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# Food Supply Chain Risk Management Situation Evaluation Model Based on Factor Analysis

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## Abstract

Food safety incidents occur frequently, so that food supply chain risk management has been paid considerable attention, and discussion on the evaluation model of risk management of food supply chain has important theoretical and practical significance. An influencing factors analysis framework for food supply chain risk management situation is constructed based on the theoretical analysis. Then factor analysis is carried out for the factors impacting the food supply chain risk management situation using questionnaire data of food production and processing enterprises. On this basis, a food supply chain risk management situation evaluation model is constructed by use of multiple regression analysis. The model suggests that the institutional factors are the most influential factors to food supply chain risk management, followed by the basic characteristic of enterprise, and finally the characteristics of employees.

**Key words:** Food supply chain risk; Management situation; Influencing factors; Evaluation model; Factor analysis

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## 1. INTRODUCTION

In recent years, with the slowdown of the global economy, some food production and management enterprises have reduced their investment in quality management to lower cost and pursue profits, which leads to the continuous occurrence of food safety affairs on a global scale. As a result, it has not only caused great damage to people's life property safety, but also generated material adverse effect on the economic and social development. In order to effectively defend and control food safety risks, governments of various counties are all reinforcing and perfecting their food safety laws and regulations systems, enhancing the food safety supervision strength. An increasing number of food enterprises are emphasizing the food supply chain risk management while many experts are developing research on the food supply chain risks management issue, which mainly involves three aspects: the source, formation, manifestation and classification, etc. of food supply chain risks (Van Rijswijk & Frewer, 2008; Dani & Deep, 2010; Xi & Chen, 2011; Mu, 2012; Hirschauer & Bavorov, 2012; Chen, Liu, & Zhang, 2014; Liu & Chen, 2014); the evaluation content, procedure and method, etc. of food supply chain risks (Sumner, Ross, & Ababouch, 2004; Manning & Soon, 2013; Manzini & Accorsi, 2013); the countermeasure and measures of food supply chain risks (Aruoma, 2006; Thakur & Donnellyc, 2010; Fei & Xia, 2013).

However, most of the current study achievements are obtained with normative research methods while the achievements obtained with empirical research method are very limited. Especially, the evaluation on the food supply chain risks management situation model from the point of empirical research has not even developed. Therefore, this paper, based on the questionnaire data, analyzes the factors impacting the food supply chain risk management situation and builds an evaluation model with the factor analysis, so as to provide a reference for enterprises to reinforce the food supply chain risk management and improve the food supply chain risk management situation.

## 2. RESEARCH HYPOTHESIS

The motivational factors influencing the enterprises

offering safety products include enterprise management and strategies, with the key factors being organizational learning, regulation type and the influence, enforcement dimension and organization culture of stakeholders (Annandale, 2000). The stronger the enterprise's motivation to offer safety products, the better its food supply chain risk management situation will be. Therefore, although the factors influencing enterprises' food supply chain risk management situations are many, when it comes to factors influencing the motivations, the major factors are nothing more than the enterprises' internal factors and external environmental factors. Among them, the enterprises' internal factors include the characteristics of the enterprises themselves, the characteristics of enterprise employees, the enterprises' internal risks management system, the organizational cultures, etc. As for this paper, it assumes that the major factors influencing the food supply chain risk management situation include the characteristics of the enterprises themselves, the characteristics of enterprise employees, the enterprises' internal risk management mechanism and the external environmental factors, as can be seen in Figure 1.

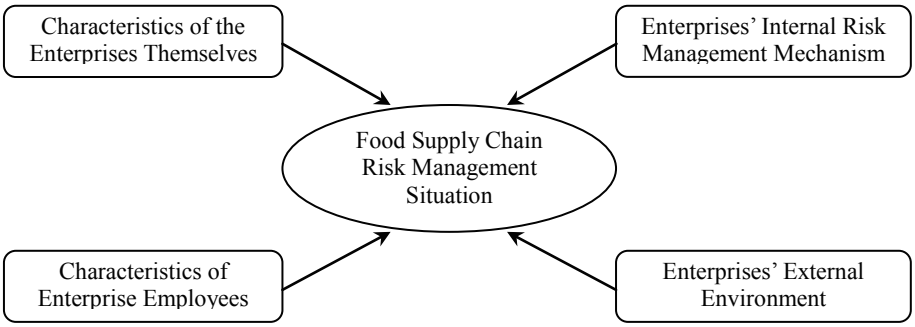


**Figure 1**
**Analysis Framework of Factors Influencing Food Supply Chain Risk Management Situation**

The analysis framework in Figure 1 includes four major parts: the characteristics of enterprises themselves, which involves the enterprises' age, ownership character, scale, cross-national business, as well as the number of enterprises' certification systems, the education level of enterprises' legal representative, etc.; the characteristic of enterprise employees, which involves the senior management team's risk attitude and awareness, the employees' educational background and skills, etc.; the enterprises' internal risk management mechanism, which involves the establishment of risk management department, the leadership of risk management department, the training frequency of the management staff, the training frequency of common staff, the identification and evaluation of risks, the formulation of food supply chain risk' emergency management measures; the external environmental factors, which involves the government's supervision and enterprises' food safety management pressure. As the external environmental factors' positive influence on the food supply chain risk management is clear and obvious, this research focuses on the analysis of the influence of enterprises themselves on food supply chain risk management, and builds an evaluation model of food supply chain risk management situation based on the factor analysis.

## 3. DATA AND ANALYSIS

### 3.1 Data Sources and Analytical Methods

The first data are acquired from the middle-senior managers like people chiefly in charge of the enterprises and managers of relevant functional departments, by adopting the methods combining field research, interview and questionnaire survey, aiming at some of the food producing and processing enterprises in Beijing, Shanxi, Hebei, Inner Mongolia, Shanghai, etc.

In consideration of this paper's research objective that is to build the evaluation model of food supply chain risk management situation by analyzing how relevant factors influence the management situation of food supply chain risk, and the fact that the information obtained is both quantitative and qualitative, this paper is thus adopting factor analysis method to conduct the research, with the help of the statistical analysis software SPSS22.0.

The questionnaire consists of three parts. The first part is about the basic information of the interviewees, which mainly includes the gender, age, education, working experience and other population characteristics and positions as well as departments, with the aim being to get a preliminary understanding of the interviewees' basic information. The second part is about the background information of the enterprises under research, including the age, ownership character and business property of the enterprises, the education background of the corporate representative, the enterprises' scale and the adopted quality certification system, etc., with the aim being to master the basic information of the sample enterprises. The third part is about the basic information of the food supply chain risk management, which is mainly to investigate the enterprises' risk management system. The observational variables and explanatory variables of this research are included in the second and the third parts.

All together, there are 354 questionnaires handed out,

with 354 questionnaires regained. The valid questionnaires amount to 296 after getting rid of the incomplete and invalid questionnaires, the effective rate being 83.62%.

### 3.2 Basic Characteristics of Samples

Generally, the sex ratio of the interviewees in this research is quite balanced, close to 1:1. In terms of the age groups, most of the interviewees are young adults at the age group of 31-40 which amounts to 35.14% of the interviewees. It is followed by interviewees at the age of 41-50 and of 20-30, amounting to 29.05% and 26.01% of the interviewees, respectively. The age group of over 51 is the smallest. Most of the interviewees are the middle-senior managers in the core departments like the production department, sales department, quality department and other departments. People with working experience under 20 years are very relatively fewer while new comers with less than 5 years of working experience are the most, amounting to 45.27%. Employees working in the enterprises for 6-10 years amount to 26.69%. Most of the interviewees are undergraduates and junior college students or below, amounting to 90% of the interviewees while few of them are graduates or above.

As is shown in Table 1, we input the sample data into the SPSS22.0 software, conducting mean value, standard deviation and F-test to the samples. The F-test of independent variables $X_1$, $X_2$ and $X_8$ to the dependent variable $Y$ is indistinctive, which declares that the influence of the three factors $X_1$, $X_2$ and $X_8$ on the dependent variable $Y$ is not outstanding.

### 3.3 Statistical Analysis on the Questionnaires' Reliability and Validity

#### 3.3.1 Questionnaires' Reliability Analysis

Reliability, or data reliability, refers to the reliability, consistency and stability of the measuring result. In the academic word, the Cronbach's coefficient alpha (coefficient of internal consistency) is often employed to show the correlation between the items of various factors. The coefficient value is between 0 to 1, and the closer to 1 the value is, the stronger correlation between the items will be. Generally, in exploratory researches, the $0.7<\alpha<0.8$ shows the questionnaires' reliability is quite good (Shi, 2012).

After the questionnaire data reduction, we shall conduct reliability analysis to the 15 variables with SPSS22.0. The result shows that the value of the Cronbach's α is 0.099. With the information in Cronbach's Alpha if Item Deleted, as well as the T-test result in Table 1, the final value of Cronbach's α is 0.754 after removing the three variables with trial and error, the three variables being $X_1$, the foundation time of the enterprises, $X_2$, the enterprise property, $X_8$, the leaders in the enterprises' risk management department, thus achieving a very good reliability standard.

#### 3.3.2 Questionnaires' Validity Analysis

The validity often refers to the effectiveness and correctness of the questionnaires, that is, the measurement degree of the questionnaires to the measured characteristics.

Specially, the construct validity is one of the important validities. This paper has employed factor analysis to test the construct validity of the questionnaire, with the detailed procedures being as following:

**(1) KMO Test and Bartlett Test**

Conduct KMO test and Bartlett test to the sample data with SPSS22.0. According to the KMO measure standard given by Kaiser, if the value is above 0.8, it means the data are fit to conduct the factor analysis (Kaiser, 1974). The acquired value of KMO is 0.808 after conducting KMO test and Bartlett test to the samples, which means the correlation between the variables are very strong. The significance probability of Bartlett test is 0.00, showing that the variables are not independent with each other, the factor model being quite reasonable. With the above two points, we can conclude that the sample is fit to be used for factor analysis.

**(2) Factor Analysis**

Based on the hypothesis raised in 2, draw the three factors with the principal component extraction method. The result is shown in Table 2. The accumulated variance contribution rate of the three factors is 59.120%, which is higher than 50%. The three factors together has explained 59.120% of the information in the questionnaires' research data. Wu (2010) pointed out that the bigger the load factor value of the item in the same dimension is, the higher the convergent validity will be. Only on load factor value of each item can be bigger than 0.5 in a same dimension, showing the scale possessing discriminant validity. In this research, all variables have met the above standards, which declares that the questionnaires possess good construct validity (Wu, 2010). Therefore, drawing three factors is quite reasonable.

**Table 1**
**Definitions and Descriptive Statistics of Major Variables**

| Variable Names | Variable Definition | All Samples | | Y General Level of Enterprises' Supply Chain Risk Management | | | | | | | | | | Variance F test Significance Probability | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very High | | High | | Ordinary | | Low | | Very Low | | | |
| | | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Value of F | sig |
| X1 Enterprises' Age | The age in 2014 | 16.475 | 15.569 | 19.310 | 16.933 | 16.437 | 10.678 | 16.435 | 18.850 | 12.333 | 14.767 | 42.000 | | 1.344 | .254 |

**To be continued**

## Continued

| Variable Names | Variable Definition | All Samples | | Y General Level of Enterprises' Supply Chain Risk Management | | | | | | | | | | Variance F test Significance Probability | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very High | | High | | Ordinary | | Low | | Very Low | | | |
| | | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Mean Value | Standard Deviation | Value of F | sig |
| X2 Enterprises' System of Ownership | 1=State-owned Business; 2=Collectively-owned Enterprises; 3=Private Enterprises; 4=Overseas-funded Enterprises; 5=Joint Venture; 6=Others | 3.186 | 1.292 | 3.129 | .619 | 3.008 | 1.141 | 3.414 | 1.504 | 3.040 | 1.306 | 3.333 | 2.517 | 1.586 | .178 |
| X3 Education Level of the Corporate Representative | 1=Junior College and below; 2=Bachelor; 3=Master | 1.793 | .771 | 2.276 | .797 | 1.847 | .780 | 1.713 | .723 | 1.400 | .645 | 1.333 | .577 | 5.522 | .000 |
| X4 Enterprises' Scale | 1=Micro-enterprises; 2=Small Enterprises; 3=Middle Enterprises; 4=Large Enterprises | 2.047 | 1.098 | 2.710 | 1.189 | 2.258 | 1.141 | 1.803 | .958 | 1.320 | .557 | 2.333 | 1.528 | 9.066 | .000 |
| X5 Enterprises' Cross-country Businesses or not | 1=Yes; 0=No | .203 | .403 | .419 | .502 | .242 | .430 | .128 | .336 | .120 | .332 | .000 | .000 | 4.149 | .003 |
| X6 Enterprises' Certification Systems Quantity | Certification Systems Quantity | 2.101 | 2.168 | 3.710 | 2.559 | 2.492 | 2.369 | 1.470 | 1.684 | 1.160 | .800 | 2.333 | 2.309 | 9.986 | .000 |
| X7 Enterprises' risk management department or not | 1=Yes; 0=No | .649 | .478 | .968 | .180 | .792 | .408 | .504 | .502 | .280 | .458 | .333 | .577 | 15.337 | .000 |
| X8 The leadership of the risk management department | 1=Board of Directors; 2=CEO; 3=Other Senior Managers | 2.366 | .962 | 2.000 | 1.065 | 2.455 | .911 | 2.407 | .938 | 2.188 | 1.047 | 4.000 | | 2.288 | .061 |
| X9 The enterprises' training frequency for the general employees | 1=Never; 2=Occasionally; 3=Often | 2.416 | .684 | 2.903 | .301 | 2.633 | .564 | 2.239 | .665 | 1.600 | .707 | 2.333 | .577 | 23.205 | .000 |
| X10 The enterprises' training frequency for the managers | 1=Never; 2=Occasionally; 3=Often | 2.551 | .652 | 2.871 | .341 | 2.742 | .510 | 2.470 | .610 | 1.680 | .852 | 2.000 | 1.000 | 21.121 | .000 |
| X11 Enterprises' identification and evaluation frequency for the food supply chain risks 0=No risk identification and evaluation; 1=Yes, but not in a systematic way; 2= Yes, there are systematic risk identification and evaluation | 1.223 | .667 | 1.645 | .608 | 1.492 | .594 | 1.009 | .549 | .440 | .507 | 1.000 | 1.000 | 26.491 | .000 | |
| X12 Enterprises' formulation of risk emergency management measures or not 1=yes; 0=no | .682 | .466 | .871 | .341 | .875 | .332 | .547 | .500 | .200 | .408 | .333 | .577 | 20.091 | .000 | |
| X13 Senior managers' risk attitude and awareness | 1=Very Weak; 2=Weak; 3=Ordinary; 4=Strong; 5=Very Strong | 4.736 | .604 | 4.903 | .396 | 4.833 | .508 | 4.684 | .652 | 4.320 | .802 | 4.667 | .577 | 4.810 | .001 |
| X14 Education level and technical abilities of the employees | 1=Very Low; 2=Low; 3=Ordinary; 4=High; 5=Very High | 4.088 | .894 | 4.548 | .675 | 4.267 | .867 | 3.846 | .897 | 3.840 | .800 | 3.667 | 1.528 | 6.493 | .000 |
| Y The enterprises' supply chain risk management situation | 1=Very Bad; 2=Bad; 3=Ordinary; 4=Good; 5=Very Good | 3.510 | .832 | \ | \ | \ | \ | \ | \ | \ | \ | \ | \ | \ | \ |

**Table 2**
**Rotating Component Matrix and Component Scoring Coefficient Matrix**

| | Components | | | | | |
|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | |
| | Load of Rotating Factor | Coefficient of Factor Scoring | Load of Rotating Factor | Coefficient of Factor Scoring | Load of Rotating Factor | Coefficient of Factor Scoring |
| Z1 Education Level of the Corporate Representative | .055 | -.066 | .708 | .330 | .196 | .038 |
| Z2 Enterprises' Scale | .262 | .112 | .672 | .340 | -.048 | -.226 |
| Z3 Enterprises' Cross-country Businesses or not | -.211 | -.195 | .713 | .349 | .179 | .101 |
| Z4 Enterprises' Certification Systems Quantity | .178 | .043 | .736 | .364 | .032 | -.143 |
| Z5 Enterprises' risk management department or not | .609 | .217 | .220 | .041 | .262 | .007 |
| Z6 The enterprises' training frequency for the general employees | .856 | .406 | .014 | -.048 | .079 | -.189 |
| Z7 The enterprises' training frequency for the managers | .867 | .398 | -.052 | -.092 | .136 | -.134 |
| Z8 Enterprises' identification and evaluation frequency for the food supply chain risks | .522 | .122 | .292 | .057 | .424 | .159 |
| Z9 Enterprises' formulation of risk emergency management measures or not | .558 | .144 | .166 | -.011 | .432 | .175 |
| Z10 Senior managers' risk attitude and awareness | .134 | -.186 | .015 | -.134 | .851 | .681 |
| Z11 Education level and technical abilities of the employees | .239 | -.075 | .150 | -.035 | .629 | .440 |
| Factor Names | F1 Enterprises' Institutional Factors | | F2 Factors of Enterprises' Basic Characteristics | | F3 Employees Individual Factors | |
| Variance Contribution | 34.031% | | 16.397% | | 8.692% | |
| Accumulated Variance Contribution Rate | 34.031% | | 50.428% | | 59.120% | |

*Note*. Extracting methods: Main component. Rotating method: Perpendicularly rotating with Kaiser Normalization. a. Rotation convergences after 5 iterations.

In Table 2 is new factors produced by perpendicularly rotating with varimax. According to factor load matrix after rotating, based on the meaning of variables, factor is defined and explained as follows:

$F_1$: Enterprise's institutional factor, including whether enterprise has risk management department, or not, frequency of manager training, frequency of general employee training, frequency of identification and evaluation of food supply chain risk, whether enterprise has risk emergency management measures.

$F_2$: Factors of enterprise's basic feature, including degree of education of enterprise legal representative, size of enterprise, whether enterprise has international business, number of certification systems

$F_3$: Factors of features of enterprise employee

Three factor scoring functions produced by factor scoring matrix are:

$$F_1=-0.066Z_1+0.112Z_2-0.195Z_3+0.043Z_4+0.217Z_5+0.406Z_6+0.398Z_7+0.122Z_8+0.144Z_9-0.186Z_{10}-0.075Z_{11} \quad (1)$$

$$F_2=0.330Z_1+0.340Z_2+0.349Z_3+0.364Z_4+0.041Z_5-0.048Z6-0.092Z_7+0.057Z_8-0.011Z_9-0.134Z_{10}-0.035Z_{11} \quad (2)$$

$$F_3=0.038Z_1-0.226Z_2+0.101Z_3-0.143Z_4+0.007Z_5-0.189Z_6-0.134Z_7+0.159Z_8+0.175Z_9+0.681Z_{10}+0.440Z_{11} \quad (3)$$

## 4. MULTIPLE LINEAR REGRESSION ANALYSIS

### 4.1 Mathematical Model for Multiple Linear Regression Analysis

Equation that describes how dependent variable Y depends on independent variables X1, X2, …, Xk and error term ε, is called multiple regression equation. Based on features of this sample, proposed multiple regression model about influencing factors of food supply chain risk management is:

$$Y = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \cdots + \beta_1 Z_1 + \varepsilon \quad (4)$$

Where, Y is dependent factor (enterprise food supply chain risk management), $\beta_0$ is a regression constant, $Z_1$, $Z_2$, $\cdots$ $Z_1$ are 11independent variables (11 factors, as shown in Table 2), ε is a random error.

### 4.2 Multiple Linear Regression Analysis of Food Supply Chain Risk Management Factor

Conduct regression analysis of sample data using SPSS22.0, entry mode choose "enter" and get results shown in Table 3.

**Table 3**
**Multiple Regression Coefficient**

| Coefficient[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlation | | | Multi-collinearity Statistics | |
| | B | Standard Error | β | | | Zero-order | leaning | Part | Tolerance | VIF |
| (Constant) | 3.500 | .038 | | 91.888 | .000 | | | | | |
| Enterprise's Institutional Factors | .403 | .038 | .486 | 10.549 | .000 | .486 | .529 | .486 | 1.000 | 1.000 |
| Enterprise's Basic Features Factors | .261 | .038 | .314 | 6.828 | .000 | .314 | .374 | .314 | 1.000 | 1.000 |
| Enterprise's Employee Characteristics Factors | .201 | .038 | .243 | 5.279 | .000 | .243 | .298 | .243 | 1.000 | 1.000 |

*Note*. a. Dependent variables Y Food Supply Chain Risk Management Situation.

Adjusted R2=0.387<0.8 indicates matching degree of the model is not ideal, but considering F test and T test are both significant, DW=1.642D≠2, indicates residual error sequence has light positive relevance; but VIF=1<5 indicates there is no high collinearity. $R^2$ is not ideal is possibly because this research only considers factors with enterprise without considering influence of other relevant factors on food supply chain risk management, causing explanatory power is low, $R^2$ is not ideal.

According to Table 3, final model of food supply chain risk management is:

$$Y = 3.500 + 0.403F_1 + 0.261F_2 + 0.201F_3 \quad (5)$$

Where, Y is food supply chain risk management
F1 is enterprise's institutional factor
F2 is the factor of enterprise's basic feature
F3 is the factor of enterprise employee

## 4.3 Summary

(1) Comparison of influence intensity of factors: based on importance comparison of influence factors on food supply chain risk management, enterprise's institutional factors > factors of enterprise's basic feature > factors of enterprise employee's features.

(2) Comparison of influence intensity of factors. According to Equation (1), (2), (3) and (5), we can get results shown in Table 4. The value of overall importance in Table 1 is just the comparison of relative importance of 11 factors, not representing the percentage of Y explained by the factor. We can find from Table 4 that factor $Z_6$ (frequency of general employee training of enterprise), factor $Z_7$ (frequency of manager training of enterprise) and factor $Z_5$ (whether enterprise has risk management department), is three factors influencing food enterprise supply chain risk management most. Followed by frequency of food supply chain risk identification and evaluation of enterprise, factors with least influence are $Z_{10}$ (risk attitude and awareness of senior managers) and factor $Z_{11}$ (educational background and skills of employee), namely, factors of features of enterprise employee, and factor $Z_3$ (whether enterprise has international business).

**Table 4**
**Statistics of Factors and Factors Importance**

| Factors | Factors Importance | | | Overall Importance | Importance Ranking | Factor Classification |
|---|---|---|---|---|---|---|
| | Enterprise's Institutional Factors | Enterprise's Basic Features Factors | Enterprise's Employee Characteristics Factors | | | |
| | .403 | .261 | .201 | | | |
| Z1 | -.066 | .330 | .038 | 0.06708 | 8 | 2 |
| Z2 | .112 | .340 | -.226 | 0.08838 | 6 | 2 |
| Z3 | -.195 | .349 | .101 | 0.03290 | 10 | 2 |
| Z4 | .043 | .364 | -.143 | 0.08361 | 7 | 2 |
| Z5 | .217 | .041 | .007 | 0.09954 | 3 | 1 |
| Z6 | .406 | -.048 | -.189 | 0.11273 | 1 | 1 |
| Z7 | .398 | -.092 | -.134 | 0.10938 | 2 | 1 |
| Z8 | .122 | .057 | .159 | 0.09583 | 4 | 1 |
| Z9 | .144 | -.011 | .175 | 0.09031 | 5 | 1 |
| Z10 | -.186 | -.134 | .681 | 0.02725 | 11 | 3 |
| Z11 | -.075 | -.035 | .440 | 0.04965 | 9 | 3 |

(3) Combining above two points, we can find that for food supply chain risk management, the most important is soundness and effectiveness of enterprise risk management system, especially frequent training of enterprise manager and general employee, regular risk identification and evaluation and establishment of risk management department. From the angle of enterprise's basic feature, as the enterprise expands and develops, enterprise's systems will be increasingly sound, and risk management naturally improves. Though factors of enterprise employee's feature have weaker influence, from the angle of institutional factor, managers are both maker, supervisor and executant of management system, while general employee are mainly executant, so managers need to fully realize the importance of food supply chain management and have high degree ability to make decision and strict supervision, and general employee need to have self-discipline. This way, we can ensure enterprise to establish right risk management system and implement it correctly and fully.

## CONCLUSION AND DISCUSSION

This research obtained first hand data of food production and processing enterprises by designing questionnaire, analyzed influence factors on food supply chain risk management of enterprises of our country, constructed evaluation models for food supply chain risk management. Results show that influence factors of enterprise food supply chain risk management mainly come from three aspects including enterprise system, basic feature of enterprise and feature of enterprise employee. From the angle of degree of influence, institutional factors of enterprise has the most influence, followed by factors of basic feature of enterprise, the least is factors of features of enter employee. It demonstrates whatever size an enterprise is, and whatever features of enterprise employee are, currently the most effective way to improve effect of our country's food supply chain risk management is to strengthen construction and implementation of risk management within enterprise.

There are some defects and imperfections in evaluation design, sample selection and model construction in this article. For example, in evaluation design, it lacks variables of feature of enterprise governance structure, structural feature of food supply chain and specific operating range. Limited geographic range of sample enterprises may result in sample error, omitting important influence factors such as environmental features of regional economy. Future research needs further improve and perfect in these aspects.

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