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*Research Article*

# An Optimization Method of Sports Service Network Layout Based on Network Communication

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Sports culture industry (CI), as a new sunrise industry, has achieved unprecedented development in the world, and many developed countries regard it as a pillar industry. In our country, the sports CI is quickly growing and contributing significantly to national economic growth. The layout mode of the sports CI is crucial in identifying regional growth advantages and resource development, as well as maximizing industrial function allocation and creating sports CI development strategy. This paper takes Dalian's sports CI as the research object and expounds the concept of sports culture, sports CI, and spatial layout of sports CI through analyzing and sorting out previous research results. This study analyses the evolution and spatial distribution of the Dalian sports CI, as well as the current challenges, using theories and methodologies from sports science and economic geography and proposes countermeasures for Dalian to develop its sports CI. Regional development theories, such as central place theory, growth pole theory, point axis theory, and Maslow's hierarchy of needs theory, have important theoretical value and practical guiding significance for the rationalization of spatial distribution of Dalian sports CI. On the basis of analyzing the resources, traffic network, and economic development of Dalian sports CI, the paper constructs the spatial distribution mode of Dalian sports CI, namely, two core points, three development axes, and multiple nodes, and puts forward the measures to optimize the spatial distribution of Dalian sports CI. This paper examines the current condition, resource architecture, and major structure of supply of leisure sports service items in the Zhejiang coastline area using the literature and field inquiry methodologies. On this basis, the optimization countermeasures of combining Zhejiang coastal leisure sports service products with recreational fishery and yacht economy are put forward to perfect the system of coastal leisure sports service products and improve the supply capacity.

## 1. Introduction

In recent years, with the improvement of people's living standard and the increase of leisure time, people's demand for coastal leisure sports is increasing. Coastal leisure sports refers to the general term that people use coastal resources and environment to carry out sports and leisure activities in their leisure time [1–3]. Sports service products refer to the nonmaterial labor achievements and specific services provided by sports industry departments for the society and the public. Our province is the most abundant in marine resources, with rich marine resources such as islands, fisheries, and tidal flats. Therefore, the development of coastal leisure sports tourism has created a broad platform for the development of marine economy and inheritance of marine culture. How to integrate coastal sports and recreational fishery, yacht economy, marine culture, and coastal leisure tourism into a coastal leisure sports industry system is the focus of this paper. In view of the growth and change of social needs, the product structure layout highlights the characteristics of diversification and hierarchy, in order to meet everyone's personalized needs to the greatest extent [4]. Therefore, starting from the idea of comprehensive and holistic, change the traditional pattern of single development of seashore leisure sports products and make full use of marine resources, reasonable layout of coastal recreational sports service products, and in understanding the current supply status quo of Zhejiang coastal recreational sports service products, resource distribution and supply main body based on the optimization countermeasures are put forward [5–7].

Sports CI is a new form of industry which extends from the development of CI and sports industry in recent years. The rise and rapid development of cultural industry has far-reaching significance in the world. China's cultural industry market is increasingly broad and has become the strategic focus of China's economic development. In 2011, the operating profit of China's cultural market reached 540 billion yuan. With the economic globalization, lifestyle and sports operation mode have also undergone corresponding changes, and the sports industry is gradually moving towards industrialization from an industry that did not aim to obtain economic benefits and has become one of the most active entertainment industries with the most growth potential [8]. As a new industrial form, the research of sports CI has been paid more and more attention. How to rationally excavate and utilize sports CI is of great social significance to the adjustment of industrial layout, upgrading of industrial structure, allocation of resources, and support of key objects [9].

In recent years, sports CI has been widely concerned at home and abroad and countries have increased the investment and development of sports CI. Many scholars have devoted themselves to the study of sports CI, presenting a number of rich research results. At present, the domestic research mainly focuses on the cultural industry and sports industry and the theoretical part of sports CI. The research on the spatial layout of sports CI is not perfect. Therefore, there is a certain theoretical innovation and realistic space for the research of this paper [10]. On the basis of sports culture, CI, and sports industry, this paper expounds the concept of sports CI, enriches the theoretical system of cultural industry, and expands the research scope of sports industry. The spatial layout of Dalian sports CI uses various theories of economic geography and regional development, which makes up for the deficiency of sports CI theory to a certain extent. Through research and analysis, this paper constructs the spatial layout mode of sports CI and puts forward the corresponding development countermeasures according to the actual situation of Dalian, which not only provides theoretical guidance and technical direction for the development of Dalian sports CI but also provides clues for further research of related industries [11–15].

Since the reform and opening-up, with the acceleration of urbanization, the development of social and economic environment, and the extensive development of national fitness activities, urban public sports has made certain development [16]. However, the following problems restrict the healthy and rapid development of urban public sports: lack of organizers and managers of community sports activities, lack of funds for sports activities, lack of legal construction, lack of overall planning for the construction of urban public sports service facilities (SSF), lack of SSF, uneven distribution or relatively idle, and so on. It is of great significance to effectively solve the reasonable layout and distribution of SSF for promoting the healthy and rapid development of sports, meeting the needs of urban residents, improving the service level of the city, and meeting the maximization of urban welfare. This paper uses geographic information system (GIS) and facility site-allocation function to optimize the spatial layout of SSF in the city and provides a new direction for the site selection of SSF and a reference way and method for the decision-makers in the site selection planning of SSF [17]. After data collection, data research, and field investigation, the geographical distribution of SSF in urban areas of City A is shown in Figure 1.

Under the background of speeding up public service construction, the construction of public service facilities should go hand in hand with social and economic development and urban construction. However, with the acceleration of the urbanization process, the scale of the city is expanding at an unprecedented speed, so the ensuing problems are beginning to appear. The construction of urban public service facilities, including the scale and service capacity of community sports facilities, is increasingly lagging behind the development of social economy and urban construction [18]. The current reality that community sports is not only the lack of funds, lack of unified planning and community sports facilities construction, various departments and units from their own interests, often in the sports infrastructure construction, open only considered in such aspects as sports department interests, cannot achieve the overall optimal, leading to lack of integrality and planning, community sports construction. The lack of resources also caused the repeated construction of facilities to a certain extent, resulting in uneven distribution of resources and relatively idle. In order to solve the contradiction between lack of resources and idle resources and properly solve the problem of community sports facility resources' layout and distribution, in this paper, in the community SSF layout optimization, we use GIS technology, using the GIS spatial analysis and auxiliary decision-making function, site selection and layout optimization, the plan of site selection for community sports facilities provide a new angle of view. It also provides a reference way and method for the site selection of other public service facilities [19, 20].

The arrangement of this paper is as follows: Section 2 explains the related work of sports CI and plays an important role in maintaining national sports culture security; Section 3 elaborates the concept of optimization process of sports service facilities layout; Section 4 analyses the experiments of various data structure and then obtains the results; Section 5 concludes the article.

## 2. Related Work

In addition, some scholars have studied the competitiveness of sports CI from the perspective of economics. Wang Xiaolin and Hu Anyi demonstrated the competitiveness of sports culture by using the index evaluation method. Zhang Shiwei and Yuan et al., from the perspective of China's national cultural security, evaluated the competitiveness of sports CI and constructed the corresponding evaluation model. The evaluation results show that a nation's sports CI plays an important role in maintaining national sports culture security. At the same time, this paper puts forward some effective measures to enhance and cultivate the competitiveness of sports CI in China.

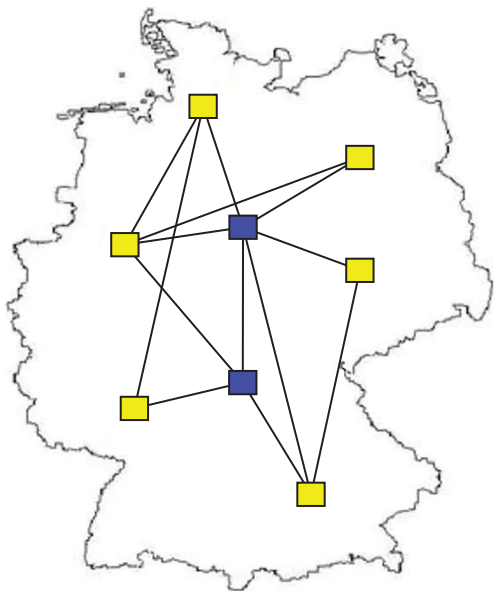

Figure 1: Geographical distribution of SSF in urban area of City A.

There are few studies on the spatial layout of sports CI in the academic circle, and the research angle mainly focuses on the spatial layout of sports industry. The findings of the evaluation demonstrate that a country's sport CI plays a crucial role in ensuring the security of its national sports culture. On this foundation, this paper can develop and think, providing a theoretical and practical foundation for the study of sports CI and space. In this work, GIS is linked with the optimization of the layout of community SSF, giving a novel perspective for community sports facility site selection as well as a reference technique and method for site selection of other public service facilities. You Zhanlan and Lei Xuanpei, in research on "Spatial Layout and Competitiveness of Sports Industry Cluster in Wuhan City Circle," constructed a spatial development mode of "one heart, two wings, and four districts" for Wuhan sports industry and put forward development strategies to enhance industrial competitiveness. Fu Lan evaluated the development and layout of the sports industry by using the fuzzy comprehensive evaluation method and analytic hierarchy process, found the deficiencies in the spatial layout of the sports industry, and put forward targeted measures. Yu Xiaohong, Zhu Xiang, and Zhu Peijuan mentioned in "Countermeasure Research on the Industrialization Development of Public Sports Venues" that the sports industry in Changsha city of Hunan formed an overall pattern of "two points and one axis area." Research on the spatial layout of sports CI can be used for reference to optimize and upgrade the spatial layout of sports industry.

To sum up, the academic circles at home and abroad have produced abundant theoretical and practical research results on cultural industry and spatial layout, as well as sports industry and spatial layout, but few research results on sports CI and spatial layout. There are still many problems to be improved. This paper can expand and think on this basis and provide theoretical and practical basis for the study of sports CI and space.

The layout optimization of public service facilities is in essence a problem of reasonable location allocation of facilities. The research on the model to solve the optimal location of public facilities first appeared in the paper of Efroymson and Ray [21]. He extended Weber's industrial location theory to the location solving model of multiple facilities and called this model Location Allocation Model (LA model). Since the location allocation algorithm was proposed to solve the problem of location selection, the LA model has been widely studied and has been applied and promoted in the facility layout or project evaluation of several government departments or private enterprises. From the 1970s, LA began to be combined with GIS technology and was used in the practice of optimal site selection, such as power plant selection in Maryland, USA, in the 1970s (Khumawala [22]). The theoretical basis for the development and layout of public facilities in China basically comes from foreign theories. Combined with the domestic situation, Chinese scholars also have a lot of research on the site selection of public facilities. Davis and Ray [23] used GIS technology and Voronoi diagram to study the location of public facilities and proposed a facility location algorithm based on Voronoi diagram that met the minimum coverage circle principle in the location of public facilities. Longley et al. [24] studied and discussed the fairness of public facilities layout. Tomizawa [25] applied GIS and Voronoi polygon to the geographical feasibility analysis of medical service facilities. Farhan and Murray [26] studied the application of location model in the layout of public facilities. Murat et al. [27] studied the layout of community public facilities. It can be seen from the above that the research on the development and layout of public facilities in foreign countries was carried out earlier and many significant achievements were made, which also played an important role in practice. Despite the late start of domestic studies, there are a lot of achievements, and the research content, research angle, and research methods are not the same, but there is no optimization of the existing layout, not to mention the layout optimization of community SSF. In this paper, GIS is combined with the optimization of the layout of community SSF, providing a new perspective for the site selection of community sports facilities and a reference way and method for the site selection of other public service facilities.

## 3. Optimization Process of Sports Service Facilities Layout

SSF are the indispensable material guarantee for residents' life, the facilities to meet the daily needs of residents, and the standard to measure the development level of public service facilities in a city. By analyzing the urban construction scale, population and economic growth trend, and the existing sports facilities, the demand for SSF in the future is predicted and the number and location of SSF are determined. The site selection of SSF should achieve the following objectives: unified planning, reasonable and scientific layout, and coexistence of demolition and new construction, taking into account both social and economic benefits, facilitating the

needs of residents, and improving supporting facilities. The principles to be followed in site selection of SSF are as follows:

(1) The principle of lowest cost: in the case of meeting needs, the land cost and construction cost of SSF should be reduced and location selection should be studied from the perspective of cost

(2) The principle of maximum satisfaction: SSF, like other public service facilities, need to meet the fitness needs of most people and increase satisfaction

(3) The principle of regional coverage: the location of SSF should follow the principle of regional coverage, that is, cover all residents in the region as much as possible

(4) The principle of convenience for residents: optimize the network layout of SSF and serve residents with reasonable layout of SSF construction, scientific management, and maximum welfare, so as to achieve both fairness and efficiency

The factors that influence the layout of public SSF involve the economic level of the city, the population of residents, age structure and spatial distance, land price, transportation, consumption level, and other factors, and these factors restrict and complement each other. Data are processed in ArcMap, and a geographic database is entrenched in ArcCatalog. The database content is shown in Figure 2.

In this paper, according to a logistics network node and the nodes between the logistics demand of gravity, the gravity model is applied to the power grid company. By improving the original model of urban economy and economic distance, expressed in power grid supplies demand factors influencing the logistics demand of gravity between nodes, with transport distance and transport rate said the economic distance between section point, More reasonable and effective aggregation of power grid logistics network in each region of the warehouse alternative nodes, at the same time to calculate the total material demand of each region of the warehouse. The formula of the improved gravity model is as follows:

$$F_{mn} = \omega_{mn}\frac{r_m r_n}{c_{mn} d_{mn}}, \tag{1}$$

where $F_{mn}$ represents the attraction of power material demand between warehouse $M$ and warehouse $N$.

At the same time, the total material demand $R_m$ of each region's warehouse area after aggregation is represented by the sum of the original material demand of the region's warehouse and the material demand of its connected warehouses:

$$R_m = r_m + \sum_{n=1,n\neq m}^{M} \omega_{mn} r_n. \tag{2}$$

When the overall material demand gravity of the logistics network of the power grid company reaches the maximum, the regional aggregation is the best, namely,

$$\max Z = \sum_{m=1}^{M} \delta_m F_m = \sum_{m=1}^{M} \delta_m \sum_{n=1,n\neq m}^{M} \omega_{mn}\frac{r_m r_n}{c_{mn} d_{mn}}, \tag{3}$$

S.T.

$$\sum_{m=1}^{M} \delta_m = A, \tag{4}$$

$$r_1 \leq R_m \leq r_2, \tag{5}$$

$$a_1 \leq A \leq a_2, \tag{6}$$

$$\begin{cases} \sum_{n=1,n\neq m}^{M} \delta_{mn}\omega_{mn} = 1, \quad \delta_n = 0, \\ \sum_{n=1,n\neq m}^{M} \delta_{mn}\omega_{mn} = 0, \quad \delta_n = 1, \end{cases} \tag{7}$$

where $Z$ represents the gravity of the overall material demand of the logistics network of the power grid company and $M$ represents the collection of alternative points in the regional warehouse.

It is necessary to calculate the optimized surface product of each warehouse first and then calculate the storage cost of each warehouse and establish the cost model of node layout optimization of power grid company logistics network. In this paper, the amount of storage per square meter is calculated and the optimized area of each warehouse is calculated by the amount of storage that regional warehouses and turnover warehouses should keep. The total storage area of the warehouse is

$$S = \frac{R}{TB}, \tag{8}$$

where $S$ represents the optimized storage area of the warehouse, $R$ represents the material demand after the optimization of the warehouse, $T$ represents the inventory turnover rate, and $B$ represents the average amount of inventory materials per square meter.

According to formula (5), the total material demand of each regional warehouse after regional aggregation of logistics network of power grid company is

$$R_i = r_i + \sum_{j=1,j\neq i}^{J} w_{ij} r_j, \tag{9}$$

where $R_i$ represents the material demand of regional warehouse $i$ after optimization and $r_i$ represents the original inventory quantity of regional warehouse $i$ before optimization.

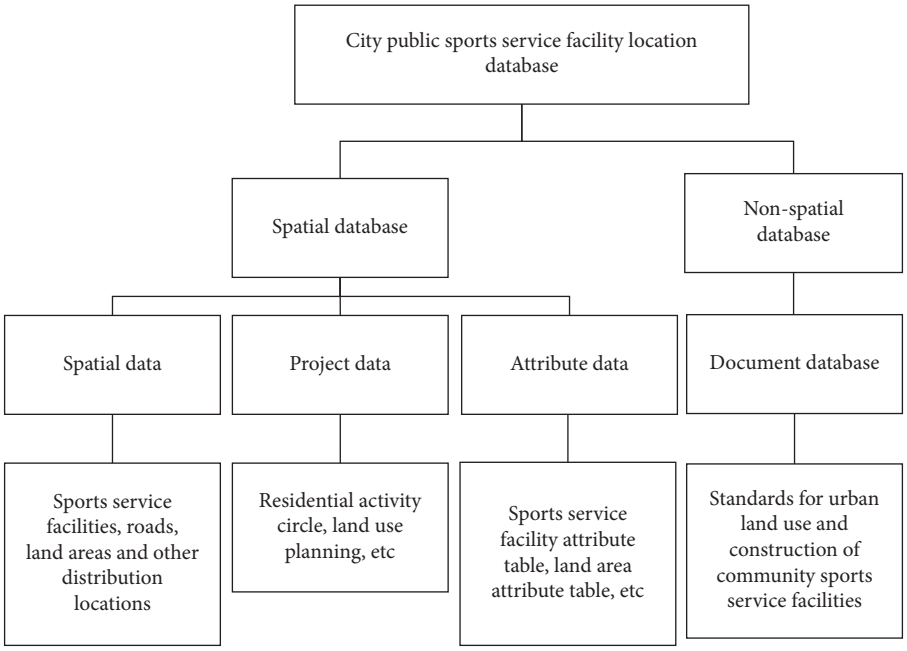


Figure 2: Database map of location of urban public SSF.

Since the optimization of logistics network in this paper involves the expansion and reduction of the alternative warehouse, the material demand of the cancelled warehouse is provided by the adjacent turnover warehouse, so the optimized material demand of each turnover warehouse is as follows:

$$R_j = r_j + \sum_{k=1,k\neq j}^{J} w_{jk} r_k, \tag{10}$$

where $R_j$ represents the optimized material demand of turnover warehouse $j$ and $r_k$ represents the original inventory material quantity of warehouse $k$ cancelled.

The cost of logistics network transformation mainly refers to the cost required for the expansion or reduction of selected warehouses.

### 3.1. Regional Warehouse Transformation Cost

$$u_i = \alpha_1 s_i + \beta_1 \gamma_i (S_i - s_i), \tag{11}$$

$$\gamma_i = \begin{cases} 1, & (S_i \geq s_i), \\ 0, & (S_i < s_i), \end{cases} \tag{12}$$

where $u_i$ represents the transformation cost of regional warehouse $i$.

Formula (12) shows that if the area of the optimized regional warehouse is larger than its original area, the regional warehouse needs to be built; otherwise, it does not need to be built. The total cost of regional warehouse transformation is

$$U_i = \sum_{i=1}^{I} \left( \alpha_1 s_i + \beta_1 \gamma_i \left( \frac{R_i}{TB} - s_i \right) \right), \tag{13}$$

where $U_i$ represents the total cost of the transformation of all regional silos.

### 3.2. Transformation Cost of Turnover Warehouse

$$u_j = \alpha_j s_j + \beta_j \gamma_j (S_j - s_j),$$
$$\gamma_j = \begin{cases} 1, & (S_j \geq s_j), \\ 0, & (S_j < s_j), \end{cases} \tag{14}$$

where $u_j$ represents the transformation cost of turnover warehouse $j$.

The logistics network operation and maintenance cost of the power grid company refers to the operation cost of the optimized regional warehouse and turnover warehouse, which mainly includes the cost of storage personnel and storage operation cost. The specific expressions are as follows.

#### 3.2.1. Total Operation and Maintenance Cost of Regional Warehouses

$$V_i = \sum_{i=1}^{I} \left( \theta_i + \mu_i \left( \frac{R_i}{TB} - s_i \right) \right), \tag{15}$$

where $V_i$ represents the total operation and maintenance cost of all regional warehouses.

#### 3.2.2. Total Operation and Maintenance Cost of Turnover Warehouse

$$V_j = \sum_{j=1}^{J} \varepsilon_j \left( \theta_j + \mu_j \left( s_j + \gamma_j \left( \frac{R_j}{TB} - s_j \right) \right) \right), \tag{16}$$

where $V_j$ represents the total transformation cost of all turnover warehouses.

## 4. Experimental Results and Analysis

Because of the disunity of the positioning standards and unclear function positioning of the material warehouses of the provincial power grid company, each warehouse is set and managed by its own power supply bureau according to its own needs, so the overall optimal layout of the warehouse cannot be considered from the perspective of the whole province, and unified management and allocation of power supplies cannot be realized within the province. In view of the above problems, this paper adopts the optimization method of logistics network node layout of power grid companies proposed above to optimize the warehouse layout of power grid companies in this province. The warehouse data of the provincial power grid company are shown in Table 1.

The gravity change of overall material capital demand of logistics network of provincial power grid company is shown in Figure 3. At this time, the regional storehouse is HK, qh, SY, and DZ, respectively, and the overall material demand gravity is the largest, which is $4.47 \times 104$. Gravity variation of overall material demand in logistics network of a provincial power grid company is shown in Figure 3.

At the same time, the cost convergence diagram of logistics network of the provincial power grid company is obtained, as shown in Figure 4. It can be seen from the diagram that the total cost of logistics network of the provincial power grid company has been significantly reduced from $5.62 \times 108$ to $5.47 \times 108$ after optimization.

From the actual situation in the paper, the provincial power grid companies of logistics network node layout is optimized, through adjusting the structure of the hierarchy of the provincial power grid company warehouse, regional aggregation model is established, and the cost model, and applied to mix together to implement the model of particle swarm optimization (PSO), finally got the optimized layout of warehouse, in the following respects has made remarkable achievements:

(1) From the perspective of cost, the total cost is reduced from $5.62 \times 108$ before optimization to $5.47 \times 108$ after optimization, which is 97.33% of the original. This effectively saves the logistics network cost of the provincial power grid company and improves the utilization rate of funds.

(2) From the warehouse number of intuitive, the provincial power grid companies of the 19 materials' warehouse are optimized to reduce to 15 and reduce the construction cost and maintenance cost of the warehouse. On the other hand, through the adjustment of the layout of the warehouse, the provincial power grid company supplies warehouse layout is more reasonable, improving the operational efficiency of the provincial power grid companies' logistics network.

(3) By adjusting the hierarchical structure of the material warehouse of the provincial power grid company, the top-down material management system of "virtual warehouse + regional warehouse- + turnover warehouse" is introduced to further clarify the positioning and functions of warehouses at different levels and realize the unified management and allocation of power materials in the province.

(4) Through the regional aggregation of the logistics network nodes of the provincial power grid company, the material demand gravity of the logistics network of the provincial power grid company reaches the maximum in the province and effectively improves the logistics service capacity of the provincial power grid company.

The running results and decision-making results of the software for location selection of urban distribution center and distribution line arrangement of self-lift point are shown in Figure 5, respectively.

The above calculation results were brought into GAMS software modeling program and solved by CPLEX solution engine. Among them, there were 151 model parameters, 34 variables, and 47 equations. After 184 iterations and 0.06 s, the optimal value of the objective function was obtained as 202952.000. The final location of the regional logistics center is the bonded logistics center and the new capital logistics center, and the supply points are Chengdu, Xi'an, Chongqing, Kunming, Changsha, Hangzhou, and Shenzhen.

Yuhu District of Xiangtan City constructed and installed 17 community sports venues and facilities in 8 surveyed streets, with a total area of 15,000 $m^2$ and a quantity of 300 pieces. Among all the community sports venues, there are 11 with 10–20 facilities, accounting for 64.71% of the total number. This batch of goods, the number of 20–30 pieces of 2, accounts for 11.76% of the total. The spatial distribution of community SSF in Yuhu District is not balanced. Yuhu Road and Yanggutang Street are relatively densely distributed, while Yuntang Street and Pingzheng Road are relatively less distributed.

Xiangtan Planning and Design Institute can collect land use, overall planning, topographic map, and some national standards; the demographic data were obtained from the household registration statistics report of Xiangtan Municipal Public Security Bureau. The smallest statistical unit available was the street. The data about the site characteristics of community SSF were collected from Xiangtan Sports Bureau and Yuhu Sports Bureau. The current situation of community SSF and site location was collected through topographic map and site investigation. The current situation of sports facilities in Yuhu District of Xiangtan City is shown in Table 2.

According to the above analysis, we need to make certain adjustments based on the uneven distribution, high coverage repetition, and poor coverage of community SSF by consulting urban planning, sports facilities plan, and other relevant documents, as well as the present layout condition. If conditions permit, adjust, relocate, or take additional

Table 1: Basic data table of material warehouse of power grid company.

| Warehouse code | Level of the warehouse | Warehouse coordinates | | Area | Material demand | Inventory turnover (%) |
|---|---|---|---|---|---|---|
| | | North latitude | East longitude | | | |
| HK | Level 1 mixed storage warehouse | 33°58′53.38″ | 330°38′33.32″ | 2800 | 843 | 253.34 |
| sy | Level 1 mixed storage warehouse | 38°38′22.00″ | 303°23′0.00″ | 3303 | 303 | 333.35 |
| dz | Level 1 mixed storage warehouse | 33°28′84.43″ | 308°88′52.34″ | 2200 | 423 | 325.23 |
| qh | Level 1 mixed storage warehouse | 33°58′32.28″ | 303°52′3.38″ | 858 | 223 | 232.32 |
| wc | Secondary mixed warehouse | 33°38′55.22″ | 330°44′33.38″ | 300 | 323 | 382.28 |
| wn | Secondary mixed warehouse | 38°43′22.00″ | 330°23′2.00″ | 482 | 325 | 330.33 |
| cm | Secondary mixed warehouse | 33°43′48.33″ | 330°00′45.00″ | 825 | 338 | 33.28 |
| da | Secondary mixed warehouse | 33°80′53.54″ | 330°33′52.38″ | 323 | 83 | 234.88 |
| tc | Secondary mixed warehouse | 33°42′22.85″ | 330°33′23.28″ | 3323 | 83 | 340.34 |
| ls | Secondary mixed warehouse | 38°30′24.52″ | 303°53′54.84″ | 320 | 328 | 333.25 |
| 1g | Secondary mixed warehouse | 33°54′34.32″ | 303°40′35.38″ | 330 | 320 | 342.32 |
| cj | Secondary mixed warehouse | 33°32′8.22″ | 303°02′23.38″ | 408 | 23 | 353.33 |
| df | Secondary mixed warehouse | 33°30′80.83″ | 308°25′80.83″ | 320 | 304 | 444.44 |

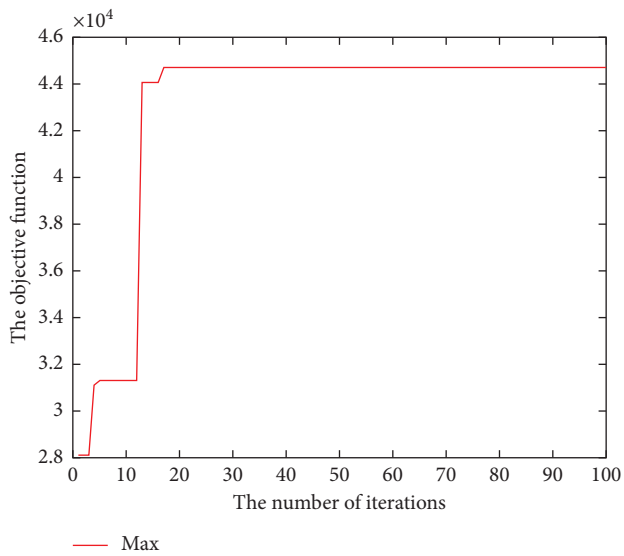


Figure 3: Gravity variation of overall material demand in logistics network of a provincial power grid company.

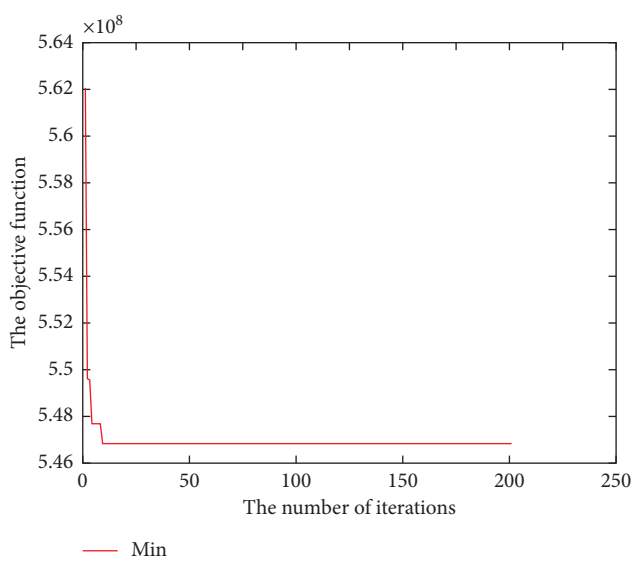


Figure 4: Cost convergence of logistics network optimization of provincial power grid companies.

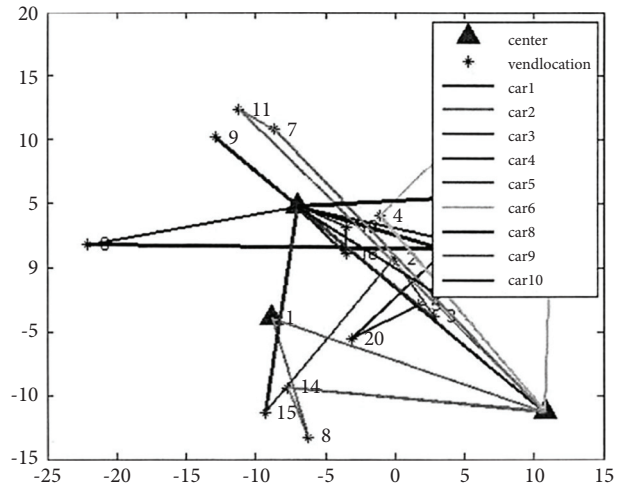


Figure 5: Operation results of sports service network node arrangement.

Table 2: Number of national fitness paths in Yuhu District, Xiangtan City.

| Year | The rain lake road | The city of main street | Pingzheng road | The cloud in the pond | Square | Zhongshan road | Kiln bay | The sheep a brighter pond | A combined |
|---|---|---|---|---|---|---|---|---|---|
| 2006 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 5 |
| 2007 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 4 |
| 2008 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 2 | 7 |

measures. In the long run, with the development of the city and the improvement of residents' living standards, new buildings will be needed to meet the growing needs of community residents. In fact, in real life, the number of new or rebuilt community SSF is often determined by the local government's budget. The planning of public facilities such as community sports involves the interests of all parties, and the final decision is often the result of political wrestling. The layout of facilities is determined through the collective selection of various actors, such as planners, the government, and the public, rather than simply by technical means. The conclusions of this paper can be used to assist decision-making. When it is impossible to reach 100% coverage, public facilities should be arranged to places where they are most urgently needed.

## 5. Conclusion

In view of the current state of sports CI development in Dalian, this paper proposes strategic measures to strengthen sports CI development and, based on the construction of industrial spatial layout patterns, proposes an effective countermeasure of sports cultural industry layout in Dalian, in the future, we can optimize the urban space for the development of sports CI, string the line to the point, and bring the point to the surface to achieve the goal of naming the international sports city in Northeast Asia as soon as possible and realize the sustainable development of sports CI. Innovations. Innovations of this paper: first of all, the sports cultural industry is the inflation of research on the sports industry and cultural industry and academia for the space circulation of sports CI and culture formation, and development of theoretical research is still in the stage. Based on the relevant theories and researches at home and abroad, this paper composes the spatial layout of sports culture industry in Dalian and proposes the basic ways and measures to promote the development of Dalian sports CI. Second, the theory and method of economic geography are applied to the spatial layout of sports CI. The regional development axis defined with regional traffic as the main medium provides theoretical reference and scientific basis for governments at all levels to rationally arrange infrastructure and clarify development ideas.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no known conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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