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The research of sports fitness needs of different populations basing on fuzzy comprehensive evaluation method

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ABSTRACT

The demand for physical exercise of people is higher and higher, sports gradually become a kind of industry. Different people's demands of sports influence the development of sports industry. So there are more and more investors investing sports industry on the requirement of different people. In order to facilitate the investors to make a more accurate and rapid determination of intention, this paper set up fuzzy comprehensive evaluation model of different people's sports demand. This paper uses the literature material, and random sampling survey method to collect data. On the basis of summarizing predecessors' work, the fuzzy comprehensive evaluation method is cited to the research problem of different people's sports demand. The white-collar worker, blue-collar worker and gold-collar worker is the judged object, and take the middle school sports demand weights and teaching sports demand weight as the weight of the set. We finally obtained two different results by computing, we got conclusion that investors should increase the building of athletics sports project investment in the field of working and living areas of gold-collar workers and white-collar workers combining with the actual situation.

KEYWORDS

Different people; Sports demand; Fuzzy theory; Weighting analysis; The mathematical model.

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INTRODUCTION

With the improvement of people's material life level, people's requirement of physical exercise is becoming more and more, sports has become a kind of fashion. Nowadays, sports have become a part of the third industry; it is can be seen that the badminton halls, basketball halls are everywhere, which is welcomed by us. At the time that many investors valued the business opportunities, the bear ability of sports consumers is limited, different people have different sports demand.

In 2012, in the paper of city urban residents sports participation behavior 's present situation investigation and influence factor's research analysis made by Wang ning, he use a variety of research methods analysis of the situation of An yang city residents' participating in sports, the analysis results show that the people of different professional has different sports participation. In 2011, In the paper< in the context of studies of the old way of life in Shanghai> made by Li Wenchuan, he took the elderly in Shanghai as the research object, the research suggests that sports exercise in the elderly of Shanghai from the pure fitness function to the multi-functional and develop gradually, their physical exercise begin the stratified phenomenon. Focus on mass practice program for older women, the elderly men laid particular stress on individual projects. In 2009, Zhang Hongqing in the paper of < in the middle-aged and old professor of sports participation in research - take Suzhou university as an example>, he used various analysis methods, the results show that the influencing factors of middle-aged and old professors' participating in physical exercise, the individual factors are the important factors, social factors are the secondary factor. In 2010, Ren Zhi-wei in the paper of <research on characteristics of different social class sports crowd in Shanxi Province>, he took six prefecture level in Shanxi Province as the research object, and research the crowd of different social classes of the sports exercise, the results show that in the society, the lower people's main purpose is to strengthen the exercise body, upper class people aim to highlight their status in society to involved in high sports consumption.

Different populations of sports demand will directly affect the investors' investment intention. In order to facilitate sports investor's investment and help the development of the sports industry in China, this paper selects the running, table tennis, badminton, aerobics, basketball and volleyball, and dancing these seven sports to focus on studying the needs of sports of different groups in accordance with the three classes of white-collar worker, blue-collar worker and gold-collar worker.

THE ESTABLISHMENT OF THE MODEL

Different consumer has different spending capacity. Therefore, this paper points the white-collar worker, blue-collar worker and gold-collar worker, these three classes to study. The work place of white-collar worker is clean, they are paid by the month, and their education degree is higher in general. Blue-collar worker mainly refers to the physical labor of professional, their general wage decided by the length of time calculation. Gold- collar worker refers to those who have higher income, mainly concentrated in business, finance and management area. Fuzzy comprehensive evaluation may appear different results based on the different weight; therefore, we need to determine whether the two results are accord with the objective facts through actual circumstances.

Data processing

The raw data of TABLE 1 and TABLE 2, comes from <the middle-aged and old professor of sports participation in research - take Suzhou University as an example>and <research on characteristics of different social class sports crowd in Shanxi Province>

TABLE 1 : the condition of middle-aged professors' participating in the sport (%)

Running	Table tennis	Badminton	Setting-up exercise	Basketball, volleyball	Dance

| 33.3% | 27.8 | 20.6 | 11.1 | 7.9 | 4.8 |

TABLE 2 : the male and female students' favorite sports of the poor areas in southern of Shanxi province

Sport project	The percentage of male（%）	The percentage of female（%）
Running	53.8	50.0
Table tennis	63.2	42.0
Badminton	68.0	75.4
Setting-up exercise	2.8	26.8
Basketball, volleyball	64.0	22.5
Dance	4.0	31.4

The data in TABLE 2 are the statistical results of boys and girls. We compare them with drawing a line chart of data in TABLE 2, and find that different of boys and girls' enjoying sports is not too large, as shown in Figure 1. In the same sport, the data result of the boys and girls are summed up, the average is got, it is shown in TABLE 3.
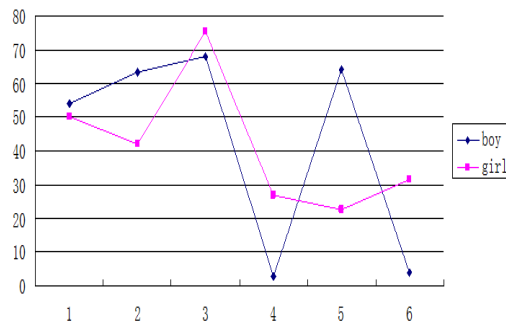

Figure 1 : Boys and girls comparison chart

TABLE 3 : the condition of middle school students' participating in sport（%）

Running	Table tennis	Badminton	Setting-up exercise	Basketball, volleyball	Dance
51.9	52.6	71.7	24.4	43.25	17.7

The data collection of judged object

The judged objects are white-collar worker, blue-collar worker and gold-collar worker. We take 20 of them (including 10 male and 10 female), summing up their data respectively and calculate their average, then we get the TABLE 4.

TABLE 4: The data collection of judged object

	White-collar worker	Blue-collar worker	Gold-collar worker
Running	23.5	41.2	15.8
Table tennis	42.3	20.8	30.8
Badminton	38.4	15.4	40.5
Setting-up exercise	9.8	8.1	7.6
Basketball, volleyball	4.6	2.6	13.8
Dance	3.1	1.1	19.7

We draw a line chart of data in TABLE 4, as shown in Figure 2. Through a preliminary comparison, we find that the distribution of group of blue collar worker's' favorite sports type is not uniform than white-collar worker group and gold-collar workers'.
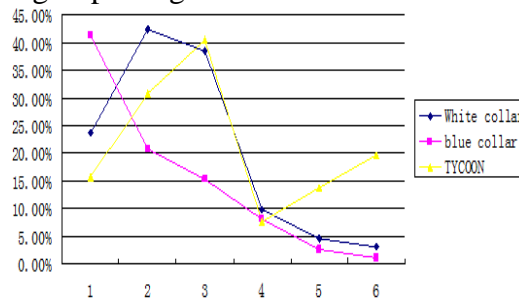

Figure 2 : Three kinds of crowd favorite sport case

Data normalization

It is easy to find the data in TABLE 1-4 that all sports in the corresponding value and is not equal to 100% for the same class of people; therefore, in order to carry out the following fuzzy comprehensive evaluation, we need normalize all valid data. Which means to sum up the corresponding data of each class, and then the adding values will be divided of every sports data the. As shown in TABLE 5.

TABLE 5 : Table of normalized data

	Professor	Middle school student	White-collar worker	Blue-collar worker	Gold-collar worker
Running	0.32	0.20	0.19	0.46	0.12
Table tennis	0.26	0.20	0.33	0.23	0.24
Badminton	0.20	0.27	0.30	0.17	0.32
Setting-up exercise	0.11	0.09	0.08	0.09	0.06
Basketball, volleyball	0.07	0.17	0.04	0.03	0.11
Dance	0.05	0.07	0.02	0.01	0.15

Fuzzy comprehensive evaluation

In general, fuzzy comprehensive evaluation involves three quantities. We set the number of the related factors of the evaluated objects is n, as $U = \{u_1, u_2, \cdots, u_n\}$, we call it factor set. We set the number of comments that may occur is m, as $V = \{v_1, v_2, \cdots, v_m\}$, we call it judge set. Because each factor's position is different, its effect is also different, so the measure is what we know the weight, as $A = \{a_1, a_2, \cdots, a_n\}$.

Fuzzy comprehensive evaluation steps as follows

(1)Establish factor set $U = \{u_1, u_2, \cdots, u_n\}$。

(2)Establish evaluation factor set $V = \{v_1, v_2, \cdots, v_m\}$。

(3)Carry on single factor evaluation $r_i = \{v_{i1}, v_{i2}, \cdots, v_{im}\}$。

(4)Establish comprehensive evaluation matrix: $R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix}$

(5)Comprehensive evaluation:as for weight $A = \{a_1, a_2, \cdots, a_n\}$, calculate $B = A \circ R$, and make evaluation according to the maximum membership degree principle.

In the comprehensive evaluation, according to the definition of operator $\circ$, we can get different mode.

Mode I : $M(\wedge,\vee)$——the type of main facto's determination, the method is:
$b_j = \max\{(a_i \wedge r_{ij}), i = 1, 2, \cdots, n\}(j = 1, 2, \cdots, m)$

The model evaluation results play a major role in the total evaluation factors, other factors do not affect evaluation, relatively, and the model is suitable for single evaluation optimal as comprehensive evaluation optimal situation.

Model II : $M(\bullet,\vee)$——the type of main factor's highlight: $b_j = \max\{(a_i \bullet r_{ij}), i = 1, 2, \cdots, n\}(j = 1, 2, \cdots, m)$

The model is similar to the model I , but it is more refined than model I . It not only highlights the main factors and also takes into account other factors; this model is suitable for the model that is not applicable to the scope of model I , or in a variety of factors that can not distinguish but refinement.

Model III : $M(\bullet,+)$——the weighted average type, the method is: $b_j = \sum\limits_{i=1}^{n} a_i \bullet r_{ij} (j = 1, 2, \cdots, m)$ s

This model take the consideration of the entire influence factor according to the importance of various factors, relatively it is suitable for the requirements of integrated optimal case.

Model IV : $M(\wedge,\oplus)$——type of taking small upper, the method is: $b_j = \min\left\{\left(1, \sum\limits_{i=1}^{n}(a_i \wedge r_{ij})\right)\right\}(j = 1, 2, \cdots, m)$

In using that model, we need to pay attention that: every a_i can not be to large, otherwise b_j will be 1; every a_i can not be to small, otherwise b_j will be the sum of every a_i, which will lead to the loss of the information of the evaluation.

Model V : $M(\wedge,+)$——Average balance type The method is: $b_j = \sum\limits_{i=1}^{n}\left(a_i \wedge \dfrac{r_{ij}}{r_0}\right)(j = 1, 2, \cdots, m)$ Among them,

$r_0 = \sum\limits_{k=1}^{n} r_{kj}$. The model is suitable for comprehensive evaluation of the elements in the matrix R, when the element is larger or partial smaller. The model established in this paper using the main factor to determine type of operator.

Setup procedure

By considering the evaluation methods of the sports demand of three classes (white-collar worker, blue-collar worker, gold-collar worker), we find different people's sports demand. So we establish the factor set $U = \{u_1, u_2, u_3, u_4, u_5, u_6\}$, among them u_1 represents the sport of running, u_2 represents the sport of table tennis, u_3 represents the sport of badminton, u_4 represents the sport of setting-up exercise, u_5 represents the sport of basketball and volleyball, u_6 represents the sport of dance. In the following Figure3, No."1" represents the sport of running, No. "2" represents the sport of table tennis, No. "3" represents the sport of badminton, No. "4" represents the sport of setting-up exercise, No. "5" represents the sport of basketball and volleyball, No. "6" represent the sport of dance.
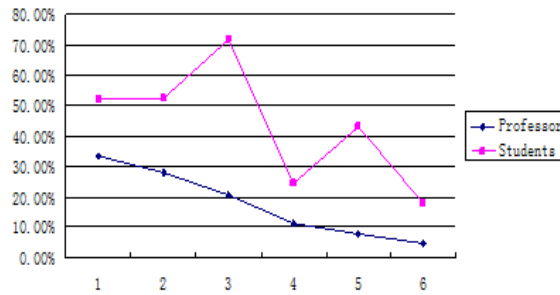
Figure 3 : Professors and students of sports demand comparison chart

This model chooses two different weights; they are respectively a professor at the university and middle school students. We can see from Figure 3, a university professor's sports demand is lower than high school students. The university professor is in the pursuit of physical and mental health because of its high quality, but because their time is limited, so they may be more suitable for the single sports demand. Middle school students in poverty of Shanxi province from remote place area, the entertainment equipment is less, their demands for sports is relatively high, therefore, we chose these two kinds of weights. From Figure 4, it is easy to find students prefer athletic sports class, the professor prefer slow movement.
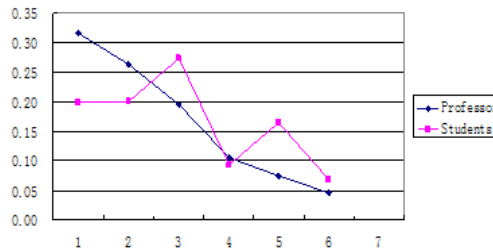

Figure 4 : Professor and Students weight comparison chart

From TABLE 5, we can know two types of the weight, the weight of sample of professor A_1, the weight of sample of the middle school student A_2:

$$A_1 = (0.32, 0.26, 0.20, 0.11, 0.07, 0.05)$$

$$A_2 = (0.20, 0.20, 0.27, 0.09, 0.17, 0.07)$$

According to the above TABLE 5, we establish a comprehensive evaluation matrix

$$R: \quad R = \begin{bmatrix} 0.19 & 0.46 & 0.12 \\ 0.33 & 0.23 & 0.24 \\ 0.30 & 0.17 & 0.32 \\ 0.08 & 0.09 & 0.06 \\ 0.04 & 0.03 & 0.11 \\ 0.02 & 0.01 & 0.15 \end{bmatrix}$$

According to the model $Ι —— M(\wedge, \vee)$, we carry on the calculation, the result is:

$$B_1 = A_1 \circ R = (0.26, 0.32, 0.24)$$
$$B_2 = A_2 \circ R = (0.27, 0.20, 0.27)$$

The result analysis

From the above results, we can find that when the weight is different, different people's sports demand is also not the same. The following is the result of two different weight analyses.

When using the weight of professor, for example, the blue-collar workers' sports demand is high, this paper analysis from two aspects. On the one hand, because pressure of the working-class life is heavy, when they realize the importance of physical exercise, most of them get older and difficult to make competitive sport. On the other hand, the income of blue-collar workers is limited; most of the athletics sport is of higher consumption, blue-collar workers can not afford it. When using the weight of middle school students, for example, white-collar workers and the gold-collar workers' demand of sports is higher. This is because that high school student pays more attention to competitive sports, so in this kind of weight, the proportion of competitive sports is larger. Because the white-collar workers and gold-collar workers under a long time pressure, they usually extract with competitive sports to reduce the pressure. On the other hand, white-collar worker and gold-collar worker's pursuit of quality of life is higher, and the sports consumption level is higher too. Due to the purpose of this study, it provides the basis for the sports investor's investment intentions, so the competitive sports are the focus of investors. Therefore, in measure the sports demand of somewhere, we should be in the weight of middle school students, because the result is more reasonable. In the future, the sports investors should increase investment in the construction of the athletics sports for white-collar workers and gold-collar workers of the near the working area and living area.

In this paper, the established model can be extended to governmental sports construction, in the process of government investment in construction, we usually consider reducing the costs and increasing the utilization ratio, therefore, when the government carries on the construction of sports they should consider using the example of weight of professor in the investigation.

CONCLUSIONS

In this paper, the fuzzy comprehensive evaluation method is usually used to solve a problem of permutation and making choice. The key of the whole process is to establish a fuzzy comprehensive evaluation matrix. The components factor of this matrix is a single element of the evaluation results. Readers can give a weight according to our experience, or refer to other literature data. But once the weight is not reasonable it may cause error calculation process and affect the outcome.

In this model, the conclusion was that PE investors should increase investment in the construction of the athletics sports for white-collar workers and gold-collar workers of the near the working area and living area. Combining with the original data, we draw a line chart, and found the distribution value of white-collar worker and gold-collar worker's sports demand is of more concentration, to some extent; it can also judge the rationality of the conclusion of this model.

ACKNOWLEDGMENT

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