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Construction of evaluation model for pharmaceutical corporate culture based on fuzzy analytic hierarchy process

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ABSTRACT

Construction of the culture is important for promoting the development of the pharmaceutical corporate, and therefore it is necessary to find out an effective evaluation method. Then the fuzzy analytic hierarchy process is applied in this research. Firstly, the basic theory of pharmaceutical corporate culture evaluation is discussed. Secondly, evaluation model for pharmaceutical corporate culture is established. Them the basic theory of fuzzy analytic hierarchy process is studied in depth. Finally, a case study is carried out, and results show that the fuzzy analytic hierarchy process evaluate the culture situation of pharmaceutical corporate effectively.

Key words: evaluation model; pharmaceutical corporate culture; fuzzy analytic hierarchy process

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INTRODUCTION

In recent years, the output value of the pharmaceutical corporate in China has increased by about 16.6%, the development speed of it has been speeding up unceasingly. Under this background, the management environment of the pharmaceutical corporate has changed quickly, and the personnel quality of the pharmaceutical corporate has improved, then the cultural construction of the pharmaceutical corporate has been strengthened, the culture taste of the pharmaceutical corporate has been improved. Therefore it is necessary to evaluate the pharmaceutical corporate culture effectively, the evaluation of corporate culture can assess and analyze current situation and construction achievement of pharmaceutical corporate culture based on many indexes that is embodied by pharmaceutical corporate correctly, objectively and completely, then the pros and cons, benefit status and development trend of pharmaceutical corporate can be reflected during the procession of cultural operation of pharmaceutical corporate, then the important information and reference can be provided for improving the culture construction and optimal decision of pharmaceutical corporate. The final aim of culture evaluation of pharmaceutical corporate is to understand the operating conditions of pharmaceutical corporate, the good and bad of the performance of pharmaceutical corporate can be evaluated systematically and reasonably [1].

It is necessary to find out an effective means for evaluate the culture of pharmaceutical corporate, the model analysis and mathematical analysis methods can be used to carry out the culture evaluation of pharmaceutical corporate. There are many affecting factors of pharmaceutical corporate culture, therefore it is difficult to construct the general evaluation model, the quantitative evaluation of it is more difficult, and the hierarchy process can carry out qualitative and quantitative evaluation, which is simple and consistent. It has been applied in many fields widely, but this method lacks scientific basis, then the fuzzy analytic hierarchy process is put forward to make up the disadvantages of hierarchy process. The fuzzy analytic hierarchy process can evaluate the culture of pharmaceutical corporate, and the valued evaluation results can be obtained [2].

Basic theory of pharmaceutical corporate culture evaluation

The pharmaceutical corporate culture is a unique culture organization structure, however the pharmaceutical

corporate culture has superiority and inferiority, the excellent pharmaceutical corporate culture can unite the economic benefits and social benefits. The pharmaceutical corporate should pay attention to credibility for external customers, and respect the internal employee, and then the pharmaceutical corporate can be promoted sustainably. The bad enterprise culture has no regard for social benefits, which pursue the maximization of profit at the cost of social benefits, then the cohesiveness of the pharmaceutical corporate can not be formed, and finally the pharmaceutical corporate will decline. Therefore it is necessary to construct the evaluate system of pharmaceutical corporate culture scientifically, and make the pharmaceutical corporate develop healthily [3].

The evaluation system of the pharmaceutical corporate culture should apply modern management science, psychology and ethology to analyze the different dimension of affecting the pharmaceutical corporate culture, which can grasp the culture level of pharmaceutical corporate and the changing rules of it.

The evaluation content of the pharmaceutical corporate culture has four cultural layers, which are material culture, behavior culture, institutional culture and spiritual culture, the evaluation of pharmaceutical corporate culture is to evaluate the four kinds of culture. The material culture is manifestation of corporate culture. In the matter of evaluating the material culture, the development of pharmaceutical product, the quality of corporate service, the credibility of pharmaceutical product, and the production environment, living environment, cultural facility and Research and development system of the pharmaceutical corporate should be concerned. Behavior culture is the cultural activity of all employees in pharmaceutical corporate during the procession of production and operation, learning and entertainment. The evaluation of the behavior culture for pharmaceutical corporate, the effect of the group activity of employees on the spirit and civilization degree of the pharmaceutical corporate should be paid attention to. The institutional culture is the external culture that is made up of management system, organization structure, and democratic management, and it is the bridge and backbone of the pharmaceutical corporate culture. In matter of evaluating the institutional culture, the actual situation of the pharmaceutical enterprises should be concerned, whether the institutional culture can promote the standardized management of the pharmaceutical enterprise or not should be focused on. The spiritual culture is the enterprise consciousness and cultural concept formed during the procession of the operation of pharmaceutical corporate, which is a deep enterprise culture using the concept as the form, in matter of evaluating the spiritual culture, the spirit, values, philosophy and the morality of the pharmaceutical corporate should be considered, the promotion of the core value system of the pharmaceutical enterprise on the production and operation management and core competitiveness of pharmaceutical corporate should be concerned [4,5].

Construction of evaluation model for pharmaceutical corporate culture

The effective pharmaceutical corporate culture evaluation must satisfy the following conditions:

(1) Choose the proper evaluation index of pharmaceutical corporate. Because there are many indexes relating to the pharmaceutical corporate culture, so the representative indexes should be chosen to suit for the comprehensive analysis requirement of pharmaceutical corporate culture.

(2) Confirm the weight value of every culture index of pharmaceutical corporate, the weight of every weight should be confirmed properly, and then the importance of evaluation index can be embodied properly.

(3) Construct the evaluation frame properly; the proper evaluation frame can reveal comprehensive information of pharmaceutical corporate culture.

(4) Analyze the application of evaluation results, the operating conditions of pharmaceutical corporate can be analyzed according to comprehensive score and contribution of every index to comprehensive indexes, the corresponding reasons can be found out, and the measurements can be taken, this is the starting point and attaching point of pharmaceutical corporate culture evaluation.

Firstly, the evaluation index system of pharmaceutical corporate culture can be constructed based on SMART principle, the affecting factor of pharmaceutical corporate culture can be screened based on information precipitation method. Then the characteristics of pharmaceutical corporate culture should be studied in depth, the evaluation indexes can be further screened based on actual situation of the pharmaceutical industry. Finally the factor analysis method is used to carry out the reducing dimension of evaluation indexes, and the optimal evaluation index system can be obtained.

According to the above method the evaluation index system of pharmaceutical corporate culture can be obtained, which is shown in table 1.

Table 1 Evaluation index system of pharmaceutical corporate culture

Material culture of pharmaceutical corporate	environmental culture	Support of government
		Developing level of pharmaceutical industry
		Strength of pharmaceutical corporate
	product culture	Software and hardware product structure
		research and development level of pharmaceutical product
		pharmaceutical
	technology and culture	popularization rate of pharmaceutical technology
		integration degree of pharmaceutical technology
	Network culture	network degree of computer system
		number and quality of websites of pharmaceutical corporate
institutional culture	business decision and leadership system	Support of business decision
		Status, power and ability of manager
	personnel system	scale of highly educated technician
		Scale of training people
	management system	Integration level of management information
		Information degree of management
	organization system	Organization and positioning of each department
		degree of information sharing and communication
Behavior culture	leadership culture	Importance of leader on the pharmaceutical corporate
		research and development ethos of leader
		Investment of leader on pharmaceutical corporate
	Employee culture	technical level of employee
		Involvement level of employee
		Business communication skills of employee
	Model culture	business capability of model
		Working enthusiasm of model
		contribution of model to development of corporate
Spirit culture	Values of pharmaceutical corporate	Reorganization of corporate on pharmaceutical industry
		Acceptation of employee on new pharmaceutical technology
	Spirit of pharmaceutical corporate	Clear degree of development aim for the pharmaceutical corporate
		cohesion of pharmaceutical corporate
	Moral of pharmaceutical corporate	Importance of pharmaceutical corporate on credit
		comply with the pharmaceutical supervision mechanism

Basic theory of fuzzy analytic hierarchy process

The weight coefficient of evaluation indexes with stable operation can be confirmed step by step according to the basic theory of fuzzy analytic hierarchy process.

Step 1: the hierarchical structure model of fuzzy analytic hierarchy process is established. In recent years, a set of subjective and objective evaluation system has been constructed, which has been applied in many fields widely. According to the existed good evaluation system and the actual situation of pharmaceutical corporate culture, the evaluation system with Chinese characteristics of pharmaceutical corporate culture can be constructed, which concludes evaluation index system, evaluation principle and evaluation basis and so on. The model of fuzzy analytic hierarchy process can be constructed based on evaluation system.

Step 2: the fuzzy judge matrix is constructed; the fuzzy judge matrix can be established based on the rating scale method of component in matrix. When the judge matrix is constructed based on fuzzy analytic hierarchy process, the judgment obtained is denoted by interval number and fuzzy number in generally, therefore the triangle fuzzy does not conclude the conception of the range, and the median can be used to reflect the possible relationship between indexes. Through the communication of index evaluation experts, the triangle fuzzy number can reflect the reorganization of experts on importance between indexes. Then the rating scale method of fuzzy analytic hierarchy process based on the triangle fuzzy number can be used in this research. The triangle fuzzy number can denote every component in fuzzy judging matrix.

The triangle fuzzy number is the fuzzy number $\tilde{M}$ on discourse, and the corresponding membership degree function is expressed as follows [6]:

$$\mu = \begin{cases} \dfrac{x-1}{m-l}, l \le x \le m \\ \dfrac{x-u}{m-u}, m \le x \le u \\ 0, other \end{cases} \quad (1)$$

where, l denotes the upper bound of $\tilde{M}$, u denotes the low bound of $\tilde{M}$, m denotes median when the membership of $\tilde{M}$ is equal to 1, and the corresponding curve is shown in figure 1.

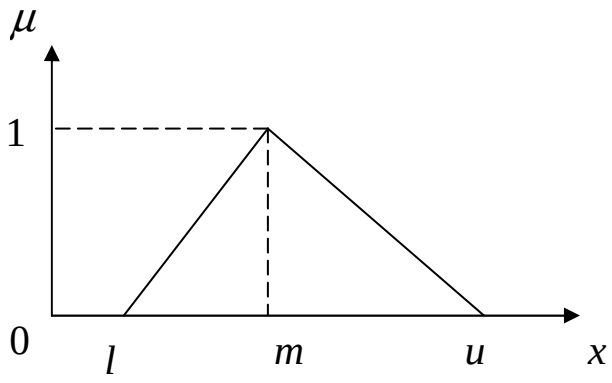

Figure 1 Membership function diagram of triangle fuzzy number

The computing method of fuzzy number is listed as follows: the fuzzy judging matrix $A = (\tilde{a}_{ij})_{m\times n}$ is given, and the fuzzy weight vector is defined as $W = (\tilde{w}_{ij})_{1\times n}$, the score vector can be calculated according to the following expression [7]:

$$\vec{R} = \vec{A} \otimes \vec{W} \quad (2)$$

where, $\vec{R} = [\tilde{r}_1 \quad \tilde{r}_2 \quad \cdots \quad \tilde{r}_m]'$, $\tilde{r}_i = \tilde{a}_{i1} \otimes \tilde{w}_1 \oplus \tilde{a}_{i2} \otimes \tilde{w}_2 \oplus \cdots \oplus \tilde{a}_{in} \otimes \tilde{w}_n$;

$\vec{A} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$, $\vec{W} = [\tilde{w}_1 \quad \tilde{w}_2 \quad \cdots \quad \tilde{w}_n]$。

$\otimes$ and $\oplus$ has the following algorithms: the following two vectors are known $\vec{C} = (c_1, c_2, c_3)$, $\vec{D} = (d_1, d_2, d_3)$, then the following expressions can be satisfied:

$$\vec{C} \oplus \vec{D} = (c_1 + d_1, c_2 + d_2, c_3 + d_3) \quad (3)$$

$$\vec{C} \otimes \vec{D} = (c_1 \cdot d_1, c_2 \cdot d_2, c_3 \cdot d_3) \quad (4)$$

The fuzzy number can be sorted based on mean value and standard variance, when the mean value is bigger and the value of the standard variance is small, the fuzzy number is bigger. The mean value and standard variance of triangle fuzzy number are calculated according to the following expressions [8]:

$$\bar{x}(\tilde{r}_i) = \frac{1}{4}(a + 2b + c) \quad (5)$$

$$\sigma(\tilde{r}_i) = \frac{1}{80}(3a^2 + 4b^2 + 3c^2 - 4ab - 2ac - 4bc) \quad (6)$$

Analysis results and discussion

In order to verify the effectiveness of evaluation model of pharmaceutical corporate culture, the six pharmaceutical corporate are chosen to carry out case study, the needed support data in the procession of evaluation is obtained through investigation, and the basic information of the six pharmaceutical corporate are shown in table 2.

Table 2 Basic information of six pharmaceutical corporate

	Corporate 1	Corporate 2	Corporate 3	Corporate 4	Corporate 5	Corporate 6
average sale in recent five years	300	289	226	294	210	320
Investment in R&D	45	40	33	42	26	50
Number of research and development institutions	16	20	24	19	18	22
Number of employees	55000	45000	51000	48000	56000	62000

The definition for importance of fuzzy number is shown in table 3.

Table 3 Corresponding relation between the fuzzy number and importance

fuzzy number	importance
$\tilde{1}$	Index 1 and index 2 has the same importance
$\tilde{2}$	Index 1 is slight more important than index 2
$\tilde{3}$	Index 1 is obvious more important than index 2
$\tilde{4}$	Index 1 is very more important than index 2
$\tilde{5}$	Index 1 is especial more important than index 2
$\tilde{2},\tilde{4},\tilde{6},\tilde{8}$	The importance lies somewhere between the two accounts

The membership degree of two grade evaluation index can be calculated according to membership degree function, the mean value of two grade evaluation index can be used as the membership degree of first grade evaluation index, according to relationship between the fuzzy number and membership, the membership of every evaluation index can transferred into corresponding fuzzy number, and the final fuzzy judging matrix can be established, which is shown as follows:

$$A = \begin{bmatrix} \tilde{5} & \tilde{3} & \tilde{8} & \tilde{6} & \tilde{2} & \tilde{9} \\ \tilde{5} & \tilde{7} & \tilde{7} & \tilde{8} & \tilde{8} & \tilde{4} \\ \tilde{6} & \tilde{7} & \tilde{5} & \tilde{7} & \tilde{5} & \tilde{5} \\ \tilde{5} & \tilde{6} & \tilde{7} & \tilde{6} & \tilde{8} & \tilde{6} \\ \tilde{6} & \tilde{8} & \tilde{7} & \tilde{4} & \tilde{5} & \tilde{6} \\ \tilde{9} & \tilde{4} & \tilde{7} & \tilde{3} & \tilde{6} & \tilde{5} \end{bmatrix}$$

The 20 experts of researching the pharmaceutical corporate culture are employed, the corresponding discussion conference is hold, the weight of first grade index is confirmed finally, which is shown as follows:

$$W = \begin{bmatrix} \tilde{5} & \tilde{7} & \tilde{5} & \tilde{8} & \tilde{4} & \tilde{5} \end{bmatrix}$$

According to expression (2), the scores of six six pharmaceutical corporate are obtained, which are shown as follows:

$$R = \begin{bmatrix} (46,52.77,81,93,101) \\ (69,82,91,110,127,136) \\ (82,110,124,132,155,175) \\ (76,91,121,144,167,178) \\ (62,73,95,104,133,164) \\ (94,102,120,142,166,195) \end{bmatrix}$$

The defuzzification operation is carried out for score of pharmaceutical corporate culture based on formulas (5) and (6), and the culture level of six pharmaceutical corporate can be sorted based on the sorted principle, the corresponding results are shown in table 4.

Table 4 sorted results of six pharmaceutical corporate culture

Sequence	pharmaceutical corporate	Mean value	Standard variance
1	corporate 6	132.4	122.4
2	corporate 1	124.6	121.5
3	corporate 4	120.3	118.4
4	corporate 2	101.7	106.4
5	corporate 3	89.4	120.6
6	corporate 5	69.5	103.1

As seen from table 4, according to the calculating results, the culture construction level of pharmaceutical corporate 1 is best, and other five pharmaceutical corporate rankings are corporate 1, corporate 4, corporate 2, corporate 3 and corporate 5. the pharmaceutical corporate with poor levels of constructing culture should learn from experience of pharmaceutical corporate with high levels of constructing culture. The pharmaceutical corporate should construct culture from the angle of material culture, institutional culture, behavior culture and spirit culture.

CONCLUSION

To create a good pharmaceutical corporate environment, build a favorable image of pharmaceutical corporate, construct a enterprise culture that suits for the development of pharmaceutical corporate, the employees and leaders of pharmaceutical corporate should make hard effort. A effective evaluation method should be constructed, the fuzzy analytic hierarchy process is applied in analyzing it, the corresponding evaluating index is established. And case study is carried out for six pharmaceutical corporate, results show that the fuzzy analytic hierarchy process can evaluate the pharmaceutical corporate culture.

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