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Analysis on Influencing Elements of Enterprise Logistics Risk Early Warning: Based on Manufacturing Industries in Beijing Area*

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ABSTRACT

Enterprise logistics risk early warning is an essential part of enterprise logistics risk management, which has been increasingly drawing the attentions of both practical and academic world. However, enterprise logistics risk early warning hasn't been radically put into practice yet. Therefore, the factors hinder the proceeding of enterprise logistics risk early warning become the key to starting the engine of enterprise logistics risk early warning. In this paper, review of researches on enterprise logistics risk early warning is provided, a questionnaire has been designed according to both exterior and internal factors influencing enterprise logistics risk early warning and a survey on manufacturing industries in Beijing area has been carried out, logistics risk early warning status and influencing elements have been analyzed based on previous survey and advices proposed are concluded to provide valuable references.

Keywords: Enterprise Logistics; Risk Early Warning; Influencing Elements

1. Preface

In China, enterprise logistics risk has not gained sufficient watch due to the ignorance of perception of risk among corporate management and inability of risk control, which contributes to the outbreak of enterprise risk accidents and increases that probability. It's proved true that effectiveness achieved by prevention work before the outbreak of risk accidents outweighs that of post-accident emergency management, hence the significance of enterprise logistics risk early warning. Both practical and academic world should pay attention to related researches.

2. Status Quo of Researches on Enterprise Logistics Risk Early Warning

So far, related researches on enterprise logistics risk early warning mainly focus on logistics service risk, outsourcing risk, reverse logistics and enterprise logistics, but the empirical researches seldom appear.

Liu (2007) [1] applied fuzzy comprehensive evaluation method to logistics service risk early warning management, formulating an index system of logistics service risk early warning and predicting logistics service risk status in both single early warning mode and comprehendsive early warning mode, and provide a set of warning signals match with logistics service risk classification. Q. Cheng (2010) [2] analyzed causes of formation of logistics service operation risk according to the connotation and categories of logistics service operation risk, and discussed the methodologies, models, substances and requirements of early warning, also provided an index system and some strategies of logistics service operation risk early warning. Y. S. Liu *et al*. (2010) [3] analyzed causing factors of risk during supply chain logistics service of logistics corporations, designing a corporate logistics risk early warning index system based on balance score card, and applied fuzzy evaluation—AHP to logistics corporations risk early warning.

L. H. Liu (2005) [4] conducted a preliminary design of logistics outsourcing, integrating fuzzy comprehensive evaluation method with outsourcing risk evaluation. G. B. Xu (2007) [5] proposed a method of corporate logistics outsourcing risk early warning based on case reasoning,

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applying analogical reasoning method to corporate logistics outsourcing risk early warning. Y. T. Hong *et al*. (2008) [6] analyzed corporate logistics outsourcing risk, and created a corresponding index system.

D. H. Yang *et al*. (2008) [7] designed an evaluation index system of reverse logistics risk early warning. W. Y. Duan (2010) [8] established reverse logistics risk early warning system, utilizing MATLAB tool kit to build up corporate reverse logistics risk early warning model and to prove BP neural network absolutely fit reverse logistics risk early warning model.

M. Q. Zhang *et al*. (2008) [9] analyzed risk types and causes of each basic logistics activity, and set up an early warning index system of activity risk, discussing the operation management mechanism of risk early warning. Xie *et al*. (2009) [10] researched into internal logistics early warning management of middle and small businesses based on tag card system, through which overall operation procedures, quality and quantity can be supervised in a dynamic way, which can improve the early warning and control system. Y. S. Liu *et al*. (2009) [11] analyzed the concept of corporate risk early warning and causes and signs of corporate logistics, discussed enterprise logistics risk early warning mechanism based on supply chain management. Cheng *et al*. (2010) [12] researched in logistics balance early warning of steel industries ports, discussing methodologies of raw material inventory early warning, achieving logistics balance and matching industry port raw material with internal raw material supplying logistics. L. Ji (2010) [13] applied forced decision method to China's corporate logistics risk level, and fuzzy comprehensive evaluation to post-risk effectiveness degree, and concluded the corresponding evaluation classification according to the data acquired by on-site researches, offering enterprises beneficial references of logistics risk early warning work.

Above researches mainly utilize normative research method, discussing logistics risk early warning at the enterprise level, which contributes little to improve logistics risk early warning. This paper utilized investigation and statistics analysis to analyze influencing elements of corporate logistics risk based on previous researching results, aiming to provide more scientific references to improvement of enterprise logistics risk early warning.

3. Methodology and Design

3.1. Research Route

Firstly through analyzing references, influencing elements of enterprise logistics risk early warning are concluded. Then though surveying manufacturing enterprises in Beijing area by questionnaires, the perception status of corporate logistics risk influencing elements of staffs of each level in manufacturing enterprises are summed up. At last, SPSS software is used to carry out quantitative analysis so as to calculate the related significance of those influencing elements to enterprise logistics risk early warning. SPSS software is used to calculate weights of each influencing factor in this research.

3.2. Design of Investigation Content

Based on analysis on references and preliminary investigation, investigation content in questionnaire is divided into two parts: one is about basic status of enterprise logistics risk early warning, the other is focusing on influencing elements.

Basic status of enterprise logistics risk early warning includes: 1) how do objects know about enterprise logistics risk early warning. 2) Whether enterprises surveyed take any measures of logistics risk early warning. 3) Whether enterprises surveyed offer staff training on risk early warning. 4) Relations among goal hit rate of enterprises' logistics risk early warning and degree of perception of risk early warning of staffs and effectiveness of risk early warning activities. 5) As for enterprise logistics risk early warning, which of below items should be solved (multiple choices allowed)?

1) How to identify and evaluate logistics risk.

2) To understand the content of logistics risk early warning process.

3) How to select proper index of enterprise logistics risk early warning.

4) To understand the organizing procedure of enterprise logistics risk early warning.

5) Others (please explain in detail).

The influencing elements of enterprise logistics risk early warning are illustrated in **Table 1**.

Table 1. Influencing elements of enterprise logistics risk early warning.

External factors	Internal factors
Uncertainty of natural environment	Emphasis put by senior executives
Uncertainty of political environment	Qualification of staffs in risk management
Uncertainty of legal environment	Logistics management level
Uncertainty of economic environment	Improvement of logistics risk management institutions
	Advancement of logistics risk management technology
	Logistics development phase

3.3. Research Object

In this research, Beijing area as a benchmark in the development of corporate logistics is selected as research geographic scale, and the manufacturing corporates are chosen as research objects, which refer to electronic manufacturing industry, electro-mechanics manufacturing industry, transportation manufacturing industry and pharmaceutical manufacturing industry. The researching investigation requires objects should work in different departments, including purchasing, production, sales, logistics and finance, and work in different levels, including first-line staff, supervisor, middle manager and senior executives. Thus an inclusive and convinced result can be showed.

3.4. Questionnaire Survey and Result Analysis

200 questionnaires have been handed out, 183 of which have been retrieved. With incomplete 3 deducted, the final sum of effective retrieved questionnaire is 180, 90% of hand-out.

1) Description of objects

Based on 180 effective retrieved questionnaires, male to female ratio is 38.3:61.7. Basic information of objects is showed in **Table 2**.

2) Reliability analysis

The Cronbach Alpha coefficient in SPSS software is used to testify reliability of questionnaires. 10 influencing elements of enterprise logistics risk early warning are of acceptable criteria, with the Cronbach Alpha coefficient of 0.763, higher than 0.7, which manifests that the questionnaires are well-reliable.

4. Analysis on Basic Status of Enterprise Logistics Risk Early Warning

After analyzing 180 effective questionnaires, basic status of enterprise logistics risk early warning of manufacturing corporations in Beijing area is obtained, as shown in **Table 3**, from which the followings can be explicitly concluded.

1) Enterprises have insufficient understanding of logistics risk early warning. As investigation result shows, 63.33% objects have no or little understanding of enterprise logistics risk early warning, with the comparison that only 8.34% know or pretty know this concept, which indicates that knowledge of enterprise logistics risk early warning need to be popularized. 71.67% corporations surveyed take no measures of enterprise logistics risk early warning. As for training on risk early warning, 73.89% corporations have no trainings on risk early warning, let alone enterprise logistics risk early warning. It can be seen that corporations attach less importance to logistics risk early warning, which need to be solved.

2) To achieve the goal set by enterprise logistics risk early warning, rich knowledge of enterprise logistics risk early warning and beneficial effectiveness of risk early warning is required. As research indicates, 47.78% objects think that corporations are not qualified in risk early warning has (a lot) to do with their knowledge and effectiveness of warning activities, while only 16.11% don't think so. Therefore corporations that are intend to achieve the goals set by enterprise logistics risk early warning need to improve two things, which one is strengthening related training, the other is improving the effectiveness of risk early warning activities.

3) As for knowledge of enterprise logistics risk early warning, the content of enterprise logistics risk early warning process and selection of index does really matter. Seen from research result, 39.44% objects think that understanding of the content of enterprise logistics risk early warning process is important, 28.33% think that selection of risk early warning index should be put on emphasis, 20.56% think that understanding of organizing procedure of enterprise logistics risk early warning is essential, and 20% think that identifying and evaluating enterprise logistics risk is critical. Besides, a small proportion of objects put inclusive and systematic training offered to staffs should be improved.

Table 2. Basic information of objects.

Work seniority	Less than 1 year	1 - 10 years	11 - 20 years	More than 20 years
Objects/sum proportion	15.60%	68.30%	11.10%	5.00%
Position	First-line staff	First-line manager	Middle manager	Senior executive
Objects/sum proportion	38.90%	20.60%	33.80%	6.70%

Department	Purchasing	Production	Sales	Logistics	Finance	Others
Objects/sum proportion	3.30%	6.10%	14.40%	6.10%	30.00%	40.10%

Industry	Electronic manufacturing	Electro-mechanic manufacturing	Transportation manufacturing	Pharmaceutical manufacturing	Others
Objects/sum proportion	15.60%	15.60%	18.30%	16.10%	34.40%

Table 3. Basic status of enterprise logistics risk early warning.

Question	Choice	Sample	Percentage
Degree of understanding of enterprise logistics risk early warning	Expert	5	2.78%
	Understand it	10	5.56%
	Know about it	51	28.33%
	Know less about it	65	36.11%
	Do not know	49	27.22%
Whether corporations take measures of enterprise logistics risk early warning	Yes	42	23.33%
	Yes, but not of logistics risk	9	5.00%
	No	129	71.67%
Whether corporations offer trainings on risk early warning	Yes. Specially	13	7.22%
	Yes. But not specially	34	18.89%
	No	133	73.89%
Relation between corporation's hit rate of logistics risk early warning and richness degree of knowledge and effectiveness of risk early warning activities	Significant	31	17.22%
	Near significant	55	30.56%
	Modest significant	65	36.11%
	Insignificant	14	7.78%
	Not at all	15	8.33%
As for enterprise logistics risk early warning, problems need be solved in terms of mastering knowledge of risk early warning (multiple choices allowed)	How to identify and evaluate enterprise logistics risk	36	20.00%
	Understanding of the content of enterprise logistics risk early warning process	71	39.44%
	How to select proper index	51	28.33%
	Understanding of organizing procedure of enterprise logistics risk early warning	37	20.56%
	Others (such as systematic knowledge of enterprise logistics risk)	3	1.67%

5. Analysis on Influencing Index of Enterprise Logistics Risk Early Warning

5.1. Analysis on Information of Influencing Index of Enterprise Logistics Risk Early Warning

Based on 180 effective questionnaires, categorized by external and internal influencing elements of enterprise logistics risk early warning and their effects, basic information of influencing elements come into being, shown as **Table 4**.

Seen from **Table 4**, although external factors have different effects on enterprise logistics risk, less objects don't think external factors have radical effects, with 22.64% think the effects are slight and 31.66%, significant. Mostly, 45.70% objects think the effects are just mild. More detailed information of each external factor's character can be found in **Table 4**.

Unlike perception of external factors, most objects consider internal factors have significant effects on enterprise logistics risk early warning, with the total of 61.67%, and only 4.81% consider that effects are slight. Among the rest, 33.52% think that effects are modest. What's more, three internal factors including attention attached by senior executives, logistics management level and quality of staff are considered that have tremendous effects by respectively 75%, 76.67% and 69.45% objects.

5.2. Factor Analysis of Influencing Elements of Enterprise Logistics Risk Early Warning

1) Factor analysis of external influencing elements

Factor analysis function in SPSS software is utilized to conduct quantitative analysis on external influencing elements of enterprise logistics risk early warning. Results are showed in **Tables 5-7**.

Seen from **Table 5**, KMO value of external influencing elements is 0.660, higher than 0.5, and Bartlett test value, sig. = 0.000. The relation among variables is insignificant, hence the factor analysis.

Concluded from **Tables 6** and **7**, four external influencing elements including natural environment, legal environment, political environment and economic environment can be represented 86.211% by 3 factors

Table 4. Basic information of influencing elements of enterprise logistics risk early warning.

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Degree of understanding of enterprise logistics risk early warning	Expert	5	2.78%
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	How to select proper index	51	28.33%
	Understanding of organizing procedure of enterprise logistics risk early warning	37	20.56%
	Others (such as systematic knowledge of enterprise logistics risk)	3	1.67%

Table 5. KMO and Bartlett's Test on external influencing elements.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.660
Bartlett's Test of Sphericity	Approx. Chi-Square	78.030
	df	6
	Sig.	0.000

Table 6. Total variance explained by external influencing elements.

Component	Initial eigenvalue			Extracted sum of squares loaded			rotated sum of squares loaded		
	Sum	Variance %	Accumulated %	Sum	Variance %	Accumulated %	Sum	Variance %	Accumulated %
1	1.845	46.128	46.128	1.845	46.128	46.128	1.316	32.905	32.905
2	0.905	22.616	68.745	0.905	22.616	68.745	1.098	27.444	60.349
3	0.699	17.466	86.211	0.699	17.466	86.211	1.034	25.862	86.211
4	0.552	13.789	100.000						

Table 7. Matrix of rotated components of external influencing elements.

Influencing elements	Component		
	1	2	3
Degree of effect of natural environment on risk early warning	0.084	0.964	0.038
Degree of effect of natural environment on risk early warning	0.650	0.405	0.266
Degree of effect of natural environment on risk early warning	0.924	−0.021	0.103
Degree of effect of natural environment on risk early warning	0.182	0.055	0.976

extracted. First factor represents degree of effect of legal and political environmental change on enterprise logistics risk early warning. Second, level of effect of uncertainty of natural environment on enterprise logistics risk early warning. Third, level of effect of uncertainty of economic environment on enterprise logistics risk early warning. Therefore, three new factors can be extracted as political-legal environment factor, natural environment factor and economic environment factor.

To control external influencing elements, those three new extracted factors can be used to simplify the surveillance on enterprise logistics operation process. In practice, to enhance the efficiency of logistics risk early warning, updated political-legal disciplines and all kinds of environmental information such as weather forecast should be considered at all times, also international economic environment should be paid attention to grasp the initiative.

2) Factor analysis on internal influencing elements

Factor analysis function in SPSS software is utilized to conduct quantitative analysis on internal influencing elements of enterprise logistics risk early warning. Results are showed in **Tables 8-10**.

Seen from **Table 8**, KMO value of internal influencing elements is 0.774, higher than 0.7, and Bartlett test value, sig. = 0.000. The relation among variables is insignificant, hence the factor analysis.

Concluded from **Table 9**, internal influencing elements can be represented 87.780% by 4 factors extracted. First factor represents quality of logistics risk management staffs and logistics management level. Second, improvement of logistics risk management institutions and advancement of logistics risk management technology. Third represents degree of effect of logistics development phase. Forth represents degree of effect of attention attached by senior executives. Therefore, four new factors extracted can be defined as logistics management soft technology, logistics management hard technology, phase of logistics development and attention attached by senior executives.

While controlling internal influencing elements, those four new extracted factors can be used to simplify the effectiveness of enterprise logistics risk early warning. As for logistics management soft technology, one of four new extracted factors, it refers to enhancement of quality of staffs of enterprise logistics risk management, such as strengthening trainings. Due to the requirement of logistics management hard technology, enterprise ought to carry out new R&D or import new logistics software and

Table 8. KMO and Bartlett's Test on internal influencing elements.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.774
Bartlett's Test of Sphericity	Approx. Chi-Square	322.435
	df	15
	Sig.	0.000

Table 9. Total variance explained by internal influencing elements.

Component	Initial eigenvalue			Extracted sum of squares loaded			rotated sum of squares loaded		
	Sum	Variance %	Accumulated%	Sum	Variance %	Accumulated%	Sum	Variance %	Accumulated%
1	2.973	49.551	49.551	2.973	49.551	49.551	1.645	27.412	27.412
2	1.053	17.547	67.099	1.053	17.547	67.099	1.508	25.126	52.538
3	0.656	10.936	78.035	0.656	10.936	78.035	1.065	17.752	70.290
4	0.585	9.746	87.780	0.585	9.746	87.780	1.049	17.490	87.780
5	0.396	6.598	94.378						
6	0.337	5.622	100.000						

Table 10. Matrix of rotated components of internal influencing elements.

Influencing element	Component			
	1	2	3	4
Degree of effect of attention attached by senior executives	0.279	0.101	0.097	0.928
Degree of effect of quality of logistics risk management staffs	0.886	0.142	0.128	0.178
Degree of effect of logistics management level	0.817	0.290	0.084	0.207
Degree of effect of improvement of logistics risk management institutions	0.224	0.851	0.068	0.295
Degree of effect of advancement of logistics risk management technology	0.220	0.785	0.365	−0.121
Degree of effect of logistics development phase	0.130	0.227	0.946	0.109

technology equipment to reach its risk management goal. In terms of phase of logistics development, this factor links closely with macroscopic environment within a country, thus any attempt to change should consider in the prospect of industry as a whole. As for attention attached by senior executives, it refers to enhancement of senior executives' understanding of logistics risk early warning and cementing of their attention attached on it, which can be realized by dissecting successful cases of enterprise logistics risk early warning, through which management can perceive the interests brought by enterprise logistics risk early warning.

6. Conclusions and Suggestions

Based on questionnaire survey, this research analyzes fundamental status and influencing elements of enterprise logistics risk early warning of manufacturing industry in Beijing area. Concluded from above discussions, 1) present status of enterprise logistics risk early warning of manufacturing industry in Beijing area is not ideal, because of insufficient attention paid and lack of professional knowledge, which haven't drawn much attentions from whatever first line staffs or management; 2) the external influencing elements of enterprise logistics risk early warning includes political-legal environment factor, natural environment factor and economic environment factor, and internal influencing elements are consist of logistics management soft technology, logistics management hard technology, phase of logistics development and attention attached by senior executives. The effect of internal influencing elements outweighs that of external counterparts.

Suggestions according to above conclusions are proposed as follows. 1) To radically shift the adverse situation of enterprise logistics risk early warning, firstly, understanding what enterprise logistics risk management is should be put onto an agenda, which is the basis. And secondly, trainings on fundamental knowledge and skills of enterprise logistics risk early warning should be enforced to make that working process understood by related staffs, who can identify and evaluate enterprise logistics risk and early warning indexes; 2) during the enterprise logistics risk early warning working process, management's perception of risk should be enhanced as well. As for external influencing elements, mends of related political-legal items should be put on more emphasis. To internal ones, more importance should be attached to improvement of logistics management level.

Although manufacturing industry in Beijing area is selected as research object in this research, to some extent, the conclusions and suggestions are valuable to the practice of enterprise logistics risk early warning of China's manufacturing industry, even other industries as well.

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