Entropy-Based Fuzzy AHP Crisis Management in the University Student Apartment Application

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Abstract: This paper established a college student apartments and crisis management ability evaluation index system, a hierarchy of fuzzy-based analysis of college student apartments and a comprehensive evaluation of crisis management capabilities. Confidence criterion adopted to determine the assessment level crisis management capabilities. The method is more scientific, intuitive and feasible than the traditional analytic hierarchy process, fuzzy comprehensive evaluation method.

1. Introduction

Crisis management refers to the organization through the crisis monitoring, crisis early warning, crisis decision-making and crisis management, to avoid and reduce the harm crisis, sum up the crisis, the development of the law of the crisis scientific, systematic a new management system. Crisis management refers to the organization through the crisis monitoring, crisis early warning, crisis decision-making and crisis management, to avoid and reduce the harm crisis, sum up the crisis, the development of the law of the crisis scientific, systematic and a new management system [1-3]. University Apartments is a crisis-prone areas severely affected by the harm the health of school development and the teachers and students. And the complex and diverse types of crises, crises random sudden loss of varying degrees of crisis, resulting in management difficulties, teachers, schools and the community are all very concerned about crisis management college apartment. Therefore, to campus security and stability, to create a good learning atmosphere of life must improve crisis management capabilities College Apartments, College Apartments and crisis management capacity to establish evaluation index system, through the system with the correct method of management to evaluate the comprehensive evaluation, thereby reducing the non-Uncertainty of the case on the lives of students and schools, and property harm, maintain and improve the running order of the normal education college to provide important guidance.

2. Determination of Evaluation Index System

Evaluation index selection directly affects the evaluation of the reasonableness of the results are correct. Therefore, when the selected index must follow the following principles:

2.1. Scientific Principles

Any scientific evaluation index system is the requirement, if the selected indicators do not have the science, then the system also does not have a scientific evaluation, it will not play after guiding the work of the crisis management role in crises Loss will be very heavy.

2.2. The Principle of the Feasibility

Purpose of the study is that it can be applied to practical work, to help managers to better, more scientific management crisis. If an evaluation index system is not feasible, then it loses its meaning.

2.3. The Principle of Flexibility in the Usage

Crisis in a different evaluation of schools is different, so the crisis in the choice of evaluation, we selected according to different circumstances of different indicators, the only way to do a feasibility of the above.

Follow the principle of a university apartment on crisis management research. Crisis Management in the College Dormitory center of each sector as crisis management priorities identified by the evaluation index, the power management, fire safety management, a major natural disaster management, student management, as this four-level evaluation, crisis management, according to the Approach, will be a detailed index system for a number of secondary indicators, the entire apartment building crisis management evaluation.

Table 1 Evaluation index system for crisis management ability of university student apartments.

Crisis Manage-ment in Student Residen-ces	Power Manage-ment	Smart energy metering system centralized
		Apartment Security Management
		Apartment safety inspections
		Apartment Supply Manager
	Fire Safety Manage-ment	Fire emergency plan
		Fire drills, training
		Evacuation guide
		Emergency Command
		Fire-fighting operations
		Communications
		Safety
	Natural disaster Manage-ment	Information Collection
		Education Management
	Student Manage-ment	Apartment Management Ordinance was enacted
		Psychological Consultation
		Administrator letter of responsibility

3. Entropy-based Fuzzy AHP

In the evaluation of research there are many methods of evaluation, different methods all have their advantages and disadvantages. This paper proposes a new evaluation method, the introduction of entropy calculations to determine the level of analysis in the evaluation index weights, combined with evaluation of fuzzy comprehensive evaluation method of fuzzy comprehensive evaluation value of the object. Finally credible identification criteria for the evaluation to determine level of evaluation objects.

Analytical Hierarchy Process (AHP), is a combination of qualitative and quantitative, systematic, hierarchical analysis. The problem of decision-making can be broken down into different elements (indicators), and these elements (indicators) are incorporated into different levels, the formation of multi-layer hierarchical structure, starting from the top step by step to establish matrix, and in accordance with the Professor of Satie 1 to 9 scale method, consider the elements (indicators) the nature, importance and measure in judging the matrix elements (indicators) to rate, usually root or the summation method to determine the matrix obtained Elements (index) the weight and consistency analysis. In this paper, determine the entropy method to handle the weights matrix[4].

In information theory, entropy reflects the degree of disorder of information can be used to measure the size of the amount of information. Information carried by a particular indicator more of the indicators that the greater the role of decision-making, the smaller the entropy value, the smaller the degree of disorder of the system. Therefore, entropy can evaluate the degree of order of

information available and its utility, that is, the value of the index to determine the composition of the comparison matrix weight of each index. The main calculation steps are as follows.

(1) To determine the matrix of the estimated value of the index value of x_{ij} and x_j^*, proximity to the ideal calculated

x_j^* is the ideal evaluation of the value of j, x_j^* the size of the evaluation of the characteristics due to differ: the profitability index, x_j^* The larger the better; and for the cost index, the smaller the better x_j^*.

$$D_{ij} = \begin{cases} x_{ij} / x_j^* & x_j^* = \max\{x_{ij}\} \\ x_j^* / x_{ij} & x_j^* = \min\{x_{ij}\} \end{cases}$$

(2) Will be close to the normalized matrix:

$$\mathrm{d}_{ij} = D_{ij} / \sum_{j=1}^{n}\sum_{i=1}^{m} D_{ij} \tag{1}$$

(3) According to the definition of entropy, the entropy index to determine the right indicators that determine the weight of the matrix[5]:

$$e(d_j) = -\frac{1}{\ln m}\sum_{i=1}^{m}\frac{d_{ij}}{d_j}\ln\frac{d_{ij}}{d_j} \tag{2}$$

Where: $\mathrm{d}_j = \sum_{i=1}^{m} d_{ij}$

$$\theta_j = \frac{1}{n - E_e}\left[1 - e(d_j)\right] \tag{3}$$

Where: $\mathrm{E}_e = \sum_{j=1}^{n} e(d_j)$

Combined with evaluation of fuzzy comprehensive evaluation method of fuzzy comprehensive evaluation value of the object, the specific steps are as follows:

(1) Determine the factor set F, reviews set E

Evaluation factor set is a collection of F, F = {f1, f2, ... fn}, is the AHP hierarchical structure established by the evaluation index, reviews set E is the set of evaluation grades, E = {e1, e2, ... Em}

(2) Statistical evaluation of single factor determining the membership vector, and the formation of membership matrix R

Evaluation of degree of membership is the subject of an evaluation of multiple objects in f_i has made the possibility of assessing the size of e_j. $R_i = (r_{i1}, r_{i2}, \cdots r_{im}), i = 1,2,\cdots n, \sum_{j=1}^{m} r_{ij} = 1$ vector of membership, membership matrix $R = (R_1, R_2, \cdots R_n)^T = (r_{ij})$

(3) According to the formula $B = \omega_F \circ R = (b_1, b_2, \cdots b_m)$ to calculate the value of fuzzy comprehensive evaluation. As the evaluation is the orderly classification, the maximum membership grade criteria do not apply. Therefore, using credible identification criteria, take confidence level, usually take 0.6 or 0.7, for reviews set E is the set of evaluation grades, E = {e1, e2, ... em}, the object of evaluation to determine the level of evaluation.

Here Entropy-based fuzzy analytic hierarchy process, to an apartment of a college student to evaluate the crisis management capabilities.

4. Numerical Example

According to Table 1, Student Residences and crisis management ability evaluation index system, the establishment of all of the matrix, you get expert scoring matrix to determine the scale of each index value of each other, and then use the entropy method to determine the appropriate weight of each index. Level indicators to determine the weight of case details.

Table 2 Index weight table.

	Power Manage-ment	Fire Safety Manag-ement	Major natural disaster Manage-ment	Student Manage-ment
Power Manage-ment	1	1	2	1
Fire Safety Manage-ment	1	1	2	1
Major natural disaster Manage-ment	1/2	1/2	1	2
Student Manage-ment	1	1	2	1

According to Table 2, the matrix diagram is as follows.

$$A = \begin{bmatrix} 1 & 1 & 2 & 1 \\ 1 & 1 & 2 & 1 \\ 1/2 & 1/2 & 1 & 2 \\ 1 & 1 & 2 & 1 \end{bmatrix}$$

All management is the profitability index. $X_j^* = 2$, the estimated value of the index x_{ij} close to the ideal value of the degree x_j^*:

$$D_{ij} = \begin{bmatrix} 1/2 & 1/2 & 1 & 1/2 \\ 1/2 & 1/2 & 1 & 1/2 \\ 1/4 & 1/4 & 1/2 & 1/4 \\ 1/2 & 1/2 & 1 & 1/2 \end{bmatrix}$$

In accordance with the formula (1) are normalized, have matrix

$$d_{ij} = \begin{bmatrix} 0.057 & 0.057 & 0.114 & 0.057 \\ 0.057 & 0.057 & 0.114 & 0.057 \\ 0.028 & 0.028 & 0.057 & 0.028 \\ 0.057 & 0.057 & 0.114 & 0.057 \end{bmatrix}$$

In accordance with the formula (2) calculation, $e(d_j)$: $e(d_1) = -0.973$, $e(d_2) = -0.973$, $e(d_3) = -0.972$, $e(d_4) = -0.973$

In accordance with the formula (3) Calculate the weights of evaluation indexes, $\theta_1=0.250$, $\theta_2=0.249$, $\theta_3=0.250$, $\theta_4=0.250$

That

$$\omega = \begin{pmatrix} 0.250 & 0.249 & 0.250 & 0.250 \end{pmatrix}$$

AHP also the logic of rationality in the Matrix and Consistency:
1) Consistency index calculated C.I.

$$C.I. = \left(\lambda_{max} - n \right) / \left(n - 1 \right)$$

$$\lambda_{max} = \frac{1}{n} \sum \frac{(\mathbf{AW})_i}{\mathbf{w}_i}$$

$$\begin{bmatrix} 1/2 & 1/2 & 1 & 1/2 \\ 1/2 & 1/2 & 1 & 1/2 \\ 1/4 & 1/4 & 1/2 & 1/4 \\ 1/2 & 1/2 & 1 & 1/2 \end{bmatrix} \begin{bmatrix} 0.250 \\ 0.249 \\ 0.250 \\ 0.250 \end{bmatrix} = \begin{bmatrix} 1.20 \\ 1.20 \\ 0.625 \\ 1.20 \end{bmatrix}$$

$\lambda_{max}=4.225$

C.I.=0.075

2) The average consistency index for the corresponding

Table 3 Average consistency index table.

n	R.I.
1	0
2	0
3	0.52
4	0.89
5	1.12
6	1.26
7	1.36
8	1.41

3) Calculation of consistency

C.R.＝C.I./R.I.=0.084＜0.1 Reasonable

The corresponding C.I. is taken from Table 3

Similarly computed, each set of indicators index layer weight vector

$\omega_1 =(0.260,0.245,0.252,0.259)$,

$\omega_2 =(0.136,0.145,0.142,0.143,0.141,0.147,0.145)$,

$\omega_3 =(0.499,0.50)$,

$\omega_4 =(0.339,0.323,0.337)$

According to the apartment of a University of the actual situation of crisis management, to make a sample survey of school teachers and students, taking a class of students and several teachers (total 20) on the crisis management work to do an evaluation. And statistics. Establish membership matrix R_1,R_2,R_3,R_4.

$$R_1 = \begin{bmatrix} 0.35 & 0.35 & 0.3 & 0 \\ 0.15 & 0.55 & 0.45 & 0 \\ 0.3 & 0.2 & 0.4 & 0.1 \\ 0.3 & 0.5 & 0.1 & 0.1 \end{bmatrix}$$

$$R_2 = \begin{bmatrix} 0.4 & 0.15 & 0.45 & 0 \\ 0.15 & 0.15 & 0.5 & 0.2 \\ 0.15 & 0.15 & 0.55 & 0.15 \\ 0.2 & 0.3 & 0.35 & 0.15 \\ 0.15 & 0.4 & 0.3 & 0.15 \\ 0.2 & 0.4 & 0.25 & 0.15 \\ 0.15 & 0.35 & 0.4 & 0.1 \end{bmatrix}$$

$$R_3 = \begin{bmatrix} 0.15 & 0.35 & 0.45 & 0.05 \\ 0.25 & 0.25 & 0.4 & 0.1 \end{bmatrix}$$

$$R_4 = \begin{bmatrix} 0.5 & 0.3 & 0.2 & 0 \\ 0.15 & 0.25 & 0.45 & 0.15 \\ 0.2 & 0.35 & 0.4 & 0.05 \end{bmatrix}$$

Fuzzy comprehensive evaluation value calculation

$B_1 = \omega_1 R_1 = (0.282 \quad 0.399 \quad 0.315 \quad 0.051)$

$$B_2 = \boldsymbol{\omega}_2 R_2 = \begin{pmatrix} 0.199 & 0.272 & 0.399 & 0.124 \end{pmatrix}$$
$$B_3 = \omega_3 R_3 = \begin{pmatrix} 0.200 & 0.300 & 0.425 & 0.075 \end{pmatrix}$$
$$B_4 = \omega_4 R_4 = \begin{pmatrix} 0.285 & 0.301 & 0.348 & 0.065 \end{pmatrix}$$

$$B = \omega R = \begin{pmatrix} 0.25 & 0.249 & 0.250 & 0.250 \end{pmatrix} \begin{bmatrix} 0.282 & 0.399 & 0.315 & 0.051 \\ 0.199 & 0.272 & 0.399 & 0.124 \\ 0.200 & 0.300 & 0.425 & 0.075 \\ 0.285 & 0.301 & 0.348 & 0.065 \end{bmatrix}$$
$$= \begin{pmatrix} 0.247 & 0.318 & 0.371 & 0.070 \end{pmatrix}$$

To judge the results obtained by the second level evaluation matrix, get the second-level evaluation results

Take confidence interval $\lambda = 0.6$, according to the formula:

$$K_i = \min\{k: \sum_{l=1}^{k} \mu_{ij} \geq \lambda, \quad 1 \leq L \leq k\}$$

reached the level of power management level management capabilities, 0.282+0.399=0.681＞0.6,Therefore, a better grade. Similarly, the availability of fire, natural disasters, the level of student management level. 0.199＋0.272＋0.399＞0.6,Therefore, the rating of fire management. 0.2＋0.3＋0.425＞0.6, The management of major natural disasters in the rating. 0.285＋0.301＋0.348＞0.6, Therefore, the grade of student management. 0.242＋0.239＋0.211＞0.6, Last school student apartments in the crisis management capacity.

5. Conclusion

Student Residences and crisis management capabilities is a long hard work, the evaluation can help college apartment management center objective management, evaluate their own crisis management capacity. Periodic comprehensive evaluation, can effectively find an apartment in crisis management center of the inadequacies in a timely manner to perfect. In this way, unexpected events can be effectively reduced the negative impact on schools and reduce the loss caused by the crisis.

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