

Research Article

Evaluation and Improvement of Food Safety Satisfaction Based on QFD

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Abstract: In view of the social phenomenon of people's generally low satisfaction with food safety, we introduced the QFD method to make evaluation and guidance for improvement. Based on scientific and reasonable evaluation index system of food safety satisfaction and the "quality house" of QFD core tool, a food safety satisfaction evaluation model was constructed. On the basis of the evaluation results, we analyzed the public food safety requirements and constructed the quality house between the public food safety requirements and the food safety satisfaction improvement measures, so as to determine the priority of configuration sequence of improvement measures.

Keywords: Evaluation and improvement modeling, food safety satisfaction, Quality Function Development (QFD)

INTRODUCTION

Food safety is a global issue, it not only affects everybody's health, but also related with the country's image and honor. In recent years, the repeated outbreaks of major food safety problems has made the public mind the haze and discontent, a serious threat to the stability of the government's credibility and social solidarity. Therefore, evaluation index system of food safety satisfaction from national and local governments is necessary. Quality Function deployment QFD is an assurance management method to convert the customer requirements into the product quality feature (Xiong, 2005). It uses the QFD method to make quantitative evaluation on the satisfaction of food safety, meanwhile, through the calculation process of the analysis of the satisfaction evaluation, it can discover and predict the future demand of the public demand on food safety and guide the work of food safety improvement, thus improve the public satisfaction.

MATERIALS AND METHODS

Evaluation index system of food safety satisfaction:

In order to ensure that the evaluation result of food safety satisfaction is reliable and effective, the selection of public satisfaction evaluation index is very important. Regarding to food safety, the international food hygiene law Committee (CAC) define it as food planting, breeding, processing, packaging, storage, transportation, marketing, consumption that are

conformed with a country compulsive standard and requirements and there is no possible damage or threat to human body health poisonous and harmful material that will lead consumers to disease death or hidden dangers to the consumers and their descendants (Gao *et al.*, 2009). According to this definition and through comparative analysis of related literature, we decided learn from the food safety satisfaction evaluation index system put forward by Chinese scholars Liang *et al.* (2010). This set of index system consists of 5 dimensions and 18 secondary evaluation index including the production and processing, management regulation, social supervision and harmful substances, the quality status and has significant reliability and validity (Liang *et al.*, 2010). The food safety satisfaction evaluation index system is shown in Fig. 1.

Evaluation model of food safety satisfaction based on QFD:

Use the quality house of the QFD core tool and through the form of matrix decomposition and the relationship between the indexes of quantitative evaluation index system of food safety satisfaction, to build the QFD evaluation model of the food safety satisfaction, as shown in Fig. 2. The left wall of the quality house is used to describe the evaluation index of food safety satisfaction. And the ceiling had listed the influence factors of these indicators. The roof means the reciprocal matrix of relationship between each influencing factor. The middle room is the relational matrix (r_{ij}), which is on behalf of the correlation degree between the evaluation index i and the influencing

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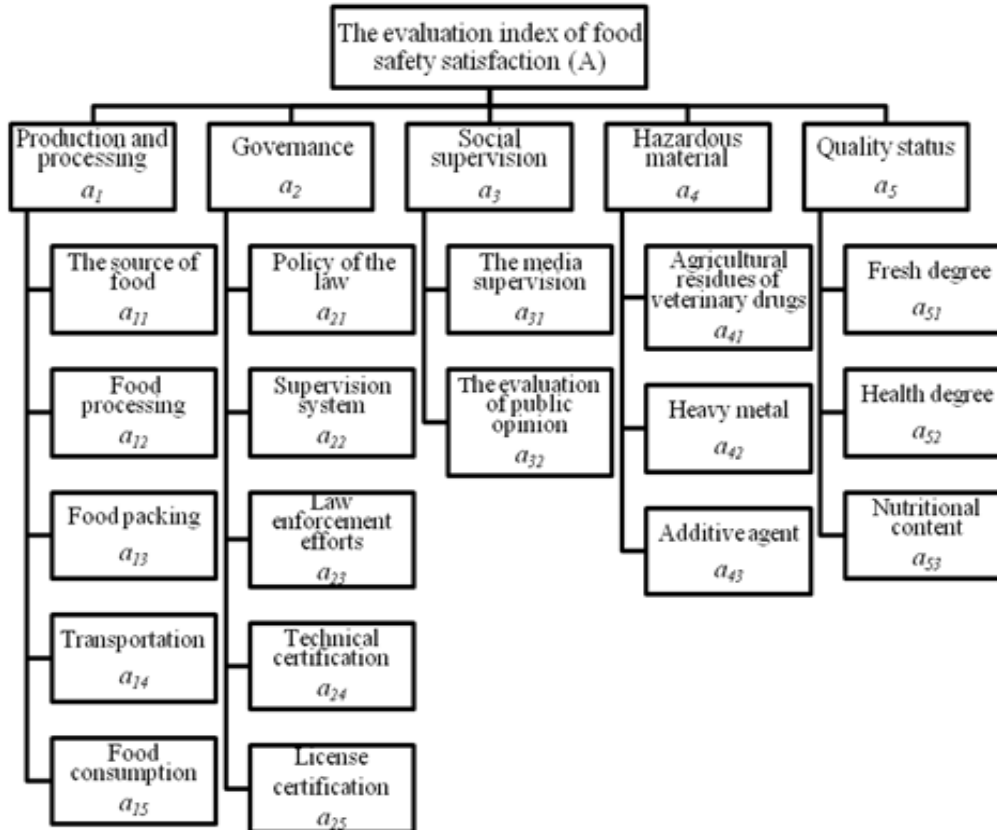


Fig. 1: Evaluation index system of food safety satisfaction

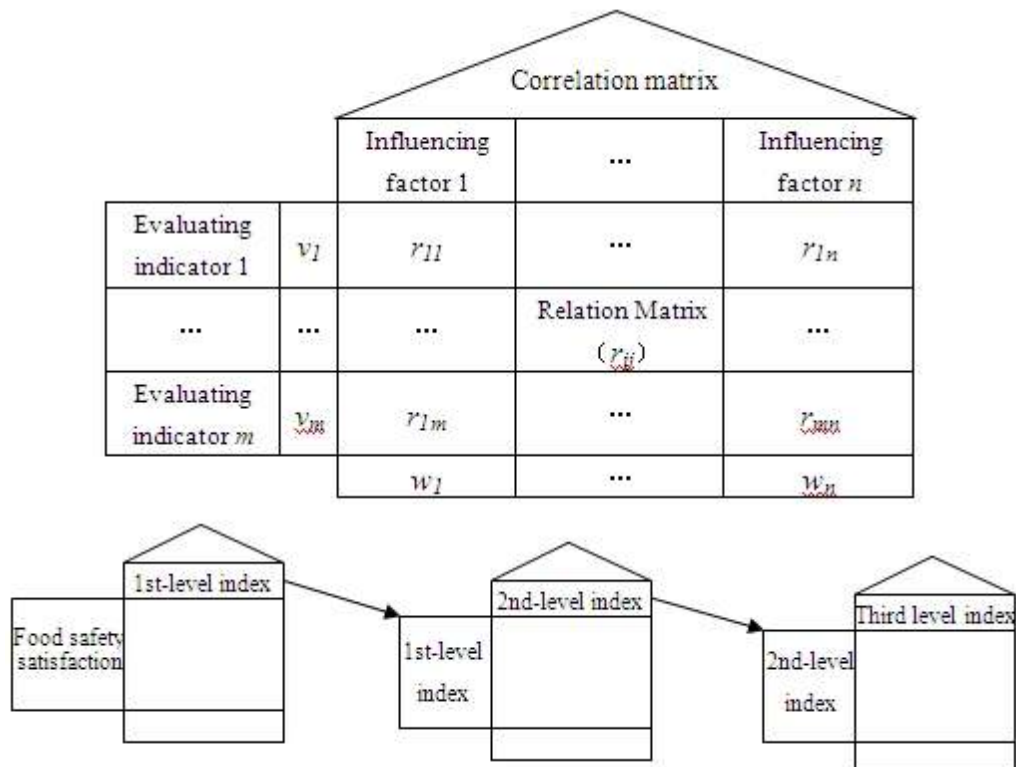


Fig. 2: Food safety satisfaction evaluation model based on QFD

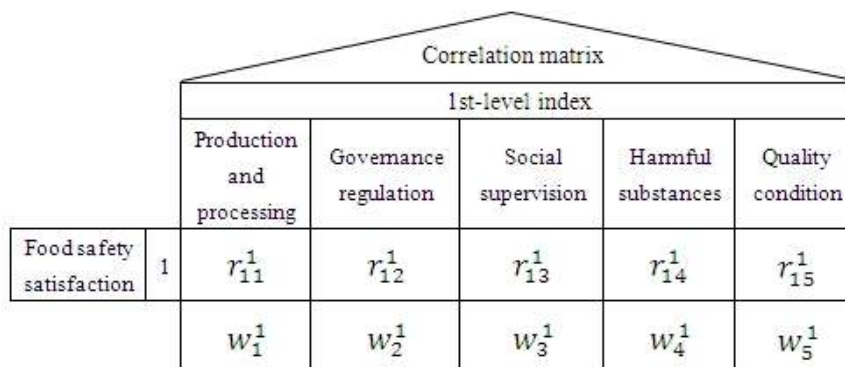


Fig. 3: First-stage evaluation model of food safety satisfaction based on QFD

Table 1: 1-9 rating scale method

1	3	5	7	9	2, 4, 6, 8
Weak	Weaker	Normal	Stronger	Close	Between adjacent level

factors j . v_m is located at the division plate between the left wall and room partition, which means the importance degree of each index. The floor w_n means the importance degree of all the factors relative to the important degree of satisfaction evaluation index for food safety. In this evaluation model, the next level indicators can be regarded as the influence factors of indicators at the next higher level and so on, we can gradually decompose food safety satisfaction and quantify analysis.

Combined with the evaluation index system of food safety satisfaction in Fig. 1 and the use of QFD evaluation model of food safety satisfaction, we can calculate the food safety satisfaction index for the public.

To build a relationship matrix: Establish the relational matrix according to the correlation degree of the next level indicator and the next higher level. Make judgment on the correlation degree between higher and lower indicators and to build relational matrix r_{ij} according to the 1-9 scaling method of T. L. Saaty as shown in Table 1 (Xu, 2013).

Firstly, to establish first-stage evaluation model. According to 1-9 level rating scale method, we can get the correlation degree $r_{1j}^1 (j = 1, 2, \dots, 5)$ between 1st-level index “Production and processing, management regulation, social supervision, harmful substances, quality condition” and food safety satisfaction and then put it into each room of first-stage evaluation model quality house as shown in Fig. 3.

Then, use the same method to give the correlation degree $r_{ij}^2 (i = 1, 2, \dots, 5; j = 1, 2, \dots, 18)$ between 18 2nd-level index and 5 1st-level index and put it into each room of second-stage evaluation model quality house, as shown in Fig. 4.

Index importance calculation: Firstly, according to the correlation matrix in Fig. 3, calculate the importance of 1st-level index w_j^1 of food safety satisfaction as formula (1):

$$w_j^1 = \frac{r_{1j}^1}{\sum_{j=1}^5 r_{1j}^1}, (j = 1, 2, \dots, 5) \quad (1)$$

Then, according to the correlation matrix in Fig. 4, calculate the importance of 2nd-level index w_j^2 of food safety satisfaction as formula (2):

$$w_j^2 = \frac{\sum_{i=1}^5 r_{ij}^2 w_i^1}{\sum_{i=1}^5 \sum_{j=1}^{18} r_{ij}^2 w_i^1}, (i = 1, 2, \dots, 5; j = 1, 2, \dots, 18) \quad (2)$$

Food safety satisfaction index calculation: Make food safety satisfaction questionnaire, to divide the satisfaction into five degrees as “very dissatisfied, not satisfied, generally satisfied, satisfied, very satisfied” and values them as 1, 2, 3, 4, 5 and let the public to grade and evaluate the 2nd-level indexes of food safety satisfaction and then take the average value as c_j . According to the formula (3), we can get food safety satisfaction C:

$$C = \sum_{j=1}^{18} w_j^2 c_j, (j = 1, 2, \dots, 18) \quad (3)$$

And then according to formula (4), we can get food safety satisfaction index CSI:

$$CSI = \frac{C-1}{5-1} \times 100 \quad (4)$$

Food safety satisfaction improvement based on QFD: By using QFD evaluation model to analyze the food safety satisfaction, we can understand the overall satisfaction of the public and which indexes are dissatisfied by them and these also have large influence on the food safety satisfaction. At the same time, we can also regard these satisfaction indexes that are easy to be judged as the public demand of food safety and forecast the future demand. In recent days that food

		Correlation matrix				
		Two-level evaluation index				
		Food source	Food processing	...	Health degree	Nutritional content
		a_{11}	a_{12}	...	a_{52}	a_{53}
Production and processing	w_1^1	r_{11}^2	r_{12}^2	...	$r_{1,17}^2$	$r_{1,18}^2$
Governance regulation	w_2^1	r_{21}^2	r_{22}^2	...	$r_{2,17}^2$	$r_{2,18}^2$
Social supervision	w_3^1	r_{31}^2	r_{32}^2	r_{ij}^2	$r_{3,17}^2$	$r_{3,18}^2$
Harmful substances	w_4^1	r_{41}^2	r_{42}^2	...	$r_{4,17}^2$	$r_{4,18}^2$
Quality condition	w_5^1	r_{51}^2	r_{52}^2	...	$r_{5,17}^2$	$r_{5,18}^2$
		w_1^2	w_2^2	...	w_{17}^2	w_{18}^2

Fig. 4: Second-stage evaluation model of food safety satisfaction based on QFD

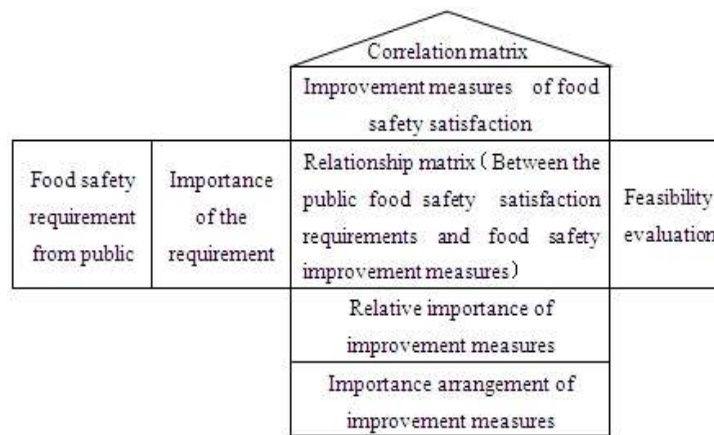


Fig. 5: "Quality house" of food safety satisfaction improvement based on QFD

safety problem happened frequently, we should continue to improve food safety satisfaction from the perspective of public demand. QFD is a quality assurance method of collaborative user and after evaluating the food safety satisfaction, it is more important to build the quality house between the public food safety demands and food safety satisfaction improvement measure through QFD method and turns it into appropriate specific improvement measures from the perspective of public food safety requirement:

Step 1: Identify the public food safety requirement according to the analysis result of the food safety satisfaction evaluation model and uses Analytic Hierarchy Process (AHP) to compare

the public food safety requirement index, thus determining the weight coefficient of every index.

Step 2: Study the factors that can affect the demand and measures through classification and conclusion, thus to determine the effective improvement measures to realize the public food safety requirements.

Step 3: Assess the correlation degree between various requirements of public food safety and food safety satisfaction improvement measures and establish the relationship matrix between the public food safety requirements and food safety satisfaction improvement measures.

Step 4: Build quality house, as shown in Fig. 5. To remit the above factors and the relationship matrix to quality house and uses the weighted synthesis method to get the relative importance of various food safety satisfaction improvement measures, so as to determine the improvement measures that should be configured for priority and thus provide the basis for food safety satisfaction improvement.

CONCLUSION

The introduction of QFD method into the food safety satisfaction study and the analysis of the combination of public food safety satisfaction evaluation and satisfaction improvement, provides a new way of thinking for the study of food safety satisfaction. By using the “quality house” of the QFD core tools, the constructed evaluation model of food safety satisfaction and quality house of food safety

satisfaction improvement, can make the food safety satisfaction be quantitative and gives intuitive and easy evaluation indexes at all levels of satisfaction and overall satisfaction and on this basis, it guides the improvement work of food safety satisfaction from the perspective of public food safety requirements.

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