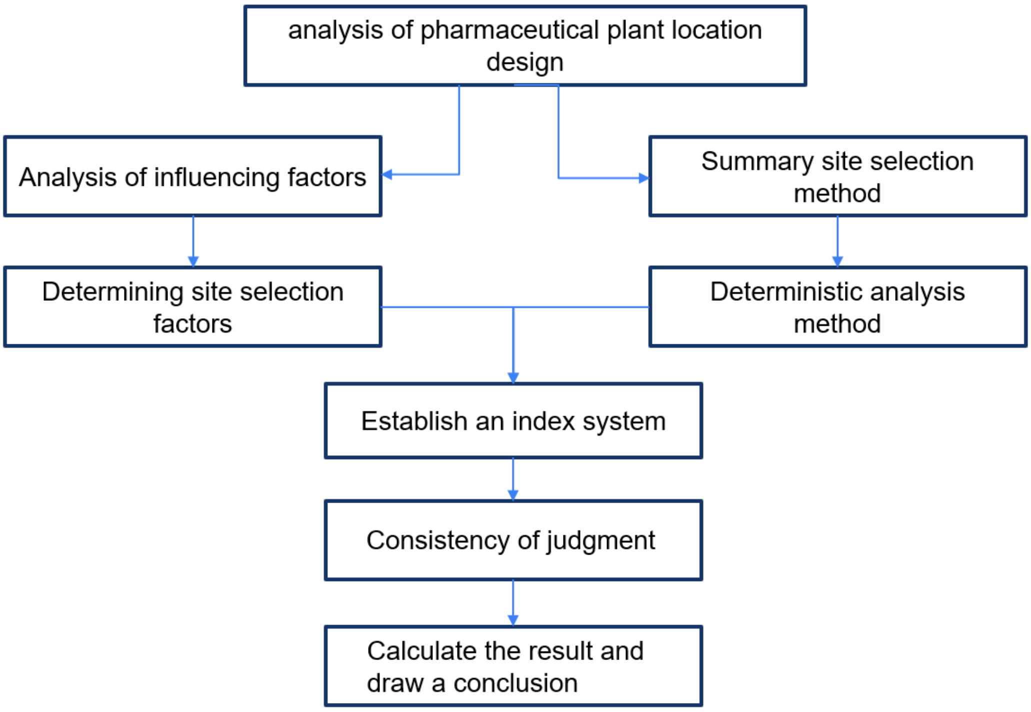

Figure 1. Technology Roadmap

1.1.5 Research Status of Topic Selection

Through searching the relevant references, we find that there are very few aspects about the location of pharmaceutical factories, and most of the construction project location studies in China are about banks or commercial outlets. Different construction projects should adopt different indicators and requirements, and most of the current site selection in China is carried out with reference to industrial site selection. For facilities such as pharmaceutical factory projects, their impact on the environment and particularity should be considered. Under the influence of environmental, economic, legal, and social factors, in-depth research and analysis should be carried out according to relevant national laws and regulations. To obtain reasonable site selection requirements (Hu J., 2020).

1.2 Research Ideas and Contents

1.2.1 Research Ideas

(1) First of all, through the Internet, literature, books and other relevant channels understand the laws, regulations and technical guidelines related to the construction project of the pharmaceutical plant, and have a preliminary understanding of the site selection of the pharmaceutical plant project.

(2) Then query the relevant materials and environmental impact assessment reports related to the location of the pharmaceutical plant, record and analyze the index factors related to the location of the pharmaceutical plant construction project, find out the common points and differences of each case, and integrate them.

(3) Analyze the key points of the summary. Factors such as economic benefit, environmental benefit and social benefit are the top priorities in the analysis, and put forward the influencing factors and evaluation index system of pharmaceutical plant site selection, and then study the assignment method of each index.

(4) Rational use of analytic hierarchy process, bring the proposed evaluation index system into it, establish a suitable analytic hierarchy process model, and verify whether it is reasonable and effective.

(5) Select the actual case, substitute the established hierarchical analysis model, conduct relevant simulation calculation on the case, comprehensively select the final result, and then use it as a suitable basis to judge the rationality of the site selection of the case and analyze the feasibility of the model.

(6) Further improve the model, adjust its structure, and make it further perfect.

1.2.2 Research Content

(1) Analyze and summarize the historical data, literature, technical guidelines for environmental assessment and environmental assessment reports related to the pharmaceutical plant project, study the current situation of the pharmaceutical plant site selection at home and abroad, and find the most suitable site selection method for China, that is, use the analytic hierarchy process to analyze the influencing factors of its site selection and establish a site selection evaluation index system, so as to reach the final conclusion. The calculation result is substituted into the actual case to judge the rationality.

(2) Analyze the factors affecting the location of the pharmaceutical plant, such as environmental and economic factors, and then summarize and put forward various factors, such as meteorological and climatic conditions, environmental function zoning, land price, etc., and quantify them, and then create corresponding indicators for record by referring to relevant laws and regulations of environmental impact assessment.

(3) Different indicators have different content requirements. Quantitative indicators corresponding to relevant influencing factors are searched for and recorded, and the meaning and content contained in the indicators are summarized to build a complete AHP location analysis model.

(4) According to the relevant literature and the contents of the EIA report, the assignment method for each indicator is summarized, and the specific assignment for the indicator elements in each layer is carried out. The calculation of weight needs to be carried out in the created model (Hu Qi, ZHOU Qianxun, Chen Qi, SHEN Baiyu & XIANG Jiaqi, 2022).

(5) The premise is that the model structure is correct. Check that there is no problem in the model, select a suitable case, including two or three plant site alternatives, compare and assign values in the established AHP model, and then compare the consistency of the calculated results with the actual results to determine the rationality and feasibility of the index system and location selection method (Chi Xiujun, 2011).

2. Location Selection of Pharmaceutical Factory

2.1 Principles of Location Selection for Pharmaceutical Factories

2.1.1 Overall Urban Planning

Pharmaceutical plant planning site selection work is a key first step into the development and construction process of pharmaceutical plants, but also a particularly critical step, the first is that we should give priority to the overall construction and development of an industry in the city where the pharmaceutical factory enterprise is located and the layout planning, such information can be obtained in the websites of relevant national functional departments such as the State Bureau of Natural Resources and the Ecological Environment Bureau. You can clearly know the environment, weather, population density, land utilization, geographical area, and the future development of a city, reasonable choice of pharmaceutical plant site is not only important for the environment but also important economically, especially in the case of reducing project costs. The location selection principle of pharmaceutical plant was proposed after understanding relevant technical guidelines and laws and regulations (Wang Hongguang & Wang Guoping, 1997).

(1) Considering the convenience of transportation at home and abroad, the transfer and transportation of raw materials between pharmaceutical factories are often more frequent, in order to more effectively reduce the transportation costs that often occur between raw materials transfer stations and on the way to the operation, pharmaceutical factories should maximize their capacity. When making the site selection planning, we should focus on the convenience of transportation.

(2) The pharmaceutical factory must be able to ensure a timely supply of water and power to the pharmaceutical factory. To maintain a modern pharmaceutical factory, it is necessary to provide sufficient water for basic life production. In the normal operation of the entire pharmaceutical enterprise, sufficient production power capacity and sufficient and stable production water source are very important for the operation of a large pharmaceutical factory enterprise group. There are many medium and large raw material factories; The losses caused by frequent

power outages and other events can be quite heavy. Therefore, it must be strictly required that there be at least one before and after two power supplies to ensure continuous power generation, in case one of the power supply in or out of the power supply short-circuit failure, there is another power supply that can be used to ensure the supply.

(3) To protect the environment, pay attention to the environmental protection of pharmaceutical enterprises, for some large modern pharmaceutical factory production enterprise management, for some harmful production environment, cannot blindly choose, because these environments will obviously affect the normal and clean production and operation of this type of pharmaceutical factory. Avoid dust, smoke, toxic gas, and other environmental pollution, but also avoid all kinds of mould and pollen in the factory. But sources of mould are everywhere and hard to avoid. In addition, a variety of harmful pollen can be transmitted through mould viruses. In the domestic control of plants and garden projects in chemical industry plants, the minimum provisions for flowers and plants in chemical factories are: the use of artificial greening without floc will not produce floc. On the other hand, the large amount of toxic and harmful waste generated in the production process of pharmaceutical companies should also be fully considered for its potential pollution to chemical production and surrounding areas. The above two basic requirements should also be done, without one.

(4) The safety distance should be conducive to ensuring drug safety, and the safety distance must not allow any negligence in terms of the choice of pharmaceutical enterprises. When selecting a good pharmaceutical factory, we should try our best to standardize it and meet the requirements of the relevant regulations and regulations of our country and the current local management of pharmaceutical factories. It is also necessary to maintain a reasonable and effective safety and production distance between us and other neighbouring plants.

(5) Enterprises should know how to save land for production activities, cherish and save land, and choose land with low investment costs, which is very important for the total investment cost of fixed assets of pharmaceutical enterprises.

(6) The impact of flood should also be considered when selecting the workshop (LU Bin, 2014). In general, the area where the plant is located should be in accordance with the prevailing town planning and the earthwork balance of flood control works, but its location should be above the local maximum annual flood level of 0.5 m.

2.1.2 Relevant National Technical Standards, Guidelines, and Policy Provisions

The Environmental Impact Assessment Law of the People’s Republic of China was deliberated at the 30th session of the Ninth Standing Committee of The State Council on October 28, 2002, and promulgated after the second amendment and revision on December 29, 2018. The Technical Guidelines for Environmental Impact Assessment for Pharmaceutical Construction Project (HJ 611-2011) is designed to regulate the environmental protection work of drug manufacturers. It was officially implemented in June 2011.

2.2 Method of Location Selection of Pharmaceutical Plant

The development of the pharmaceutical industry is related to the development of society and people’s health. The pharmaceutical factory site should be carefully, consider many factors, the focus of which should be the pharmaceutical process produced in the wastewater, waste gas, and solid waste pollution to the environment, they exist in the microorganisms, gases and so on harm to human health. The pharmaceutical industry has entered an era of reform and innovation, in clinical trials, drug production and other life cycle to give a series of support, a rational pharmaceutical factory is very important for the pharmaceutical industry.

2.2.1 Traditional Method of Site Selection

In the traditional way of location selection, usually select several alternative sites, and then evaluate and analyze them, among which the most common are: the ratio matrix method, judgment priority method, centre of gravity method mathematical programming method, mathematical planning method, scoring method and so on. All three methods have their advantages and disadvantages.

2.2.2 Geographic Information System (GIS)

GIS is a hot method in China’s space field. Its system adopts computer hardware system to collect, store, manage, operate, analyze, display, and describe all or part of the geological data of the surface (including the atmosphere), and can provide various data (in short, analyze various natural phenomena and activities in the world) (Zhang Qian, 2012). GIS technology combines its unique visual geographical analytical capabilities with conventional database operations such as inquiry and statistics. It has powerful data processing and data processing capabilities. Simply put, it is a data-based database used to process massive data (Li Ning, 2022). GIS is a very general technology with a complete digital analysis function. 3S technology is also one of the most valuable technologies at present. The excellent performance of GIS can be used as a reference and guarantee for other technologies. Through the comprehensive mathematical modelling analysis of images, the correlation relationship is found, which lays a solid basis for the realization of the purpose. In addition, GIS mainly relies on satellite and remote sensing technology. With the support of many satellites and remote sensing technologies, GIS retains a large amount of data information for our use. The returned pictures can be found as hidden connections through complete mathematical model reasoning application, thus laying a good foundation.

2.2.3 Fuzzy Comprehensive Evaluation Method

Mr. Chad, a famous computer automation expert in the United States, proposed a fuzzy comprehensive evaluation method in 1965. By using the subordination in fuzzy mathematics, the qualitative evaluation method is transformed into a quantitative evaluation method, which uses the fuzzy mathematics method to make a comprehensive evaluation of the target limited by numerous impact factors (Xue Yanyu, 2022). Use fuzzy mathematics to make an overall evaluation of things or objects that are subject to multiple factors. The advantages of this method are: the conclusion is clear, the system is complete, it can solve fuzzy and difficult-to-quantify problems, has strong solving ability, and can be used to solve a variety of uncertain problems.

3. Analytic Hierarchy Process

3.1 Concept of Analytic Hierarchy Process

AHP has the following characteristics: It makes a profound analysis of the nature, influencing factors and internal relationships of problems, and uses limited quantitative knowledge to transform decision-making thinking into simple decision-making problems with multi-objectives, multi-criteria, or no structural characteristics (He Yujie, 2021). The theoretical architecture of AHP is clear and intuitive, and its basic principle is to divide a problem into multiple simpler problems according to the way of decision level and subdivide fewer parts of larger elements (Ji Dan & Guo Zheng, 2009). The top-level purpose layer refers to the limiting factor of complex problems as the limiting layer of hierarchical analysis, and the subunit of the limiting factor is the unit of hierarchical structure (Yang Yongfeng, 2022). In this way, we can quickly analyze the problem, find the most important impact factors, and then consider other factors. Mathematically, we're going to put it all together by building a model that looks for similarities between the elements. The establishment of the model helps us to analyze the problem more quickly. In the process of site selection, the most influential factors to be considered and the second influential factors to be considered will be listed as key factors in the future site selection process of pharmaceutical factories.

3.2 Basic Principles of Analytic Hierarchy Process

The four principles of site selection are the same city, the influencing factors are independent, the indicators can be quantified, and they are related to site selection. Therefore, according to the four principles of site selection and relevant literature, the analytic hierarchy process can be roughly divided into four basic steps (Zhang Weiwei, 2007):

(1) First determine the influencing factors of site selection.

(2) Refine the influencing factors into the middle layer, determine different alternatives, and form a hierarchy.

(3) Score each factor to form a judgment matrix.

(4) Use the decision matrix to obtain the maximum weighting value in order to obtain the best scheme.

3.3 Advantages and Disadvantages of Analytic Hierarchy Process

Advantages:

(1) Systematization: For analytic hierarchy process, the target is not only an individual, but also a system formed by various aspects because of this individual, which is then decomposed in the above aspects and compared with the decomposed contents. Then, based on the above two steps, comprehensive consideration is carried out and relevant decisions are finally made, which plays an important role and influence in system analysis (Li Wei, 2019).

(2) Simplicity: The calculation process of the analytic hierarchy process is extremely simple, and the results reflected are also intuitive and clear, which is very easy for decision-makers to understand and master.

(3) Practicability: Combining qualitative and quantitative methods, traditional methods have relative limitations in solving problems, and there are many difficult problems, and the analytic hierarchy process can analyze and solve such problems when dealing with problems.

Cons:

(1) Limitations: only one option can be selected from the existing option, and it cannot create a new, more favourable option.

(2) Uncertainty: too many indicators mean too much data, and the weight cannot be determined. More indicators will construct more matrices, resulting in errors in the comparison judgment between the two indicators.

(3) Subjectivity: In the construction of a hierarchical model and comparison matrix, the subjective aspect of people has a great influence. Therefore, to solve this problem, it is necessary to have a lot of data and professional support (An Bowen & Hou Zhenmei, 2021).

4. Choose the Appropriate Method

4.1 Advantages and Disadvantages of Fuzzy Comprehensive Evaluation Method

Advantages:

(1) The fuzzy comprehensive evaluation method is to accurately quantify the fuzzy evaluation objectives, so that the fuzzy data included can be evaluated scientifically, reasonably, and truly (Li Ting, Yang Lian & Cui Shangshu, 2022).

(2) The evaluation result is not a point value, but a vector. Compared with other methods, the biggest advantage of this evaluation is that it can obtain more information. At the same time, the existing information can be processed to make it more perfect, and then the obtained information and results are more valuable.

Cons:

(1) Compared with other methods, FEM calculation is more complex and cumbersome, and it is also more subjective when evaluating indicators.

(2) When the index set U is large, the sum of weight vectors is 1, which will cause a new problem, that is, the relative membership weight coefficient is relatively small, and the fuzzy matrix R cannot match the two factors in the weight vector, so the result is not clear and its content cannot be expressed intuitively (Xue Yanyu, 2022).

(3) Can only analyze the existing target plan, and cannot produce a new, more reasonable plan.

4.2 Advantages and Disadvantages of GIS Method

Advantages:

(1) Input methods include scanning input, GPS input, digital instrument input and other methods, and can obtain specific data from DBASE, FOXBASE and other databases, and correct these data.

(2) In the process of mapping, there is a great advantage, that is, it can be dynamically modified according to its own subjective intention. This editing ability and multimedia data ability are the biggest advantages, and it has the function of integrating the attributes of multiple data from the structure.

(3) It has the characteristics of spatial analysis and corresponding functions with good stability, and can realize the overlap of three-dimensional objects and the retrieval of topological space (Yang Yiyuan & Yang Cunjian, 2022).

Cons:

(1) At present, GIS is still in a closed environment without any spatial data and models, so there are huge differences in the structure of geographic information.

(2) In the measurement process, various errors will inevitably occur due to the differences in carrier properties and media of relevant data (Cui Tao, 2011).

From the above description, we can know that there are many methods in the location selection process of pharmaceutical plants, such as fuzzy evaluation method, gray clustering method of gray system theory, expert system method, geographic information system (GIS) method, etc. After understanding their respective characteristics and principles, I think the analytic hierarchy process is still necessary for the location selection analysis of pharmaceutical plants. The influence factors can be clearly seen and the calculation is clear. Other methods are complicated in data application and require complex mathematical models for analysis and operation, which will cause time delay. Moreover, every step of calculation requires careful calculation, and the wrong step will lead to the wrong step in the next step. In the process of operation, all the influencing factors should be listed for data collection, and then analyzed and compared to draw a conclusion. The following contents are included in the conclusion: the weight distribution and consistency of each influencing factor, and the proportional distribution of the number of questionnaires to different influencing factors in the survey.

5. Construct the Index System Model

First of all, we classify the selected impact factors according to their characteristics to form element layer C, target layer A is the decision target, the middle layer of the analytic hierarchy process is the impact factor of the location of the pharmaceutical factory, the subsystem of the middle layer is the refinement of the element layer and further refinement, and the last layer is the scheme layer. An AHP architecture pattern consisting of a target layer, intermediate layer and solution layer has been formed.

5.1 Analysis of Influencing Factors

According to the development planning of Jiangsu Province and Taizhou City, as well as the influencing factors to be considered in site selection, I selected the following influencing factors, namely environmental factors, and economic factors, in combination with the actual situation. The environmental factors are divided into four parts, namely meteorological conditions, environmental functional zoning, water environment, environmental sensitive points and protection objectives, and the economic factors are divided into two parts, namely traffic distance and land price. Further refine the environmental factors, the meteorological conditions are divided into wind direction and wind speed, and geological conditions are not considered because there is no obvious difference in the same city; Environmental function zoning is divided into ambient air, acoustic environment and surface water. The water environment is listed separately because water is an essential raw material in pharmaceutical factories, and the type of water used in different treatment processes will also be different. Although pharmaceutical plants have treatment processes, pollution caused by waste gas, waste water and waste residue will still affect sensitive targets (ZHANG Yanming, LEI Teng-yun, GAO Rui & LI Jing-yu, 2019), which should be protected.

(1) Meteorological conditions

Meteorological conditions are a key step in the site selection because the pharmaceutical factory will produce some gases in the process of pharmaceutical, these gases will be emitted into the air, under normal circumstances, pharmaceutical companies and factories will choose the upwind direction of residential buildings, which can effectively reduce or avoid the impact of smoke production on the surrounding residents. In addition to the wind direction, the air velocity has a greater effect on the concentration of pollutants. At higher speeds, the larger the spread area of smoke, the smaller the concentration of pollutants. Therefore, the location must consider the wind direction and wind speed.

(2) Environmental function zoning

The sound environment, ambient air, and surface water are placed in the functional area. Because the mechanical sound of the pharmaceutical factory is sometimes very loud in the pharmaceutical process, the noise source (type, quantity, and noise level), the existing noise sensitive targets, the boundary noise exceeding the standard, and the population distribution affected by noise should be fully listed in the site selection. The surrounding influences are not the same, so consider the acoustic environment; In the pharmaceutical process, due to the use of a large amount of water, pharmaceutical wastewater is produced, which has a certain impact on the environment, so consider surface water; The exhaust gas produced by the pharmaceutical factory will have a certain impact on the air, so consider the ambient air.

(3) Water environment

Surface water conditions generally include water system distribution, hydrological characteristics, extreme water conditions, distribution and utilization of surface water resources. According to the specific content of the environmental impact assessment report, the main evaluation indicators related to site selection are water resources distribution and water quality. Pharmaceutical factories require endless supply of water as long as the process is complete, and different drugs require different types of water. So consider the water environment.

(4) Environmental sensitive points and protection targets

When selecting the site, the pharmaceutical factory should consider the surrounding influences, that is, sensitive points and protection targets, and consider their scale and type, such as whether it is a national nature reserve, natural scenic spot, mineral deposit area, etc.

(5) Traffic distance

The distance factor is one of the factors affecting the economy, which affects the costs related to the transportation of drugs and raw materials. Secondly, the transportation distance affects the kind of transportation means used, and different transportation means also have different degrees of environmental pollution.

(6) Land price

In the same city, there will be different prices in different areas. A cheap price means a small economic cost, expensive price means a high construction cost.

5.2 Establish an Indicator System

Table 1. Index system

Target layer	Primary factor	Secondary factor	Tertiary factor
	Environmental factor	Meteorological condition	Wind speed

		Environmental function zoning	Surface water
			Ambient air
		Water environment	Water quality
Analysis of pharmaceutical plant location design			The extent to which water resources are used.
			Distribution of water sources
		Environmental sensitive points and environmental protection objectives	Distribution scale of sensitive points
			Protection target type
	Economic factor		Land price
			Traffic distance

5.3 Finding Feature Roots and Feature Vectors

The elements in the three layers are connected from the bottom to the top in pairs according to the rule to form a judgment matrix, which is called aij, then you can set (Yang Yanhua & Lv Yuejin, 2018).

$$a_{ij}>0 \qquad (5.1)$$

$$a_{ij}=1/a_{ij}\ (i,j=1,2,3,\dots)\ a_{ij}=1 \qquad (5.2)$$

Under the goal of pharmaceutical plant location design, environmental and economic factors are divided into meteorological conditions, environmental functional zoning, water environment, land price and traffic distance, etc., and the importance of each factor is determined by a certain proportion of each influencing factor judged by experts. In order to obtain a quantitative discrimination matrix, it is necessary to compare various influencing factors. Psychologists believe that the limit of people’s ability to distinguish between information registers is 7, 2, and the matrix is expanded according to the importance of each factor. The maximum eigenvalue (λmax) of the judgment matrix and the eigenvector ω=(ω1, ω2, ω3,... ωt) T is the approximate value of the eigenvector and the weight of each factor. As shown in the table:

Table 2. shows the importance level

figure	Degree of importance
1	Equally important
3	Slightly important
5	Relatively important
7	Very important
9	Absolutely vital
2、4、6、8	It’s somewhere in between

5.4 Checking Matrix Consistency Indicators

To test the consistency of the matrix, define (Wang Lang, 2017):

$$CI=(\lambda max - n)/(n-1) \qquad (5.3)$$

If CI=0, it can be judged to be consistent. It is acceptable that the higher the CI, the lower the compatibility of the decision matrix. Generally, as long as the CI does not exceed 0.1, the consistency of the decision matrix can be recognized; otherwise, it is necessary to conduct a secondary comparison judgment again. For the 1-9 order matrix, the average random consistency index RI is shown in Table 3.

Table 3. Relationship between RI and order

order	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

5.5 Weight

5.5.1 Significance of Weights

Quantitative evaluation indicators are very important for site selection design analysis, and each indicator factor has different degrees of importance for site selection evaluation, so it is necessary to establish a weight evaluation system and determine the weights of different indicators at different levels to judge the importance.

5.5.2 Rules for Determining Weights

(1) Principle of system optimization: In an index system, the function of each index and its contribution to the whole system is different. Therefore, when determining the weight of each indicator, it is necessary to correctly grasp the relative proportion of each indicator and properly allocate it. The principle of system optimality should be adopted to ensure the consistency of the whole system.

(2) The principle of combining subjective and objective, that is, the weight of the evaluation index reflects the guiding intention and the subjective value of the evaluator. When evaluators think an index is more meaningful, they usually give it a greater weight. However, the real evaluation is often different from the evaluator's subjective evaluation, resulting in great deviation. Therefore, the judge should pay attention to the following points when determining the weight.

(3) 1) combination of historical indicators and realistic indicators; 2) Organically link social identity to the company's identity; 3) To maintain a balance between the same industry, between the types of work; It is necessary to consider subjective and objective reality, and organically unify the orientation intention of the assessment with the actual situation.

5.5.3 Weighting Methods

At present, there are mainly the following methods for determining weights (Cui Tao, 2011):

(1) Expert intuitive judgment method

This is a redistribution of the weight of each index by experts according to their understanding and judgment of each evaluation index. This kind of evaluation mainly depends on the personal experience and ability of the evaluator, which is subjective and biased. This method saves time and effort and is easy to use, so it is often used in dealing with simple practical problems.

(2) Weight factor judgment table method

The evaluation expert group is formed, and the experts judge the evaluation index factors and score them, and carry out statistics and analysis on the scores of the experts. According to the score value and average score value of each evaluation index given by experts; the weight of each index is determined.

(3) Sorting method

An evaluation team was formed, and the experts compared the impact of the first or second secondary goal in the evaluation with the corresponding first-level indicators according to their own subjective judgment. Starting from the smallest goal, the weights were assigned in turn, and the data of the experts were analyzed and summarized. Finally, these data are summarized in the hands of various experts. Repeat many times.

(4) Analytic Hierarchy Process

The analytic hierarchy process (AHP) is a comprehensive analysis method from qualitative to quantitative analysis. Because the analytic hierarchy process (AHP) can overcome the shortcomings of other evaluation methods, it is more suitable for solving more challenging decision-making problems with more complex structures. Therefore, this paper chooses the analytic hierarchy process (AHP) to analyze the weights of the index system in the analysis of suspended designs of pharmaceutical plants immediately.

6. Case Study

6.1 Case Background

Taizhou is on the north bank of the Yangtze River, Huaihe River, Jiangsu centre, Binjiang coast, and is an important city in China's coastal areas. It is separated by a river from Nantong, Yancheng, Yangzhou, Suzhou, Wuxi, Changzhou, and Zhenjiang in the east and north respectively, and is in the north and southeast of Jiangsu Province. It is an important waterway with unique advantages. Taizhou is located between 119°43' and 120°33' E and is in the south of the northern temperate zone in the world's five belts. Taizhou City presents the characteristics of narrow east and west, north, and south oblique, long and wide. The topography of the city is high in the north and south, and low in the east and west. The maximum straight distance between the north and the south is 55 kilometres, and the narrowest is 19 kilometres. The maximum north-south straight distance is 124 km. The total area of the city is 5790 square kilometres, and the urban area is 428 square kilometres, of which 82.74% is land and 17.26% is water (CHENG Ying, Wu Ying, Peng Ting & Wang Yuxiang, 2022). According to the influencing factors in the index system and the development plan of Taizhou city, the paper analyzes the influencing factors of the location of the proposed pharmaceutical factory, to make a more objective evaluation report.

Taizhou Pharmaceutical High-tech Industrial Park is in Taizhou Gaogang District, as a state-level development zone, with 5 functional parks including biomedicine, chemical new materials, electronic information, high-end equipment manufacturing and port logistics. It has jurisdiction over 5 townships and 7 streets, with a total land area of 404.5 square kilometres and a population of 540,000. This project is mainly for the preparation workshop and the raw material workshop. Through the engineering analysis of the project, the main pollution sources, main pollution factors and the discharge of pollutants are found, and the production process and characteristics of the project are analyzed and evaluated, so the countermeasures for pollution prevention and pollution reduction are proposed.

The main production processes are washing, distillation, extraction, fermentation, and other physical processes. Three wastes are produced in the production process, namely waste water, waste gas and waste residue. The wastewater can be treated by the sewage treatment plant, which has completed the process transformation project, and the scale of the project is 25,000 m3 of sewage treatment capacity per day. The modified process flow is mainly treated by the methods of coarse grid and collection well + fine grid, aerated sand settling tank + high-density clarifying tank + hydrolysing acidification and baffling sedimentation tank +AAO and secondary sedimentation tank + high-density sedimentation tank + ozone + aerated biochar tank + disinfection (Li Ting, Yang Lian & Cui Shangshu, 2022). The exhaust gas produced in the pharmaceutical industry is mainly from the volatilization of organic matter (such as VOCs) and the production of pollutants (such as dust), which can be filtered through the HEPA filter matched with the weighing hood, and then filtered through the HEPA filter at the exhaust outlet of the air conditioning system in the workshop, to achieve unorganized emission. The gas produced by volatilization of organic matter can be treated by chemical washing, plasma process and condensation process (Li Xiang, 2013) and the solid waste is handed over to relevant personnel for professional treatment and then transported to the landfill.

6.2 Comparative Analysis of Site to Be Selected

The following is an analysis of the two sites based on various influencing factors:

Site 1: Located in Taizhou, Jiangsu Province, Pharmaceutical high-tech Park (Zhu Juping, 2022), Xiangtai Road east, Lingzhi Road south, Nantang Road north. Industrial land is reserved on the east side of the project site, separated by the proposed Nantang Road on the south side, Xiangtai Road on the west side (Zhang Shujun, 2014), and Lingzhi Road on the north side. The nearest environmentally sensitive target to the project site is the households in Erqiao Village on the west side of 400m. 2 production workshops (1 production workshop on the west side and 1 production workshop on the east side are reserved for this project), 1 warehouse and 1 administrative building, as well as other auxiliary structures such as hazardous chemical warehouse, hazardous waste temporary storage room, fire pool, sewage treatment station, and emergency pool will be constructed in the entire plant.

Site 2: Located in Hailing District, Taizhou City, Jiangsu Province (Xu Gang, 2019), with a population of 570,000 and an area of 305 square kilometres, it has 7 streets and 4 towns under its jurisdiction, including 7 streets of East, South, West, North, middle, Jingtai Road and Hongqi, and 4 towns of Jiulong, Suchen, Gang Yang and Huagang by the end of 2021.

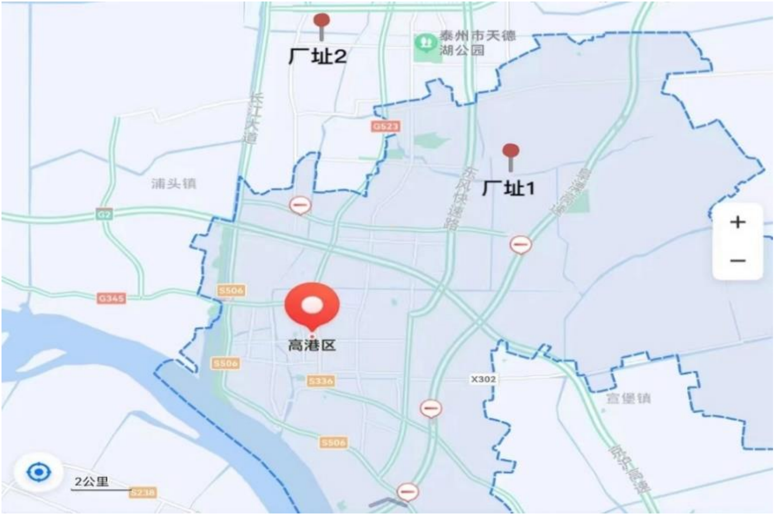

Figure 2. Comparison map of plant location

The results are shown in Table 4. The data of site 1 and site 2 come from the environmental impact assessment report, the two sites are included in the scheme layer of the index system, and the most suitable site for the pharmaceutical plant is gradually obtained according to the analytic hierarchy process. If the result is that site 1 is the most suitable, the analytic hierarchy process model is feasible for the location of the pharmaceutical plant. Therefore, the analytic hierarchy model needs to be further adjusted (Wang Jisheng, 2009).

By comparing the sites of the two pharmaceutical factories, it can be found that they are the same in sensitive target distribution, water quality, land price and other evaluation factors, but different in other aspects such as wind speed, wind direction, ambient air, etc., and the differences are important factors for site selection, which means that for environmental pollution problems, two pharmaceutical plants of the same size will produce different levels of pollution (Li Yanling, Wu Jianwei & Zhu Yexing, 2017).

Table 4. Comparison results of different sites with the same factor

Evaluation factor	Factory Site 1	Factory Site 2
Wind speed (m/s)	2.2-3.9	3.4
Wind direction	southeaster	southeaster
Ambient air	Secondary functional area	Third-class functional area
Surface water	Environmental Quality Standards for Surface Water (GB3838-2002) Class III	Environmental Quality Standards for Surface Water (GB3838-2002) Class II
Acoustic environment	Acoustic Environmental Quality Standard (GB3096-2008) Category 3 area	“Sound Environmental Quality Standard” (GB3096-2008) Category 3 area
Distribution of water sources	The main rivers around the project are the Yangtze River, the diversion River and the Nanguan River	The project is located in the vicinity of the Yangtze River (Tongnan) and Huaihe river (Lixia River) water system confluence, rivers criss-cross, water network dense, extensive waters.
Water quality	Second class	Second class
Land Price (Yuan/mu)	55000	55000
Types of environmental protection objectives	Nature reserves, residents	Scenic spots, institutions, residents
Environmentally sensitive target distribution scale	scarce	scarce

6.3 Analyzing Layers

The selected influencing factors are compared in pairs and scored by experts. The weight (W) of each factor in each level is calculated by their structural model. The standard weight (Wi) is calculated by standardizing the weight (W) of each factor. Wi is the standard weight (Zhang Tao, Li Jinguo & Xu Chunfeng, 2019), which is the weight of each influence factor related to the target layer in Figure 5.

When scoring the influencing factors in the index system, I divided the design analysis of target layer (A) A: pharmaceutical plant site selection into environmental factors B_1 and economic factors B_2, and divided environmental factors B_1 into meteorological conditions C_1, environmental function zoning C_2, water environment C_3, environmental sensitive points and protection targets C4. Economic factor B2 is divided into land price C_5 and traffic distance C_6, and environmental factor B_1 is again detailed, that is, meteorological condition C_1 is divided into wind direction D_1 and wind speed D_2, environmental function division C_2 is divided into ambient air D3, acoustic environment D4 and surface water D5, and water environment C_3 is divided into water source distribution D_6, water source utilization degree D_7 and water quality D_8. Environmental sensitive points and protection target C4 are divided into list distribution scale D_9 and protection target type D_{10}.

6.3.1 Comparative Analysis of the Target Layer

Table 5. Analysis of Pharmaceutical Plant Location Design A

Analysis of Pharmaceutical Plant Location Design A	Environmental factors B_1	Economic factor B_2	weight
Environment factor B_1	1.0000	8.0000	0.8889
Economic factor B_2	0.1250	1.0000	0.1111

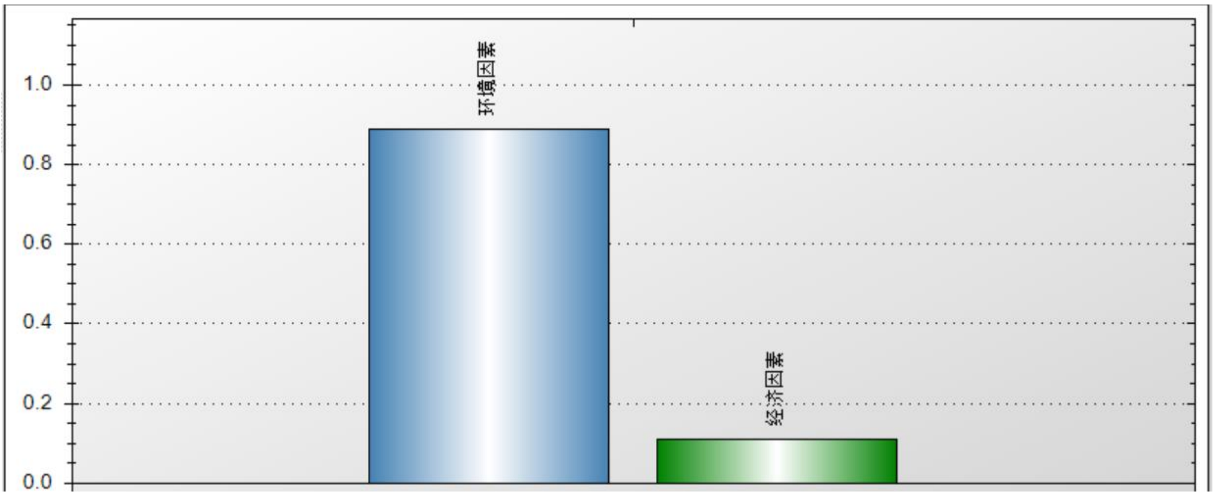

Figure 3. Consistency analysis diagram of pharmaceutical plant location design analysis

From this, we can see that the weight of environmental factors > the weight of economic factors, which shows that environmental considerations are essential in environmental site selection. Where the consistency ratio is 0.0000, complete consistency, weight is 1.0000, λmax value is 2.0000. Environmental issues are related to people's life and health (Lu Yanjie, 2021), and has long been one of the major challenges faced by China's social development. Construction projects are evaluated from the perspective of environmental protection, and waste gas, waste water and solid waste generated in the production process and their treatment measures are the top priority (Zhong Min, 2022). It can be seen that among the factors for the location of pharmaceutical plants, we should consider as much as possible what impact the three wastes produced by pharmaceutical factories may have on the environment, what ways to reduce and solve, followed by economic costs.

6.3.2 Comparison and Analysis of the Middle Layer

(1) Analysis of environmental factors:

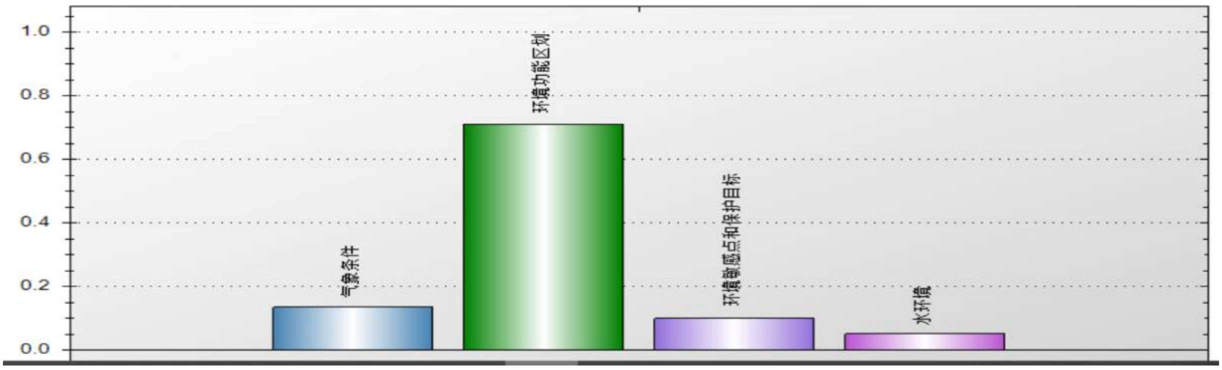

Figure 4. Consistency distribution of environmental factors

Table 6. Analysis of Environmental Factors B_1

Environmental factors B_1	Meteorological condition C_1	Environmental function zoning C_2	Environmental sensitive points and protection targets C_4	Water environment C_3	weight
Meteorological condition C_1	1.0000	0.1250	2.0000	3.0000	0.1360
Environmental function zoning C_2	8.0000	1.0000	9.0000	9.0000	0.7120
Environmental sensitive points and protection targets C_4	0.5000	0.1111	1.0000	3.0000	0.1005
Water environment C_3	0.3333	0.1111	0.3333	1.0000	0.0515

In the weight analysis of environmental factors, it can be seen that in the chart, the weight of environmental function zoning > weight of meteorological conditions > weight of environmental sensitive points and protection targets > weight of water environment. Environmental function zoning is a classification of various functional areas of the study area combining the harm of environmental pollution to human body and the benefits brought by environmental investment. It is characterized by the development of environmental objectives for each area, and different functional areas perform different functions. When a pharmaceutical factory is built in two areas of the same city, the evaluation factors in its functional areas are different, and the environmental pollution is different. From the perspective of environmental protection, environmental functional zoning has the greatest impact on site selection. Environmentally sensitive targets include national nature reserves, scenic spots and other areas sensitive to environmental pollution. The preparation of the environmental impact assessment report is not only to ensure the rationality and scientificity of the site selection of the construction project, but also to comprehensively analyze the regional, natural, resources, social and economic conditions (He Yujie, 2021), to formulate a reasonable development plan for the region from the perspective of environmental protection according to the region's bearing capacity for resources, environment and society, and to comprehensively consider environment and economy. The project can only develop sustainably. When compiling the surface water environment in the environmental impact statement, it is necessary to determine the surface water environmental impact assessment level based on the sewage discharge characteristics of the construction project and the environmental characteristics of the receiving water body, which determines the qualified water quality of the wastewater discharged in the production process after treatment. Meteorological conditions mainly include wind speed and wind direction (Liu Zhongxin & Tao Lei, 2018). Considering that the exhaust gas emitted in the production process of a pharmaceutical factory has different degrees of influence on the surrounding sensitive targets at different wind speeds and wind directions, combined with environmental functional zoning, environmentally sensitive targets and surface water environment, I believe that meteorological conditions are very helpful to the environmental factors in the location of a pharmaceutical factory. The consistency ratio is 0.0736, which is acceptable, the weight for the target layer A is 0.8889, and the λmax value is 4.1964.

(2) Analysis of economic factors:

Table 7. Consistency analysis of economic factors

Economic factors B_2	Land cost C_5	Traffic distance C_6	weight
Land cost C_5	1.0000	1.0000	0.5000
Traffic distance C_6	1.0000	1.0000	0.5000

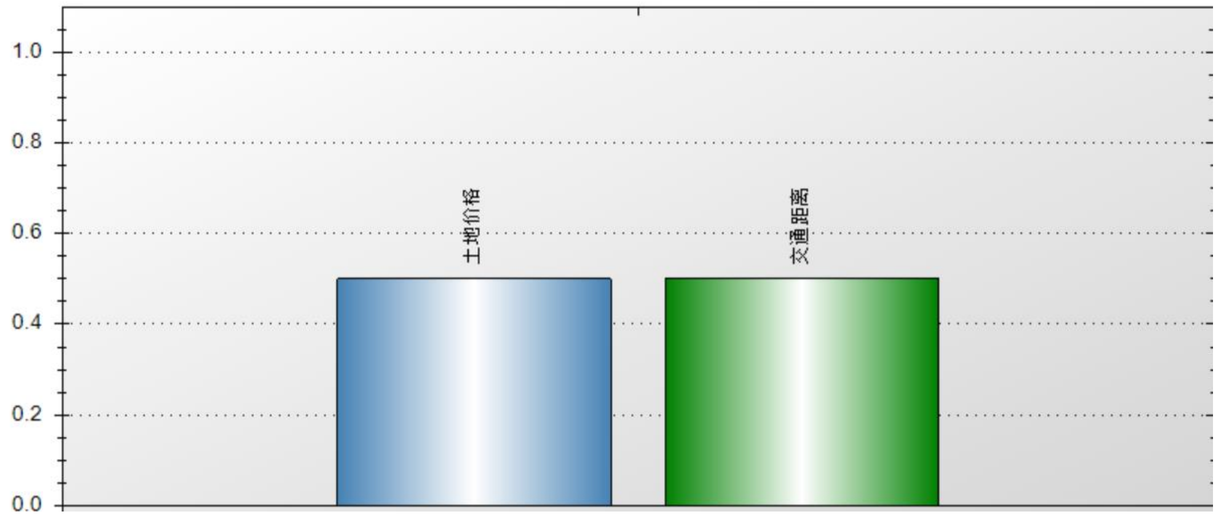

Figure 5. Consistency distribution of economic factors

Land price and traffic distance account for the same proportion and the same weight among the influencing factors of site selection. In the process of site selection, environmental factors are given priority and then economic factors are considered. The impact of land price and traffic distance is very small, so the importance of these two factors in site selection is consistent. The consistency ratio is 0.0000, completely consistent, the weight for the target layer A is 0.1111, and the λ max value is 2.0000.

(3) Analysis of meteorological conditions:

Table 8. Consistency analysis of meteorological conditions

meteorological conditions C_1	Wind speed D_2	Wind direction D_1	weight
Wind speed D_2	1.000	0.1250	0.1111
Wind direction D_1	8.000	1.0000	0.8889

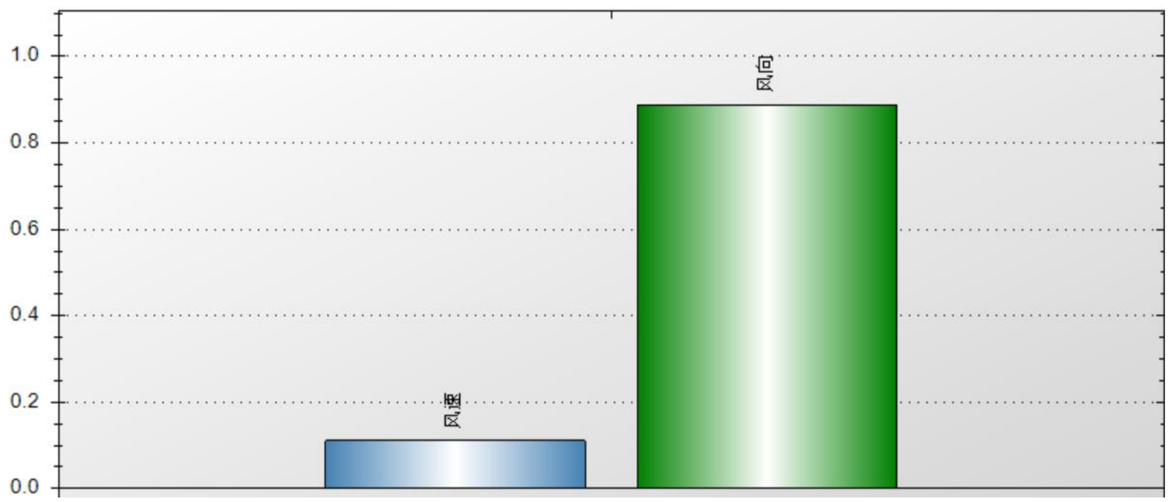

Figure 6. Consistency distribution of meteorological conditions

As can be seen from the figure, the weight of wind direction is more important than that of wind speed, because wind direction has an impact on pollutants discharged into the atmosphere (Peng Wang-Min Zi, Xu Wei-min & Kong Xin-Hong, 2010), while wind speed has a moderate impact. The consistency ratio is 0.0000, that is, it is completely consistent, the weight of the target layer A is 0.1209, and the λmax value is 2.0000.

(4) Analysis of environmental function zoning:

Table 9. Consistency analysis of environmental function zoning

Environmental function zoning C_2	Ambient air D_3	Acoustic environment D_4	Surface water D_5	weight
Ambient air D_3	1.0000	7.0000	0.3333	0.2946
Acoustic environment D_4	0.1429	1.0000	0.1111	0.0567
Surface water D_5	3.0000	9.0000	1.0000	0.6486

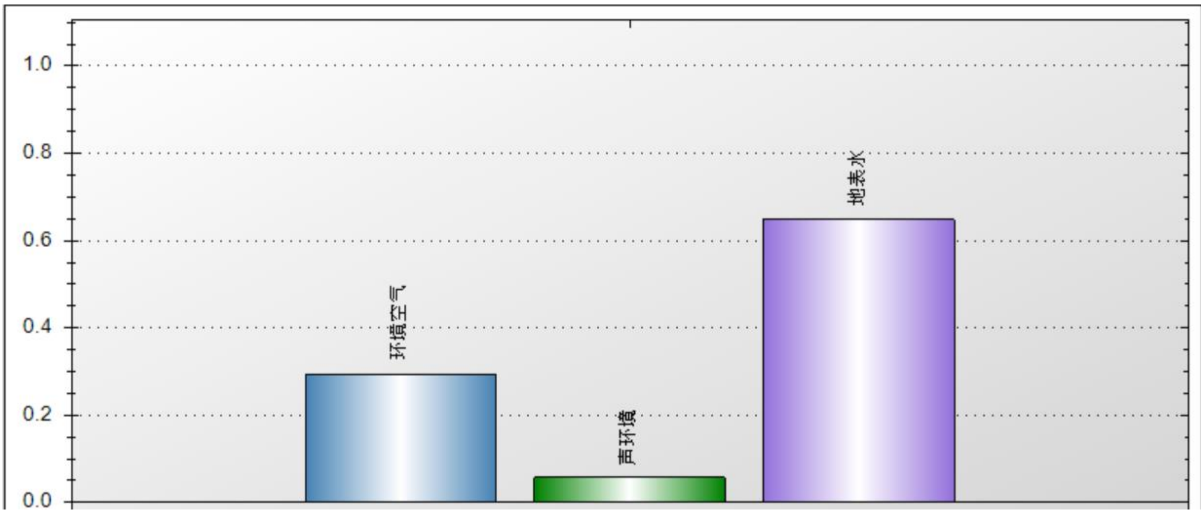

Figure 7. Consistency distribution of environmental function zoning

By comparing the three constraints in the environmental function zoning, it can be seen that the weight of surface water > the weight of ambient air > the weight of acoustic environment after scoring by relevant experts. The environmental influencing factors mainly include ambient air, acoustic environment, water environment and solid waste. Among them, solid waste generated in the pharmaceutical process is treated by professional personnel. Consider only surface water, acoustic environment, and ambient air. When pharmaceutical factories produce drugs, sometimes waste water will affect surface water. Secondly, the acoustic environment is also an influential factor to be considered. The noise generated by factories is mainly reduced through building sound insulation, shock-absorbing pads and soft joint connections. However, most of the exhaust gas produced by pharmaceutical factories is systematically discharged, and corresponding treatment measures will be taken to make the emission of major impact factors meet the standards (Pu Enyuan & Zhang Yan, 2022). Therefore, a consistency ratio of 0.0782, less than 0.1, is acceptable, with a weight of 0.6329 for the target layer A and a λmax value of 3.0813.

(5) Analysis of environmentally sensitive points and protection targets:

Table 10. Consistency analysis of environmentally sensitive points and protection targets

Environmental sensitive points and protection targets C_4	Protection target type D_{10}	Distribution scale of sensitive points D_9	Weight
Protection target type D_{10}	1.0000	0.2500	0.2000
Distribution scale of sensitive points D_9	4.0000	1.000	0.8000

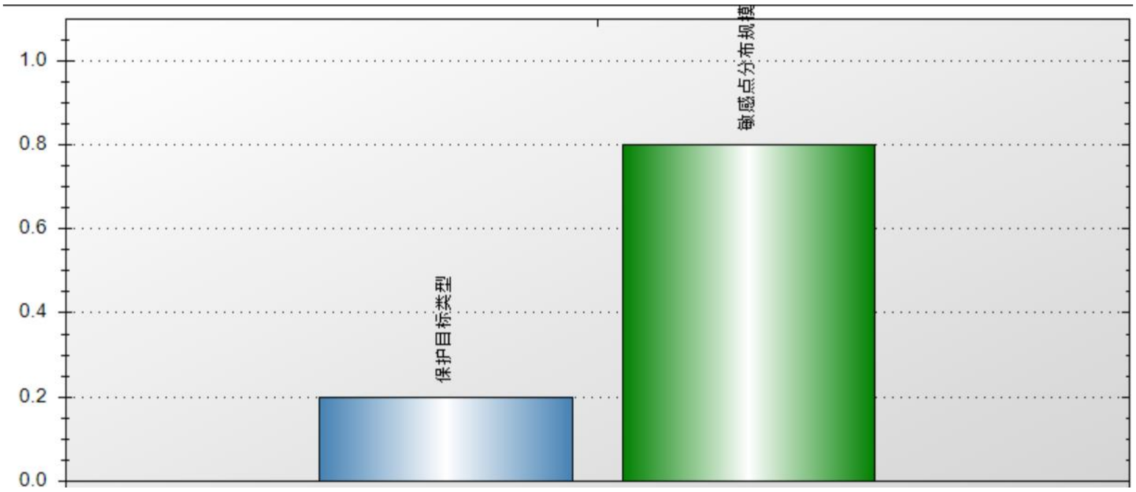

Figure 8. Consistency analysis diagram

For industrial parks in two areas of the same city, the types of environmental protection targets are different, such as whether there are nature reserves or not. As can be seen from the figure, the weight of the distribution scale is 0.800, while the type of protection target is only 0.200, indicating that the importance of the distribution scale is far greater than that of the protection target type. Secondly, the construction project should comply with the relevant provisions of the site selection in the Technical Guidelines for Environmental Impact Assessment for Pharmaceutical Projects (Huan-guo Zhang, 2018), and there should be protective facilities between the construction project and the surrounding environmentally sensitive targets. If it is close to the project location, relocation should be considered. The consistency ratio is 0.0000, which is completely consistent, so it is acceptable. The weight of target layer A is 0.0893, and the λmax value is 2.0000.

(6) Analyze the water environment:

Table 11. Consistency analysis of water environment

Water environment C_3	Distribution of water source D_6	The extent to which water resources are used D_7	Water quality D_8	weight
Distribution of water source D_6	1.0000	0.2000	0.1667	0.0819
The extent to which water resources are used D_7	5.0000	1.0000	0.5000	0.3431
Water quality D_8	6.0000	2.0000	1.0000	0.5751

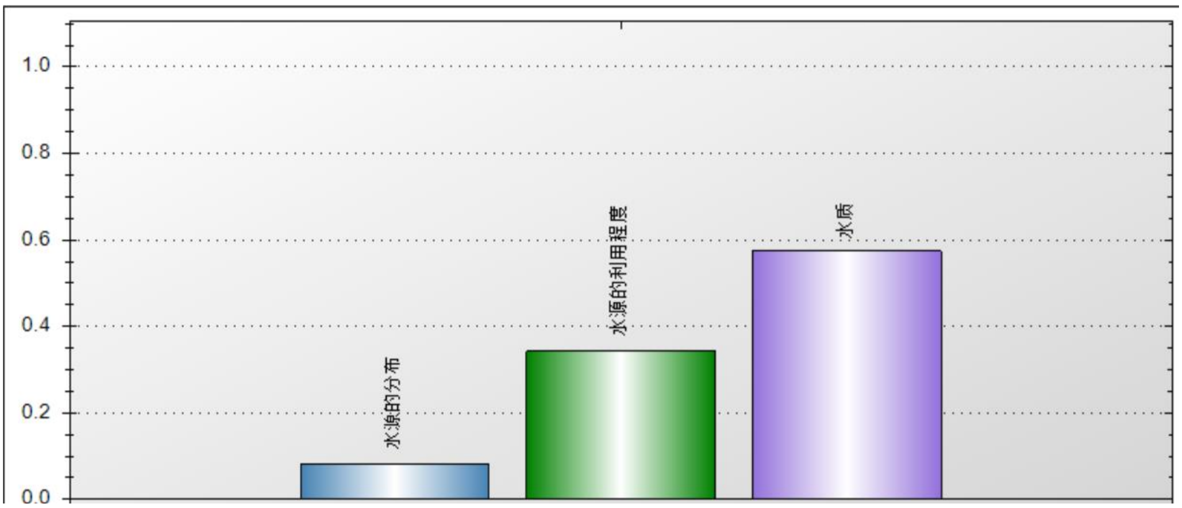

Figure 9. Water environment consistency analysis diagram

It can be seen from the figure that the weight of water quality > the weight of water source utilization > the weight of water source distribution, which shows that water quality is extremely important for water environment and site selection. Different drugs need different water and require different water quality (Zhang Tao, Li Jinguo & Xu Chunfeng, 2019). Because pharmaceutical factories are set up in industrial parks according to regulations, the distribution of water sources to a certain extent can be without careful consideration. The consistency ratio is 0.0280, less than 0.1 is acceptable, the weight for the target layer A is 0.0458, and the λmax value is 3.0292.

6.3.3 Comparison and Analysis at the Solution Layer

Table 12. Weights of Alternatives

Alternative plan	weight
Option one	0.5534
Option two	0.4466

6.4 Determining the Site Result

The final weight value is obtained by the comprehensive calculation of the weight value of each layer and the weight of each index of the scheme layer.

Site 1 is 0.5534, site 2 is 0.4466, and the final scheme is ranked as Site 1 > Site 2,

The site of the factory is the site of the actual case.

Compared with the results of the actual case, the site 1 of the actual case was selected as the construction of the pharmaceutical project.

Plant location, consistent with the calculation. Through analysis and comparison, the situation at two or more sites can be obtained.

In this case, the model is used to assign values to each indicator and determine its weight (Cui Tiejun & Li Shasha, 2022), which can be obtained at the end of calculation.

The good results can facilitate the selection of the optimal location of the pharmaceutical plant. The scheme is feasible and has certain reference value for the problems about the location of the pharmaceutical plant that may appear in the future.

7. Conclusions

The proportion of pharmaceutical industry in the national economy continues to grow, and a good site selection is the basis for success. This paper analyzes and compares the factors affecting the site selection of pharmaceutical factories, determines the weight and consistency of each indicator, establishes an indicator system, and adopts AHP method to obtain the importance degree of each influencing factor. After reading a large number of references and EIA reports, I found that traditional research methods could not clearly show the relationship between the influencing factors. AHP model is clearly hierarchical and intuitive, which is of great help to site selection. Increasing demands on the pharmaceutical industry are one of the challenges facing pharmaceutical companies. The purpose of this paper is to minimize the environmental, public health and economic impacts of pharmaceutical plant siting. Two constraints, including 12 sub-constraints, are considered in the calculation process of location design of pharmaceutical plant. The weight is obtained by the expert score and the importance is obtained. After searching a lot of relevant literature and comparing various site selection methods, analytic hierarchy process (AHP) is a good choice for the site selection of pharmaceutical factories, which is more concise, clear and hierarchical. Therefore, AHP model is used as the main tool for the design and analysis of pharmaceutical factory selection, and the site selection of pharmaceutical factories is analyzed and compared according to the environmental characteristics of Jiangsu Province and the environmental development of Taizhou City. It more clearly reflects the factors that affect the location of pharmaceutical factories and their importance, and can provide an effective and true reference basis for people who want to engage in planning site selection in the future. The impact indicators selected in the analytic hierarchy process are representative, scientific and feasible indicators obtained according to the specific environmental status of Jiangsu Province and Taizhou City and by searching for relevant environmental impact assessment reports of Taizhou City. The next most important step is to convert these impact indicators from qualitative to quantitative. The current site selection work provides reference materials for practitioners to solve the problem of pharmaceutical plant site selection.

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