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Based on the analytic hierarchy process selection and adjustment of china's sports industry structure optimization research

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ABSTRACT

The contribution of the sports industry in economic development in the proportion rising, is the new sunrise industry with huge energy. At present China's sports industry output value of GDP is far less than the European and American developed countries. Promote the rapid development of the sports industry and I optimize formula to perfect the sports industry the key to the development of sports industry. In this paper, based on the analytic hierarchy process (ahp), to optimize the sports industry structure schemes are discussed, it is concluded that the optimal scheme and the implementation methods of each scheme adjustment.

KEYWORDS

Analytic hierarchy process; Sports industry; Industry structure optimization; Optimal scheme.

INTRODUCTION

Sports industry structures are mutual correlated, industries correlation effects, motive power principle and coordination mechanism are complex and changeable, reasonable sports industry structure has important significances in sports industry healthy, rapidly development. To adjust sports industry structure and optimize industrial structure setting, different scholars put forward each kind of schemes. Formers have made lots of discussion in the schemes' merits[1-5].

The paper according to documents and interviewing experts, it establishes sports industry structure scheme selected hierarchical structure, researches sports industry institution scheme optimal problems from quantization perspective[6-9]. Finally it gets optimal scheme, which provides theoretical references for sports industry structure development.

SPORTS HIERARCHICAL SCHEME DEFINING

According to experts' opinions and documents, define criterion layer and scheme layer that speed up sports construction, as following TABLE 1.

TABLE 1 : Sports hierarchical structure

Target layer	Criterion layer B	Scheme layer C
Sports industry optimization (A)	Increase sports demand structure (B_1)	Improve government and market relations (C_1)
	Strengthen sports supply structure (B_2 }	Perfect sports industry policies (C_2)
	Perfect sports trade structure (B_3)	Increase public service construction(C_3)
	Perfect social structure (B_4)	Establish sports industrial districts(C_4)
	Intensify sports industries combination (B_5)	

Construct hierarchical structure

In analytic hierarchy process optimization decision-making algorithm, hierarchical structure mainly has three layers, 1, target layer (A), 2, criterion layer (B_m), 3, scheme layer (C_n). According to criterion layer constraint conditions, calculate schemes weight sizes for multiple schemes, and according to weight sizes, rank and define schemes priorities. Sports industry structure optimization hierarchical structure is as following Figure 1.

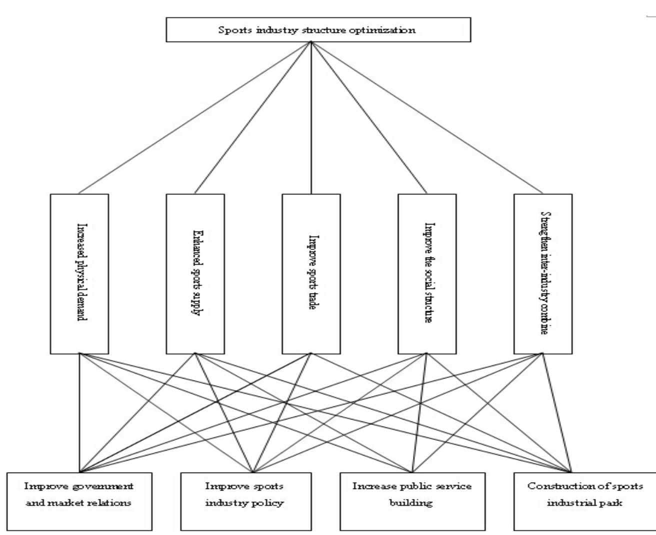

Figure 1 : Sports industry structure optimization hierarchical structure

Judgment matrix

In sports industry structure optimization layers, criterion layer has five conditions $B=(B_1, \ B_2, \ \cdots \ B_5)$, which has restriction in target fulfillment. By comparing criterion importance, comparison result is using 1-9 or their reciprocal to express**[10,11]**. B_i, B_j Importance comparison structure is using a_{ij} to express, all comparison result composes judgment matrix A. Its expression is as following:

$$A=\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1j} \\ a_{21} & a_{22} & \cdots & a_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ a_{i1} & a_{i2} & \cdots & a_{ij} \end{pmatrix}$$

Among them, after Saaty researching, it is thought that using 1~9 scale to express comparison structure conforms to people judgment ability. Use 1~9 numbers and their reciprocals to express a_{ij} value. Number respective expressive definitions are as following TABLE 2.

TABLE 2 : 1~9 scale meaning

Scale	Meaning
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is more important than the later by comparing two factors
7	Indicates the former is more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
Even number	Represents importance is between two odd numbers
Reciprocal	Represents importance is between two odd numbers

Weight vector and maximum feature value calculation

Firstly, make normalization on all column vectors of A and get matrix D:

$$D=\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} \bullet \begin{pmatrix} 1/\sum_{i=1}^{n} a_{i1} & 0 & \cdots & 0 \\ 0 & 1/\sum_{i=1}^{n} a_{i2} & \cdots & 0 \\ 0 & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & 1/\sum_{i=1}^{n} a_{in} \end{pmatrix}$$

Matrix then carries out solving sum by line:

$$E=D\bullet(1 \quad 1 \quad \cdots \quad 1)_{1\times n}^{T}$$

$$E=(e_{11} \quad e_{12} \quad \cdots \quad e_{1n})^{T}$$

Normalize matrix E and solve weight vector:

$$W = (w_1 \quad w_2 \quad \cdots \quad w_n)^T = \left(e_{11} / \sum_{i=1}^{n} e_{i1} \quad e_{12} / \sum_{i=1}^{n} e_{i1} \quad \cdots \quad e_{1n} / \sum_{i=1}^{n} e_{i1} \right)^T$$

Maximum feature value, weight vector corresponding maximum feature value, then it surely has:

$$AW = \lambda_{\max} W$$

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(AW)_i}{w_i}$$

Consistency test

CI Represents matrix consistency indicator, CR represents matrix consistency ratio, test matrix consistency by calculating the two indicators: $CI = \frac{\lambda_{\max} - n}{n-1}$, among them, n represents judgment matrix one layer factors number, and meanwhile it also the matrix order: $CR = \frac{CI}{RI}$.

Among them, RI represents Random Consistency Index value, as following TABLE 3 show.

TABLE 3 : RI value table

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Assume in layer B that m pieces of factors values computational result is α_m, corresponding consistency indicator value is respectively CI_m, in next layer C, n pieces of factors to layer A computational weight is β_{nm}, then layer C factors total arrangement weight is: $w_i = \sum_{j=1}^{m} \alpha_i \beta_{ij}$.

Combination consistency test consistency ratio is: $CR = \frac{\sum_{j=1}^{m} \alpha_j CI_j}{\sum_{j=1}^{m} \alpha_j RI_j}$

Judgment criterion whether matrix meets consistency or not is: when $CR \geq 0.1$, it is reasonable. When $CR < 0.1$, it is unreasonable.

SPORTS INDUSTRY STRUCTURE ADJUSTMENT OPTIMAL SCHEME

Criterion layer and scheme layer weight vector calculation

According to TABLE 1, sports development hierarchical structure constructed judgment matrix and calculation weight vector are respectively as following TABLE 4-9.

TABLE 4 : Factor B to target A importance weight

A	B_1	B_2	B_3	B_4	B_5	W
B_1	1	1	1/7	1/3	1/5	0.058
B_2	1	1	1/7	1/3	1/5	0.058

B_3	7	7	1	3	2	0.456
B_4	3	3	1/3	1	1	0.183
B_5	5	5	1/2	1	1	0.246

TABLE 5 : Scheme C to criterion B_1 importance weight

B_1	C_1	C_2	C_3	C_4	W
C_1	1	3	7	8	0.576
C_2	1/3	1	5	5	0.276
C_3	1/7	1/5	1	3	0.097
C_4	1/8	1/5	1/3	1	0.052

TABLE 6 : Scheme C to target B_2 importance weight

B_2	C_1	C_2	C_3	C_4	W
C_1	1	2	3	1/5	0.166
C_2	1/2	1	3	1/7	0.114
C_3	1/3	1/3	1	1/9	0.055
C_4	5	7	9	1	0.665

TABLE 7 : Scheme C to target B_3 importance weight

B_3	C_1	C_2	C_3	C_4	W
C_1	1	3	7	5	0.598
C_2	1/3	1	2	1	0.170
C_3	1/7	1/2	1	1/2	0.082
C_4	1/5	1	2	1	0.150

TABLE 8 : Scheme C to target B_4 importance weight

B_4	C_1	C_2	C_3	C_4	W
C_1	1	1	1/5	3	0.148
C_2	1	1	1/5	3	0.148
C_3	5	5	1	9	0.647
C_4	1/3	1/3	1/9	1	0.057

TABLE 9 : Scheme C to target B_5 importance weight

B_5	C_1	C_2	C_3	C_4	W

C_1	1	2	5	3	0.483
C_2	1/2	1	3	1	0.229
C_3	1/5	1/3	1	1/3	0.080
C_4	1/3	1	3	1	0.208

Computed result, consistency test

Carry out consistency test and combination consistency test on above five judgment matrixes' weight vector calculation, maximum feature value and consistency test indicator list as following TABLE 10-11.

TABLE 10 : Selection scheme weight and test indicator

B W C	B_1	B_2	B_3	B_4	B_5
	0.058	**0.058**	**0.456**	**0.183**	**0.246**
C_1	0.576	0.166	0.598	0.148	0.483
C_2	0.276	0.114	0.170	0.148	0.229
C_3	0.097	0.055	0.082	0.647	0.080
C_4	0.052	0.665	0.150	0.057	0.208
λ_j	4.206	4.108	4.026	4.032	4.033
CR_j	0.076	0.038	0.0096	0.012	0.012

TABLE 11 : Scheme layer total arrangement weight table

Target layer	**Scheme layer**	**Weight**
Sports industry optimization (A)	Improve government and market relations(C_1)	0.4616
	Improve sports industry policy(C_2)	0.1836
	Increase public service building (C_3)	0.1843
	Construction of sports industrial park (C_4)	0.1716

CONCLUSION

In sports industry structure optimization schemes, according to analytic hierarchy process calculation, it gets "improve government and market relations" scheme weight is the maximum one, therefore optimal scheme should work on transforming government functions, well handling with market and government relations, construct market-oriented sports industry. The scheme should be priority considered in concrete implementation.

Improve government and market relations have comprehensive advantages, its prominent advantage is that it can perfect sports trade structure, which has largest impacts on sports trade. Perfect sports industry policy's prominent advantage is increasing sports demand, improving market demand ability. Increase public service construction's prominent advantage is perfecting social structure, improving sports industry structure survival environment. Prominent advantage is increasing sports supply structures that can vigorous promote sports production manufacturing development, strengthening sports product and service supply. Different districts sports industry structure has specificities, government selects proper schemes according to practical situations to propel to sports industry development and optimize industry structure.

REFERENCES

[1] Zhang Lin, Liu Wei, Lin Xian-Peng, Zhang Li, Yang Yue, Huang Hai-Yan; China Sport Science, **28(10)**, **(2008)**.
[2] Zhang Li, Wang Li-Yuan, Xu Xiao-Juan, Liu Chang; Journal of Shanghai Physical Education Institute, **31(1)**, 38-43 **(2007)**.
[3] Mei Xiao-Bing, Liu Xiang; Journal of Chengdu Physical Education Institute, **38(9)**, 12-15 **(2012)**.
[4] Lin Xian-Peng; China Sport Science, **20(4)**, 1-5 **(2000)**.
[5] Luo Lei, Zhang Lin, Huang Hai-Yan; China Sport Science, **32(11), (2012)**.
[6] Dong Feng, Wu Xiang-Zhi, Zhang Lin; Journal of Nanjing Institute of Physical Education, **26(1)**, 35-41 **(2012)**.
[7] B.Zhang, S.Zhang; G.Lu; Journal of Chemical and Pharmaceutical Research, **5(9)**, 256-262 **(2013)**.
[8] B.Zhang; International Journal of Applied Mathematics and Statistics, **44(14)**, 422-430 **(2013)**.
[9] B.Zhang; H.Yue; International Journal of Applied Mathematics and Statistics, **40(10)**, 469-476 **(2013)**.
[10] B.Zhang, Y.Feng; International Journal of Applied Mathematics and Statistics, **40(10)**, 136-143 **(2013)**.
[11] Bing Zhang; Journal of Chemical and Pharmaceutical Research, **5(2)**, 649-659 **(2014)**.