Study on the risk evaluation model of catering O2O food quality and safety

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Abstract: The purpose of this paper is to analyze the risk points that may lead to food safety in the operation and development of catering O2O supply chain. Based on the operational mode of catering O2O supply chain, the system risk factors were identified by theoretical and literature analysis. Also, the expert Delphi method was used to put forward a comparatively perfect food quality and safety risk assessment system in catering O2O industry, and an evaluation model was constructed based on the fuzzy comprehensive evaluation method of analytic hierarchy process (AHP) to provide a reference for the development of food safety management of the catering O2O industry.

1 Introduction

In recent years, new catering O2O industries such as "Internet + catering" have emerged. However, beneath the surface of a thriving catering industry are many food safety concerns. In order to solve the problem of O2O food safety effectively, we must pay attention to the research of food quality and safety management in catering O2O supply chain. At present, the research on food quality and its management is still very few [2]. As a new product in the Internet era, the regulation and research of catering O2O mode is still in its infancy, especially in the food quality risk assessment in catering O2O supply chain. Therefore, it is of great theoretical and practical significance to to build a new food safety risk management system of catering O2O. Also, it guides relevant departments more practical and timely to carry out food safety risk management.

2 Operational Mode and Risk Analysis of Catering O2O Supply Chain

2.1 Operational mode of catering O2O supply chain

Catering O2O supply chain is mainly based on the O2O platform for information collection and transmission. It's operational flow is shown in figure 1.

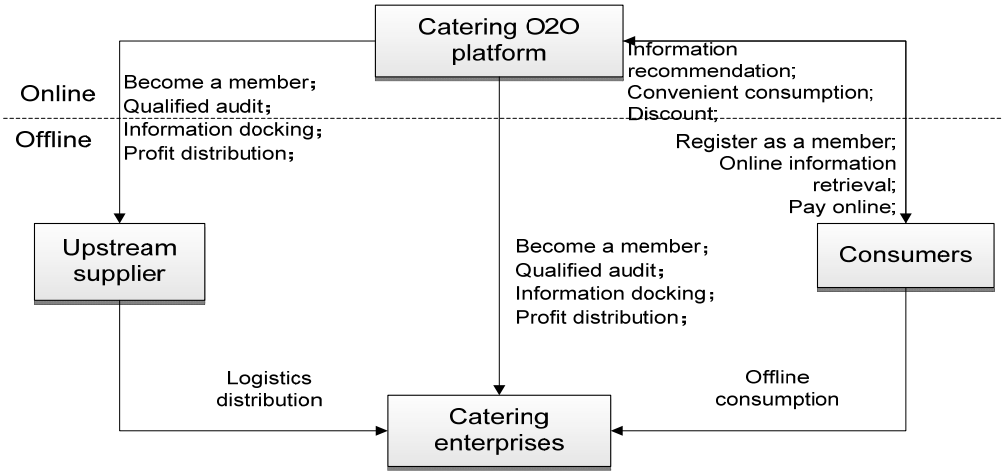

Figure 1. The operational flow of the catering O2O supply chain.

2.2 Identification and Analysis of Food Safety Risk of Catering O2O

According to catering O2O supply chain operation process, food quality risk factors were identified and divided into three parts: online subsystem risk, offline subsystem risk and system external risk.

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2.2.1Online subsystem risk

Online subsystem risk refers to the food quality risk caused by online part of the catering O2O supply chain which can be divided into the following three links according to its operation process: platform entry, consumption decision and evaluation feedback.

2.2.2 Offline subsystem risk

Offline subsystem risk refers to the food quality risk caused by offline part of the catering O2O supply chain. This part of the risk can be similar to the risk of the traditional catering supply chain system, which can be divided into the following three major parts: food production, circulation and catering consumption.

2.2.3 System external risk

The system external risk comes from the change of market environment, legal policy and technology development of external supply chain system. It is mainly divided into macroscopic environment and technological environment.

3 Establishment of risk evaluation model of catering O2O food quality based on supply chain

3.1 Establishment of food safety risk system

This paper uses theoretical and literature analysis methods and selects the food quality safety risk factors in existing literature of related domain as the reference source from the perspective of the supply chain. On this basis, Delphi method is used by designing the questionnaire of food quality risk factors in catering O2O supply chain to form a food quality risk assessment index model, which is shown in figure 2 below.

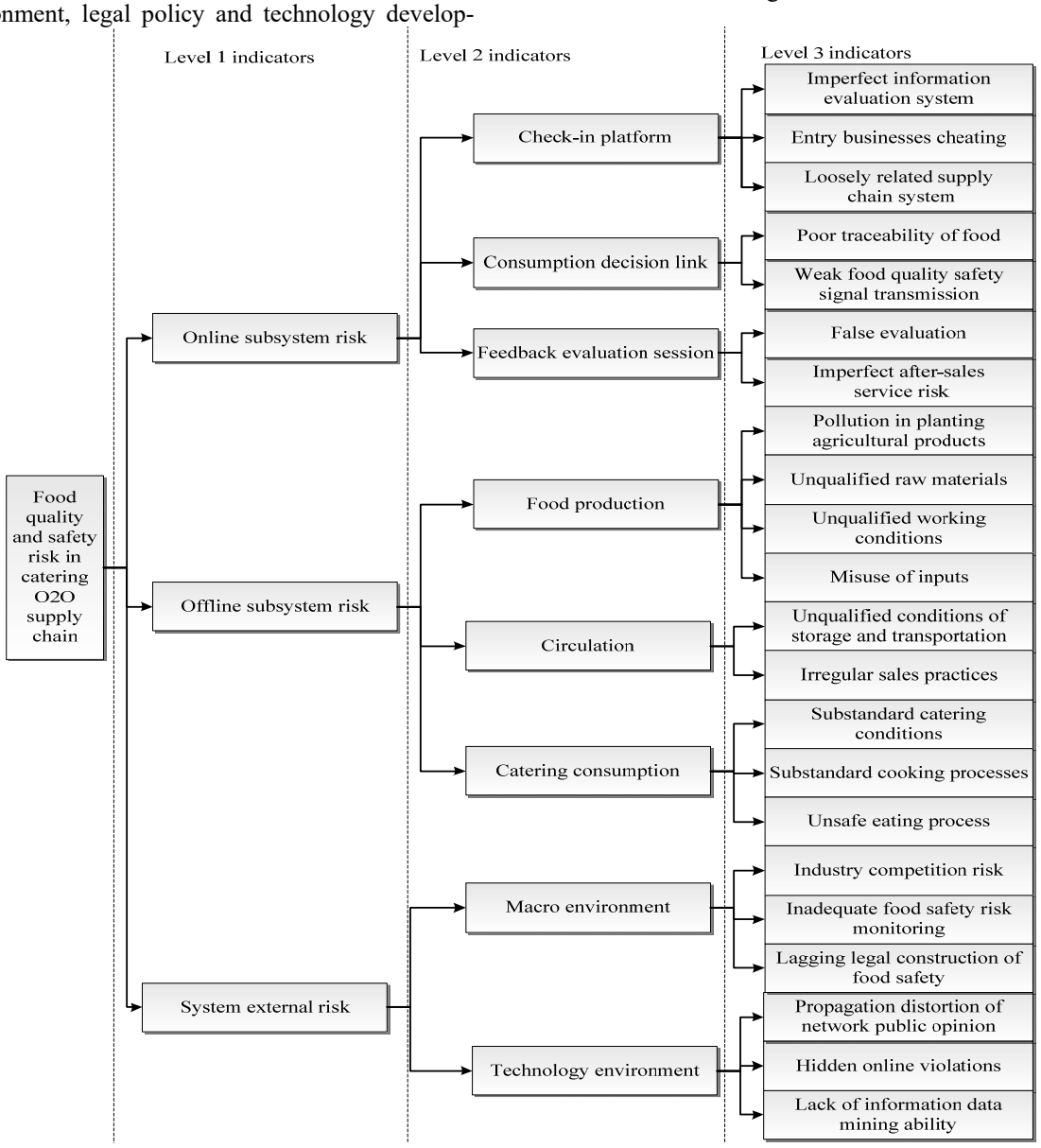

Figure 2. Food quality risk hierarchy model in catering O2O supply chain.

3.2 Establishment of food safety risk assessment model

This paper uses analytic hierarchy process (AHP) and fuzzy comprehensive evaluation method to construct the catering O2O food quality risk evaluation model. Firstly, the weight of risk factors in the index system is calculated by AHP. Then, risk assessment level set and index membership matrix are established. Finally, the fuzzy comprehensive evaluation is carried out according to the weight calculated by AHP and the evaluation matrix is obtained by the expert scoring method.

3.2.1 The construction of hierarchical structure model of risk evaluation

Risk factors are divided into hierarchical structures to construct the risk hierarchy model, determine the index factors at all levels, and form the risk evaluation index set.

A=（A1，A2，A3）={（A111，A112，A113），（A121，A122），…，（A321，A322，A323）}

3.2.2 Calculation of judgment matrix and relative weight

In the analytic hierarchy process (AHP) of this paper, 9-level bipolar scale is used to depict the relative importance of the factors in each level through the natural numbers 1 to 9. Suppose $\overline{C}$ is the judgment matrix of A_{ij}, and b_{mn} is the importance ratio of the tertiary indicator A_{ijm} and A_{ijn} to secondary indicator A_{ij}. Then:

$$\overline{C} = (b_{mn})_{kk} = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1k} \\ b_{21} & b_{22} & \dots & b_{2k} \\ & & & \\ b_{k1} & b_{k2} & \dots & b_{kk} \end{bmatrix}; \quad (3\text{-}1)$$

According to the synthesized weight calculation results of each scheme layer, the weight of each hierarchy factor can be obtained: W = (w1, w2, w3); Wi= (wi1,wi2,… , wij); Wij= (wij1,wij2,…, wijk) .This article selects Yaahp (Yet Another AHP) V10.3 software to carry on the model construction, the judgment matrix data entry as well as the weight computation.

3.2.3 Fuzzy comprehensive evaluation

Determine the level of risk evaluation, establish index membership matrix and construct the risk evaluation vectors. The maximum value of evaluation vectors is the final evaluation result.

4 Application of food quality risk assessment model

4.1 Sample data source

In this survey, a total of 100 questionnaires were sent out, 93 of which were recovered and 88 of which were valid. The effective recovery rate of the questionnaire was 88%.

4.2 Risk assessment of food quality and safety

Calculate the weight of risk factors in the way of AHP. Figure out the membership degree of all levels of food quality risk indicators in catering O2O supply chain in the way of grade-specific gravity method. According to the establishment of food safety risk assessment model, one of the index weight and membership degree results as shown in Table 1:

Table 1. Level 1 indicator weight and membership degree table.

Level 1 indicators (Ai)	Weight (Wi)	Membership degree						
		Minimum risk	Lower Risk	Low Risk	Medium Risk	High Risk	Higher Risk	Maximum Risk
Online subsystem risk（A1）	0.2793	0.03	0.06	0.27	0.31	0.23	0.10	0.01
Offline subsystem risk（A2）	0.5724	0.00	0.04	0.31	0.23	0.22	0.21	0.05
System external risk（A3）	0.1483	0.00	0.07	0.17	0.18	0.30	0.19	0.08

The evaluation vector of food quality risk in catering O2O supply chain can be obtained according to the weight matrix and membership degree matrix of the first level index: P=Wi•Ri=（0.0084，0.0500，0.2449，0.2781，0.2347，0.1763，0.0433）

In the evaluation vector P, the maximum membership degree is 0.2781, and the corresponding risk fuzzy comprehensive evaluation score is 4.46, which corresponds to "average risk" in the risk grade assessment.

4.3 Risk assessment results analysis

The comprehensive evaluation of food safety risk in catering O2O supply chain at this stage is "average risk". This indicates that in the current market environment and industry background, catering O2O food safety risk is in a relatively mild state and the overall food safety risk level is acceptable, but there is still room for improvement.

5 Conclusions

By analyzing the evaluation results, this paper puts forward the following four suggestions: improve the catering safety risk identification and warning mechanism in the O2O mode, improve awareness of risk management of Internet food safety, improve the level of Internet catering information technology, and strengthen supervision of food safety in Internet catering.

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