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MANAGEMENT CONFLICT INNOVATION IDEAL SOLUTION EVALUATION BASED ON IMPROVED ENTROPY FUZZY COMPREHENSIVE EVALUATION METHOD

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Abstract. *The management innovation ideal solution is widely used in many parts of management field. In this paper, we evaluate the management innovation ideal solution of management conflict: pleasure-institutionalized, denoted as (P⊕I). By defining the quantifiable index and the non-quantifiable index, the management innovation evaluation function is established which considers the above two classes indexes together. The evaluation result of each management innovation solution is got by the management innovation evaluation function. Combined with the entropy fuzzy comprehensive evaluation method, innovation ideal solution of management conflict (P⊕I) is got. This method can reduce the influence of human factors in fuzzy comprehensive evaluation. Finally, an application is provided as an illustration to show the effectiveness of this method.*
Keywords: Management innovation, Management conflict, Fuzzy comprehensive evaluation, Management innovation evaluation function

1. **Introduction.** Innovation is defined as the following: *adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization* [1]. Newness or novelty is a common term in the definitions of innovation across disciplinary fields. Management innovation is the introduction of a new structure, process, system, program, or practice in an organization or its units [2,3]. The potential role of management innovation for strategic change, organizational renewal, and effectiveness has been noted by scholars in multiple disciplines.

Enterprises have gradually realized the important role of management innovation, but it is difficult to apply the advanced management theory as technology innovation [4]. In addition to technological innovation, the enterprises should be able to apply the scientific theory and methods to the practice of enterprises [5,6].

With expert estimation method to confirm the index weight, the conclusion is influenced by too many human factors [7]. In [8] the secondary fuzzy comprehensive evaluation is proposed and used to risk assessment of floor water inrush in coal mines.

As the above analysis, the remainder of this paper is organized as the following. The evaluation index of the management conflict ideal solutions is provided in Section 2. In Section 3, improved entropy fuzzy comprehensive evaluation is presented. In Section 4, a case is given to illustrate the effectiveness of the proposed model and the algorithm. The conclusion is given in Section 5.

2. **Evaluation Index of the Management Conflict Ideal Solutions.** In management innovation process, management conflicts are inevitable, and the management conflict $(P \oplus I)$ is the most important. So we should pay more attention to the management conflict $(P \oplus I)$ in the management innovation process.

In the case analysis, the paper adopts the 5 ideal solutions to determine the enterprise capability index, which is obtained by the theoretical literature research. The solution to the different conflict problems will often involve the different ability index of the indicators, and combine the concrete management problem to present the different expression form. It also may be improved or worsened and have different expressions.

Enterprises are trying to improve the employee's sense of ownership, but the excessive concern for employees will affect the implementation of the company's system and efforts. How to establish a benign up and down communication mechanism causes the $(P \oplus I)$ conflict. Access management conflict resolution matrix, and we can get original solutions as the following: split (A_1), nested structure (A_2), reverse (A_3), persistent (A_4), and local quality (A_5).

TABLE 1. The management innovation ideal solution

Split (A_1)	It is the communication with the staff into a variety of forms.
Nested structure (A_2)	It is the basic unit which is to set up staff coordination meeting.
Reverse (A_3)	It is to change the direction of the top-down command relationship.
Persistent (A_4)	It is a mechanism which is continuing to play a role.
Local quality (A_5)	It is combined with the informal communication form.

In the process of solving the conflict management innovation, the improvement or deterioration of indexes is used to determine the rationality of the management solution.

The optimization parameter is ***pleasure*** (P), and the deterioration parameter is ***institutionalized*** (I). The reference principles are A_1, A_2, A_3, A_4, and A_5. The improved organizational capacities are as follows: productivity, employee stability, working enthusiasm, and profit. The deteriorated organizational capacities are as follows: personal interests conflict, cost, time, and power conflict.

3. Improved Entropy Fuzzy Comprehensive Evaluation Model.

In this section we will establish improved entropy fuzzy comprehensive evaluation model as following three steps: comprehensive quantitative strategy of the management innovation evaluation indexes, the ideal solution weight calculation with entropy method and fuzzy comprehensive evaluation solution.

3.1. Comprehensive quantitative strategy of the management innovation evaluation index.

In the management innovation ideal solution evaluation, the evaluation index can be divided into quantifiable indexes (QIs) and non-quantifiable indexes (NQIs). If the value of the ith quantifiable useful index is f_{1i} which can be got by actual data, the value of the ith non-quantifiable useful index is f_{2i} which can be got by expert score. The management innovation solution ideal level of useful function index can be synthesized consideration as the following:

$$F_1 = \sum_{i=1}^{n_1} \alpha_{1i} f_{1i}, \quad \sum_{i=1}^{n_1} \alpha_{1i} = 1, \tag{1}$$

$$F_2 = \sum_{i=1}^{n_2} \alpha_{2i} f_{2i}, \quad \sum_{i=1}^{n_2} \alpha_{2i} = 1. \tag{2}$$

In Equations (1) and (2), α_{1i} is the weight of the ith quantifiable useful index, n_1 is the number of the quantifiable useful indexes, α_{2i} is the weight of the ith non-quantifiable useful index, n_2 is the number of the non-quantifiable useful indexes, F_1 is the weighted average of quantifiable useful indexes, and F_2 is the weighted average of non-quantifiable useful indexes.

If the value of the ith quantifiable harmful index is h_{1i} which can be got by actual data, the value of the ith non-quantifiable harmful index is h_{2i} which can be got by expert score. The management innovation solution ideal level of harmful function index can be synthesized consideration as the following:

$$H_1 = \sum_{j=1}^{m_1} \beta_{1j} h_{1j}, \quad \sum_{j=1}^{m_1} \beta_{1j} = 1, \tag{3}$$

$$H_2 = \sum_{j=1}^{m_2} \beta_{2j} h_{2j}, \quad \sum_{j=1}^{m_2} \beta_{2j} = 1. \tag{4}$$

Here, β_{1j} is the weight of the jth quantifiable harmful index, m_1 is the number of the quantifiable harmful indexes, β_{2j} is the weight of the jth non-quantifiable harmful index, m_2 is the number of the non-quantifiable harmful indexes, H_1 is the weighted average of quantifiable harmful indexes, and H_2 is the weighted average of non-quantifiable harmful indexes.

As above analysis, in management innovation ideal solution evaluation process, the useful indexes and harmful indexes coexist. The ideal level of such an ideal solution is to compare the relationship between the level of useful index and harmful index. When H_1, H_2 are larger or F_1, F_2 are smaller, the level of the ideal is higher. When H_1, H_2 are smaller or F_1, F_2 are larger, the level of the ideal is lower. The traditional evaluation function is:

$$M(H_1, H_2, F_1, F_2) = (H_1 + H_2)/(F_1 + F_2). \tag{5}$$

However, it is worth noting that, the evaluation Function (5) is unreasonable in the structure mechanism. Concretely, 1) the evaluation Function (5) is meaningless when $F_1 + F_2 = 0$; 2) although $F_1 + F_2 \neq 0$, the calculation result is too unreasonable to match the actual situation when there exists a big gap between $F_1 + F_2$ and $H_1 + H_2$ (such as $F_1 + F_2 = 0.001$, $H_1 + H_2 = 100$, and the evaluation result is 10000 which is too big to match the actual situation). For making up these two shortcomings, we propose the management innovation evaluation function to evaluate the ideal level of ideal solution.

As above analysis, we can regard the management innovation evaluation function $M(H_1, H_2, F_1, F_2)$ as a mapping from $[0, \infty)^4$ to $[0, \infty)$, and it satisfies the following principles:

Principle 1. $M(H_1, H_2, F_1, F_2)$ is monotone non-decreasing about H_1, H_2;

Principle 2. $M(H_1, H_2, F_1, F_2)$ is monotone non-increasing about F_1, F_2;

Principle 3. $M(H_1, H_2, 0, 0)$ is monotone increasing.

Naturally, we can construct many kinds of management innovation evaluation functions. It is easy to see, the following functions

$$M_1(H_1, H_2, F_1, F_2) = (m_1 H_1 + m_2 H_2) / (1 + (k_1 F_1 + k_2 F_2)^a), \tag{6}$$

$$M_2(H_1, H_2, F_1, F_2) = (m_1 H_1 + m_2 H_2)\, e^{-(k_1 F_1 + k_2 F_2)}, \tag{7}$$

are two common management innovation evaluation functions. Here, $m_1, m_2, k_1, k_2, a \geq 0$.

In the process of evaluation, the bigger the I is, the higher the innovation level of the solution is, and the more likely it will be to achieve results. When $m_1 = m_2 = k_1 = k_2 = a = 1$, we can get $M(H_1, H_2, F_1, F_2) = (H_1 + H_2)/(1 + F_1 + F_2)$.

3.2. **The ideal solution weight with entropy method.** All assessment factors set a comprehensive evaluation model assessment factors set: $U = (U_1, U_2, \cdots, U_n)$, and the overall assessment of the assets will be assessed by the factors set composition. r_{ik} $(i = 1, 2, \cdots, n, k = 1, 2, \cdots, m)$ is the evaluation result of U_k by the ith categories evaluator, which is got by management innovation evaluation function. A fuzzy relationship evaluation matrix $R = (r_{ij})_{m \times n}$. We will establish an algorithm composite entropy and

management innovation evaluation function to calculate the weight $W = (w_1, w_2, \cdots, w_m)$ by the following three steps.

Step 1: Calculate

$$z_{ik} = \frac{r_{ik}}{\sum_{i=1}^{n} r_{ik}}, \quad i = 1, 2, \cdots, n, \quad k = 1, 2, \cdots, m. \tag{8}$$

Step 2: Calculate the assessment value of the entropy of factors:

$$e_k = -\frac{\sum_{i=1}^{n} z_{ik} ln z_{ik}}{mn}, \quad k = 1, 2, \cdots, m. \tag{9}$$

Step 3: Calculate the weights $W = (w_1, w_2, \cdots, w_m)$:

$$w_k = \frac{1 - e_k}{\sum_{i=1}^{m}(1 - e_i)}, \quad k = 1, 2, \cdots, m. \tag{10}$$

3.3. **Fuzzy comprehensive evaluation solution.** From the R and W, using fuzzy matrix synthesis operator, the indicators are to be assessed fuzzy comprehensive evaluation sets:

$$B = W \cdot R^T = (w_1, w_2, \cdots, w_m) \cdot R^T = (b_1, b_2, \cdots, b_n). \tag{11}$$

Here, $b_k = \sum_{i=1}^{n}(b_i r_{ik})$, $k = 1, 2, \ldots, m$.

If the assets are assessed more complicatedly, there can be more level classifications, modeled on the model, an entropy fuzzy comprehensive evaluation. The evaluators weight distribution parameters are used in vector-under: $V = (v_1, v_2, \cdots, v_n)^T$. Comprehensive assessment of the evaluation of all views, are grey entropy fuzzy comprehensive evaluation results

$$d = B \cdot V^T = (b_1, b_2, \cdots, b_n) \cdot (v_1, v_2, \cdots, v_n)^T. \tag{12}$$

The proposed improved entropy fuzzy comprehensive evaluation model contains different decision making consciousnesses with different management innovation evaluation functions.

4. **Case Analysis.** In this section, we will combine with a case (the data is in Tables 2-4) to show the management conflict $(P \oplus I)$ ideal solution evaluation problem, and further more we will analyze the feature and effectiveness of the proposed evaluation model which is established in Section 3.

Next, we will get the index judgment matrix of the management conflict "pleasure-institutionalized". When $k = 1$, we can get the following evaluation value.

From Tables 2-4, we can get the $(P \oplus I)$ management innovation judgment matrix. Next we use management innovation evaluation function $M(H_1, H_2, F_1, F_2) = (H_1 + H_2) \Big/ \left(1 + (F_1 + F_2)^k\right)$, $k \geq 0$.

Table 2. The index judgment matrix (Expert 1)

Index	A_1	A_2	A_3	A_4	A_5
Productivity	1	0.2	0.2	1	1
Employee stability	0.2	1	0.2	0.2	0.2
Working enthusiasm	0.8	0.2	1	0.5	0.5
Profit	1	0.2	0.2	1	1
Personal interests conflict	1	0.2	0.2	1	1
Cost	0.2	0.2	1	0.2	0.2
Time	0.5	0.3	1	0.5	5
Power conflict	1	0.2	0.2	1	1
evaluation value	0.81	0.84	0.64	0.73	0.33

TABLE 3. The index judgment matrix (Expert 2)

Index	A_1	A_2	A_3	A_4	A_5
Productivity	1	0.2	0.2	1	1
Employee stability	0.5	1	0.5	0.5	0.5
Working enthusiasm	0.9	0.5	1	0.3	0.8
Profit	1	0.2	0.2	1	1
Personal interests conflict	0.8	0.3	0.5	0.8	1
Cost	0.2	0.2	1	0.2	0.2
Time	0.5	0.3	1	0.5	5
Power conflict	0.9	0.6	0.6	0.7	0.9
evaluation value	1	0.79	0.59	0.88	0.41

TABLE 4. The index judgment matrix (Expert 3)

Index	A_1	A_2	A_3	A_4	A_5
Productivity	1	0.2	0.2	1	1
Employee stability	0.3	0.8	0.3	0.6	0.2
Working enthusiasm	0.6	0.4	0.9	0.6	0.3
Profit	1	0.2	0.2	1	1
Personal interests conflict	0.7	0.7	0.9	0.8	0.8
Cost	0.2	0.2	1	0.2	0.2
Time	0.5	0.3	1	0.5	5
Power conflict	1	0.4	0.5	0.8	1
evaluation value	0.85	0.62	0.46	0.97	0.31

TABLE 5. The $(P \oplus I)$ management innovation judgment matrix

Management innovation evaluation function	Expert	A_1	A_2	A_3	A_4	A_5
$(H_1 + H_2)/(1 + F_1 + F_2)$	Expert 1	0.81	0.84	0.64	0.73	0.33
	Expert 2	1	0.79	0.59	0.88	0.41
	Expert 3	0.85	0.62	0.46	0.97	0.31
$(H_1 + H_2)/(1 + (F_1 + F_2)^2)$	Expert 1	0.75	0.81	0.61	0.72	0.30
	Expert 2	0.93	0.76	0.53	0.82	0.37
	Expert 3	0.81	0.59	0.42	0.91	0.25
$(H_1 + H_2)/(F_1 + F_2)$	Expert 1	1.11	1.78	0.67	1	0.38
	Expert 2	1.42	1.36	0.61	1.27	0.46
	Expert 3	1.21	1	0.47	1.39	0.36

When $k = 1$, the improved entropy fuzzy comprehensive evaluation method is used to determine the importance degree of each evaluation factor for the weight vector W, $W = (0.36, 0.18, 0.13, 0.24, 0.09)$, and $B = (0.73, 0.83, 0.74)$. By actual conditions, three kinds of experts weighting coefficients were 0.4, 0.3, 0.3, so $V = (0.4, 0.3, 0.3)$ by the grey entropy fuzzy comprehensive evaluation model of comprehensive evaluation results to: $d = (0.73, 0.83, 0.74) \cdot (0.4, 0.3, 0.3)^T = 0.762$. Therefore, in the management conflict ***pleasure-institutionalized***, the evaluation value of the ideal solution A_1 is the highest 0.36, so it should be ***Split*** as a way to resolve the conflict. The credibility of the evaluation results is 0.762 which is higher than 0.5.

Next we use different management innovation evaluation function $k = 2$. The evaluation value of the ideal solution A_2 is the highest 0.35, so it should be ***Nested structure*** as a way to resolve the conflict. The credibility of the evaluation results is 0.76 which is high.

Using the traditional evaluation function $M(H_1, H_2, F_1, F_2) = (H_1 + H_2)/(F_1 + F_2)$, the evaluation value of the ideal solution A_3 is the highest 0.31, so it should be ***Reverse*** as a way to resolve the conflict. The credibility of the evaluation results is 0.36 which is lower than management innovation evaluation function $M(H_1, H_2, F_1, F_2) = (H_1 + H_2)/\left(1 + (F_1 + F_2)^k\right)$, $k = 1$ or $k = 2$.

Because the management innovation evaluation function $M(H_1, H_2, F_1, F_2) = (H_1 + H_2)/(1 + (F_1 + F_2)^k)$, $k \geq 0$ does not contain the case of the denominator being zero, it is more effective than the traditional evaluation function $M(H_1, H_2, F_1, F_2) = (H_1 + H_2)/(F_1 + F_2)$. When we use different management innovation evaluation function the result will be different which shows the proposed model contains different decision making consciousnesses.

5. **Conclusion.** In this paper, in order to evaluate the management innovation ideal solution of the management conflict, we proposed the improved entropy fuzzy comprehensive evaluation method. The proposed model contains different decision making consciousnesses and avoids the case of the evaluation function denominator being zero. With a case of management conflict $(P \oplus I)$ ideal solution evaluation problem we show that the ***Split*** and ***Nested structure*** is the better way to solve the management conflict and the credibility of the proposed method is higher than the traditional method. The other three ways ***Reverse***, ***Persistent***, and ***Local quality*** also can solve the management conflict ***pleasure-institutionalized***, but the effect is not better than ***Split*** and ***Nested structure***. So the evaluation result is more credible and this proposed method is more concise and effective. Furthermore we can study how to select the management innovation evaluation function to make the result more reasonable.

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