Research Article

Optimization of Ice and Snow Sports Industry Chain Structure Based on Sensor Network Communication and Artificial Intelligence

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As a new tourism industry model, the ice and snow sports tourism industry has played an increasingly important role in the development of China's entire tourism industry. This paper analyzes the structural optimization of the ice and snow sports industry chain based on sensor network communication and artificial intelligence and aims to fully apply sensor network communication and artificial intelligence technology to the development of the ice and snow sports industry. Let us look for an optimized method to promote the development of the ice and snow sports industry chain structure. This paper conducts a research on the optimization of the ice and snow sports industry chain structure based on sensor network communication and artificial intelligence. In the method part, this article explains the architecture of sensor nodes and networks, uses the long-term monitoring of wireless sensor networks and the flexibility of the data acquisition structure, combined with the superiority of artificial intelligence in information processing and analysis, to obtain and analyze the experimental data of this research, and introduces the specific content of artificial intelligence and the ice and snow sports industry. In the algorithm, the grey relational analysis method is introduced. In the part of the experimental results, experiments were carried out on the ice and snow city resources, competitive advantages, the quarterly average value of the ice and snow sports enterprise prosperity index, ice and snow sports venues, GDP, and the speed comparison and structure of the development of the sports industry, and simulation experiments were carried out from the perspective of sensors. On the whole, the development curve of China's ice and snow sports industry basically conforms to the economic development curve. With the slowdown of GDP growth rate, the growth rate of the sports industry slowed down simultaneously. However, despite the continued decline in economic growth, the sports industry has ushered in a peak of development, with a growth rate of 89.45%, a year-on-year increase of 69.3 percentage points. This phenomenon shows that the sports industry has sufficient endogenous development momentum and huge development potential. It is an important driving force and emerging growth point of the economic society and modern services. It has a comprehensive driving role in stimulating urban consumption, promoting economic transformation and upgrading, and driving the development of the service industry.

1. Introduction

Wireless sensor network is a multihop self-organizing network composed of hundreds of simple and low-cost sensor nodes. It integrates and intersects many disciplines such as networking, microelectronics, wireless communication, and

intelligent computing technology. Since the WSN terminal can use different types of sensors, it can also achieve long-term monitoring and data collection, so its design is very flexible; the network structure can also be customized, and it also has a personalized data fusion strategy. Therefore, the typical applications of WSN include intelligent ecological and

environmental monitoring, biological health monitoring, natural disaster early warning and rescue, building safety status monitoring, smart city data collection and management, and positioning and navigation.

Artificial intelligence is a discipline created by human science. In the final analysis, it still needs to serve people. In-depth analysis of artificial intelligence, the so-called “intelligence,” usually refers to people’s ability to be embodied by thinking process and mental work in the activities of understanding and transforming the objective world. It includes perception ability, thinking ability, and behavior ability. The core of human intelligence lies in knowledge, which is manifested in knowledge acquisition ability, knowledge processing ability, and knowledge application ability.

For the optimization of the sports industry chain structure, sensor network communication, and artificial intelligence, many researchers have done a lot of related research in this area. Yi investigated the coverage of mobile sensor networks affected by communication delays that change over time. Each sensor must move along a fixed closed curve. Assuming that the maximum speeds of the sensors are different from each other, the input saturation constraints of sensors with first-order dynamic characteristics will be different. The results show that, even with time-varying communication delays, low-gain feedback can be used to design distributed coverage control laws for mobile sensors. If there is an upper limit on the delay of the sensor and its derivative, the sensor network is guaranteed to reach the optimal configuration and minimize the coverage cost function. In this study, the maximum allowable upper limit of sensor delay is increased by selecting the lower limit of the sensor’s low control gain. Finally, a numerical example is used to verify the proposed coverage management method. The authors have studied sensor networks but has never applied them in this field [1]. Thrall J. H. et al. believed that AI surveillance programs can help radiologists prioritize work lists by identifying suspicious or positive cases for early review. AI programs can be used to extract “radiological” information from images that cannot be recognized by visual inspection, which may increase the diagnostic and prognostic value derived from image data sets. The authors predict that artificial intelligence will bankrupt radiologists, and radiologists are more likely to incorporate artificial intelligence methods into their practice. The success of artificial intelligence in imaging will be measured by the value it creates: improved diagnostic certainty, faster turnaround times, better patient outcomes, and a better quality of life for radiologists. Artificial intelligence provides a new and promising method to analyze image data. Radiologists will explore these new avenues and may play a leading role in the medical applications of artificial intelligence. The authors are concerned about the application of artificial intelligence in the field of radiology, but the study did not combine related algorithms to illustrate [2]. Yi et al. believe that clarifying the effectiveness of universities in assisting the development of the sports industry and evaluating the effectiveness of the development of the sports industry in

universities is an effective way to further promote the development of the sports industry in colleges and universities. A variety of methods and theories are used to evaluate the function of the development of the university sports industry, such as WSR methods and theories. In the development of the sports industry, functional evaluation indicators are constructed based on expert opinions, and analytic hierarchy process and fuzzy comprehensive evaluation methods are used. The authors used some evaluation tools to learn the process of the sports industry but did not make relevant suggestions for the development of the sports industry [3].

Based on sensor network communication and artificial intelligence, this paper conducts an optimization study on the structure of the ice and snow sports industry chain. In the method part, this article explains the sensor node and network architecture and introduces the specific content of artificial intelligence. As for the algorithm, the grey relational analysis method is introduced. In the part of the experimental results, experiments were carried out on the ice and snow city resources and competitive advantages and simulation experiments were carried out from the perspective of sensors. The innovation of this paper is to combine sensor network communication with artificial intelligence, to study the optimization method of industrial chain structure, so as to better realize the improvement of related products. Through the application of artificial intelligence decision tree algorithm, Bayesian algorithm, and other algorithms, the application of sensor network communication technology and the various factors involved in the ice and snow sports industry chain are analyzed in detail, and the current problems in the development of the ice and snow sports industry are analyzed and a solution is sought.

2. Optimization of the Structure of the Ice and Snow Sports Industry Chain Methods Based on Sensor Network Communication and Artificial Intelligence

2.1. Sensor Network Communication. The sensor node is generally composed of four parts, as shown in Figure 1, which are energy module, communication module, processor module, and sensor module [4, 5]. In some special cases, with different applications, some functional modules can be added accordingly, such as mobile device modules and positioning device modules, to provide more functions for people to use, and sensor nodes can detect many of the surrounding environments. Signals, such as pressure, smoke, speed, humidity, and heat, are widely used [6].

Processor. The processor always performs tasks and controls the functions of other components in the sensor node. The processor is usually used in many other embedded systems because of its low cost, flexibility to connect to other devices, ease of programming, and low power consumption [7].

Transceiver. The transceiver usually lacks a unique identifier. Its usual operating states are transmission, reception, idle, and sleep. Many current transceivers have built-in state

FIGURE 1: Sensor node architecture (pictures from Baidu picture).

machines that automatically perform certain operations. The power consumption of most transceivers running in idle mode is almost equal to the power consumption in receiving mode. Therefore, in terms of energy consumption, it is best to completely turn off the transceiver instead of putting it in idle mode when not transmitting or receiving data. When switching from sleep mode to transmission mode, transmitting data packets will consume a lot of power [8].

Memory. From the perspective of energy consumption, the most suitable memory is the chip memory and flash memory of the single-chip microcomputer. Flash memory is used because of its cost and storage capacity. The memory requirements are very dependent on the application. Two types of memory are based on storage purposes: user memory for storing application-related or personal data and program memory for programming [9].

Power Supply. Since wireless sensor nodes are usually placed in hard-to-reach locations, it may be expensive and inconvenient to replace the battery frequently. An important aspect of developing wireless sensor nodes is to ensure that there is always enough available energy to power the system. Sensor nodes for sensing, communication, data processing, and data communication require more energy than any other process [10].

Sensors. Each sensor node has a certain coverage area, which can accurately report the observed specific conditions. There are several sources of energy consumption in the sensor: signal sampling and conversion of physical signals to electronic signals, signal conditioning, and analog-digital conversion [11].

Through the control of the sensor, it can automatically generate a good structure of the sensor, improve the efficiency of the routing protocol and the MAC protocol, and lay the foundation for data fusion, time synchronization, and so forth; due to the high correlation between the sensor network and specific applications, the location information locates the node and uses the computing and storage capabilities to perform data fusion.

The working mechanism of the wireless sensor network is to first place a large number of nodes in the designated detection area, so that each node forms one or more distributed network infrastructures according to a certain

self-organization and cooperation and then use sensors to sense and collect data from the designated areas in real time. The original information of the area, such as temperature, pressure, motion, trajectory, and sound, is then stored in the respective storage units and then according to the needs of the network or neighbor node information to determine whether to interact or merge data. Finally, the aggregation node is passed to the collaborative Internet or the computing center through the external network for the later comprehensive data screening and processing [12, 13]. Figure 2 shows the basic architecture of the sensor network.

The wireless sensor network is essentially a distributed wireless sensor node group. These node groups are randomly distributed in or near the monitoring area. They form a network through self-organization. This is an embedded system structure that collects local data through a battery with a limited amount of power, processes, stores, manages, and integrates data forwarded by other nodes. The convergence node is connected to the external network of the sensor network and the Internet to realize the conversion of the communication protocol. At the same time, it releases the monitoring tasks of the management node and forwards the data to the external network.

2.2. Artificial Intelligence. Participants of artificial intelligence at the technical level mainly refer to technology companies with algorithms as their core competitiveness, and they provide artificial intelligence algorithm platforms or engines, while participants at the application level mainly refer to the use of artificial intelligence algorithms to develop related applications for specific problems. At this stage, the leading companies in China's intelligent industry mainly research core algorithms, starting from the basic layer, while small- and medium-sized startups start from the technology and application support, mainly researching voice, visual recognition, and so forth, and then bring artificial intelligence into products and services in various fields such as security, finance, and education [14, 15].

There are many kinds of artificial intelligence algorithms, but the main idea is to perceive the environment and then make decisions to achieve the target output to the greatest extent. Many artificial intelligence algorithms can be trained and learned from data to improve their system performance.

FIGURE 2: Wireless sensor network architecture.

Common theories include Markov processes, Bayesian networks, and decision trees.

The rules of Bayesian network induction are

$$\delta(i|O) = \frac{\delta(O|i)\delta(i)}{\delta(O)}, \quad (1)$$

$$\delta(i, v|O, P) = \frac{\delta(O|i, v, P)\delta(i, v|P)}{\delta(O|P)}, \quad (2)$$

where $\delta(i|O)$ is the likelihood function for processing the data node and $\delta(O)$ is the training process of the normalization factor. i, v is the probability distribution. Similarly, the decision tree algorithm of artificial intelligence can be expressed as

$$R(i) = - \sum_{i=1}^n \eta_i \log_2(\eta_i), \quad (3)$$

$$r(j) = \frac{n_{ij}^2}{n_j} \sum_i (i|j)p(i|j). \quad (4)$$

Among them, the data value input by the sensor network needs an independent value set $R(i)$ to adjust, and formula (4) is a trial-and-error function, which can improve system performance.

Through a period of training, learning, and memory, artificial intelligence algorithms can simulate humans and make corresponding decisions on problems according to human needs. This is like human beings; through continuous learning and memory of the external environment, a certain experience is cultivated, so that they can have a good response when facing things [16, 17].

2.3. Ice and Snow Sports Industry. The scarcity of ice and snow resources lead to strong regional differences. Only in cold regions can ice and snow be formed and the conditions for the industrialization of ice and snow sports can be achieved. The complex of various production and operation industries such as the ice and snow fitness and entertainment

industry, the competitive performance industry, the sporting goods industry, and the training industry has jointly constructed a huge ice and snow industry market, which provides fitness, entertainment, participation, and repetition. The winter competition events are mainly divided into two types: snow events and ice events. Among them, the ice and snow projects are divided into many small projects with their own characteristics. Because these sports projects use different clothing and equipment and compete in different venues in different competition methods, the ice and snow competitions have unique charm and attractiveness, greatly increasing the viewing of the game [18, 19].

Ski sports tourism is an organic fusion of tourism. The ski tourism resources are divided into three categories, namely, the core resources of ice and snow sports tourism, the related resources of ice and snow sports tourism, and the basic resources of ice and snow sports tourism. Among them, the core resources of ice and snow sports tourism are subdivided according to the composition of resources, divided into two subcategories: development resources and competition resources [20, 21].

2.4. Industry Chain Structure. The optimization and upgrading of the industry mainly refers to the advancement and rationalization of the industrial structure. Advancement refers to the gradual transformation from the primary stage of agriculture as the mainstay to the industrialization stage with the processing and manufacturing industry as the core, and, with the continuous development of industrialization, it gradually enters the postindustrial era with modern service industry as the leading industry [22].

Industrial clusters have seven obvious characteristics: (1) Most of the products of cluster enterprises belong to the same industry. (2) Enterprises within the industry have obvious connections, such as professional division of labor and supplier-customer. (3) They have cost advantages and can basically complete corporate procurement through the links of internal enterprises in the industry. (4) Most of the scale of the enterprise belongs to small and medium enterprises. (5) The products of cluster enterprises have strong market competitiveness. (6) Industrial clusters are spontaneously formed by enterprises and have a growth process from embryonic form to mature clusters. (7) They have obvious learning effect. According to the characteristics of cluster industries, industrial clusters can be divided into three categories: traditional industrial clusters, high-tech clusters, and resource and technology clusters.

The production capacity of the sector is adapted to market demand, and the demand income elasticity of the industry and the production income elasticity are basically balanced, and the total output and total profit of the economy are basically balanced; generally use high processing, high value-added, technology intensification, knowledge, and service to be the signs of the industrial structure. These signs are not opposite. The way that they complement each other and judge whether the industrial structure is necessary needs to be comprehensive [23, 24].

2.5. Grey Relational Analysis. Grey correlation analysis is a tool to measure the degree of correlation between elements through the similarity or difference in the evolution of elements, that is, the degree of “grey correlation.” The advantages of this method are the following: First, it makes up for the shortcomings of using mathematical statistics in system analysis. Second, it can also be applied to the size of the sample and whether the sample is normal. There exists

$$G_m = (g_m(1), g_m(2), \dots, g_m(i)). \quad (5)$$

The matrix is composed of evaluation index data matrix and reference value:

$$G = (G_0, G_1, \dots, G_j) = \begin{bmatrix} g_0(1) & g_1(1) & g_2(1) & \cdots & g_j(1) \\ g_0(2) & g_1(2) & g_2(2) & \cdots & g_j(2) \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ g_0(i) & g_1(i) & g_2(i) & \cdots & g_j(i) \end{bmatrix}. \quad (6)$$

The second step is to make the indicator data nondimensional, that is, to perform nondimensional processing on each column of X . The dimensionless value is

$$K_m = (k_m(1), k_m(2), \dots, k_m(i)). \quad (7)$$

The commonly used methods of dimensionless processing are as follows:

- (1) Averaging method: find the average value of each indicator value of the sequence G_m , and then compare each element with its average value:

$$k_m(i) = \frac{g_m(i)}{(1/I) \sum_{n=1}^I g_m(n)}. \quad (8)$$

- (2) Initialization method: compare each element of the sequence G_m with the initial value $g_m(1)$ of the sequence, so there is

$$k_m(i) = \frac{g_m(i)}{g_m(1)}. \quad (9)$$

- (3) Interval value method: find the range of the sequence G_m , and then subtract the minimum value from each element of the sequence, and compare it with the range, and then we have

$$k_m(i) = \frac{g_m(i) - \min_n g_m(n)}{\max_n g_m(n) - \min_n g_m(n)}. \quad (10)$$

In order to unify the polarity of the data, the sequence K_m that has undergone dimensionless processing must be subjected to polarity conversion processing to obtain a dimensionless and nonpolar sequence H_m . There are the following polarity change processing methods for three different polarity data sequences:

- (1) Nonpolarization of maximum polarity: compare each element of the sequence K_m with the maximum value of the sequence, namely,

$$h_m(i) = \frac{k_m(i)}{\max_n k_m(n)}. \quad (11)$$

- (2) Nonpolarization of moderate value polarity: set $k_m(0)$ as the moderate value of the sequence K_m ; then the transformation formula is as follows:

$$h_m(i) = \frac{\min\{k_m(i), k_m(0)\}}{\max\{k_m(i), k_m(0)\}}. \quad (12)$$

- (3) Nonpolarization of the minimum polarity: compare the minimum value of the sequence K_m with the elements of the sequence, namely,

$$h_m(i) = \frac{\min_n k_m(n)}{k_m(i)}. \quad (13)$$

After the polarity treatment of the above nonpolarization method, a nondimensional and nonpolar sequence can be obtained:

$$H_m = (h_m(1), h_m(2), \dots, h_m(i)). \quad (14)$$

Suppose that there is an index that is evaluated by V criteria, and the time length is n , considering the degree of correlation between other factors and it.

Define $H_0 = \{h_0(1), h_0(2), \dots, h_0(i)\}$ as a reference sequence and $H_m = \{h_m(1), h_m(2), \dots, h_m(i)\}$ as a comparison sequence; the grey correlation coefficient of H_m and H_0 is

$$\sigma_m(i) = \frac{\min_m \min_i \Delta_m(i) + \tau \max_m \max_i \Delta_m(i)}{\Delta_m(i) + \tau \max_m \max_i \Delta_m(i)}. \quad (15)$$

The correlation degree of H_m and H_0 is

$$t(H_0, H_m) = \frac{1}{s} \sum_{i=1}^s \sigma_m(i). \quad (16)$$

The absolute value of the difference is

$$|\hat{h}_0(i) - \hat{h}_m(i)|, i = 1, 2, \dots, r; k = 1, 2, \dots, s. \quad (17)$$

The fourth step is to sort the degree of correlation and calculate the correlation coefficient.

$$\omega_m(i) = \frac{\min + \sigma \max}{|\hat{h}_0(i) - \hat{h}_m(i)| + \sigma \max}. \quad (18)$$

The fifth step is to determine the interindustry interdependence. Assuming the interindustry association degree is $t_{gm} = t(H_g, H_m)$, the interindustry association degree can be formed into an association degree matrix T :

$$T = \begin{Bmatrix} t_{11} & t_{21} & \cdots & t_{i1} \\ t_{12} & t_{22} & \cdots & t_{i2} \\ \vdots & \vdots & \ddots & \vdots \\ t_{1i} & t_{2i} & \cdots & t_{ii} \end{Bmatrix}. \quad (19)$$

3. Results

3.1. Resource Analysis of China's Ice and Snow Cities. Table 1 shows the resources for the four relatively well-developed ice and snow sports cities in China. The four cities are Harbin, Beijing, Changchun, and Shenyang.

3.2. Analysis of Competitive Advantage. Some foreign countries also have certain advantages for the development of winter sports, as demonstrated in Table 2; these countries include Switzerland, Japan, South Korea, and France.

3.3. Quarterly Average of Business Climate Index. Table 3 shows the average of the four quarters of enterprise prosperity index. Entrepreneur confidence index in the first and fourth quarters remained relatively close to that in the second and third quarters as a whole, and some industries were even much higher than the second and third quarter indexes, such as accommodation and catering and computer software services. According to the analysis of the business climate index, the business climate indexes of the industry, construction industry, and transportation industry in the first and fourth quarters were 128.45, 134.43, and 107.34, respectively, and the production situation boom indexes were 117.12, 98.54, and 105.65, respectively. Among them, in the analysis of the prosperity index of the production situation of enterprises, the indices of the retail trade, real estate, and social service industries in the first and fourth quarters were 141.66, 121.56, and 117.68, respectively, which were higher than the values in the second and third quarters. With the huge promotion of ice and snow sports event tourism, these relatively dull winter industries have become an important growth point for the ice and snow economy in one fell swoop.

3.4. Ice and Snow Sports Venues. Table 4 shows the types of customers participating in ski sports such as experience type, learning type, and vacation type. Generally, the experience-based sports venues are relatively simple, while the learning-based venues have some small curves, which are challenging. The resort-based ice and snow venues are relatively complicated, but they are not as targeted as the learning type for ice and snow sports. The venue is strong.

3.5. Comparison of GDP and the Development Speed of the Sports Industry. This article compares the development growth rate of ski sports with the GDP growth rate in Figure 3. Obviously, the growth rate of the former is higher than that of the latter.

3.6. Structural Benefit Analysis. Adjust the number of sending nodes to 5, and keep the initial values of other parameters unchanged. The comparison of the average throughput and energy consumption simulation results of the three MAC protocols is shown in Figure 4.

3.7. Simulation Experiment. In the same simulation environment, for the average throughput output, the throughput and energy consumption performance of the HCW-MAC protocol are improved compared to the CW-MAC protocol. From the perspective of average energy consumption output, the average energy consumption of CW-MAC is greater than that of HCW-MAC. This also shows that, compared to the "empty window period," the "collision rate" has a greater impact on the throughput. This is because the "collision rate" is proportional to the number of sending nodes, and the performance of the HCW-MAC protocol proposed based on improving the impact of the "collision rate" has improved significantly.

Figure 5 shows the simulated average delay of high-priority packets. The high-priority data packet of ER-MAC has a lower delay than the high-priority data packet of X-MAC.

Another experiment is demonstrated in Figure 6. The load is changed within 5000 s. The network traffic changes every 100 seconds.

This paper simulated the positioning accuracy of each algorithm under different communication radius, and the comparison is demonstrated in Figure 7. As the final communication radius increases, the positioning accuracy of all algorithms has dropped to a very low level. This is mainly because the increase in the communication distance of nodes has brought about the increase in the number of beacon nodes that can be received, which makes it easier for unknown nodes to estimate the position coordinates. For sensor networks, a longer communication radius also represents greater energy consumption. The AIWO-Powell positioning algorithm can be implemented with the smallest communication radius under the same positioning accuracy requirements. Therefore, AIWO-Powell is beneficial to save node positioning. The energy consumption is also conducive to further extending the life of the network.

4. Discussion

In recent years, with the rapid growth of Chinese residents' demand for training activities, the developed Asian ski and skate sports tourism countries represented by Japan and South Korea have also begun to seize the market in China, and targeted tourism business and special promotional activities have been carried out. All major ski tourism consumption areas set up general agents; a Japanese ski website was set up in cooperation with relevant Chinese companies, so that consumers can directly obtain information and activities related to outbound travel, such as the establishment of Japan Ski Net and South Korea Ski Net. Convenient and affordable transportation conditions, complete ice and snow sports tourism facilities, high-quality supporting services, and exotic characteristics

TABLE 1: List of ice and snow resources in various regions.

District	Temperature	Ice and snow resources	Duration
Harbin	-30°C-15°C	Natural	5 months
Beijing	-8°C-5°C	Mainly artificial	2 months
Changchun	-20°C-15°C	Natural	3 months
Shenyang	-20°C-5°C	Mainly natural, supplemented by artificial	3 months

TABLE 2: Analysis of foreign competitors.

Classification	Main competitor	Competitive advantages	Competitive disadvantages
Foreign competitors	Davos, Switzerland	1. World-class sports ice and snow facilities	1. Relatively cumbersome immigration procedures
	Hokkaido, Japan	2. Advanced management, high-quality service	2. Prone to communication barriers such as language
	Gangwon-do, South Korea	3. Perfect integrated market	3. Relatively high prices during peak tourist seasons
	Alps, France	4. Relatively low travel consumer prices 5. Excellent natural conditions and exotic customising strategy	

TABLE 3: Quarterly average of enterprise prosperity index.

Index	Entrepreneur confidence index		Business boom index		Production situation boom index	
Seasons	Quarters 1 and 4	Quarters 2 and 3	Quarters 1 and 4	Quarters 2 and 3	Quarters 1 and 4	Quarters 2 and 3
Overall situation	129.33	131.89	126.7	129.87	107.87	116.86
Industry	127.34	128.78	128.45	128.94	117.12	111.04
Construction industry	141.35	139.65	119.45	134.43	98.54	158.34
Transportation industry	112.43	125.35	104.23	107.34	105.65	116.75
Retail trade	132.53	143.27	141.66	140.65	105.76	96.78
Real estate industry	119.43	120.54	121.56	118.71	102.33	122.99
Social services	110.09	119.11	117.68	115.41	102.64	122.09

TABLE 4: Types of customers participating in ski sports.

Ski resort type	Ski attributes	Field features	Customer characteristics	Customer group positioning
Experience	Tourist attribute	The facilities are simple, with only junior roads	More than 90% are experience customers, staying for an average of 2 hours	Sightseeing customer
Learning	Sports attribute, tourist attribute	A small drop, located in the suburbs	Self-driving customers account for a large proportion, with an average stay of 3-4 hours	Local resident
Holiday	Sports attribute, tourist attribute, holiday attribute	A certain scale and a complete range of ski products	The average stay time of guests is more than 1 day	Vacation crowd

FIGURE 3: Comparison of sports industry added value growth rate and GDP growth rate from 2016 to 2020.

FIGURE 4: Performance simulation comparison of two MAC protocols. (a) Average throughput output. (b) Average energy consumption output (the number of sending nodes is 5).

FIGURE 5: Delay effect under 7 network loads.

FIGURE 6: Comparison of packet delay between protocols under traffic changes.

FIGURE 7: Comparison of positioning accuracy of various algorithms under different node communication radii.

have become eye-catching selling points and advantages of tourism in Japan, Canada, and other countries, attracting more domestic senior ice and snow sports tourism enthusiasts to ski, vacation, and travel. France and Switzerland, the sacred places of ice and snow sports tourism, have deeply attracted many ski enthusiasts with their advanced management models, complete facilities, high-quality services, and romantic European culture. In view of learning foreign advanced experience, seek the management mode suitable for its own development needs. Comparing China's cities with ice and snow resources, it is not difficult to see that Harbin has more competitive advantages than the other three cities in terms of ice and snow tourism climate resources, especially in terms of snow quality and the number of days of low-temperature weather. Due to the natural geographical advantages, the snow quality of Harbin's ice and snow sports tourism resources is basically based on natural snow. Only under special circumstances will artificial assisted snowmaking occur.

Comparing the ice and snow sports industry with GDP growth shows that, from 2017 to 2019, the growth rate of China's sports industry slowed down, but it was still about 5 percentage points higher than the GDP growth rate over the same period. On the whole, the development curve of China's sports industry basically conforms to the economic development curve. With the slowdown of GDP growth rate, the growth rate of the sports industry slowed down simultaneously. However, despite the continued decline in economic growth, the sports industry has ushered in a peak of development, with a growth rate of 89.45%, a year-on-year increase of 69.3 percentage points. This phenomenon shows that the sports industry has sufficient endogenous development momentum and huge development potential. It is an important driving force and emerging growth point of economic society and modern services. It has a comprehensive driving role in stimulating urban consumption, promoting economic transformation and upgrading, and driving the development of the service industry.

5. Conclusion

The adjustment of the sports industry policy is a continuous and dynamic process, and the content of the optimization of the sports industry structure is different in different regions

and different development stages. The rationalization of the structure of the sports industry is the basic condition of the heightening, and the heightening is the goal and destination of the rationalization, and the two complement each other. The rationalization of the sports industry structure mainly refers to the objective proportional relationship with the related industries within the sports industry to eliminate backward industries, adjust the uncoordinated sports industry structure, and promote the coordinated development of various industries within the sports industry. The advancement of the sports industry structure mainly follows the evolution law of the sports industry structure. Through innovation, the technological content of the sports industry is improved, and the development of the sports industry structure is accelerated.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare no conflicts of interest.

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