Research Article
Research on Food Safety Guarantee System Based on AHP

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Abstract: All kinds of food safety accidents occurred frequently in recent years, the main reason is that food safety system construction failed to synchronize with the internet, this study sets up food safety technical standard system based on the AHP evaluation model, learns lessons from food safety related bulletin, revises for the food industry standard, innovates from technology and regulatory reform, so as to promote international food safety system construction.

Keywords: AHP evaluation, food industry standard, food safety system

INTRODUCTION

The issue of food security first came to the world's attention in the 1970s when a widespread world food crisis broke out. It was then that the United Nations Food and Agriculture Organization (FAO) raised the issue at an international conference. The issue of food security has become even more urgent and complex (Buzby, 2003). It has brought new challenges for every country concerned about national food security. China, historically an agricultural nation, has naturally always been concerned about this issue and has many measures in place to help secure food supplies. So, there are many challenges and uncertainties ahead. This paper starts from the concept of food security, proposes AHP models having on this problem, looks at how China is reacting and lastly offers some suggestions on how China can ensure its national food security.

Food is the most important element of peoples' lives, according to a Chinese saying. Since ancient times, food security has been regarded as a fundamental issue for human beings. China has been making measures to ensure its food security since the Shang dynasty. Food was regarded as: "the life of all people and precious for the country." The governments of ancient China all gave top priority to food production and distribution. "Food is the government's foremost responsibility." Many famous statesmen and strategists such as Guan Zhong, Shang Yang, Li Kui, Jia Yi and many others all had their own strategies to ensure China's food security. The issue of food security was first raised by the international community in the 1970s. Since then the securitization of food issue became internationalized and Food Security has been an ongoing concern. Ever since the FAO issued its definition of food security in November 1974, which is "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices", 1 perceptions and thinking on this issue have changed markedly, especially with the advancement of globalization. The focus on food security has been expanding ever since with deeper concerns being raised beyond the key issue of food availability. Governments, as well as NGOs and scholars, have been changing their ideas when it comes to food security. Take the U.K. for example. Several decades ago the country had a "food security strategy" which it updated in 2010 to cope with new developments. It now lays focus on household and individual food security, sustainability of global resources, the elasticity of food supply chains, food safety and quality and so on. China has traditionally focused on national security and its ability to cope with different kinds of food crises (Dong and Hao, 2009). But recently, its attention has moved towards other areas, such as human security, environmental issues and so on.

MATERIALS AND METHODS

For the building index system, we can use AHP and entropy weight to determine the index weight of subjective and objective information, respectively, comprehensive weights are obtained, in order to improve the accuracy and credibility of evaluation results.

When determining our security system coordinated integrated evaluation system of the index weight j, we should comprehensively consider the results of subjective and objective weights way, that electricity security system coordinated weight value j of comprehensive is concluded.

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The determination method of subjective weight coefficient: Using AHP to determine the subjective weights of evaluation indexes, the main steps are as follows.

Constructing judgment matrix, scaling method for evaluation of each factor to carry on the assignment, the importance of the judgment j matrix of structure are as follows.

The sheer level and a consistency check of judgment matrix: As the largest of judgment matrix eigenvalue and eigenvector and carries on the satisfaction degree of validation. The calculation steps are following.

Calculated judgment matrix product of all the elements:

$$m_i = \prod_{i=1}^{n} b_{i,j} \, i = 1,2,\cdots,n$$

The Nth root:

$$\varpi_i = \sqrt[n]{m_i}\,(i = 1,2,\cdots,n)$$

On vector normalization processing:

$$\varpi = \left(\varpi_1, \varpi_2, \cdots, \varpi_n\right)^{T}$$

That is, to the desires of feature vector:

$$\omega_i = \frac{\varpi_i}{\sum_{j=1}^{n} \varpi_j} \, i = 1,2,\cdots,n$$

Calculate the maximum characteristic root matrix:

$$\lambda_{max}: \lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(A\omega)_i}{\omega_i}$$

Consistency check of judgment matrix, namely $CR = CL/RI$, Among them, $CI = \frac{\lambda_{max} - n}{n-1}$, When $CR < 0.10$, the judgment matrix is satisfied consistency, otherwise we need readjust the element values.

Hierarchy total ordering: That needs to compute synthetic weight of each factor on the system's overall goal, to determine the relative importance that all the factors of A-layer have for the system overall goal-A layer. This process has been run from the top layer to the bottom layer.

The method of determining the coefficients of objective weight: Entropy weight is a kind of objective method of endow with weight, namely to determine the index weight according to relative degree of change about the index's influence on the overall system, greater degree of relative change means larger weights of indicators (Song and Chen, 2008). The main steps of using Entropy weight to give weight are as follows.

The original matrix: Index of comprehensive evaluation of a sample about *m*, a problem about *n* index, the formation of the original matrix are formatted as follows:

$$X = \left\{x_{i,j}\right\}_{m \times n}\left(0 \leq i \leq m, 0 \leq j \leq n\right)$$

Index normalized processing: Since the dimension and the order of the magnitude of each indicator has certain differences, we have to eliminate the influences of different dimensions on the evaluation result, so it is necessary to standardize various indicators:

$$x'_{i,j} = \begin{cases} \dfrac{X_j - X_{min}}{X_{max} - X_{min}} - A \\ \dfrac{X_{max} - X_j}{X_{max} - X_{min}} - B \end{cases}$$

Index after normalization treatment, the matrix proportion is as follows:

$$Y = \left\{\frac{x'_{i,j}}{\sum_{i=1}^{m} x'_{i,j}}\right\}\left(0 \leq i \leq m, 0 \leq j \leq n\right)$$

Calculation index information entropy and information utility value: The first item index j of information entropy value is:

$$e_j = -k\sum_{i=1}^{m} y_{i,j}\ln y_{i,j}\left(k = 1/\ln m\right)$$

Information utility value depends on the difference in value between 1 and the index of information entropy e_j. Its computation formula is:

$$dj = 1 - e_i$$

Calculation entropy of index: The entropy value of the *j* item parameter values is defined as weight:

$$\omega_j = \frac{d_j}{\sum_{i=1}^{m} d_j}$$

RESULTS AND DISCUSSION

Comprehensive evaluation results: If we determine weight set by the AHP $A = \{a_1, a_2, \ldots, a_n\}$ and weight set by entropy weight method: $W = \{\omega_1, \omega_2, \ldots, \omega_n\}$,

the power of ecological system coordination in the comprehensive evaluation system of the first comprehensive weights of indicators j is as follows:

$$Z_j = \frac{a_j \omega_j}{\sum\limits_{j=1}^{n} a_j \omega_j} \left(j = 1,2,\cdots, n \right)$$

Calculate comprehensive evaluation index: Through calculation results of the comprehensive evaluation index system and index weight, we use the weighted average model to calculate the comprehensive evaluation index of power ecosystem coordinate (H_{3e}) and evaluate the power coordination degree of ecosystem. Its computation formula is as follows (Yu, 2007; Zheng, 2007):

$$H_{3e}(i) = \sum\limits_{j=1}^{n} Z_j x'_{i,j}(i)(0 \leq H_{3e}(i) \leq 1)$$

CONCLUSION

We should rethink food security in the context of AHP model. We should establish a new and comprehensive food security strategy and policies to deal with this changing situation to mitigate and adapt to economic change, pursue sustainable development and a green economy. This new strategy should cover a diverse range of fields including industrialization strategy, energy security strategy, agriculture and rural development strategy and water security strategy.

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