

Research on Supplier Evaluation Based on Entropy Method and TOPSIS

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Abstract: When purchasing raw materials, production enterprises should fully consider the reliability of suppliers, so as to enable enterprises to achieve the highest profits while operating normally. This paper makes a self-made scoring system and establishes an evaluation model of influencing factors. Analyze the influencing factors that affect the importance of suppliers on the known data sheets as the evaluation criteria. According to the supplier's ordering and supply data, a scoring system was made, and the scores of 402 suppliers were used as the original information matrix of entropy weight method to determine the weights. The TOPSIS model was established to evaluate the importance of 402 suppliers.

1. Introduction

The formation of supply chain competitive advantage requires not only the performance of individual enterprises, but also the comprehensive performance of suppliers. In today's fierce and uncertain competitive environment, effective supplier management is the key to meet the rapidly changing needs of customers. Therefore, supplier management has become one of the important contents of supply chain management.

2. Supplier Evaluation Model Based on Entropy Method and TPOSIS

Knowing the ordering data and supply data of 402 suppliers in recent 5 years, in order to find out important suppliers, we must first determine which factors affect the importance of suppliers, that is, which indicators can be used as plus items and which indicators can be used as minus items of suppliers. Through data charts and analysis, it can be found that the total supply quantity (as shown in Figure 1), supply times (as shown in Figure 2) and supply quality (the ratio between the difference between supply quantity and order quantity and order quantity) of 402 suppliers in recent 5 years are quite different. These are all factors that affect the importance of suppliers. In order to develop normally, an enterprise must have sufficient raw materials and deliver them continuously. Therefore, the more the total supply, the better the supplier, the more the supply times, and the higher the supply quality. These three factors will become the main factors affecting the importance of suppliers. On this basis, the supplier evaluation model can be established.

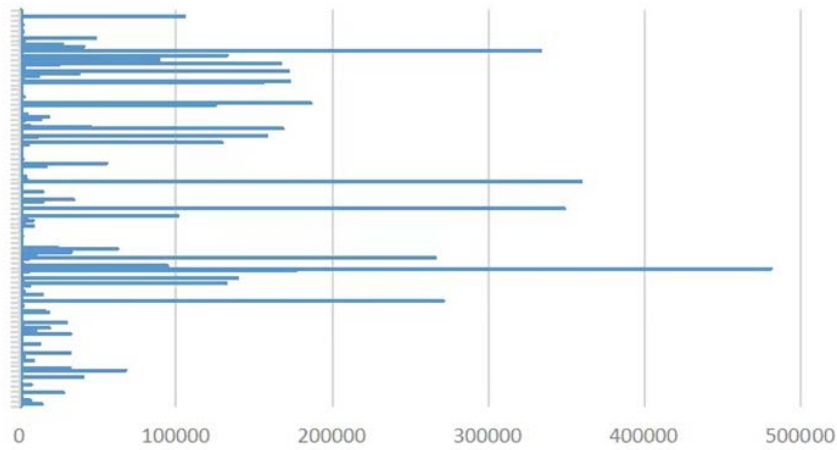


Figure 1: Comparison of total supply of 402 suppliers in recent 5 years.

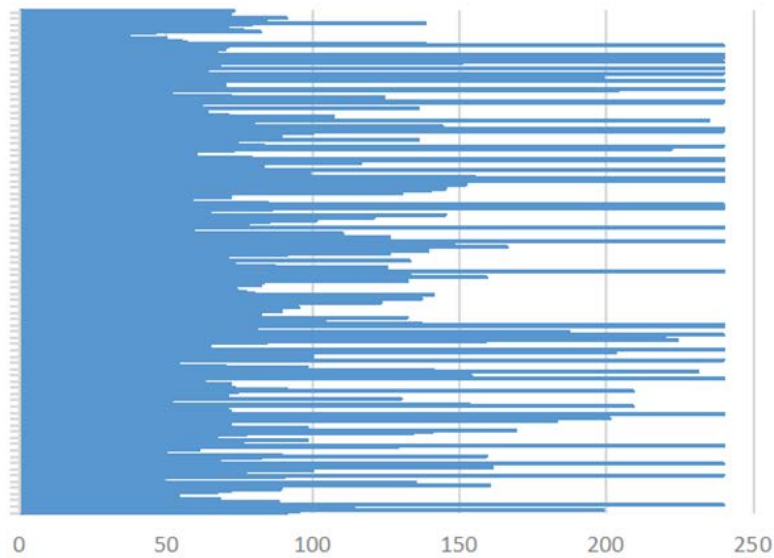


Figure 2: Comparison of supply days of 402 suppliers.

•Entropy method gives weight to influencing factors.

Establish a judgment matrix for three influencing factors of 402 suppliers [1].

$$X = (x_{ij})_{mn} \quad (i = 1, 2, \dots, m, j = 1, 2, \dots, n)$$

$$X = (x_{ij})_{mn} = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{i1} & \cdots & x_{ij} & \cdots \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{pmatrix}$$

In which $m=402$ and $n=3$.

Standardize the judgment matrix.

$$r_{ij} = \frac{x_{ij} - \min\{x_{ij}\}}{\max\{x_{ij}\} - \min\{x_{ij}\}}$$

The entropy of three influencing factors of 402 suppliers is: [2].

$$H_j = -\frac{1}{\ln m} \sum_{i=1}^m f_{ij} \ln f_{ij}$$

Among them, f_{ij} is the characteristic proportion of the i -th object, in order to break the limitations of the traditional entropy rights method, now improved $f_{ij} = \frac{r_{ij}+1}{\sum_{i=1}^m (r_{ij}+1)}$

Calculate the entropy weight of influencing factors of supplier importance.

$$\omega_j = \frac{1 - H_j}{n - \sum_{j=1}^n H_j}$$

•TOPSIS evaluation model

Known initial evaluation matrix.

$$X = (x_{ij})_{mn} \quad (i = 1, 2, \dots, m, j = 1, 2, \dots, n)$$

Normalize the initial matrix.

$$B = [b_{ij}]$$

$$b_{ij} = x_{ij} / \sqrt{\sum_{i=1}^m x_{ij}^2}$$

Establish a weighted judgment matrix.

$$C = \omega B = \begin{pmatrix} \omega_1 b_{11} & \omega_2 b_{12} & \cdots & \omega_n b_{1n} \\ \omega_1 b_{21} & \omega_2 b_{22} & \cdots & \omega_n b_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ \omega_1 b_{i1} & \cdots & \omega_j b_{ij} & \cdots \\ \vdots & \vdots & \vdots & \vdots \\ \omega_1 b_{m1} & \omega_2 b_{m2} & \cdots & \omega_n b_{mn} \end{pmatrix}$$

Acquisition of 402 suppliers in the weighted judgment matrix C^+ and negative idea C^-

$$\begin{cases} C^+ = \{c_{01}^+, c_{02}^+, \dots, c_{0n}^+\} = \max_{1 \leq j \leq n} \{c_{ij}\} \\ C^- = \{c_{01}^-, c_{02}^-, \dots, c_{0n}^-\} = \min_{1 \leq j \leq n} \{c_{ij}\} \end{cases}$$

Evaluate Euclidean distance between 402 suppliers and ideal solution.

$$\begin{cases} D^+ = \sqrt{\sum_{j=1}^m (c_{ij} - c_j^+)^2} \\ D^- = \sqrt{\sum_{j=1}^m (c_{ij} - c_j^-)^2} \end{cases}$$

Calculate the relative fit between the supplier and the ideal solution.

$$E_i = \frac{D_i^-}{D_i^+ + D_i^-}$$

3. Model Solving

Since there is no evaluation value of each supplier on the influencing factors, a self-made scoring system is made. The largest number of each influencing factor is rated as 100 points, the smallest is rated as 0 points, and the others are rated as specific scores according to equal scores to obtain the initial matrix X. [3]

After the entropy rights method, the weight of the three influenza is determined, and the result is $\omega_j = (0.5622, 0.2307, 0.2071)$, where the corresponding influencing factors are supplied, the number of supplies, supply quality.

The initial information matrix and weight matrix are brought into TOPSIS evaluation model, and finally the relative fit degree between 402 suppliers and ideal solution is obtained, which is sorted from big to small. The 50 suppliers with the highest relative fit degree are the 50 most important suppliers.

4. Conclusion

Firstly, this paper analyzes the influencing factors of supplier importance on the known data table. According to the ordering and supply data of suppliers, the scores of 402 suppliers are taken as the original information matrix of entropy method to determine the weights, and TOPSIS model is established to evaluate the importance of 402 suppliers. Finally, the top 50 suppliers are regarded as reliable suppliers.

References

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