Advance Journal of Food Science and Technology 9(10): 745-748, 2015
DOI: 10.19026/ajfst.9.1652
ISSN: 2042-4868; e-ISSN: 2042-4876

Submitted: March 3, 2015 Accepted: March 14, 2015 Published: September 20, 2015

**Research Article**

# Assessment on the Food Management Quality Based on the Method of Improving TOPSIS

Mengyan Wang
Henan College of Finance and Taxation, Zhengzhou, Henan, China

**Abstract:** Based on the analysis of the existing methods of evaluating foods, this study puts forward a comprehensive evaluation method for Foods quality to improve TOPSIS method, so as to avoid the problem of the scheme of the ideal solution and the negative ideal solution is too close to the problem, which can improve the scientific and reasonable feature of the traditional TOPSIS method. The development of the society has an increasing requirements for the food management quality in the future. Food management education is a public compulsory course for students who are in higher normal colleges, which is with distinctive feature of normal education and is closely related to the important course for training the qualified foods.

**Keywords:** Food management, qualified foods, TOPSIS method

## INTRODUCTION

The evaluation on foods is a judging and evaluating process for the education administrative departments or schools to judge and evaluate foods according to certain standards for the working status and achievements in the work. But the existing evaluation method basically is from the qualitative aspect to study, or use the artificial statistics evaluation measurement as data, then draw the conclusion, therefore, these methods are inefficient, which are lack of scientific feature and fairness. In this study, it is based on the method of improving TOPSIS, making evaluation from two aspects: teaching and quality, in order to ensure the Foods science and other subjects can communicate with each other usually and regularly communicate, which can help to guide students with the internship and make preparation for internship (Ye, 2008).

Food management education can undertake three tasks in colleges and universities:

- To teach foods the basic theory of Food management education required, provide basic training for their future use of food management knowledge in quality, promote the formation of teaching ability.
- Food management education is the scientific basis of educational theory, Food management education teaching can provide Food management education for foods to learn and master various teaching methods and lay a good foundation through the relevant knowledge.
- To guide students to use their knowledge of Food management education in the current study, improve their learning ability and constantly improve their own food management qualities, promote their food management health (Pedrycz, 2007).

So on one hand, it can help the public Foods to grasp the practical teaching and play an important role in guiding foods' internship; on the other hand, it also can make the Student have the opportunity to contact with the common education, so as to make up the shortage of the knowledge structure of teaching Food management education, meanwhile, it can change the situation of Food management education teaching for its lacking real content and speaking generally. Young students should probe into the first-line quality, which should often go to the classes of middle school to listen to classes or do experiments, so as to enrich the perceptual knowledge.

## MATERIALS AND METHODS

**TOPSIS method:** TOPSIS (The Technique for Order of Preference by Similarity to Ideal Solution) was first proposed by Hwang and Yoon (1981), it is according to the degree of the finite objects that is close to the ideal goal to sort, which is a kind of evaluating the relative merits of the existing objects. The method of TOPSIS is an approximation to the ideal ranking method, this method only requires each utility function is monotone on the line. This method is an effective method that is commonly used for the analysis of multi-criteria decision, which is also known as TOPSIS method and it is widely used in evaluating the food management quality of the work, benefits evaluation, etc. TOPSIS method can evaluate the object and order according to the geometric distance from the positive ideal solution and the geometric distance from the negative ideal

Table 1: The constructer of judgment matrix

| | $D_1$ | $D_2$ | $D_3$ | ... | $D_n$ |
|---|---|---|---|---|---|
| $D_1$ | $d_{11}$ | $d_{12}$ | $d_{13}$ | ... | $d_{1n}$ |
| $D_2$ | $d_{21}$ | $d_{22}$ | $d_{23}$ | ... | $d_{2n}$ |
| $D_3$ | $d_{31}$ | $d_{32}$ | $d_{33}$ | ... | $d_{3n}$ |
| ... | ... | ... | ... | ... | ... |
| $D_n$ | $d_{n1}$ | $d_{n2}$ | $d_{n3}$ | ... | $d_{nn}$ |

solution, if the evaluated object is the one that is the closest to the positive ideal solution and far away from the negative ideal solution, then it is the best, otherwise it is the worst (Tong, 2010). Each index of the positive ideal solution can reach to the optimum value of each evaluation index, the index of the negative ideal solution can reach to the worst value of each evaluation index.

**Evaluation on food management abilities of colleges by the application of TOPSIS method:**

**The determination of evaluation index weight in TOPSIS method:** The weight coefficient is a whole that can be decomposed into several factors (index), which is used to indicate the proportion of each factor in the whole, shorted for weight. The weight of index reflects the index in the whole of the relative important degree; at the same time, it is also the reflection of the understanding degree that the subject of the index had evaluation on its value, namely, the more important the index is, the larger the weight; otherwise, the smaller the weight is. During the period of having comprehensive evaluation, the weight of each factor is usually given the weights by experience directly, which is lack of scientific feature, resulting in making it difficult to be objective and accurate. Study on the binding characteristics of training innovative talents in Colleges and universities, through the division of the training mode for training the innovative talents in colleges and universities, determining the weights by scaling method proposed by Professor Satty (Ming, 2009).

**Constructing the judgment matrix of each layer: quantitative grading method:** Various factors at the same level, according to its excellent degree or important degree can be divided into several grades, which can be assigned with the quantitative value (Table 1). Represented by 1-9 scale method proposed by Satty (1980) and Jia (2009). Generally it uses 5 levels of quantitative grading method, namely equal, weak, strong, very strong, extremely strong, the corresponding assignment can be as 1, 3, 5, 7 and 9, respectively. As for one element is secondary to another element, the quantitative assignment can countdown in reverse order 1, 3, 5, 7 and 9, respectively. If the classification of some problem can have higher accuracy and the above 5 levels of quantitative analysis can not enough to describe it clearly, which can be inserted in 2, 4, 6 and 8, respectively and become the 9 level quantitative method. The judgment matrix is established: as for each layer of the factors (such as $D_i$), you can build a judgment matrix, $d_{ij}$ can represent the degree of importance assignment value a factor of $D_i$ on the other factor $D_j$.

**To determine the weight of the layer:** First of all, calculate the component $W_i$ of $W$ by using square root:

$$wi = \left( \prod_{i=1}^{n} d_y \right)^{1/n} \quad i = 1,2,\cdots, \quad n$$

Secondly, putting $w = (w^1, w^2,\ldots w^n)^T$ into normalization processing, getting weight vector $w^0 = (w_1{}^0, w_2{}^0,\ldots w_n{}^0)^T$:

$$w_A = \sum_{i=1}^{n} w_i \quad w_i^0 = w_i / w_A$$

Once again, calculating A's maximum characteristic root $\lambda_{max}$:

$$\lambda_{\max} = \sum_{i=1}^{n} BW^0 \Big/ nw_i^0$$

In the formula: representing vector with No. *i* element.

**Determining the combination weight:** Combination weight is the relative importance weight that can calculate the bottom indexes related to the top layer (total goals). This process is from the highest level to the lowest level, layer by layer. If a hierarchy of $A$ contains m factors of $A_1$, $A_2$,... $A_m$, the combination weight is $a_1$, $a_2$,... $a_m$, the next layer $B$ contains $n$ factors of $B_1$, $B_2$,... $B_n$, the layer weights of factors $A_j$ were $b_{1j}$, $b_{2j}$,...$b_{nj}$.

**Determining the weight of each evaluation indexes:** The layer of the evaluation index for the Foods' teachisng practical abilities system of colleges can be shown by the table. Five index systems in the first layer are: teaching factor, incentive factor, management factor, curriculum factor, evaluation factor, the weight of each factor, the elements of judgment matrix to the value of the target layer and the as well as the five

Table 2: The weight of each evaluation index

| Management factor 0.26 | | | | Incentive factor 0.19 | | | Controlling factor 0.32 |
|---|---|---|---|---|---|---|---|
| $D_{11}$ | $D_{12}$ | $D_{13}$ | $D_{14}$ | $D_{21}$ | $D_{22}$ | $D_{23}$ | $D_{34}$ |
| 0.49 | 0.10 | 0.18 | 0.25 | 0.17 | 0.11 | 0.30 | 0.11 |
| Structural factor 0.15 | | | | | | | or |
| $D_{41}$ | $D_{42}$ | $D_{43}$ | $D_{44}$ | | | | |
| 0.39 | 0.27 | 0.12 | 0.18 | | | | |

Table 3: The original data of the evaluated foods

| Index Teacher | The effect of teaching: Foods' evaluation | The effect of teaching: Experts' evaluation | Teaching hours: The amount of the theory class | Teaching hours: The amount of the experimental class | The main achievements: The general evaluation on scientific research (points) | The main achievements: The general evaluation on papers, textbooks and monographs (points) |
|---|---|---|---|---|---|---|
| $A_1$ | Excellent | Good | 110 | 86 | 7.5 | 4.0 |
| $A_2$ | Excellent | Excellent | 130 | 70 | 9.5 | 5.5 |
| $A_3$ | Good | Medium | 100 | 90 | 4.0 | 6.5 |
| $A_4$ | Good | Good | 95 | 110 | 5.0 | 7.5 |
| $A_5$ | Medium | Good | 75 | 105 | 6.5 | 4.5 |
| $A_6$ | Medium | Bad | 55 | 125 | 2.5 | 6.0 |
| $A_7$ | Bad | Medium | 120 | 80 | 9.5 | 5.5 |
| $A_8$ | Good | Medium | 95 | 65 | 7.5 | 7.0 |
| $A_9$ | Good | Good | 110 | 85 | 4.0 | 4.5 |
| $A_{10}$ | Excellent | Good | 90 | 80 | 4.5 | 9.0 |

factors in the final calculation with the weight of the lower layer index, The results are as follows in Table 2.

## RESULTS AND DISCUSSION

**Analyzing and evaluating the examples of food management and practical abilities:** Now, we took the comprehensive evaluation on parts of professional Foods in a certain college of Wuhan as the analyzing example, the original data is shown in Table 3. In the table, ($A_1$, $A_2$, $A_3$, $A_4$, $A_5$, $A_6$, $A_7$, $A_8$, $A_9$ and $A_{10}$, respectively) is the teacher who is evaluated, mainly level it with 3 indicators.

Making the attribute value that is in the form of language phrase go on fuzzy quantization process, so this kind of attribute value after the quantifying fuzzy attribute values, then: $M$ (bad) = 0.11, $M$ (general) = 0.27, $M$~ (medium) = 0.50, $M$~ (good) = 0.73, $M$~ (excellent) = 0.89. The experimental class shall be converted according to the requirements, plus the theory class to get the total hours of the foods' participation in the evaluation, the method of calculation is: the total hours = experimental class *0.7+ theory class. Thus, the evaluation index can be expressed as: foods' evaluation, experts' evaluation, the total hours of teaching class, the hours of quality, the hours of extracurricular exchanging class, totally 5 secondary indexes. Then normalize the data, which can get the decision matrix after being normalized: $Z = (z_{ij})$ $m \times n$, ($m$ = 1, 2, …, 10; $n$ = 1, 2, 3, 4, 5):

$$Z = \begin{bmatrix} 1 & 0.78 & 0.79 & 0.63 & 0 \\ 1 & 1 & 1 & 0.92 & 0.26 \\ 0.78 & 0.49 & 0.46 & 0.13 & 0.54 \\ 0.78 & 0.78 & 0.76 & 0.35 & 0.72 \\ 0.49 & 0.78 & 0.26 & 0.56 & 0.17 \\ 0.49 & 0 & 0.07 & 0 & 0.46 \\ 0 & 0.49 & 0.89 & 1 & 0.35 \\ 0.78 & 0.49 & 0 & 0.70 & 0.63 \\ 0.78 & 0.78 & 0.96 & 0.20 & 0.17 \\ 1 & 0.78 & 0.12 & 0.28 & 1 \end{bmatrix}$$

According to the previously introduced determination method, the index weight can be calculated: $W$ = {0.12, 0.12, 0.29, 0.24, 0.23}, thus get normalized weight the decision matrix $X = WZ$.

Table 4: The positive ideal solution and the negative ideal solution

| Teacher | $D_i^+$ | $D_i^-$ | $U_i$ | Sorting order |
|---|---|---|---|---|
| $A_1$ | 0.2534 | 0.3176 | 0.5561 | 4 |
| $A_2$ | 0.1688 | 0.4079 | 0.7071 | 1 |
| $A_3$ | 0.2845 | 0.2199 | 0.4359 | 8 |
| $A_4$ | 0.1824 | 0.3215 | 0.6379 | 3 |
| $A_5$ | 0.3089 | 0.1978 | 0.3903 | 9 |
| $A_6$ | 0.4053 | 0.1216 | 0.2308 | 10 |
| $A_7$ | 0.2010 | 0.3690 | 0.6472 | 2 |
| $A_8$ | 0.3163 | 0.2512 | 0.4426 | 7 |
| $A_9$ | 0.2704 | 0.3180 | 0.5403 | 5 |
| $A_{10}$ | 0.3049 | 0.2874 | 0.4851 | 6 |

$$X = \begin{bmatrix} 0.121 & 0.094 & 0.231 & 0.153 & 0 \\ 0.121 & 0.121 & 0.289 & 0.221 & 0.061 \\ 0.094 & 0.059 & 0.135 & 0.033 & 0.126 \\ 0.094 & 0.094 & 0.222 & 0.085 & 0.167 \\ 0.061 & 0.094 & 0.077 & 0.136 & 0.040 \\ 0.059 & 0 & 0.021 & 0 & 0.103 \\ 0 & 0.059 & 0.260 & 0.239 & 0.082 \\ 0.094 & 0.059 & 0 & 0.169 & 0.146 \\ 0.094 & 0.094 & 0.282 & 0.051 & 0.042 \\ 0.121 & 0.094 & 0.039 & 0.071 & 0.231 \end{bmatrix}$$

**Step 5:** Calculate the properties of the evaluation object (scheme) and the distance to the positive ideal solution as well as the distance to the negative ideal solution:

$$D_i^+ = \prod x_i - x^+ \prod 2 = \prod x_i - \vee x \prod 2 = \sqrt{\sum_{i=1}^{n} (x_{ij} - x_j^+)^2}, i = 1,2,\cdots,m$$

$$D_i^- = \prod x_i - x^- \prod 2 = \prod x_i - \wedge x \prod 2 = \sqrt{\sum_{i=1}^{n} (x_{ij} - x_j^-)^2}, i = 1,2,\cdots,m$$

**Step 6:** Calculate the relative closeness degree of the evaluation object (program):

$$U_i = \frac{\prod x_i - \wedge x \prod 2}{\prod x_i - \wedge x \prod 2 + \prod x_i - \vee x \prod 2} = \frac{D_i^-}{D_i^- + D_i^+}, i = 1,2,\cdots,m$$

According to the value of $U_i$ of each scheme, sort the evaluated personnel in order. Apparently, when $U_i$ tends to be equal to 1, the scheme is the most optimal, in this study, the comprehensive evaluation of the

evaluated personnel is the best. Namely, the value of $U_i$ determines the pros and cons of the scheme.

According to Step 5 and 6, $D^+_i$, $D^-_i$, $U_i$, (i = 1, 2, …, 10), can be got, which is as shown in Table 4.

## CONCLUSION

This paper is based on summarizing the current status of the researching method for the comprehensive evaluation on food management, it proposed the method for food management foods' comprehensive evaluation based on improving TOPSIS method. Finally, it tested this method through the examples to prove that this method is convenient, practical and feasible, which can better reflect the objectivity, impartiality and effectiveness of the evaluation. This method made full use of the evaluation indexes with the given information, which was not strictly limited to the amount of the index. Judging from the whole process, the idea and structure is simple, easily operate, which can fully reflect the results of the evaluation and show the maneuverability of this evaluation system.

## REFERENCES

Hwang, C.L. and K. Yoon, 1981. Multiple Attribute Decision Making: Methods and Applications. Springer-Verlag, New York.

Jia, B.B., 2009. Build a diversified teacher evaluation system. Chinese Sci. Educ. Innov. Trib., 32: 234-240.

Ming, H., 2009. Evaluation of university teachers performance management. J. South China Norm. Univ., 4: 133-135.

Pedrycz, W., 2007. Fuzzy neural networks with reference evaluation as pattern classifiers education. IEEE T. Neural Networ., 3: 36- 37.

Satty, T.L, 1980. The Analytic Hierarchy Process. McGraw-Hill, New York.

Tong, Q., 2010. University teachers performance appraisal index system based on BSC theory research. Stat. Decis., 2: 73-75.

Ye, B., 2008. Revolution and its reason of American colleges evaluation research based on TOPSIS. J. Educ., 14(5): 74-80.