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Research of the Suppliers' Risk Evaluation and Prevention Based on the Type a Cooperation Relationship

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Abstract

The current economic environment is full of competition and uncertainty, all kinds of uncertain factors contain risk in the integrated supply chain. As the upstream supply chain enterprises, suppliers are playing an important role. The suppliers' risk is one of the main sources of the supply chain risk, so it becomes the important issue in the current economic environment. From the perspective of the cooperation relationships between enterprise and supplier, the risk evaluation indexes of type a cooperation are identified combined with the current market characteristics. The Fuzzy Model is used to have a comprehensive supplier risk assessment and the effective risk prevention measures are put forward based on the theory which aims to provide references for enterprises' risk evaluation and prevention.

Key words: Supplier risk; Type a cooperation; Risk evaluation; Fuzzy model; Risk protection

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INTRODUCTION

With the development of the supply chain, the way that buyer purchase goods from the supplier has changed from the traditional raw materials and spare parts to the high industrialization specialized system and local assembly which calls for the close cooperation between the partners. In this situation, when problem happen, they will suffer greater risk and loss because the partners invest a lot into their business which will go in vain immediately (Peter & Thomas, 2011). So it becomes the key point for enterprises to evaluate and prevent the suppliers' risk effectively and accordingly.

Recently, as the awareness of the suppliers' risk is improving, the related researches also carry out deeply. Some analyzed the source of the suppliers' risk from the perspective of the whole supply chain, the multilevel supplier risk index system is provided based on the theory, the suppliers' risk management is discussed, which pointed that the way to reduce the suppliers' risk is to strengthen the control of the supply chain's optimization (SUN, 2009; WU, LIU & ZHANG, 2008). But the measure are not mentioned to prevent the suppliers' risk accordingly; some provided the third party logistics supplier selection should be based on the business experience, technical level, strategic objectives, compatibility and other aspects from the perspective of industrial and commercial enterprises (YU, 2008). But it lacks the prevention measures for enterprise and supplier in the dynamic cooperation. Some are based on the specific environment such as the electronic commerce and the disordered environment, which discussed suppliers' risk prediction and management, analyzed the supply chain structure according to the specific circumstances of the endogenous and exogenous risk, then they could control and manage risk factors effectively in choosing suppliers (SUN, 2008; CHEN, 2011; HU, 2010). But one particular perspective have limitations for suppliers' risk assessment and prevention which can only provided a kind of suppliers' risk. Some based on the mathematical model such as Grey Prediction, Grey Hierarchy Analysis

Grey Clustering, established the comprehensive suppliers' risk assessment index system according to the suppliers' risk management requirements and combined with some experts' knowledge and some relevant authorities' measure indexes. By using the mathematical model, we can enhance the result more accurately, objectively and comprehensively (GU, 2011; LIANG, JIANG & XIA, 2010). But this kind of index system are lack of pertinence, especially for small companies, which not only lead to higher evaluation cost, but also can not reflect the degree of risk effectively, and eventually damage the interests of enterprises. Some are based on the development of the supply chain and information systems, the traditional evaluation method were reformed which have been unable to meet the risk management, then the way to manage risk was discussed, and some theories were provided for the suppliers' risk prevention (Ari Salonen, 2011; FENG & LI, 2011). But most of the methods remained in the theory level which application rate is low and the applicability is limited. So it is necessary for us to study suppliers' risk assessment and prevention according to the current trend of social development and enterprises' own characteristics. According to supply chain structure division, the cooperation relationships between enterprise and supplier are divided into type A, type V and type T. A further study is done on type A. The main contents include: (1) Indexes selection. From the perspective of the cooperation type, combined with the changes in the domestic market and development situation, some risk factors are selected, which were easily ignored by us and can reflect the risk. (2) Mathematical modeling. Fuzzy analysis method is used to have a quantitative supplier risk evaluation. (3) Risk prevention. To solve the problem calls for the cooperation between the enterprise and supplier to take the measures to prevent risk before it happen.

1. ANALYSIS ON SUPPLIERS' RISK INDEXES BASED ON TYPE A COOPERATION RELATION

The structure of the supply chain can be divided into three types: Divergence type, Convergence type, Adaptability type. According to this, the form of the cooperation can be divided into type A, type V and type T. Type A relationship refers to the enterprise who is in the core of the cooperation, such as plane industry, automobile industry, boat industry, which call for high technology. This kind of cooperation usually calls for Early Supplier Involvement (ESI), design and develop product together, and Vendor-managed Inventory (VMI). So in addition to carry out a strict inspection and assessment about the supplier's finished goods, quality, inventory, orders, some factors such as the inflation, personnel loss and other factors that often be overlooked should be taken into considered (Brindley, 2009). According to the internal risks and external risks, select some of the main factors for the construction of the risk index system.

1.1 Externa Risks

(1) Natural disaster: A lot of enterprises and suppliers didn't put the natural disaster into their risk evaluation system when they cooperate, considering that it won't happen. But when we reviewed the cases in recent years, we could find that various disasters occurred frequently. For example, the south snow disaster and a giant 8-magnitude quake off the country in 2009; 8 typhoon storm swept across the coastlines of China; Earthquake happened in Haiti and Qinghai, a catastrophic debris flow happened in our country in 2010; Flood disaster happened in Thailand, a giant 9-magnitude quake off in Japan triggered the nuclear leak in 2011. This kind of enterprises usually choose one supplier to have a deeper cooperation due to the cooperation relationship, so when the natural disaster happened, he supply chain will be interrupted easily because of the suppliers inadequate. So we choose the disaster alert degree and emergency scheme as the main indexes.

(2) Inflation: Inflation is an important phenomenon in Chinese market now. Under this background, to some suppliers, the worst consequence is that some management and investment funds will lost, and after a certain period of funds circulation they will come to a bad situation such as lack of money and orders, declining in sales and inventory increases. On-process inventory, finished goods inventory (dead sales), raw material inventory and accounts receivables inventory all will increase the suppliers' cost. These signals may reflect that supplier have come into financial problems which even will lead to bankruptcy. So the risk indexes include the total inventory cost, cash flow, capital return rate, debt repay ability, profitability, operation ability, growth ability, and the main indexes are the capital return rate and the debt repay ability.

1.2 Internal Risks

(1) Finished goods quality: Suppliers' finished goods quality is the main risk factors of type A cooperation. In addition to the suppliers' own goods quality, the transportation, unreasonable packaging, rough handling, the loss of parts and other factors will affect the quality of products. Recently, safety and quality of the warehousing and distribution product is taking on greater significance after dangerous events happened frequently in all walks of life: Explosion ripped through warehouse at plant because of the badly damaged building and machine which had been used for years; car accidents happened because of heavy-loaded and fast speed (Bharadwaj & Neeraj, 2004). So we choosing the explosion facility condition, facility cleanliness, staff quality, open box of product, Mean Time Between Failure (MTBF) as the risk indexes, and the main indexes are the open box of product and MTBF.

(2) Technical staff drain: The talent distribution of

the enterprise is also conform to the laws of Pareto, which means 20% stuff contribute to 80% value (LIU, 2008). Unreasonable downsizing and technical staff job-hopping will cause the loss of technical personnel. They usually have a rich experience, keen judgment, multi-angle analysis ability. These technical personnel loss often cannot catch enough attention by their boss in a short-term, which will not only reduce the enterprise operation efficiency, but also will destruct the original interpersonal relationship network of the enterprise. As more work are moved to suppliers, their manufacturing expertise and engineering prowess developed substantially, the technical staff job-hopping frequently will lead to the threat that the enterprises' supplier will become their competitors. So we choose the department of personnel fixed degree and organizational structure fixed degree as the main risk indexes.

(3) Enterprise culture: Close cooperation calls for the unanimous agreement, coordination and trust. So enterprise culture's consistency in cooperation is particularly important. The risk of cultural differences happen in various aspects of the cooperation. For example, are they willing to develop new products and new technology according to the market creatively together? Such as the electronic products which have a short product life cycle. Is the atmosphere there full of bribing and corruption that suppliers would probably concentrate on wooing the enterprise buyer and ignore the quality and the service of the products? Are they willing to share the information with each other in some kind of field to keep the enterprise operation transparency? So we choose the cooperation satisfaction index, compatible degree, information sharing degree, leadership quality as the risk indexes, the main indexes are the cooperation satisfaction index and the information sharing degree.

(4) Environmental protection: Environmental protection has become the focus of every country in the world now. China reduced its greenhouse gas emissions by 1.5b tons between 2006 and 2010, the biggest decrease of any country in the period. In the upstream supply chain, suppliers are obliged to fulfill the green consciousness and the policies and regulations well formulated by the government when cooperated with the downstream partners in order to achieve the goal of green sourcing and green production, to conserve and utilize the resource measurably. So the risk indexes include energy conservation degree, environmental awareness degree, product pollution degree and emission reduction rate, the main risk indexes are the energy conservation degree and the product pollution degree.

2. SUPPLIERS' RISK INDEXES SYSTEM CONSTRUCTION BASED ON THE TYPE A COOPERATION RELATIONSHIP

From the perspective of the high probability of risk and greater loss and according to the principle of the system design, we select the indexes that are easily measured and quantified for the type A suppliers. The second level risk evaluation system should have greater adaptability in case of the harder work and higher cost, so it could be suitable for most cases. In view of this, the evaluation index system consists of 6 first level and 12 second level indexes. As shown in Table 1.

Table 1
The Suppliers' Risk Evaluation Indexes System Based on Type a Cooperation

Risk Classification	First level indexes (U_i)	Second level indexes (U_{ij})
External risk	natural disaster(U_1)	disaster alert degree(U_{11})
		emergency scheme(U_{12})
	inflation(U_2)	capital return rate(U_{21})
		debt repay ability(U_{22})
	finished goods quality(U_3)	open box of product (U_{31})
		MTBF(U_{32})
Internal risk	technical staff drain(U_4)	department of personnel fixed degree(U_{41})
		organizational structure fixed degree(U_{42})
	enterprise culture(U_5)	cooperation satisfaction index(U_{51})
		information sharing degree(U_{52})
	Environmental protection(U_6)	energy conservation degree(U_{61})
		product pollution degree(U_{62})

3. THE CONSTRUCTION OF THE SUPPLIERS' RISK EVALUATION MATHEMATICAL MODEL BASED ON TYPE A COOPERATION

3.1 The Application of the Fuzzy Model

Based on the type A cooperation, the suppliers' risks contain the external risk effected by natural factors and market volatility factors and the internal risk effected by the change of internal factors in the dynamic cooperation systems. Because the influence of factors are random and fuzzy, it is usually inaccurate for suppliers' risk prediction. From this perspective, the method is used based on the likelihood of the fuzzy mathematics to study the suppliers' risk degree, which will make suppliers' risk evaluation

more accurate. The general statistical samples can be seen as random set projection theory of single point, fuzzy sets can be manifested as random sets and random sets of fall shadow also conform to shadow of large number theory (QIN & WEI, 2008). Therefore, the fuzzy mathematics method is adopted to evaluate the cooperation of A type.

3.2 Expert Group Judgment

In order to improve the accuracy of the results, we targeted the 10 experts among finance, logistics, environmental protection and other specialists in different areas to have a independent judgment, in case of its field limitation which will cause the risk evaluation result unreasonable. We adopted hundred-mark system, the lower the expert marked, the lower the final evaluation value is, which suggesting that this factor will cause higher and greater risk in cooperation. There is a prediction based on the cooperation of type A for its supplier, as shown in Table 2.

Table 2
The Prediction Made by Expert Based on a Type Cooperation for a Company's Supplier

	U_1	U_2	U_3	U_4	U_5	U_6
Expert 1	100	90	90	90	90	100
Expert 2	80	90	60	70	80	100
Expert 3	70	90	60	75	85	90
Expert 4	80	80	75	80	80	90
Expert 5	100	90	80	90	80	100
Expert 6	90	85	75	85	85	95
Expert 7	85	80	80	80	80	90
Expert 8	85	75	65	75	85	95
Expert 9	80	90	60	75	85	80
Expert 10	70	70	75	80	80	80
Average	84	84	72	80	83	92
Normalized	0.169	0.169	0.145	0.161	0.167	0.185

*** According to the theory of fuzzy mathematics, each factors has different effect to the prediction to some extent, so the average value should be figured out first , the sum of it are 495, then normalized it: A= (0.169, 0.169, 0.145, 0.161, 0.167, 0.185).**

3.3 Establish the Set of the Suppliers' Evaluation

According to five risk levels of safety, good, vigilance, risk, loss, 10 experts made an independent evaluation about the 12 second level indexes. Similarly, we adopt hundred-mark system, the lower the expert marked, the lower the final evaluation value is which suggesting that this factor will cause higher and greater risk in cooperation. V= (V1, V2, V3, V4, V5) = (safety, good, vigilance, risk, loss). The set of the suppliers' evaluation based on type A cooperation are shown in Table 3.

Table 3
The Set of the Suppliers' Evaluation Based on Type a Cooperation

		Safety	Good	Vigilance	Risk	Loss
U_1	U_{11}	2	3	4	1	0
	U_{12}	0	3	5	1	1
U_2	U_{21}	3	2	3	2	0
	U_{22}	1	3	6	0	0
U_3	U_{31}	0	1	3	4	2
	U_{32}	0	0	2	6	2
U_4	U_{41}	3	4	2	1	0
	U_{42}	1	4	4	1	0
U_5	U_{51}	2	3	3	2	0
	U_{52}	2	3	4	0	1
U_6	U_{61}	0	3	4	2	1
	U_{62}	0	2	5	2	1

According to the Table 3, results can be found:

$$R=\begin{pmatrix} 0.2 & 0.3 & 0.4 & 0.1 & 0 \\ 0 & 0.3 & 0.5 & 0.1 & 0.1 \\ 0.3 & 0.2 & 0.3 & 0.2 & 0 \\ 0.1 & 0.3 & 0.6 & 0 & 0 \\ 0 & 0.1 & 0.3 & 0.4 & 0.2 \\ 0 & 0 & 0.2 & 0.6 & 0.2 \\ 0.3 & 0.4 & 0.2 & 0.1 & 0 \\ 0.1 & 0.4 & 0.4 & 0.1 & 0 \\ 0.2 & 0.3 & 0.3 & 0.2 & 0 \\ 0.2 & 0.3 & 0.4 & 0 & 0.1 \\ 0 & 0.3 & 0.4 & 0.2 & 0.1 \\ 0 & 0.2 & 0.5 & 0.2 & 0.1 \end{pmatrix}$$

The fuzzy model of M (* , +) is used for comprehensive evaluation, results can be found:

B = A*R = (0.338, 0.522, 0.757, 0.352, 0.129).

3.4 Results and Analysis

Because the 0.757 is the maximum value, according to the principle of maximum degree, the enterprise risk degree goes to vigilance, which means that this company should alert for its supplier and adjust risk link timely. As the same time, the external risks consist of natural disaster and inflation got a lower evaluation marks, and the internal risks consist of finished goods quality and technical staff drain got a lower evaluation marks, which indicates that these factors should be given more attention because of the higher risk degree by analyzing the Table 2. To have a further analysis of Table 3, results can be found that most expert take an vigilance attitude towards the disaster emergency plan number in the natural disasters, he debt paying ability of the inflation risk and structure

fixed degree of the technical staff drain risk, they take an risk attitude towards the MTBF of the finished goods quality risk. Therefore, more attention should be paid to the factors of MTBF, number of emergency plan and the debt paying ability, strict inspection and prevent should be taken to these risks accordingly.

4. SUPPLIERS' RISK PREVENTION BASED ON TYPE A COOPERATION

4.1 Natural Disasters

To do the disaster prevention work. Many enterprises consider that the probability of occurrence is very small, and it will never take place on them. But when we review these years, the supply risk caused by natural disasters happened everywhere. So the enterprises should take the risk prevention seriously, formulate the alternatives before cooperation. In cooperation with suppliers, they should negotiate with them in advance about the products delay, financial disputes and other matters caused by the natural disaster. At the same time, the internal quality of staff training should be taken into consideration to ensure that they have the risk guard consciousness, master the basic self-help method, and will keep the enterprises' normal operation as much as possible.

4.2 Inflation

To improve its logistics management level as well as to have a comprehensive study of suppliers. Some suppliers will sale their products in the form of paper sale, which will put the enterprises into the situation of "negative stock" crisis (CAI, 2012). So enterprises themselves should improve logistics management level, and standardize their regulations at first. In the cooperation of the suppliers, check whether the suppliers' balance sheets have good performance; whether they own the toxic assets; whether they have own the good assets and semi flowing assets instead of cash, which can help them to get more profits instead of order decreasing and reduce the probability of getting into financial crisis due to market volatility. Enterprises should take conservative financial plan, pay attention to the accumulation of funds, reduce the liabilities and focus on cash flow, maintain financial flexibility and patency. When there is a fluctuation in the market and the economic situation is not stable, they could operate their company and cooperate with their suppliers easily and stably.

4.3 Finished Goods Quality

Examine the production and related aspects of the quality and safety strictly. First of all, examine the supplier's production and quality of products strictly. Check the product once qualified rate rather than the production qualified rate, the open box of product and other statistical indicators to ensure the suppliers' product quality. At the same time, companies should establish a set of auditing suppliers' transportation standards. This procedure includes risk scores and a series of basis standards depending on the risk grade levels, suppliers in accordance with these terms are qualified for high value goods products transportation. In the process of cooperation, they should have an Improvement Continuity Management (ICM): do a inspection grading assessment about the production or warehouse environment regularly, identify problems and pointed out timely, eliminate unsafe factors caused by the disasters. By operating Total Productive Maintenance (TPM), we can reduce the number of wrong parts and improve the comprehensive efficiency of the equipment so that the quality of the products can be ensured. Pay attention to the safety training, helping them to master the relevant professional knowledge and have a good problem consciousness. In the ordinary weekday, works should pay more attention to their own devices, such as sound, vibration, heat, which will improve their ability to deal with the abnormal problems, thereby improving the ability of problems solving. Having a clean, warm and efficient work environment will help them to lay a stable foundation for long-term cooperation in the future (GAO, 2009).

4.4 Technical Staff Drain

Transfer the organization structure scientifically. Research shows that many enterprises believe that it is inevitable to do job cut in order to eliminate employees to reduce costs and enhance the profit. However this kind of view is totally wrong. What should the enterprise do first is to study and analysis the learning curve, and have a reasonable downsizing after that. Those in the edge of the organization who have little network contact are much easier to be ignored, and are more likely to leave, leading to the loss of expertise and external knowledge. For example, the computer maintenance personnel can not only solve the problem of network virus with a shorter period of time than others, but provide some creative ideas combined with practical issues, which can be free from other members of the interference. To avoid such problems, enterprises must make great efforts to find and attach importance to such technical talent, to use some measures, such as the common project which will allow them to participate in and show their talents fully in this process, to realize their own values, to act as full membership of this organization, thus arousing their creativity and retain their hearts.

4.5 Enterprise Culture

Strengthen consciousness of the idea exchange between enterprises and supplier. The enterprise and supplier have common interests, by strengthening the communication and exchange ideas, they will achieve the goal of inter-dependence, integration, institutionalization ultimately. In the pursuit of maximum profits, the asymmetry information should be eliminated as much as possible. Trust your suppliers. It is known that the total cost will

eventually pass on the enterprises themselves. So when facing dangerous, don't embarrass your suppliers, conduct the price squeeze or ask for its increase in inventory so that we can lay the stable foundation for a long-term cooperation. Any enterprise's success is short-lived, it is only have cooperation with their partners and built logistics alliance, where they can achieve the information integration, technology and customer sharing, develop new ways, accumulate experiences together, can the supplier actually form a sense of belonging, share weal and woe with the enterprise forever.

4.6 Environmental Protection

Take the responsibility to the environmental protection, energy saving and emission reduction. Attention should be paid to the environmental protection from every aspect of the cooperation by enterprises and suppliers. In addition to deal with cost issues, enterprises and suppliers need to reach a consensus that it is more important to have the environmental protection awareness. Although from a financial perspective, some green investment can't achieve a desired effect right now, but definitely there is a return in the long term. Technical innovation is one of the main methods to make profits through low carbon production. Therefore, enterprises and suppliers should work together actively to the development the new technologies, and improve the utilization rate of resources. For example, Sky NRG, a Dutch-based jet fuel supplier, provides jet fuel for KLM Royal Dutch Airlines, which successfully completed a flight from Amsterdam to Paris with fuel produced from gutter oil in June, 2011, becoming the first airline company to do so. Sky NRG has purchased 20 tons of gutter oil as a sample from Qingdao to be used on airlines for tested. The company said it will purchase 120,000 tons each year from China if the oil is usable. This cooperation not only conserves jet fuel energy and protects environment, but also create more opportunities and profits for more companies.

CONCLUSION

According to the current development of the society and the enterprise's own characteristics, a deep study is made on type A based on the cooperation relationship. The fuzzy comprehensive evaluation is taken for an example to show the process of the suppliers' risk assessment and prevention. Finally, according to the risk, some specific suggestions are put forward for reference in order to enhance the enterprises' risk awareness. Further study of the cooperation relationship of type V and type T haven't been taken. More attention will be paid to the two aspects of this research in the future to provide a theoretical support for enterprises' risk assessment and prevention.

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