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Basketball product manufacturing industries influence factors analysis based on fuzzy mathematics

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ABSTRACT

With Chinese economic rapidly development, basketball product manufacturing industries are also accordingly rapid developing, but its development is not smooth and steady, as important tertiary industry, Chinese basketball product manufacturing industries has become important guarantee in tertiary industry development, the paper evaluates on Chinese basketball product manufacturing industries on the basis of fuzzy evaluation system, focuses on sports products manufacturing enterprises innovation ability, and establishes enterprise innovation modules. By lots of experiences, it endows on basketball product manufacturing industries influence factors, and gets innovation ability to realize basketball product manufacturing industries, as well as calculates each relative proportion. Therefore we can get in present stage; Chinese basketball product manufacturing industries innovation ability are still in initial stage, so the system still needs to constant update, perfect and develop.

KEYWORDS

Basketball product;
Manufacturing industries;
Hierarchical matrix;
Fuzzy mathematics;
Sports products

INTRODUCTION

In recent years, with NBA being much-touted by each country basketball enthusiasts, its basketball product manufacturing industries have also accordingly been rapidly developed, and attracted attentions of person from all circles of society, establish a perfect basketball product manufacturing industries innovation system is a new requirement in basketball relative fields rapidly development under new historical period, so widely emphasis has been put on the fuzzy mathematical application.

Among them, lots of scholars have made efforts, and got plentiful achievements, which provides beneficial conditions for scholars from all circles of society researching on it, and provides impetus for basketball development. Such as, Wang Ni, she created basketball product manufacturing industries evaluation model based on neural network, and applied multiple linear regression method to predict on basketball product manufacturing industries, in addition, she also provided correct schemes for improving basketball product manufacturing industries; Wang Guo-Yong adopted documents literature, investigation method, expert interview method to relative comprehensively analyze basketball product manufacturing industries social values contents,

he though it had economic values. More comprehensive and detailed discussed basketball product manufacturing industries values, which provided rough frame for future basketball product manufacturing industry development researching. Zheng Yong and others made research and analysis of "sports products manufacturing industries" innovation. Meanwhile, there were also lots of scholars had made relative deeper research on basketball product manufacturing industries other aspects. Wang Fang, he proposed basketball product manufacturing industries development features and evaluation system, from which his weight was got by adopting experts and experiences as well as other methods that had stronger objectivity; Gui Lin-Sheng, in relative basketball product manufacturing industries research data, he indicated that during nineties in last century, Chinese basketball product manufacturing industries GDP weight still kept huge paces with relative developed countries.

The paper on the basis of previous research results, it analyzes and discusses fuzzy hierarchical algorithms and provides theoretical basis for it, in addition, we should correctly grasp basketball product manufacturing industries innovation abilities difference levels by referencing lots of experiences, evaluates sports manufacturing industries innovation ability from multiple aspects, so that builds good foundation for Chinese basketball industrial development.

FUZZY HIERARCHICAL ANALYSIS THEORY'S ESTABLISHMENT

Use mathematical method to research and handle with mathematics with fuzzy phenomenon is fuzzy hierarchical analysis. Nowadays, fuzzy hierarchical analysis application has already widespread in social sciences' each field, which fully reflects its powerful vitality and seepage force. The model carries out comprehensive consideration and research on the premise that takes multiple factors into account, realizes relative reasonable evaluation effects, so we use fuzzy hierarchical analysis to evaluate on basketball product manufacturing industries, its method and steps are as following:

At first, it should define evaluation objects, it is individual variable affected by y pieces of factors, and its factor set is α, which is defined as: $\alpha = (\alpha_{i,}\alpha_i, \alpha_i, \cdots, \alpha_i)$, and regulates $\alpha_i (i = 1,2,3,\cdots, y)$. Due to each variable weight is different, defined evaluation grades' impacts are also different, we assume that its weight allocation is a_i, and $b_i = (b_{1,} b_2, b_3, \cdots b_y)$, from which $b_i (i = 1,2,3,\cdots, y)$ is formula (2)weight, according to common sense, we known $b_i \geq 0$ and $\sum_{i=1}^{y} b_i = 1$, if every factor b_i contains n pieces of sub factors, their factors set is $\alpha_i = (\alpha_{i,1,}\alpha_{i,2}, \alpha_{i,3}, \cdots, \alpha_{i,n})$, then corresponding weight is $b_i = (b_{i,1,}b_{i,2}, b_{i,3}, \cdots b_{i,n})$, weight to $\alpha_{i,j}$ is b_i, according to common sense, it is clear $b_{i,j} \geq 0$ and $\sum_{j=1}^{n} b_{i,j} = 1$, establish a evaluation indicator set as: $g = (g_{1,} g_2, g_3, \cdots, g_s)$. Corresponding evaluation objects can be divided into s pieces of different grades, here, we let $g_{1,} g_2, g_3, \cdots, g_s$ to be each merit evaluation grade from high to low, such as excellent, good, qualified, and unqualified so on. By matrix compositional operating, it can get its corresponding volleyball players' volleyball performance evaluation results that: $c = b * r = (b_{1,} b_2, b_3, \cdots b_y) * (r_1, r_2, r_3, \cdots, r_y)^T = (c_1, c_2, c_3, \cdots, b_y)$, from fuzzy set c, we can utilize maximum grading method to get a defined evaluation grade. Because $H_k = \{H_I\}$, and then H_K final evaluation result grade is k.

BASKETBALL PRODUCT MANUFACTURING INDUSTRIES COMPREHENSIVE EVALUATION

Model establishment

According to basketball product manufacturing industries features, we apply fuzzy mathematical comprehensive mode, consider multiple factors on this conditions, to realize target layer, it establishes factor set, judgment set; the paper researches on basketball product manufacturing industries innovation ability input and innovation ability output two main aspects, constructs evalu-

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ation indicator system that successively divides as: excellent, good, medium, qualified, bad these five grades to judge, so corresponding set is: $v=\{excellent,\ good,\ medium,\ qualified,\ bad\}=\{v_1,v_2,v_3,v_4,v_5\}$, we let r_{ij} to be the j factor the i remark's possibility extent.

Construct hierarchical structure

At first apply hierarchical analysis into Chinese basketball product manufacturing industries' innovation ability, establishes target layer, criterion layer, project layer relation as TABLE 1 show:

According to the plan, we establishes hierarchical analysis structural diagram to further analyze basketball product manufacturing industries innovation ability hierarchical analysis whole process is as Figure 1 show:

CONSISTENCY TEST

Test hierarchical single row model

We take target testing on above indicators:

$$DI=\frac{\lambda_{\max}-n}{n-1}$$

In above formula, maximum value is using $\lambda_{\max}$ to express, matrix order number uses n to express. Among them, if DI value gets bigger, judgment matrix completely consistency deviation degree will be bigger, otherwise, it is on the contrary.

For judgment matrix A (WI value is TABLE 2),

$$\lambda^{(0)}{}_{\max}=4.073,\ RI=0.9$$

$$DI=\frac{4.073-4}{4-1}=0.24$$

$$DR=\frac{DI}{RI}=\frac{0.024}{0.90}=0.027<0.1$$

We let r_{ij} to represent importance qualitative sorting scale, and its value is among 0, 0.5, 1, and then make binary comparison on indicator B_i and B_j, the setting is indicator importance binary comparison principle:

TABLE 1 : Hierarchical structural table

Target layer	Measure layer	Criterion layer
Based on Basketball product manufacturing industries analysis A	the proportion of funding B_{11}	Cultivate innovation ability input status C_1
	the proportion of R&D funding B_{12}	
	the proportion of scientific and technical personnel remuneration B_{13}	
	Utilization of scientific and technological achievement Enterprise B_{14}	
	New product sales revenue proportion B_{15}	Cultivate innovation ability output status C_2
	Proportion of professional and scientific and technical personnel B_{16}	
	The number of independent intellectual property patents B_{21}	
	The average proportion of scientific and technical personnel remuneration B_{22}	

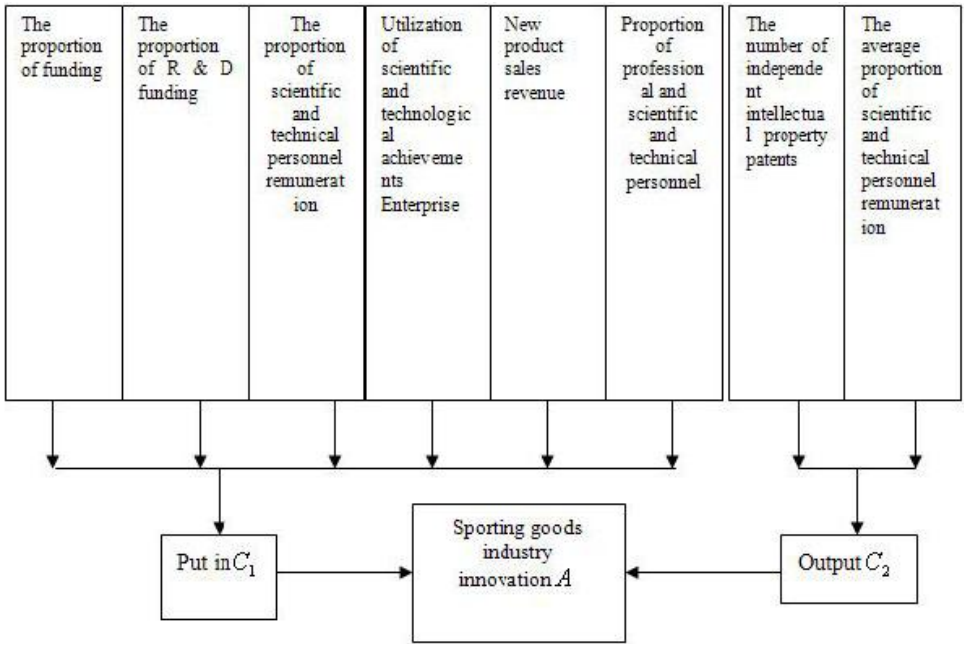

Figure 1 : Analysis of China's basketball goods industry level

If $B_i = B_j$, then==0.5;

If $B_i < B_j$, then r_{ij} =1; r_{ji} =0;

If $B_j > B_i$, then=0;=1;

(1) At first to criterion C_1, corresponding binary comparison qualitative sorting matrix that includes eight indicators is:

$$r = \begin{bmatrix} 1 & 0 & 0.5 & 1 & 0.5 & 1 \\ 0.5 & 0.5 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0.5 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0.5 & 0.5 & 0.5 \\ 0 & 0 & 0 & 1 & 0.5 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0.5 \end{bmatrix}$$

According to the matrix, it solves each indicator weight:

$$r = \begin{bmatrix} 1 & 0 & 0.5 & 1 & 0.5 & 1 \\ 0.5 & 0.5 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0.5 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0.5 & 0.5 & 0.5 \\ 0 & 0 & 0 & 1 & 0.5 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0.5 \end{bmatrix}$$

Combines with membership function, it lists under criterion B_1 conditions relative membership vector form is: η_0 =(0.7 1 0.7 0.36 0.36 0.09); after normalization is: η_1 =(0.22 0.31 0.22 0.11 0.11 0.03)

(2) In criterion B_2 : $r_2 = \begin{bmatrix} 0.5 & 1 \\ 0 & 0.5 \end{bmatrix}$, η_{20} =(1 0.33), after normalization: η_2 =(0.75 0.25)

(3) Give target layer A to criterion layer B relative conditions binary comparison ordered consistency judgment formal matrix: $r' = \begin{bmatrix} 0.5 & 1 \\ 0 & 0.5 \end{bmatrix}$, η =(1 0.33), after normalization: η =(0.75 0.25)

(4) According to above three kinds of computation indicators, it can get target layer's weight β_{ij}, $\beta_{ij} = \eta_i * \eta_{ij}$ (when $i = 1; j = 1,2,3,4,5,6$; when $i = 2, j = 1,2$).

Weight comprehensive sorting vector's calculation

At first, calculate all experts provided judgment matrix weight vector. According to multiple experts provided judgment matrix: $Bk = (\alpha k_{ij})_{n \times n}$.

According to above steps, it establishes weight vector: $Yk = \{Y_{k1}, Y_{k2}, Y_{k3}, \cdots, Y_{kn}\} (k = 1,2,\cdots x)$, here k repre-

TABLE 2 : WI value

n	1	2	3	4	5	6	7	8	9	10	11
WI	0	0	0.57	0.92	1.1	1.25	1.33	1.40	1.44	1.47	1.58

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sents one expert from them, x represent the total amount of experts, j represents one indicator in a target layer, n is total amount of a target layer.

Then, calculate weight vector geometric average number, according to formula: $Y'j = \sqrt{Y_{f1} \times Y_{f2} \times k \times Y_{fs}}$, from which $W'j$ is x experts one target layer one indicator endowed weight value's geometric average value. Go ahead with normalization processing, according to formula $Y_j = \frac{Y'f}{\sum_{j=1}^{n} Y'f}$, in formula geometric average value handled weight after normalization is using $Y'j$ to express, and it is one target layer j indicator's weight, so it gets $Y'j$ weight, so that gets the layer total sorting table, as TABLE 3:

By above TABLE 3, we can get that to realize basketball manufacturing industries innovation ability, innovation ability input and innovation ability output proportions should be 0.65and 0.35, but make comparison on current basketball manufacturing industries innovation ability input and output status is not going very well. Therefore, to Chinese basketball manufacturing industries' enterprises, they should enlarge basketball product manufacturing industries' average proportion of scientific and technical personnel remuneration, proportion of professional and scientific and technical personnel, proportion of new product sales revenue, proportion of funding, proportion of R&D funding, proportion of scientific and technical personnel remuneration and utilization of scientific and technological achievements Enterprise as well as other factors proportions.

TABLE 3 : Hierarchical total sorting table

	C_1	C_2	B hierarchical
	0.65	**0.35**	**Total sorting result**
B_{11}	0.23		0.18
B_{12}	0.30		0.22(max)
B_{13}	0.24		0.18
B_{14}	0.09		0.06
B_{15}	0.12		0.09
B_{16}	0.02		0.01(min)
B_{21}		0.75	0.18
B_{22}		0.25	0.07

CONCLUSIONS

(1)The paper makes investigation on Chinese basketball product manufacturing industries innovation ability development environment, explores its existing problems, by constructing fuzzy comprehensive evaluation system, focuses on basketball product manufacturing industries' innovation ability, and establishes enterprises innovation ability modules.

(2)According to the model most important part weight allocation, only according to different basketball product manufacturing industries' relative weights, it can comprehensive evaluate different basketball product manufacturing industries' existing problems, the model has universalities.

(3)Basketball product manufacturing industry comprehensive evaluation mode is affected by lots of factors, we make use of fuzzy mathematical method to comprehensive evaluate and indicate it has obvious advantages, in addition, the model carries out theoretical construction and judgment from basketball product manufacturing evaluation theory and practices, it has scientificity, which can provide guiding opinions for basketball product manufacturing industries development in China.

(4) By final hierarchical total sorting, we can get our basketball product manufacturing to proportion of funding, proportion of R&D funding, proportion of scientific and technical personnel remuneration, utilization of scientific and technological achievements Enterprise, proportion of new product sales revenue, proportion of professional and scientific and technical personnel as well as other relative proportions, all of them should be properly increased, so that Chinese basketball product can develop towards higher level.

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