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Chinese urban and rural mass sports participation ability fuzzy comprehensive evaluation

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ABSTRACT

China is a country of the greatest population, for masses sports participation status, carry out measurement on Chinese national fitness activities, on the basis of integration of urban and rural, establish fuzzy comprehensive evaluation model, it gets comprehensive evaluation value: facility U_1 is38%, staff cultivation U_2 is 25%, sports organization cultivation U_3 is 22%, high class stadium construction U_4 is15%, therefore, Chinese sports construction mainly surrounds sports facilities construction and sports staff as well as organization cultivation, so that can effective improve mass sports participation degree.

KEYWORDS

Fuzzy comprehensive evaluation;
National fitness;
Sports facility and stadium;
Health level;
Sports participation;
Sports industry.

INTRODUCTION

Chinese economic development ratio is not so balanced, and economy is an important link in social development and even is basis, village and town residents don't quite understand real physical education and national fitness significances, awareness of national fitness is to be improved, and support to village and town sports is still not big enough. By comparing, urban high class stadium has good forces. Based on economic development is not very balanced, and economy is the important link in social development, even is basis, village and town residents don't quite understand real physical education and national fitness significances, awareness of national fitness is to be improved, and support to village and town sports is still not big enough, by comparing, urban high class stadium has positive effects.

For Chinese sports service industry, urban and rural economic imbalanced development is up to sports service industry distribution important factors. The paper based on analytic hierarchy process model, it carries out sports service industry development strategy research on village and town regions. Due to economic development ratio is not very balanced, and economy is the important link in social development, even is basis; village and town residents don't quite understand real physical education and national fitness significances, awareness of national fitness is to be improved, and support to village and town sports is still not big enough, by comparing, urban high class stadium has positive effects.

By TABLE 1, it is clear about Chinese different working environment staff fitness ways and fitness purposes.

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TABLE 1 : Different social classes' participated in sports construction status

	Horizontal indicator					
	Enhance quality	Entertainment	Social communication	Improve sports level	Emotion adjustment	Beauty building, body building
Nation and social administrative staff	51.4	16.4	7.7	4.9	5.5	14.2
Managerial staff	26.0	23.3	25.0	5.5	4.4	25.9
Private entrepreneur	32.4	19.0	22.9	5.7	12.4	7.6
Professionals	48.0	7.5	4.9	7.5	14.6	17.6
Clerks	37.7	21.2	9.2	3.5	8.5	19.9
Individual business	56.9	15.8	6.5	4.1	10.3	6.4
Commercial service personnel	38.3	14.9	11.3	4.9	9.7	21.0
Workers	35.4	13.6	14.6	3.0	4.8	18.6
Agricultural laborers	33.2	20.2	11.8	2.3	20.9	11.6
Laid-off workers	32.2	11.2	22.4	5.6	15.4	13.3

Take Beijing as an example, sports construction development on the basis of national fitness features is as following Figure 1-2 show.

MODEL ESTABLISHMENTS

Fuzzy comprehensive evaluation model

Utilize fuzzy comprehensive evaluation, steps are as following:

(1) Establish factor set U :

$$U = \begin{pmatrix} U_1 & U_2 & \cdots & U_k \end{pmatrix}$$

(2) Establish judgment set V (evaluation set);

(3) Establish evaluation matrix fuzzy mapping from U to V , obtained fuzzy relations are as following matrix shows:

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

(4) Establish weight set, $A = (a_1, a_2, \cdots, a_n)$, it meets

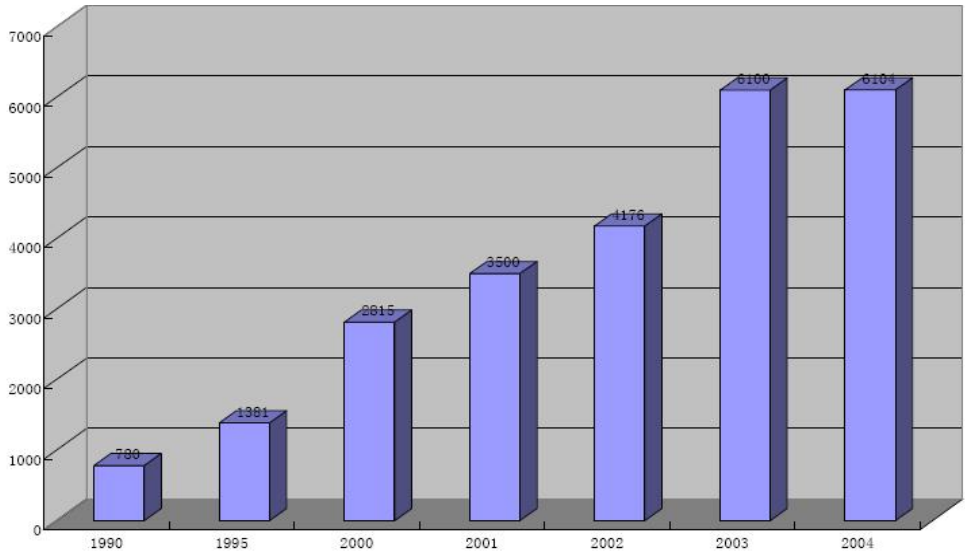

Figure 1 : Beijing standard stadium construction

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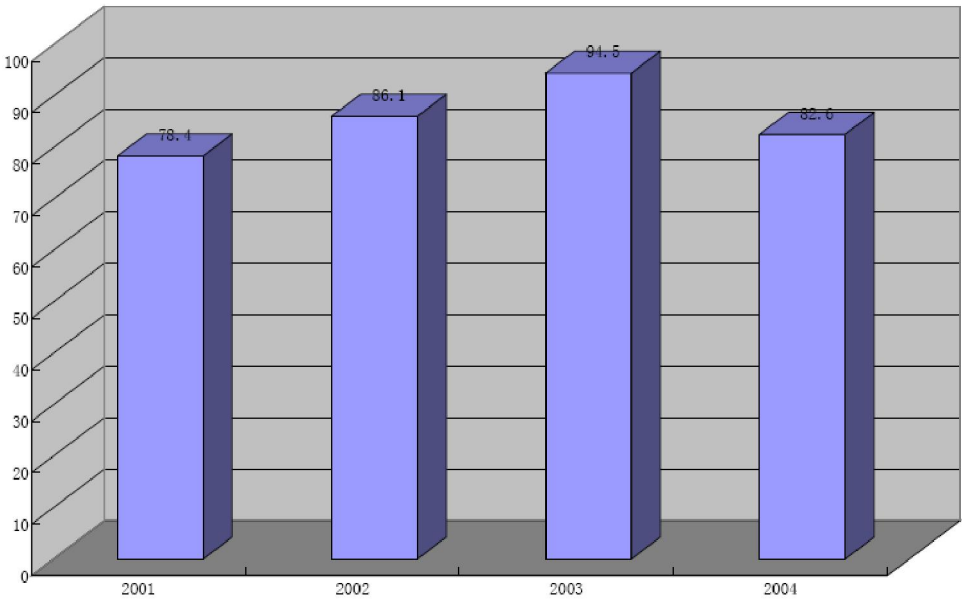

Figure 2 : National fitness sports facility fitness area

conditions:

$$\sum_{i=1}^{n} a_i = 1 \quad a_i \geq 0$$

(5) Fuzzy relation R every line will reflect the line influence factors to object judgment degree, meanwhile, R every column will reflect the column influence factors to object judgment degree.

$$\sum_{i=1}^{n} r_{ij} \quad j = 1, 2, 3, \cdots, m$$

$$B = A \cdot R$$

$$= (a_1, a_2, a_3, \cdots, a_n) \cdot \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

$$= (b_1, b_2, b_3, \cdots, b_n)$$

In V, fuzzy combination is evaluation set B. Based on above described facts, actual change model is as Figure 3.

As Figure 3 show, it gets fuzzy comprehensive evaluation change model, and can establish corresponding every factor grade evaluation transformation function, evaluation factors u1, u2, u3, u4, u5 membership functions can be expressed as following:

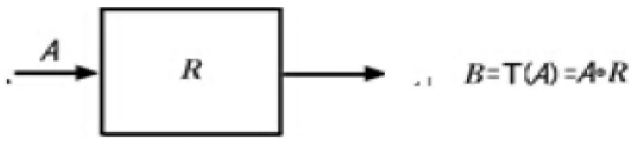

Figure 3 : Change model

$$u_{v1}(u_1) = \begin{cases} 0.5(1 + \dfrac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\ 0.5(1 - \dfrac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\ 0 \quad , & u_i < k_2 \end{cases}$$

$$u_{v2}(u_1) = \begin{cases} 0.5(1 - \dfrac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\ 0.5(1 + \dfrac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\ 0.5(1 - \dfrac{u_i - k_3}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\ 0.5(1 - \dfrac{k_3 - u_i}{k_2 - u_i}), & u_i < k_3 \end{cases}$$

$$u_{v1}(u_1) = \begin{cases} 0, & u_i \geq k_2 \\ 0.5(1 - \dfrac{k_1 - u_i}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\ 0.5(1 + \dfrac{k_3 - u_i}{k_2 - u_i}), & u_i < k_3 \end{cases}$$

Combine with fuzzy comprehensive evaluation model to evaluate Chinese urban and rural mass sports participation ability

Establish factor set U, among

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them $U=(U_1 \quad U_2 \quad U_3 \quad U_4)$. Among them, facility is U_1, staff cultivation is U_2, sports organization cultivation is U_3, high class stadium construction is U_4, it gets TABLE 2.

By TABLE 2 listed factors, it gets evaluation set:

$U_1=\{u_{11},u_{12},u_{13},u_{14}\}$

$U_2=\{u_{21},u_{22},u_{23},u_{24},u_{25}\}$

$U_3=\{u_{31},u_{32},u_{33}\}$

$U_4=\{u_{41},u_{42},u_{43},u_{44}\}$

By collecting data and analyzing, it gets four kinds of factors importance ranking statistics, as TABLE 3 show.

By TABLE 3 sorting, it gets facility U_1, staff cultivation U_2, sports organization cultivation U_3, high class stadium construction U_4 four aspects' rank matrix:

$U_2=\{23,7,4,0\}$

$U_2=\{7,18,8\ 0\}$

$U_3=\{0,9,13,12\}$

$U_4=\{3,0,9,21\}$

Obtained weighted vector from rank 1 to rank 2:

$\beta=\{\beta_1,\beta_2,\beta_3,\beta_4\}=\{0.4,0.3,0.2,0.1\}$

$U_i^*=U_i\cdot\beta^T$

$U_1^*=12$, $U_2^*=9.7$, $U_3^*=6$, $U_4^*=5$

The paper takes normalization processing:

$U_1^*=0.35$, $U_2^*=0.3$, $U_3^*=0.2$, $U_4^*=0.15$

It gets:

$\bar{A}=(0.35 \quad 0.3 \quad 0.2 \quad 0.15)$

The paper gets remark membership by government propelling to sports, as TABLE 4 shows.

TABLE 5 is describing residents to the city sports construction satisfaction degree, according to the result to make evaluation, the paper obtained evaluation according to Chinese sports each kind of indicators, and it gets TABLE 6.

By above model, it gets single layer indicator weight factor fuzzy set is:

$U_1^*=\{U_{11},U_{12},U_{13},U_{14},U_{15}\}=\{0.25\ 0.25\ 0.2\ 0.15\ 0.15\}$

$U_2^*=\{U_{21},U_{22},U_{23},U_{24}\}=\{0.54\ 0.1\ 0.24\ 0.14\}$

$U_1^*=\{U_{31},U_{32},U_{33},U_{34}\}=\{0.4\ 0.3\ 0.1\ 0.2\}$

TABLE 2 : Sports undertaking s to mass impact evaluation indicator system

Facility U_1	Staff cultivation U_2	Sports organization cultivation U_3	High class stadium construction U_4
Introduction of facility u_{11}	Coaches' cultivation u_{21}	Competition u_{31}	Introduction of stadium u_{41}
Facility maintaining u_{12}	Faculty cultivation u_{22}	Activity u_{32}	High class stadium development u_{42}
Competition facilities construction u_{13}	Introduction of foreign teachers u_{23}	Lecture u_{33}	High class stadium targeted group u_{43}
Daily facilities construction u_{14}	Cultivation expense u_{24}	Outbound visiting u_{34}	
Equipment maintaining and changing u_{15}			

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TABLE 3 : Four kinds of factors importance degree ranking statistics

Classification	Rank1	Rank 2	Rank 3	Rank 4
Facility U_1	23	7	4	0
Staff cultivation U_2	0	0	15	18
Sports organization cultivation U_3	0	9	13	12
High class stadium construction U_4	3	21	9	0

TABLE 4 : Remarks membership

Evaluation way	Set scores interval			
	0-60	60-80	80-90	90-100
Very good	0	0	0.05	0.95
Good	0	0.05	0.9	0.05
Normal	0.05	0.9	0.05	0
Bad	0.95	0.05	0	0

$U_1^* = \{U_{41}, U_{42}, U_{43}\} = \{0.3\ 0.4\ 0.3\}$

By TABLE 5, and combine with TABLE 3 remarks membership, the paper gets facility U_1, staff cultivation U_2, sports organization cultivation U_3, high class stadium construction U_4, each aspect evaluation set:

Facility $U_1 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.95 & 0.05 \\ 0 & 0.05 & 0.95 & 0.05 \\ 0 & 0.05 & 0.95 & 0.05 \end{pmatrix}$

TABLE 5 : Residents to the city sports construction satisfaction degree

Investigation item	Satisfied	Normal	Dissatisfied
Community infrastructure	38	25	37
Special field	42	23	35
Fitness stadium	54	32	14
Government input intensity	25	45	30

TABLE 6 : Chinese sports each indicator obtained evaluation valu

Each layer indicator	Evaluation value	Each layer indicator	Evaluation value
Introduction of facility u_{11}	Very good	Competition u_{31}	Very good
Facility maintaining u_{12}	Very good	Activity u_{32}	Good
Competition facilities construction u_{13}	Normal	Lecture u_{33}	Good
Daily facilities construction u_{14}	Normal	Outbound visiting u_{34}	Normal
Equipment maintaining and changing u_{15}	Normal	Introduction of stadium u_{41}	Good
Coaches' cultivation u_{21}	Very good	High class stadium development u_{42}	Very good
Faculty cultivation u_{22}	Very good	High class stadium targeted group u_{43}	Normal
Introduction of foreign teachers u_{23}	Very good		
Cultivation expense u_{24}	Good		

Staff cultivation $U_2 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$

Sports organization cultivation $U_3 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0.05 & 0.9 & 0.05 & 0 \end{pmatrix}$

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High class stadium construction

$$U_4 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$$

$$B_i = A_i \cdot R_i$$

Make normalization processing with obtained B_i, it gets fuzzy evaluation matrix:

$$\bar{B} = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{pmatrix} = \begin{pmatrix} 0.07 & 0.27 & 0.13 & 0.53 \\ 0 & 0.1 & 0.4 & 0.5 \\ 0.08 & 0.46 & 0.38 & 0.08 \\ 0.14 & 0.2 & 0.3 & 0.36 \end{pmatrix}$$

It gets comprehensive evaluation value:

$$Z = U^* \cdot B = \begin{pmatrix} 0.38 & 0.25 & 0.22 & 0.15 \end{pmatrix}$$

CONCLUSION

Facility U_1 is38%, staff cultivation U_2 is 25%, sports organization cultivation U_3 is 22%, high class stadium construction U_4 is15%. Therefore, Chinese sports construction mainly surrounds sports facilities construction and sports staff as well as organization cultivation, so that can effective improve mass sports participation degree. For village and town sports construction, improve village and town areas' economic development level, per capita income, improve fitness awareness and physical education; develop sports resources, enhance fitness sports ability.

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