Research on Fuzzy Theory-Based Government Promotion to Public Sports Service Development

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Abstract: The Chinese government functions presentation in sports, many of them have been rapidly developed, the paper according to status that Chinese government promotes to sports public service development, applies fuzzy mathematics to represent some factors set into people's consciousness. By establishing attributes scale on one object, it carries on fuzzy mathematical analysis of one object, in China's enhanced physical ability exercises state budget, it mainly invests in sports facilities, sports relative staff cultivation, organizing all kinds of sports to cultivate, sports relevant undertakings revitalization these four aspects, and meanwhile the paper also according to the four aspects, it makes fuzzy comprehensive evaluation, gets that Chinese government such four aspects sports construction research. By fuzzy comprehensive evaluation, the paper gets fuzzy comprehensive evaluation value, it indicates located indicator range is in the score interval of 80-90, therefore it can illustrate that Chinese government plays crucial roles in promoting public sports service development, which should attract higher attention.

Keywords: Factor analysis, fuzzy evaluation, public sports service.

1. INTRODUCTION

From the medium-term of 60s to 80s, Chinese economy has been rapidly developed, Chinese government carries out social sports development, it lets Chinese tertiary industry proportion to greatly increase, and in order to propel to sports development, the Chinese government drives every sector to vigorously carry out sports development, and revitalize national sports [1, 2].

With Chinese opening-up and reform, Chinese sports public service field has been hugely developed, due to implementation of Chinese civil public sports right, Chinese government supplying mode on publics sports service tends to regular, and speed up the coordination of all aspects and sports public service industry relationships [3].

Fuzzy mathematics is a theoretical system that is formed by fuzzy set and fuzzy logic, fuzzy mathematics is applied in pattern recognition and artificial intelligence, as a relative brand new discipline, fuzzy mathematics represent some factors set into people's consciousness [4]. By establishing attributes scale on one object, it carries on fuzzy mathematical analysis of one object, firstly the object should have fuzziness or uncertainty, and researched objects have multiple influence factors restriction, therefore the paper researches on Chinese government promotion to public sports service development according to fuzzy comprehensive evaluation.

2. CHINESE SPORTS PUBLIC SERVICE STATUS ANALYSIS

Chinese public sports service facilities budget after year 1971, occupied sports facilities budget total proportion is increasing by year, as Table **1** shows.

As Table **2** shows, China enhances physical ability exercise state budget, carries out state investment in apparatus facility, department revitalization, organizing cultivation, coach cultivation four aspects.

By Table **1** showed data, we get total amount change graph with time increasing, as Fig. (**1**) shows.

In Fig. (**1**), it is clearly indicated that Chinese government state budget on enhancing physical ability exercise is in the yearly rising trend.

2.1. Fuzzy Comprehensive Evaluation Model

Fuzzy comprehensive evaluation model is fit for multiple factors uncertain fuzzy calculation, the paper utilizes fuzzy comprehensive evaluation, and steps are as following:

At first the paper establishes factor set U, $U = \begin{pmatrix} U_1 & U_2 & \cdots & U_k \end{pmatrix}$

(2) Secondly establish evaluation set V (assessment set) V,

(3) Establish evaluation matrix fuzzy mapping from U to V, it gets fuzzy relation as following matrix shows,

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

Table 1.   Year 1971to 2004 government to sports facilities budget and public sports facilities budget.

Time	Sports Facilities Budget (Hundred Million)	Public Sports Facilities Budget (Hundred Million)
Year 1971	35.28945	7.07500
Year 1972	41.945456	17.456412
Year 1973	58.8954	21.18850
Year 1974	89.31950	37.96750
Year 1988	169.46429	66.12856
Year 1989	185.45864	78.45875
Year 1990	186.45867	80.45674
Year 1991	189.45678	78.78156
Year 1992	194.35421	89.48564
Year 1995	253.34455	153.57016
Year 1996	265.45784	162.45678
Year 1997	285.88654	98.748564
Year 2000	480.45674	----
Year 2001	5380.37463	86.4554
Year 2002	3873.56447	12.84756
Year 2003	358.84719	11.45787
Year 2004	306.53946	10.45786

Table 2.   Chinese enhancement of physical ability exercises state budge statistics in 1996.

Year	Apparatus Facility	Department Revitalization	Organizing Cultivation	Coach Cultivation	Total Amount	GDP (%)
1985	1604	710	70	6	2309	0.071
1986	1455	541	75	6	2770	0.071
1987	1441	965	74	6	2598	0.075
1988	1707	986	72	9	2921	0.081
1989	1777	1156	74	12	3081	0.084
1990	1903	1193	85	28	3562	0.085
1991	2184	1276	91	30	3978	0.087
1992	2363	1456	98	72	3964	0.085
1993	2670	1345	100	80	4336	0.093
1994	2624	1786	1000	73	4456	0.095
1995	2788	1535	98	95	4689	0.094

(4) Establish weight set, $A = (a_1, a_2, \cdots, a_n)$, it meets 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.
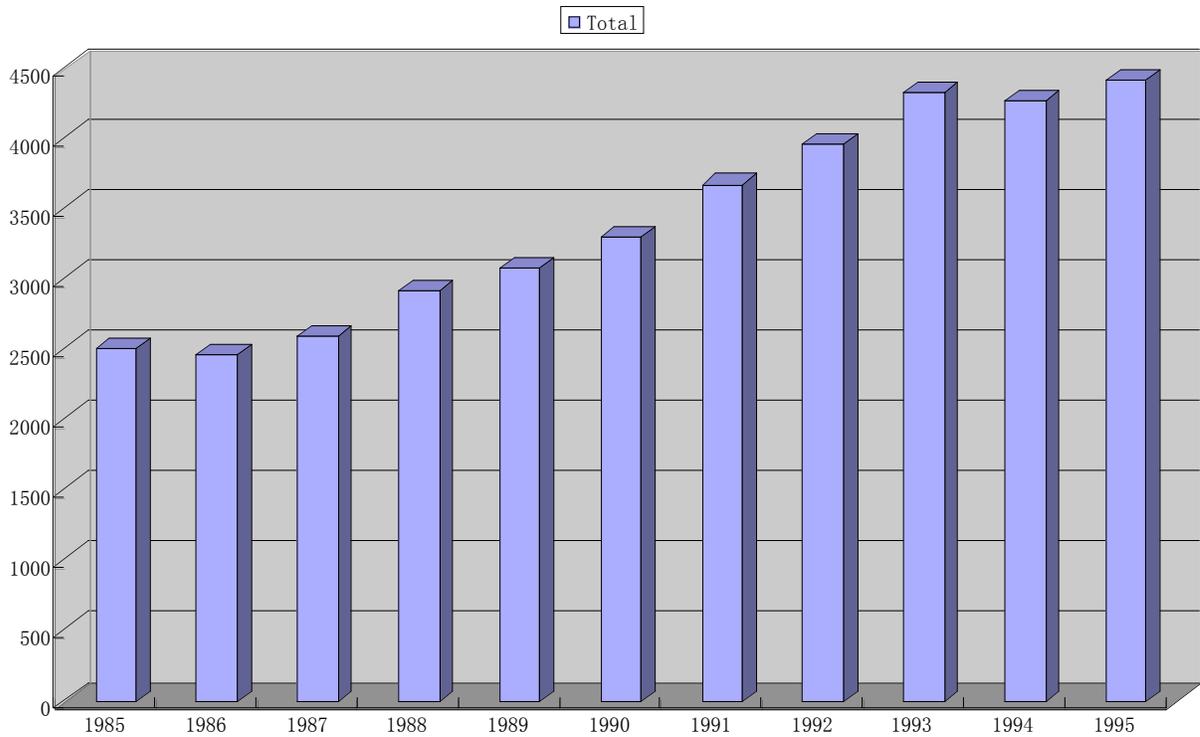
Fig. (1). Total amount change graph with time increasing.

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

Secondly carry out following calculation:

$$B = A \cdot R$$

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

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

In V, fuzzy combination is evaluation set B. Based on above described facts, actual fuzzy comprehensive evaluation obtained simple change model is as Fig. (**2**) shows:

With Fig. (**2**) marketed contents, 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 formula(1)、(2)、(3) shows :

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

$$u_{v2}(u_1) = \begin{cases} 0.5(1 - \dfrac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\ 0.5(1 + \dfrac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\ 0.5(1 - \dfrac{u_i - k_3}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\ 0.5(1 - \dfrac{k_3 - u_i}{k_2 - u_i}), & u_i < k_3 \end{cases} \quad (2)$$

$$u_{v1}(u_1) = \begin{cases} 0, & u_i \geq k_2 \\ 0.5(1 - \dfrac{k_1 - u_i}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\ 0.5(1 + \dfrac{k_3 - u_i}{k_2 - u_i}), & u_i < k_3 \end{cases} \quad (3)$$

2.2. Combine with fuzzy Evaluation Model to Evaluate

By above model principle, it establishes factor set U, from which $U = (U_1 \quad U_2 \quad U_3 \quad U_4)$. Among them, sports facilities U_1, sports relative staff cultivation U_2, organizing all kinds of sports to cultivate U_3, sports relevant undertakings revitalization U_4, it gets Table **3**. The paper establishes small factors set in the four important factors.

By Table **3** listed factors, it gets evaluation set.

Table 3. Chinese sports undertakings evaluation indicator system.

Facilities U_1	Staff Cultivation U_2	Organizing Cultivation U_3	Undertakings Revitalization U_4
Facility introduction u_{11}	Coaches cultivation u_{21}	Competition u_{31}	Undertakings introduction u_{41}
Facilities maintenance u_{12}	Teaching and administrative staff cultivation u_{22}	Activity u_{32}	Undertakings development u_{42}
Competition facilities construction u_{13}	Foreign coaches introduction u_{23}	Lecturing u_{33}	Traditional undertakings revitalization u_{43}
Daily facilities construction u_{14}	Cultivation expense u_{24}	Overseas tour u_{34}	
Apparatus maintenance and changing u_{15}			

Table 4. Four kinds of factors importance degree ranking statistics.

Classification	Rank1	Rank 2	Rank 3	Rank 4
Facilities U_1	23	7	4	0
Staff cultivation U_2	0	0	15	18
Organizing cultivation U_3	0	9	13	12
Undertakings revitalization U_4	3	21	9	0

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

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

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

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

By collecting data and analyzing, it gets four kinds of factors importance ranking statistics, as Table **4** shows.

By Table **4** sorting, it gets sports facilities U_1, sports relative staff cultivation U_2, organizing all kinds of sports to cultivate U_3, sports relevant undertakings revitalization 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

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

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

$U_1^* = 14$, $U_2^* = 9.4$, $U_3^* = 4$, $U_4^* = 5.6$

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 establishes remarks membership, as Table **5** show.

The paper through Chinese sports each indicator obtained evaluation in sports facilities, sports relative staff cultivation, organizing all kinds of sports to cultivate, sports relevant undertakings revitalization all aspects, it gets Table **6**.

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

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

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

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

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

By Table **5**, and combine with Table **3** remarks membership, the paper gets sports facilities U_1, sports relative staff cultivation U_2, organizing all kinds of sports to cultivate U_3, sports relevant undertakings revitalization U_4 each aspect evaluation set

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

Table 5.   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

Table 6.   Chinese sports each indicator obtained evaluation value.

Each Layer Indicator	Evaluation Value	Each Layer Indicator	Evaluation Value
Facility introduction u_{11}	Very good	Competition u_{31}	Very good
Facilities maintenance u_{12}	Very good	Activity u_{32}	Good
Competition facilities construction u_{13}	Normal	Lecturing u_{33}	Good
Daily facilities construction u_{14}	Normal	Overseas tour u_{34}	Normal
Apparatus maintenance and changing u_{15}	Normal	Undertakings introduction u_{41}	Good
Coaches cultivation u_{21}	Very good	Undertakings development u_{42}	Very good
Teaching and administrative staff cultivation u_{22}	Very good	Traditional undertakings revitalization u_{43}	Normal
Foreign coaches introduction u_{23}	Very good		
Cultivation expense u_{24}	Good		

Sports relative staff cultivation $U_2 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$

Organizing all kinds of sports to cultivate

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

Sports relevant undertakings revitalization

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

For above evaluation sets, carry on following calculation: $B_i = A_i \cdot R_i$

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

$\bar{B} = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{pmatrix} = \begin{pmatrix} 0.07 & 0.27 & 0.23 & 0.43 \\ 0 & 0.1 & 0.7 & 0.5 \\ 0.08 & 0.16 & 0.28 & 0.28 \\ 0.14 & 0.2 & 0.3 & 0.36 \end{pmatrix}$

It gets comprehensive evaluation value: $Z = U^* \cdot B = (0.39 \quad 0.06 \quad 0.25 \quad 0.30)$

CONCLUSION

Fuzzy mathematics is from people recognition on external world, due to suffer numerous factors influences, human recognized things are fuzzy. By fuzzy mathematics, it analyzes Chinese government promotion to public sports service development. By analysis, it gets that Chinese government in sports facilities U_1, sports relative staff cultivation U_2, organizing all kinds of sports to cultivate U_3, sports relevant undertakings revitalization U_4 four aspects evaluation value is : $Z = (0.39 \quad 0.06 \quad 0.25 \quad 0.30)$. By result indication, on a whole, Chinese government plays crucial roles in promoting public sports service development,

but in some aspects, such as overseas tour, apparatus maintenance and changing, traditional undertakings revitalization and other aspects, it needs to be further improved.

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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