Investigation of Economic Financing Mode Management of Supply Chain in Pharmaceutical Enterprises

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In China, small and medium-sized pharmaceutical enterprises are a special group of enterprises, which not only make a significant contribution to the national economy, but also play a significant role in the livelihood. However, due to the relatively small size of small and medium-sized enterprises, capital shortage is very likely to occur in the development process, and the high investment and high risk in the pharmaceutical industry can lead to financing difficulties. In order to solve the above problems, this paper briefly introduces the situation of capital shortage in the supply chain of small and medium-sized pharmaceutical enterprises and the receivable financing mode used to solve the problem of capital shortage. After that, five experts evaluated six factors influencing financing efficiency, namely, financing cost, risk, term, institutional norms, degree of freedom and capital arrival rate, of enterprise X. A comprehensive fuzzy evaluation model is used to evaluate the efficiency and possibility of four receivables financing modes. The results showed that the weight A of the six factors; the efficiency of four receivables financing modes is non-recourse factoring mode, recourse factoring mode, pledge mode and securitization mode, from high to low. This led to the conclusion that enterprise X should give priority to the receivables financing mode without recourse factoring.

Keywords: pharmaceutical enterprise, receivable financing model, fuzzy comprehensive evaluation, supply chain

1. INTRODUCTION

Currently, small and medium-sized pharmaceutical enterprises have great potential for competition in China's pharmaceutical market. Therefore, it is supported by relevant national policies and has made important contributions to China's economic development. However, limited by the size of enterprises and the fact that most of them are just starting businesses, it is often easy to suffer from capital shortage. [1] Proposing financing to financial institutions has become

the main means to solve this problem. At present, small and medium-sized pharmaceutical enterprises are financed more by bank credit. However, in the traditional credit model, [2] these small and medium-sized pharmaceutical enterprises are affected by their insufficient development and imperfect bank credit mechanisms, which leads to a long-term low credit rating and difficulty in obtaining credit financing. Financing difficulties for small and medium-sized pharmaceutical enterprises are as follows. The first is that the small and medium-sized pharmaceutical enterprises are often in urgent need of loans and are high risk. Second, small and medium-sized pharmaceutical enterprises are not large enough in scale and have a lack of stable capital accumulation. At the same time, due to their small scale, they

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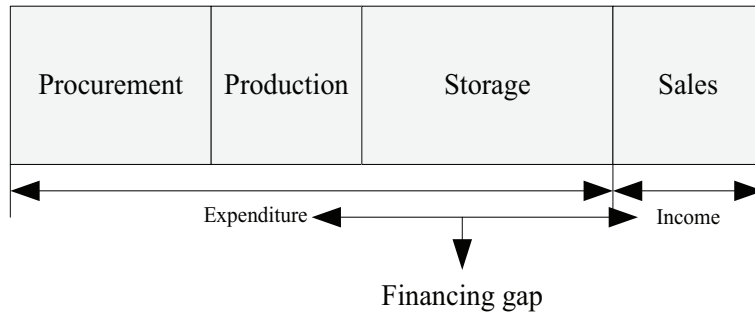
Procurement	Production	Storage	Sales

Expenditure ◄——————► Income

Financing gap

Figure 1 Schematic diagram of shortage of funds in pharmaceutical enterprises.

lack awareness of financial risks. Third, due to the small scale, the overall assets of small and medium-sized pharmaceutical enterprises have more liquid assets, and the changes are fast, which makes it difficult to get mortgage loans. Finally, small and medium-sized enterprises usually start quickly or have low operating income, which leads to a higher operating risk in the evaluation by financial institutions. These are the reasons why financing of small and medium-sized pharmaceutical enterprises is difficult.

At this time, supply chain finance, a new financing mode [3] was proposed, which connected financial institutions, small and medium-sized enterprises in the supply chain with logistics, and alleviated the financing difficulty of small and medium-sized pharmaceutical enterprises. Yan et al. [4] designed a supply chain financial system (SCF) consisting of retailers, manufacturers and commercial banks with limited funds, and a two-layer Stackelberg game model with banks as leaders was established. They compared and analyzed the optimal strategies in financing schemes such as traditional supply chain without capital constraint, SCF without credit guarantee and SCF with full credit guarantee. The results showed that, based on the appropriate guarantee coefficient, some credit guarantee contracts can realize the profit maximization and channel coordination of the supply chain system and achieve the super coordination effect. Yan et al. [5] established a two-layer Stackelberg game model with banks having the leading role and manufacturers as the auxiliary for the supply chain financial system. Through the comparison with two typical cases of non-financing scheme and unlimited credit line financing schemes, the important interaction between operation decision and financial decision in the supply chain financial system was found. The conclusion was that different interest rates and credit lines affect supply chain operation. Jin et al. [6] studied a supply chain financing system composed of retailers, suppliers and risk-averse banks with limited funds. By introducing the insurance policy into the supplier financing model, a mathematical optimization model was established, from which the optimal inventory and insurance decisions under different circumstances are derived, namely, the insurance without information, the insurance with information symmetry and the insurance with information asymmetry. In this paper, five experts were employed to evaluate six factors affecting financing efficiency, namely, financing cost, risk, term, institutional norms, degree of freedom and capital arrival rate of enterprise X. A comprehensive fuzzy evaluation model was used to evaluate the efficiency and possibility of four receivables financing models.

2. FINANCING MODEL

With the development of the economy, the market competition at home and abroad is more and more fierce, and the division of labor in social and economic activities is more and more complex and detailed. For large enterprises, due to their relatively independent industrial chain, social division of labor and relatively free distribution of resources, they are less impacted by competition than small and medium-sized enterprises. For more small and medium-sized enterprises, which are important components of the national economy, due to their small size, it is difficult to gain a foothold in the fierce competition market by relying on their own resources. Therefore, small and medium-sized enterprises need to keep close contact with other enterprises in the upstream and downstream of their supply chain, and strive for enough external financing to help their own development.

As shown in Figure 1, the supply chain of small and medium-sized pharmaceutical enterprises is divided into procurement, production, storage and sales. [7] In the three links before the sales link, the enterprise's capital is in the state of expenditure, even in the sales link, before the income is in the state of expenditure. Therefore, it can be found that the capital gap of enterprises mostly appears in the purchase, production and sales links. In view of the above supply chain financing problems, receivable financing mode can be adopted.

Receivables financing mode [8] is that small and medium-sized pharmaceutical enterprises apply for financing from banks and other financial institutions, similar to traditional credit loans, but the collateral for financing, the receivables from the buyer will be obtained by the enterprise. For the treatment of accounts receivable, this mode can be divided into accounts receivable pledge financing and accounts receivable buyout financing. For the treatment of accounts receivable, this mode can be divided into accounts receivable pledge financing and accounts receivable buyout financing, both of which mortgage the relevant authority of accounts receivable to the bank. But the difference is that the latter will inform the buyer to deliver the money to the bank, and the former is more suitable for the medical enterprise in urgent need of money.

Accounts receivable financing mode connects the supply chain of enterprises with financial institutions, and its process [9] is shown in Figure 2. Firstly, the seller, i.e. small and medium-sized pharmaceutical enterprises, signs a transaction contract with the buyer, i.e. the core enterprise downstream of the supply chain, and delivers the goods stored in the warehouse. Secondly, the buyer shall check and verify the
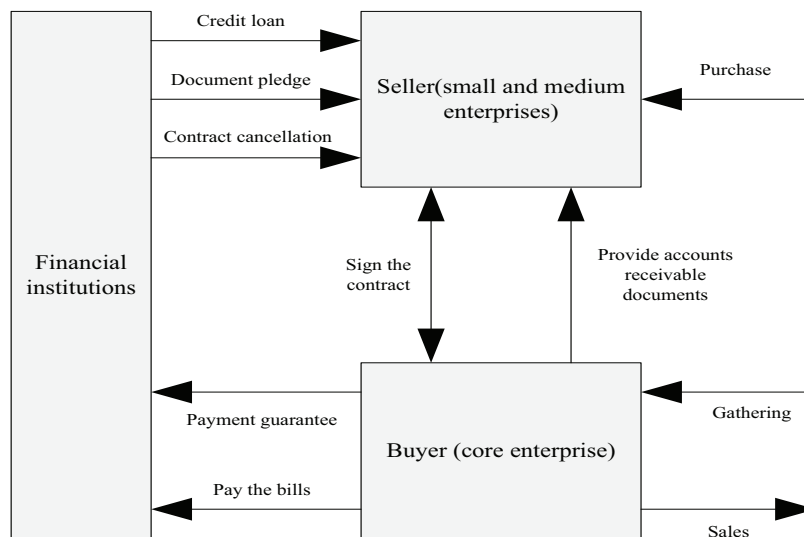
Figure 2 Receivable financing mode flow.

goods upon receipt of the goods, issue accounts receivable documents and deliver them to the seller after passing. Thirdly, after the seller gets the documents, it uses them as collateral to apply for loans from banks and other financial institutions, while the buyer makes a guarantee for the seller and makes a payment commitment to the financial institutions. Fourthly, after the documents are examined and approved, the financial institution shall lend money to the seller according to the stipulated standards. Fifth, after receiving the loan, the seller uses it to purchase raw materials for production to produce the next batch of products. Sixth, the downstream buyer sells the goods and obtains payment. Seventh, the buyer shall make payment to the financial institution after receiving the payment. Finally, the financial institution shall cancel the contract between the seller and the institution after receiving the payment.

3. CASE ANALYSIS

3.1 Basic Information of Enterprise X

3.1.1 Background Information

Enterprise X is a pharmaceutical circulation enterprise in XX province, which mainly produces drugs for treating infectious diseases. Its main business is the wholesale and retail of drugs, health care products and medical equipment. The main business objects are large medical institutions and chain drugstores. Its business model is shown in figure 3. Raw materials are purchased from raw material suppliers. After producing the goods, they are wholesaled to large medical institutions and retailed to chain drugstores.

3.1.2 Enterprise Accounts Receivable

As shown in Table 1, in recent years, the operating income of enterprise X has been constantly increasing. However, there are a lot of accounts receivable shares in the process, indicating that credit sales exist in the process of increasing business income. [10] It can be found from the table that in recent years, accounts receivable accounts for about 50% of total assets in the medium and long term and accounts for about 30% of operating income. Although accounts receivable with a higher proportion makes the total assets of the enterprise appear to have increased significantly, in fact accounts receivable does not belong to working capital and cannot play a substantial role in production and operation. At the same time, the growth rate of total assets and operating income is about half of that of accounts receivable. In the long run, it will lead to rapid growth of the total revenue of the apparent enterprise, but the actual lack of liquidity to maintain production and operation.

3.2 Analysis of Receivable Financing Mode of Supply Chain

3.2.1 Factors Set

The financing efficiency of an enterprise's supply chain accounts receivable is affected by many factors. This paper refers to several factors recognized academically at present, and finally selects cost, risk, deadline, institutional norms, freedom of freedom and capital arrival rate as factors affecting the efficiency of receivable financing. [11] Therefore, different weights should be given to different factors. [12]

3.2.2 The Weight Set

Although the six main factors affecting financing efficiency are selected, the effect of each factor on financing efficiency is different in the actual evaluation. As shown in table 2, different evaluation languages are used to reflect the weight of factors, and the language is converted into triangular fuzzy number for quantitative analysis. This paper invited 5 professionals to evaluate the six factors selected. In this paper, five professionals are invited to evaluate the six factors selected. The evaluation terms are limited to the language in table 2. At the same time, since five experts have different qualifications and opinions, the evaluator should be given weight to ensure the objectivity of the evaluation.
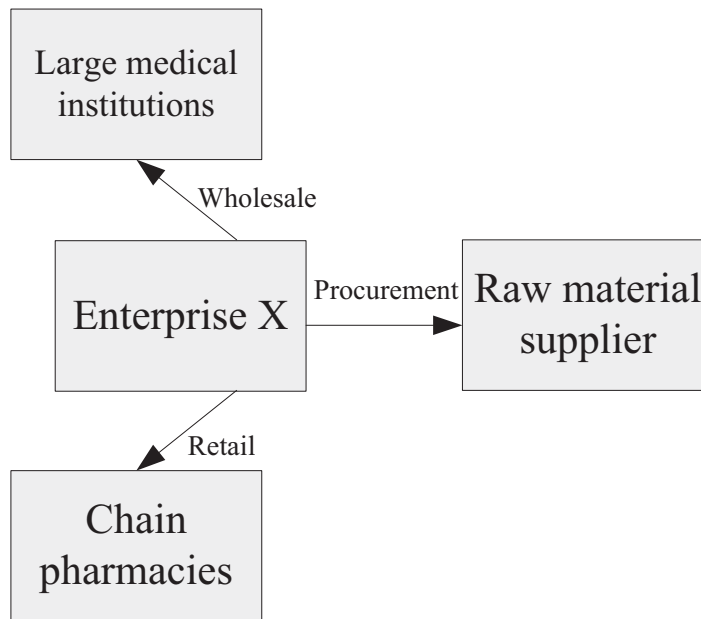
Figure 3 Business model of enterprise X.

Table 1 Accounts receivable proportion of enterprise X in recent years.

Annual	Accounts receivable/ten thousand yuan	Total assets/ten thousand yuan	Proportion / %	Operating income/ten thousand yuan	Proportion / %
2012	3878	7869	49.28	13641	28.43
2013	4735	10145	46.67	17791	26.61
2014	6698	13491	49.65	22741	29.45
2015	9008	18681	48.22	28281	31.85
2016	11591	21525	53.85	32539	35.62

Table 2 The language used to reflect the weight and the corresponding triangular fuzzy number.

A language that reflects weights	Triangular fuzzy number
Make a big difference	(0.8,1.0,1.0)
Great influence	(0.5,0.8,1.0)
Affect the general	(0.2,0.5,0.8)
Less affected	(0.0,0.2,0.5)
Basically no effect	(0.0,0.0,0.2)

In this paper, the weight of experts is set as 0.3, 0.3, 0.2, 0.1, and 0.1 according to their work experience.

3.2.3 Evaluation Sets

The evaluation set is the collection of evaluation results of various factors. The impact of various factors on financing efficiency is evaluated as high or low.

3.2.4 Membership

Membership [13] is the possibilty of making an evaluation on the evaluation object under a certain project, and the value range is between 0 and 1. There are three modes of receivables financing: pledge, factoring and securitization, among which factoring is divided into non-recourse factoring and recourse factoring. The pledged financing mode is the mode of applying for financing from financial institutions with accounts receivable as collateral. The pledged accounts receivable has the right to be disposed of freely or by a third party. This financing mode is usually applied when the enterprise is in urgent need of funds, which belongs to short-term financing. Factoring financing mode is a mode in which the receivables generated after the transaction between small and medium-sized enterprises and core enterprises are transferred to factoring companies to obtain financing. The factoring company is usually a commercial bank, and the bank is the new creditor after the transfer. The risks arising from receivables shall be borne by the bank. Among them, the factoring with recourse fails to transfer the risk to the bank completely, while the factoring without recourse transfers the risk to the bank completely. Securitization mode is a financing mode that converts receivables into securities in asset securitization institutions and then puts them into capital pools to issue securities in the financial market. The membership degree of the six influencing factors in the

Table 3 The degree of membership of influencing factors under different accounts receivable financing modes.

Financing model	Membership	Cost	Risk	Deadline	System specification	Degrees of freedom	Capital arrival rate
The pledge way	High	0.8	0.4	0.3	0.7	0.4	0.9
	Low	0.2	0.6	0.7	0.3	0.6	0.1
Non-recourse factoring	High	0.4	1.0	0.8	0.7	1.0	0.5
	Low	0.6	0.0	0.2	0.3	0.0	0.5
Factoring with recourse	High	0.7	0.6	0.5	0.8	0.7	0.6
	Low	0.3	0.4	0.5	0.2	0.3	0.4
Securitization mode	High	0.8	0.1	0.4	0.2	0.8	0.2
	Low	0.2	0.9	0.6	0.8	0.2	0.8

four methods is shown in table 3. For enterprises, efficient financing efficiency is conducive to their development. Based on the above data, this paper made a comprehensive judgment on the most efficient of the four methods.

3.3 Analysis Results of Receivable Financing Mode

(1) Weight of six influencing factors

According to the triangular fuzzy number in table 4 and the expert weight set above, weight A of the six factors was obtained by using the formula: [14] Triangular matrix function = expert weight * triangular fuzzy number matrix, and normalization. The weight A of the six factors is 0.25, 0.23, 0.15, 0.05, 0.1, and 0.23.

(2) Four kinds of fuzzy comprehensive evaluation of financing efficiency

According to Table 3, four evaluation matrices are established.

$$P_{Pledge} = \begin{bmatrix} 0.8 & 0.2 \\ 0.4 & 0.6 \\ 0.3 & 0.7 \\ 0.7 & 0.3 \\ 0.4 & 0.6 \\ 0.9 & 0.1 \end{bmatrix}$$

$$P_{\text{Non - recourse factoring}} = \begin{bmatrix} 0.4 & 0.6 \\ 1.0 & 0.0 \\ 0.8 & 0.2 \\ 0.7 & 0.3 \\ 1.0 & 0.0 \\ 0.5 & 0.5 \end{bmatrix}$$

$$P_{\text{Factoring with recour}} = \begin{bmatrix} 0.7 & 0.3 \\ 0.6 & 0.4 \\ 0.5 & 0.5 \\ 0.8 & 0.2 \\ 0.7 & 0.3 \\ 0.6 & 0.4 \end{bmatrix}$$

$$P_{\text{Securitization}} = \begin{bmatrix} 0.8 & 0.2 \\ 0.1 & 0.9 \\ 0.4 & 0.6 \\ 0.2 & 0.8 \\ 0.8 & 0.2 \\ 0.2 & 0.8 \end{bmatrix}$$

Then the efficiency of the four receivables financing models is calculated according to the fuzzy comprehensive evaluation formula [15] $N = A \otimes P$ where N is the comprehensive evaluation model, and $\otimes$ is the synthesis method of weight and evaluation matrix. The comprehensive evaluation of the final financing efficiency is shown in table 5:

As shown in Figure 4, the efficiency of four receivables financing modes is non-recourse factoring mode, recourse factoring mode, pledge mode and securitization mode, from high to low. Among them, the probability of high financing efficiency of non-recourse factoring is 69.9%, the probability of high financing efficiency of recourse factoring is 63.1%, the probability of high financing efficiency of pledge is 53.8%, and the probability of high financing efficiency of securitization is 42.2%. That is to say, through the evaluation of the six influencing factors of the enterprise, five experts finally found that the enterprise's choice of non-recourse financing mode of receivable financing has the greatest possibility to make the financing efficiency high. In conclusion, enterprise X should give priority to factoring without recourse when choosing the receivables financing mode, and then consider other financing modes to improve the financing efficiency of the enterprise.

4. ANALYSIS

The financing mode based on supply chain is divided into: pledge mode, recourse and non-recourse factoring mode and securitization mode. In the case of Company X, the above four supply chain financing modes were analyzed. The first is financing cost, which is essentially the reward provided by one party who uses capital to one party who owns capital The institution that provides the loan in the pledge will make a comprehensive evaluation on the enterprise and its downstream customers and approve the corresponding

Table 4 The triangular fuzzy number of the evaluation of influencing factors by different experts.

Factors	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5
Cost	(0.8,1.0,1.0)	(0.5,0.8,1.0)	(0.5,0.8,1.0)	(0.8,1.0,1.0)	(0.5,0.8,1.0)
Risk	(0.5,0.8,1.0)	(0.8,1.0,1.0)	(0.5,0.8,1.0)	(0.5,0.8,1.0)	(0.5,0.8,1.0)
Deadline	(0.5,0.8,1.0)	(0.2,0.5,0.8)	(0.2,0.5,0.8)	(0.0,0.2,0.5)	(0.0,0.2,0.5)
System specification	(0.0,0.2,0.5)	(0.0,0.0,0.2)	(0.0,0.2,0.5)	(0.0,0.0,0.2)	(0.2,0.5,0.8)
Degrees of freedom	(0.2,0.5,0.8)	(0.0,0.2,0.5)	(0.2,0.5,0.8)	(0.2,0.5,0.8)	(0.0,0.0,0.2)
Capital arrival rate	(0.5,0.8,1.0)	(0.5,0.8,1.0)	(0.8,1.0,1.0)	(0.5,0.8,1.0)	(0.8,1.0,1.0)

Table 5 Efficiency distribution of four receivables financing modes.

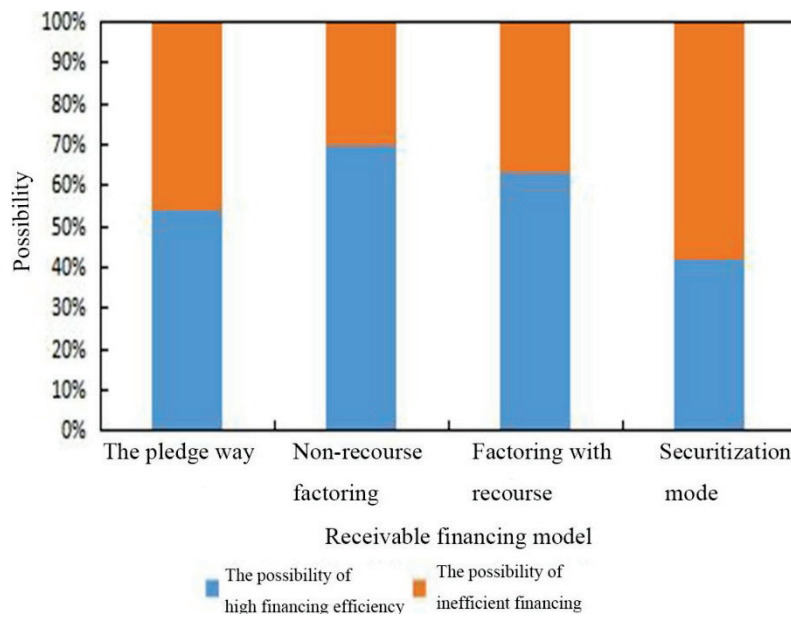| Financing model	The pledge way		Non-recourse factoring		Factoring with recourse		Securitization mode	
The financing efficiency	High	Low	High	Low	High	Low	High	Low
Possibility	0.538	0.462	0.699	0.301	0.631	0.369	0.422	0.578

Figure 4 Probability distribution of high and low efficiency of four receivables financing mode.

amount. 80% of the corresponding amount can be obtained at most if the quality of receivables of Company X is excellent. Considering the interest after one year which is the time limit for pledge credit, the cost rate is 4.67%. In the factoring mode, in addition to the normal loan interest, the enterprise also needs to pay a certain factoring rate. As the nonrecourse factoring completely transfers the risk to the bank, the factoring rate is higher generally, and the cost rate of the recourse and non-recourse factoring is 4.88% and 4.95% respectively. In the securitization mode, the enterprise gives the loan to the corresponding institution and then divides its future cash flow generated into different shares of securities for sale, and the loan and interest are repaid with the funds raised by the sale of securities. In addition, the cost of securitization includes the financing expenses, so the cost rate is 4.08%. On the premise that other conditions of the four modes are similar, the lower the cost of financing, the higher the efficiency of financing. In respect to the financing risk, the way the pledge takes the transaction between enterprises as

the guarantee of loan, means the risk remains in the enterprise itself; once the transaction between enterprises breaks, it will be difficult to repay the loan. As a small and medium-sized pharmaceutical enterprise, the downstream customers of Company X also include retail customers such as drugstores in addition to stable hospitals, which are relatively unstable. In recourse factoring, there are still some risks because of the reservation of recourse. In non-recourse factoring, there are basically no risks for enterprises because the creditor's rights are completely transferred to banks. The securitization mode is similar to the factoring mode, which completely transfers the power of receivables to banks, so there is basically no risk in credit, but the return of funds is slow because of the small scale, small fame and low recognition and poor circulation of security, and the inflation and policy adjustments in that period may lead to difficult recycling of the principal. In terms of financing term, the pledge mode is limited to line of credit within one year, while the factoring mode has no time limit due to the transfer of loan ownership, and there was

also no time limit for securitization, but interest shall be paid regularly. In terms of the regulation of financing system, it is more dependent on the maturity of the capital market. The higher the regulation, the more likely the banks are to adopt the factoring mode, so the system is more standardized. As the securitization mode is still in the initial stages, the regulation system is not complete. In terms of financing freedom, the pledge mode is the most restricted, so it is necessary to indicate the purpose of the loan, while factoring and securitization do not have to bear the risk because of the transfer of power, and the purpose of the loan is not limited. In terms of the fund availability rate of financing, in pledge and factoring modes, the enterprise needs to be audited. In particular, the factoring mode transfers risks to the factoring business, which will be more strict in the audit. The securitization mode has more complicated operations, involves more institutions, and has the lowest fund availability rate. Based on the above analysis, it is concluded that the non-recourse factoring mode is more suitable for Company X

5. CONCLUSION

Firstly, this paper briefly introduced the shortage of funds in the supply chain of small and the receivable financing mode used to solve the problem of capital shortage. Then, five experts evaluated six influencing factors of enterprise X. A comprehensive fuzzy evaluation model was used to evaluate the efficiency and possibility of four receivables financing modes. The results are as follows. First, based on expert weight and the triangular fuzzy number of experts' evaluation on the six factors, the weight A of the six factors, cost, risk, duration, institutional norms, degree of freedom and capital availability, was obtained, 0.25, 0.23, 0.15, 0.05, 0.1 and 0.23, respectively. Second, the efficiency of four receivables financing modes was calculated based on weights of the six factors and the membership of the six factors under the four receivables financing modes the using fuzzy comprehensive evaluation formula. The efficiency of the four modes was non-recourse factoring mode, recourse factoring mode, pledge mode and securitization mode, from high to low. The enterprise should give priority to non-recourse factoring when choosing accounts receivable financing mode.

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