

On Selection of Small or Medium Size Enterprises by a Logistics Alliance under Unified Credit Model

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Abstract:

Finance, transportation, and warehouse (FTW) is an effective way to solve the financing difficulties of the small or medium size enterprises. Under the unified credit model of FTW, it is very important for the logistics alliance to make right choices small or medium size enterprises and grant the right credit quantity to them for maximum profits with minimum risk when considering the limits of credit amounts and storage capacity. We are solving this problem by integrating analytic hierarchy process (AHP) and linear programming (LP). An actual case is used to demonstrate the effectiveness of the proposed method.

Key words: unified credit model of FTW; logistics alliance; analytic hierarchy process (AHP); linear programming (LP)

1. INTRODUCTION

Since China's reform and opening up, Chinese economy is witnessing a rapid development. Small and medium-size enterprises play an important role in national economy development. According to the statistics, since 2009 years, the number of small and medium-size enterprises accounts for more than 99% of the total number of enterprises. At the same time, the final products and services which created by small and medium enterprises accounts for 60% of the gross national product (GNP) and they also provide a lot of jobs.¹ So we can say that, small and medium-size enterprises have an important position in the economic development of our country. However, the development of small and medium-size enterprises has generally faced financing difficulties. Analyzing the reason, one hand, the credit rating and the level of credit of small and medium-size enterprises are poor. And the fixed assets that can be used for the pledge is lack of guarantee. So bank awarded to small and medium-size enterprise's loan will face a higher risk; the other hand, small and medium-size enterprise loan generally has the characteristics of small amount, high frequency and time urgency, so the management costs are high. The two reasons will lead to the situation that banks are reluctant to lend money to small and medium-size enterprises.

For the plight of the financing difficulties of small and medium-size enterprises, many scholars puts forward the suggestion and methods from different aspects, such as, the establishment and improvement the credit guarantee scheme and capital market for small and medium enterprises. These methods have certain reference value for solving the problem of the financing difficulties, but these methods can't effective solve this problem.

In order to solve this problem, Zhu Daoli and Luo Qi innovative proposed the concept of FTW. We can say that, FTW is an effective way to solve the financing difficulties of the small and medium-size enterprise (2002).FTW is a service of small and medium-size enterprises as the main business, the flow of goods warehousing being its basis, covering the small and medium-size enterprise credit integration and reconstruction, logistics distribution. It is an integrated service platform for E-commerce and traditional business (2002).According to the relationship between the parties, FTW is divided into model FTW and unified credit FTW. The unified credit pattern of FTW means that according to the scale of the logistics enterprises, credit and performance, the bank award logistics enterprise the credit quota. And then, logistics enterprise allocate the credit quota according to the small and medium-sized enterprise's credit stratus and provide credit guarantee for small and medium-sized enterprises, which based on the goods in FTW as collateral to ensure the safety for the funds.

As liberation daily report in 2009, affected by the financial crisis, China's textile industry suffered a huge blow, seriously hindering the development of local economy. Shanghai Fu Dan university institute cooperated with local companies, supported by the theory and technology,

1 'Shanxi province chamber of commerce', 2009, <http://www.sxjsh.net/dectial2.asp?Nid=284>

successfully developed the FTW business model, helping local small and medium-size enterprise finance more than 300 million, and even saved more than 5000 jobs. This not only confirmed the development prospect of FTW, but also proves the advantage of FTW.

In 2013, Ping An Bank and Mechi group co., LTD., and Huai Kuang modern logistics co., LTD., to signed a 30 billion cooperation agreement in Shen Zhen, which proves the feasibility of logistics alliance participating in logistics finance. For example, under the situation of the alliance, logistics companies are more likely to get the trust of the bank, so they can obtain the higher banking facility. The logistics alliance we mentioned in the article is based on logistics enterprise strategic alliance cooperation, which refers to two or more logistics enterprises, in order to achieve their strategic goals, through a variety of protocols, signed the contract of formatting a loose network structure which is risk-sharing, synergistic beneficial, benefit sharing (2009).

In the international community, the study of FTW starts early and the development is mature. The west has extended theoretical research in FTW. It is not only involved with the law, regulations, business model and operation monitoring, but also included with the application of credit rating technology, design of the loan contract and risk control research and so on. What's more, the actual operation experience is also abundant (Albert Rakish, 1948). In China, the FTW is a new business. For most enterprises, FTW is only a new concept. But the FTW is gradually becoming a hot topic in Chinese academia. At the same time, scholars pay more and more attention to FTW. From the perspective of FTW, Yang Jingling (2013) considered the possible risks under unified credit model; Li Li (2010) by building a model studied how the logistics enterprises choose the small and medium-sized enterprises with obtaining the maximum total effect at the minimum risk. This shows that, most of the literature of FTW is think that the third party logistics enterprise is the intermediate link of FTW, and there is no literatures research studying the FTW from the aspect of logistics alliance.

From the perspective of logistics alliance, Pang Yan(2013)introduces a new financing model -- logistics financial , this paper gives a simple introduction of logistics financial concept and application advantage, and describes the basic principle and essential profit pattern ;Wang Bing(2010) by studying the logistics enterprise present situation, through analysis the intrinsic demand and extrinsic motive about the development of logistics enterprises, combining with the current developing situation of logistics alliance in China, put forward the strategies and suggestions on the development of logistics alliance; Daniel Granot etc.(2005) through the instance, analyzing the supply chain alliance which based on the formation of the Internet, combined with the situation of the participants are given different models, through model calculation, obtained the advantage of alliance and the presence of defect. This show that, there are few scholars think the FTW and logistics financial from the aspect of logistics alliance, the document of logistics finance has major from the third party logistics enterprise, so there is no relevant literature including logistics alliances and logistics finance together.

This article from the perspective of comprehensive considering logistics alliance possessing some competitive advantage and thinking the logistics alliance from the field of logistics finance

bringing new opportunities, promote the further development of FTW and solve the problem of financing difficulties of small and medium-sized enterprises .

2. MODEL INTRODUCTION

Under the unified credit model, logistics alliance has the credit quotas granted from bank. Logistics alliance can provide collateral loans to small and medium-sized enterprises. But the logistics enterprises are facing the problem of how to choose the enterprises. Rational logistics alliance will select the right small and medium size enterprises and grant the right credit quantities to right them, on the basis of risk control, within the scope of credit lines granted by banks and considering the limited inventory capacity such that the profit is maximized with the risk minimized. For now, there are many methods to choose, such as Analytic Hierarchy Process (AHP) and Linear Programming theory (LP).

AHP method is a decision-making method that combines with qualitative and quantitative analysis. The analytic hierarchy process is proposed by the famous American Operations Research T.L. Saaty in the early 1970s. Its advantage is to break down complex problem into several combinations of factors and form a hierarchical structure according to its dominance relations. By pair wise comparison, it can determine the relative importance of various factors in the hierarchy, and through comprehensive human experience and judgment, it can decide the order to the importance of the factors and its weight. However, under normal circumstances of AHP, it only applies to selecting a single enterprise and can't determine the specific line of credit which granted to small and medium-sized enterprises. LP method is an operation research study which earlier and faster developed and more widely applied, and it's a more mature approach; it's an important branch in operations research study. Its advantage is that you can determine the line of credit, but its major defect is the weight of each key assumptions are equal, but in reality, seldom there are. Because the logistics alliance enterprise providing loans to small and medium-size enterprises can reap the benefits, but it also will be faced with huge risk and the level of risk will vary with the different of small and medium-sized enterprises credit status. For the collateral changed, logistics alliance for small and medium enterprise from different risk weights perspectives to consider, so directly using the LP method will exist a big error. To solve this problem, this article will combine of AHP and LP methods. That is firstly, use of AHP method to calculate the risk weighting of small and medium-sized enterprises, secondly use the risk weighting as the objective function coefficient of LP model.

3. COUPLED AHP AND LP MODEL

3.1 By using AHP method to measure the risk weighting of small and medium-sized enterprises

3.1.1 Hierarchy of risk assessment for small and medium-sized enterprises.

About risk assessment, He Juan, He Yong (2008)has pointed that although there are tangible goods as collateral, it still cannot relax the investigation for the customer's credit rating and

solvency. According to their view, risk assessment can be discussed from three ways: the risk of collateral, regulatory and credit. Every aspect has a series of specific indicators to measure. For example, we can establish the evaluation indexes system which consists of four aspects: price volatility, quality level, liquidity, loss of speed and the difficulty of deterioration to measure the solvency of collateral; use asymmetric information, the company's management and the company's handing of the collateral risk control during storage means to measure the regulatory risk of enterprise; use the fiduciary responsibility, risk indicators, date inefficient and environmental constraints to measure other aspects of corporate credit risk. According to the Satty1-9 proportional scaling law, to establish judgment matrix, and then respectively calculate each enterprise's risk portfolio weights.

3.2 Model structure

3.2.1 The objective function

When we using the AHP method obtained every small and medium-size enterprise's risk weighting R_i , we can use R_i as the coefficient of the objective function which can structure the LP method. we consider that X_i is the loan amount which is logistics alliance affords to the small and medium-size enterprises; a is the credit balance which belongs to logistics alliance; b_i is the estimated value of the pledged; c is the remaining capacity of the logistics alliance coffers; v_i is the collateral pledge rate; f_i is the collateral value of the unit volume. Because logistics alliance is a coalition composed by a number of logistics enterprises, there will have some cost in allocation and distribution of profits. So we set up internal communication costs which is C_i and the costs of distribution of profits which is C_e . For every aspect of logistics alliance chooses the best companies to operate, compared with other types of businesses providing the same services, the declining casts are C_j . In terms of the objective function, Yu Ping point out that under the unified credit model, bank for the logistics alliance enterprises adopt fixed rent contract (2007). In this contract, when bank granted the credit quotas to the logistics alliance, the interest rate is r_d . When logistics alliance configured quota funds to small and medium-size enterprises, the interest rate is r_i . From above points, we can say that, under the unified credit model, if we are using simple interest calculated interest, what logistics alliance will get the spread income is r_e . To simplify the problem, this article assumes that spreads income includes income from regulatory revenue and storage which are logistics alliance enterprises should get. So $retx_i$ represents the spread income earned from the i number of small and medium-size enterprises, $R_i(retx_i)$ indicates that the utility gained from the i number of small and medium-size enterprises, we use TU (Total Utility) to represent the total utility obtained from small and small and medium-size enterprises, so the objective function is that

$$\max TU = \sum R_i (retx_i) - C_i - C_e + C_j \quad (1)$$

3.2.2 Constraints

1. Limits of Total credit. The financed amount from logistics alliance for small and medium-size enterprises can not exceed the credit balance of credit which is obtained from the bank, as shown in (2)

$$\sum X_i \leq a \quad (2)$$

2. Limits of Small and medium-size enterprises credit. To ensure the safety of fund, logistics alliance does not provide loans to the small and medium-size enterprises according to their total assessed value, but in accordance with a certain pledge discount rate payment. Therefore, the actual amount of financing available to small and medium-size enterprises is less than or equal to the value of collateral pledged in accordance with the discounted rate, as shown in (3)

$$X_i \leq b_i v_i \quad (3)$$

3. Limits of Warehouse capacity. The volume of pledge dose not exceed the volume of logistics alliance itself has. X_i / v_i represents logistics alliances to give the first i small and medium-size enterprises the x_i business loans, i should provide value to the logistics alliance pledges, so we use $X_i f_i / v_i$ to represent the volume of pledges, as shown in (4)

$$\sum | X_i / v_i | f_i \quad (4)$$

But the credit given to each enterprise can not be negative, as shown in (5)

$$X_i \geq 0 \quad (5)$$

4. Limits of League fees. Because logistics alliance is an alliance of many companies, there must be some additional cost in the operation, as shown in (6)

$$C_i > 0, C_e > 0 \quad (6)$$

C_i and C_e are proportional to the credit.

5. Limits of decrease in cost. Because logistics alliance compared with a single logistic enterprise, the declining costs can not be negative, otherwise, the alliance will not be able to continue, as shown in (7)

$$C_j > 0 \quad (7)$$

6. Limits of total utility. Because each operation of logistics alliance is the best choice, the total utility of logistics alliance which participate in the FTW should be greater than the total utility of single logistics enterprise which participate in the FTW, as shown in(8)

$$C_j - C_i - C_e > 0 \quad (8)$$

Through the above theoretical analysis, we can draw a conclusion that, in considering the limits of total credit, warehouse capacity, because the alliance mode will generate additional costs and the cost will be decrease, logistics alliance should consider the interest rates and risk when it choose the financing object. The interest rate of the financing object given may not the highest and may not is the lowest risk. Through integrated account, the interest rates and risk factors in these two factors, the finance company should be able to get the maximum benefit by making logistics alliance.

4. CASE STUDY

Since the 1990s, a logistics enterprise in China began the exploration of FTW and achieved rapid development. In the end of nineties, FTW has become one of this company’s pillar industries. At present, the logistic company establishes cooperative relations with a number of commercial banks and provides FTW service to more than 500 customers. This company has more than 60 affiliated companies in China. In the end of 2008, the pledged loan which the Cheng Du branch can be used is 20 million. With remaining 15000 m² treasury area, 70% pledge rate and 3 months loan period. When the company wants to carry out this business, it needs to pay 7% annual interest rate to the bank. At the same time, the cost of the company’s profit distribution is 0.05% of the credit amount and the cost of the internal communication is 0.01% of the credit amount. The cost of decline is 4% of the credit amount. The credit amounts which the company grants to the small and medium-size enterprise are integers. There are four

Table 1 four companies related data

Corporate	Loan rates/%	Estimated value/ten thousand	Unit value of space / (m ² • ten/thousand)
1	9	1200	5
2	10	900	6
3	11	800	7
4	8	1000	4

4.1 Single hierarchical arrangement

According to the surveyed results of the four logistics enterprises, list the judgment matrix, obtaining the weight and consistency test.

(1) Judgment matrix A-B

A	B ₁	B ₂	B ₃
B ₁	1	2	4
B ₂	1/2	1	3
B ₃	1/4	1/3	1

W₁=0.557, W₂=0.320, W₃=0.123, W₄=0.113, CR₁=0.017<0.1, meet the consistency requirements.

(2) Judgment matrix B₁-D

B ₁	D ₁	D ₂	D ₃	D ₄
D ₁	1	1/3	1/2	1/4
D ₂	3	1	2	1/2
D ₃	2	1/2	1	1/3
D ₄	4	2	3	1

W₁=0.096, W₂=0.277, W₃=0.161, W₄=0.466, CR₁=0.012<0.1, meet the consistency requirements.

(3) Judgment matrix B₂-D

B_2	D_1	D_2	D_3	D_4
D_1	1	5	3	2
D_2	1/5	1	1/2	1/3
D_3	1/3	2	1	1/2
D_4	1/2	3	2	1

$W_1=0.482, W_2=0.088, W_3=0.158, W_4=0.272, CR_1=0.005<0.1$, meet the consistency requirements.

(4) Judgment matrix B_3 -D

B_3	D_1	D_2	D_3	D_4
D_1	1	2	5	4
D_2	1/2	1	4	3
D_3	1/5	1/4	1	1/2
D_4	1/4	1/3	2	1

$W_1=0.490, W_2=0.305, W_3=0.079, W_4=0.126, CR_1=0.018<0.1$, meet the consistency requirements. .

4.2 Total taxis of hierarchy

D layer elements	B_1	B_2	B_3	D-layer hierarchical ordering weight
	0.557	0.320	0.123	
D_1	0.096	0.088	0.490	0.268
D_2	0.277	0.088	0.305	0.220
D_3	0.161	0.158	0.079	0.150
D_4	0.466	0.272	0.126	0.362

4.3 Calculate the loan amount

Max TSV= $0.268 \times (0.02 \times 0.25 \times X_1) + 0.220 \times (0.03 \times 0.25 \times X_2) +$
 $0.150 \times (0.04 \times 0.25 \times X_3) + 0.362 \times (0.01 \times 0.25 \times X_4) - 0.05\% \times 2000 -$
 $0.01\% \times 2000 + 4\% \times (X_1 + X_2 + X_3 + X_4)$ St

$$\left. \begin{array}{l} X_1 + X_2 + X_3 + X_4 \leq 2000, \\ X_1 \leq 1200 \times 0.7, \\ X_2 \leq 900 \times 0.7, \\ X_3 \leq 800 \times 0.7, \\ X_4 \leq 1000 \times 0.7, \\ \frac{X_1}{0.7} \times 5 + \frac{X_2}{0.7} \times 6 + \frac{X_3}{0.7} \times 7 + \frac{X_4}{0.7} \times 4 \leq 15000, \\ C_i > 0, C_e > 0, \\ C_j > 0 \\ C_j - C_e - C_i > 0 \\ X_i \geq 0, \quad i = 1, 2, 3, 4. \end{array} \right\}$$

Been solved by Lingo software: $X_1 = 840, X_2 = 630, X_3 = 133, X_4 = 396$, we can draw a conclusion that we must select companies 1,2,3,4, and every enterprise respectively grants the loan amount is 8.4 million,6.3 million,1.33 million and 3.96 million.

According to the calculation result of the foregoing, we can draw a conclusion that, under the limited conditions of funds, stocks and other resources and considering the interest rates, financing risk. A conclusion can be made that, although the enterprise 1 interest rate is not the biggest, and the risk is not the smallest, but the company still got a majority of the financing funds. At the same time, although company 2 gives higher interest rates than company 1, but the company's collateral value is lower than others, so the amount of financing which the company 2 gets is lower than company 1. Although the company 3 can give the highest interest rates, but the value of its collateral is smallest, therefore company 3 did not get much of the financing. Because company 4 gives the lowest interest rates, although the collateral value is high, but still could not get the most of financing. Although this actual case, we can conclude that, the financing object is made by considering the rate and each enterprise financing risk, instead of unilateral considering interest rates or risk.

5. CONCLUSION

In this paper, by using the method of AHP and LP, in considering risk control and the constraints of credit funds and storage capacity, the author studied how to select the small and medium-sized enterprise. The results showed that risk control is an important aspect of logistics alliance enterprises to development this business. Through the actual case, we found that, under the unified credit model, for logistics alliance, it is not higher interest, higher loans, even in some

cases, the logistics alliance will not grant the enterprise loans. It's the same way that it is not lower enterprise's risk, higher loans, instead that the limits of credit funds, inventory and considering the interest rate and the risk weight for the influence of total utility obtained for logistics alliance should be considered.

REFERENCES

- [1] Albert Rakish, 'Economic Aspects of Inventory and Receivable Financing', *Law and Contemporary Problems*, 13-4 (1948), 566-578.
- [2] Daniel Granot Greys Sosic, 'Formation of Alliances in Internet-Based Supply Exchanges', *Management Science*, 51-7 (2005), 92-104.
- [3] He Juan, 'The Creation of FTW Risk Evaluation Index System[A]', *Enterprise Economy*, 6 (2008), 1227-1229.
- [4] He Shengyu, Guo Xiaolin, *Logistics Alliance Research*, China Economic Publishing House, 2009.
- [5] Lili, 'On Selection of Small-or-Medium-Size Enterprises by a 3-Party Logistics under Unified Credit Mode', *Industrial Journal*, 4-8 (2010), 48-52.
- [6] Luo Qi, Zhu Daoli, Chen Buoming, 'A Third-party Logistics Service Innovation: Financing Warehouse and Its Operation Model', *China Business and Market*, 16-2 (2002), 11-14.
- [7] Pang Yan, Pan Yongting, 'Logistics for Agricultural Products Enterprises Financial Profit Model Study', *Enterprise Economy*, 8-10 (2013), 40-43.
- [8] Wang Bing, 'Threats and Opportunities for the Development of Logistics Alliance in China' *Logistics Technology*, 4 (2010), 29-33.
- [9] Yang Linlin, Zhu Donghong, 'Analyze the Risk and control of FTW Collateral in Unified Credit Mode', *Logistics Sci-Tech*, 1-2 (2013), 44-48.
- [10] Yu Ping, Feng Yu, Feng Gengzhong, 'The Contract Choice About Credit and Logistics Enterprise', *Finance and Economy*, 22-10 (2007), 25-27.