Enterprise Ordering and Transportation Scheme Based on Entropy Weight TOPSIS Method

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Abstract. In this paper, we use the entropy weight TOPSIS method to quantitatively analyze the importance of suppliers to enterprises and establish a single objective function supplier selection model. Specifically, by checking the reliability of the data, the validity of the data in the attachment is guaranteed. The supplier's important metric system is constructed by using six indicators, and a single objective function is established to solve it by Lingo programming. In addition, the objective function aiming at the minimum number of suppliers and the objective function aiming at the minimum production cost of the enterprise is established, and the quantitative analysis method is used to consider the value of the transfer plan and the order plan. Furthermore, a dual-objective planning model aiming at enterprise storage costs and transportation costs is established, and the Lingo program is used to obtain the most economical ordering plan for the new enterprise in the next 24 weeks. Finally, the sensitivity of the considered models was analyzed by SPSS.

Keywords: entropy weight TOPSIS method; SPSS; multi-objective programming model; storage theory.

1. Research Background

The raw materials of a building board company can be divided into three types: A, B, and C. The company produces 48 weeks per year and needs to formulate 24-week raw material customization and transfer plan in advance. According to the weekly production capacity of the enterprise, the raw material ordering plan is formulated, and the forwarder is entrusted to transfer the supply to the enterprise warehouse [1].

In order to quantitatively analyze the importance of suppliers, it is based on supplier risk, order fulfillment rate, supply importance, market share, average supplier reputation, and coefficient of variation. The indicators are selected from these aspects, and the reliability of the given data is analyzed to determine whether the data is true or reasonable. Next, a quantitative index system of 402 suppliers is established, and the quantitative index system is comprehensively evaluated using the entropy weight TOPSIS method. Then, the objective function is established and solved to select the 50 most essential suppliers plan.

Under the premise of ensuring the capacity demand, an objective function with the minimum number of suppliers as the goal is established, which ensures the minimum number of the supplier. The constraints of the objective function are determined according to the actual situation. The minimum required number of suppliers can be obtained by substituting them into Lingo [2]. Then use the minimum order cost of the enterprise as the objective function to establish a model, use the Lingo program to solve the problem, get the demand for the three types of raw materials A, B, and C required, and allocate the order quantity according to the comprehensive ranking of suppliers, and determine the company's next 24 weeks order plan. Combining with the actual situation, the ordering plan of the enterprise is analyzed, and a dual objective function aiming at the lowest transportation cost and storage cost of the enterprise is established. The constraints are determined according to the actual

situation, and the Lingo program is used to solve the ordering plan and transshipment plan of the enterprise in the next 24 weeks.

2. Model Establishment and Solution

By substituting the data into SPSS for reliability analysis, the results are shown in Table I and Table II.

Table I. Summary of case handling

		Number of cases	%
case	efficient	402	100
	exclude	0	0
	total	402	100

Table 2. Reliability statistics

Cronbach	Cronbach based on normalization terms	Number of items
982	997	240

According to the market economic situation, there are six quantitative indicators of the characteristics of supplier selection by enterprises [9]. The selected indicators are as follows:

Supplier risk: Supplier risk is expressed through the length of the cooperation cycle between the enterprise and the supplier. The expression is as follows:

$$F_i = \frac{G0_i}{240} \tag{1}$$

Order fulfillment rate: an index to measure the supply capacity of an enterprise based on the order quantity. The formula is as follows:

$$c_i = \frac{\sum_{j=1}^{240} G_{ij}}{\sum_{j=1}^{240} D_{ij}} \times 100\% \tag{2}$$

Supply importance: use H_{ij} to represent the supply importance of the ith supplier in the jth week. $\overline{H}_i$ represents the average importance of the ith company, (i=1.2…402, j=1.2…240). The formula is as follows:

$$H_{ij} = \sum_{j=1}^{240} \frac{G_{ij}}{Z_j} \tag{3}$$

$$\overline{H}_i = \frac{H_{ij}}{240} \tag{4}$$

Market share: Indicates the market share of the product within the marketing scope of the S_i supplier. The formula is as follows:

$$S1_i = \frac{\sum_{j=1}^{240} GA_{ij}}{G_1} \tag{5}$$

$$S2_i = \frac{\sum_{j=1}^{240} GB_{ij}}{\mathrm{G}_2} \tag{6}$$

$$S3_i = \frac{\sum_{j=1}^{240} GC_{ij}}{\mathrm{G}_3} \tag{7}$$

Average supplier creditworthiness: The euclidean distance is used to describe the supplier creditworthiness, and the formula is as follows:

$$d_i = \sqrt{\sum_{j=1}^{240} (G_{ij} - D_{ij})^2} \ (i = 1.2 \ldots 402) \tag{8}$$

$$R_i = \frac{d_i}{240} \tag{9}$$

Coefficient of variation: The coefficient of variation indicates the stability of the supply and demand relationship between suppliers and enterprises. The expression formula is as follows:

$$E_{ij} = \frac{G_{ij}}{D_{ij}} \tag{10}$$

$$B_i = \frac{\sqrt{\frac{1}{240}\sum_{j=1}^{240}(E_{ij}-\overline{E_{ij}})^2}}{\frac{1}{240}\sum_{j=1}^{240}E_{ij}} \tag{11}$$

Where $\overline{E_{ij}}$ represents the average of the 240 weeks E_{ij} of the i-th supplier.

According to the solution formula of six quantitative indicators of supply characteristics and using Matlab software to program and calculate, six supply risk index data of 402 suppliers are obtained, and the data of the top 20 suppliers are shown in Table III.

Table 3. Data of the relevant evaluation indicators of the top 50 companies

ID	F_i	c_i	H_i	S_i	R_i	B_i
S001	0.127917	0.212121	0.000013	0.000033	0.298375	4.396070
S002	0.364067	0.883495	0.000071	0.000188	0.261141	1.722735
S003	0.878826	0.920092	0.003310	0.009071	3.070370	0.709185
S004	0.140262	0.089762	0.000016	0.000043	0.994036	3.861744
S005	0.494262	1.000000	0.001807	0.004757	0.242384	1.135986
S006	0.071875	0.064935	0.000007	0.000021	0.833833	7.552391
S007	1.290173	1.000000	0.001710	0.004782	1.245241	0.675941
S008	0.071250	0.436170	0.000010	0.000028	0.066275	7.348477
S009	0.074028	0.043357	0.000007	0.000021	1.827966	6.926694
S010	0.141076	0.295139	0.000043	0.000113	0.650454	3.812647
S011	0.159449	1.000000	0.000023	0.000059	0.023199	3.503273
S012	0.067500	0.094156	0.000008	0.000020	0.437103	8.061906
S013	0.109688	1.000000	0.000012	0.000030	0.018634	5.075147
S014	0.085417	0.875000	0.000006	0.000019	0.017678	6.316619
S015	0.081944	0.001004	0.000007	0.000019	43.906573	6.615130
S016	0.077292	0.973684	0.000008	0.000025	0.013819	6.704518
S017	0.115422	0.711340	0.000036	0.000095	0.129502	4.581875
S018	0.161146	0.584071	0.000016	0.000044	0.070341	3.557023
S019	0.064667	0.393502	0.000030	0.000073	0.331767	8.377906
S020	0.141146	0.393443	0.000018	0.000050	0.121264	3.789657

In order to eliminate the different influences of the dimension, positive, and negative directions of the indicators, the fuzzy membership method is used to standardize the data processing of the indicators. The normalization formula of the positive indicators can be as follows:

$$w_{in} = \frac{y_{in} - \min\limits_{1\le i\le 402} y_{in}}{\max\limits_{1\le i\le 402} y_{in} - \min\limits_{1\le i\le 402} y_{in}} \tag{12}$$

The negative indicator adopts the standardized formula:

$$w_{in} = \frac{\max\limits_{1\le i\le 402} y_{in} - y_{in}}{\max\limits_{1\le i\le 402} y_{in} - \min\limits_{1\le i\le 402} y_{in}} \tag{13}$$

In order to determine the weight of different supply characteristics of suppliers, the entropy weight method is used to calculate the index weight, and the importance weight of the supply characteristic index is determined. With the help of Matlab programming, the entropy value f_n, the difference coefficient g_n and the weight coefficient K_n is obtained. The specific data are shown in Table IV.

Table 4. Entropy value, difference coefficient, and weight coefficient value of each index

index	F_i	c_i	H_i	S_i	R_i	B_i
ej	0.987641	0.942771	0.598209	0.597273	0.641342	0.99948
gj	0.012359	0.057229	0.401791	0.402727	0.358658	0.00052
sj	0.010021	0.046403	0.32579	0.326548	0.290815	0.000422

Let y_{ij} be the weighted value of the normalized data of the nth indicator of the i-th small and medium-sized enterprise, w_{in} be the normalized value of the nth indicator observation value of the i-th small and medium-sized enterprise, and k_n is the weight coefficient. According to the weighting method, we can get:

$$y_{in} = w_{in}k_n \tag{14}$$

The weighted data of the top 20 companies are shown in Table V.

Table 5. Weighted data of 6 evaluation indicators of the top 50 companies

ID	F_i	c_i	H_i	S_i	R_i	B_i
S001	0.009068	0.009817	0.000033	0.000018	0.000242	0.000411
S002	0.007260	0.040993	0.000247	0.000225	0.000211	0.000418
S003	0.003318	0.042693	0.012205	0.012104	0.002585	0.000421
S004	0.008974	0.004135	0.000046	0.000031	0.000830	0.000412
S005	0.006263	0.046403	0.006658	0.006335	0.000195	0.000420
S006	0.009497	0.002982	0.000012	0.000002	0.000695	0.000402
S007	0.000168	0.046403	0.006299	0.006368	0.001043	0.000421
S008	0.009502	0.020221	0.000022	0.000012	0.000046	0.000402
S009	0.009481	0.001980	0.000012	0.000002	0.001535	0.000404
S010	0.008967	0.013672	0.000144	0.000126	0.000540	0.000413
S011	0.008827	0.046403	0.000070	0.000053	0.000010	0.000413
S012	0.009531	0.004339	0.000014	0.000001	0.000359	0.000400
S013	0.009208	0.046403	0.000030	0.000015	0.000006	0.000409
S014	0.009393	0.040599	0.000009	0.000000	0.000005	0.000405
S015	0.009420	0.000013	0.000013	0.000000	0.037102	0.000405
S016	0.009456	0.045181	0.000017	0.000008	0.000002	0.000404
S017	0.009164	0.032999	0.000118	0.000101	0.000099	0.000410
S018	0.008814	0.027089	0.000046	0.000033	0.000049	0.000413
S019	0.009552	0.018240	0.000096	0.000071	0.000270	0.000399
S020	0.008967	0.018237	0.000052	0.000041	0.000093	0.000413

By analyzing the weighted data matrix, it can be seen that there are many data equal to zero in the weighted matrix. Such data is meaningless and is not conducive to the calculation of the subsequent model evaluation. Therefore, such data is effectively processed, and the data is equal to 0 in the matrix. It is regarded as 1×10^{-6} because it occupies a small weight, it does not affect the evaluation of the index, and it is convenient to calculate the evaluation of the index [3].

The positive ideal solution of the evaluation system is:

$$y_n^+ = (y_1^+, y_2^+, \cdots, y_6^+) = (0.01002\ ,\ 0.04640,\ 0.32578,\ 0.32654,\ 0.29081\ 0.00042) \quad (15)$$

The negative ideal solution of the evaluation system is:

$$y_j^- = (y_1^-, y_2^-, \cdots, y_6^-) = (0.00001,\ 0.46403,\ 0.00033,\ 0.00033,\ 2.90815,\ 0.00422) \quad (16)$$

Let d_i^+ be the Euclidean distance between the ith enterprise and the positive ideal solution, and d_i^- be the Euclidean distance between the ith enterprise index and the negative ideal solution, which can be expressed as:

$$d_i^+ = \sqrt{(y_1^+ - y_{i1})^2 + (y_2^+ - y_{i2})^2 + \cdots + (y_6^+ - y_{i6})^2}$$

$$d_i^- = \sqrt{(y_1^- - y_{i1})^2 + (y_2^- - y_{i2})^2 + \cdots + (y_6^- - y_{i6})^2} \quad (17)$$

Let f_i be the relative closeness of all indicators of the ith enterprise to the ideal solution, which can be expressed as:

$$f_i = \frac{d_i^-}{d_i^- + d_i^+} \quad (18)$$

The development status of the evaluated index is determined by calculating the degree of closeness. The larger the relative closeness f_i is, the closer the evaluated index is to the ideal solution, the more important it can guarantee the production of the enterprise.

In order to describe the importance of ensuring the production of enterprises, we introduce a single-objective programming model. Supposing that the company needs to order three kinds of raw materials, A, B, and C, in a week, and the quantities of three kinds of raw materials are x_1, x_2, x_3, m^3 respectively. At this time, the satisfaction degree of the supplier for the raw material orders ordered by the company can be expressed by the following objective table function:

$$\text{Max } \frac{\frac{x_1 * c_{Ai}}{0.6} + \frac{x_2 * c_{Bi}}{0.66} + \frac{x_3 * c_{Ci}}{0.72}}{28200} \quad (19)$$

The magnitude of the importance of enterprise production is 0-1, so:

$$0 <= \frac{\frac{x_1 * c_{Ai}}{0.6} + \frac{x_2 * c_{Bi}}{0.66} + \frac{x_3 * c_{Ci}}{0.72}}{28200} <= 1 \quad (20)$$

The total supply always fluctuates around the average amount of raw material acquired, then:

$$h_{ij} = k \times S_{ij} \times H_{ij} \quad (21)$$

Through data analysis with Excel software, it is known that suppliers of A, B, and C raw materials cooperate with enterprises every week, which can be expressed as:

$$3 <= \frac{x_1}{h_{ij'}} + \frac{x_2}{,h_{ij''}} + \frac{x_3}{,h_{ij'''}} <= 402 \quad (22)$$

The difference between the total capacity in the cycle and the capacity provided by the supplier's total supply should be greater than or equal to meet the production demand for two weeks, so:

$$28200 \times 240 - \sum_{i=1}^{240} \frac{x_1 * c_{Ai}}{0.6} + \frac{x_2 * c_{Bi}}{0.66} + \frac{x_3 * c_{Ci}}{0.72} \geq 56400 \quad (23)$$

Objective function:

$$\text{Max } \frac{\frac{x_1 * c_{Ai}}{0.6} + \frac{x_2 * c_{Bi}}{0.66} + \frac{x_3 * c_{Ci}}{0.72}}{28200} \quad (24)$$

The following conditions:

$$St.\begin{cases} 0 <= \frac{\frac{x_1*c_{Ai}}{0.6}+\frac{x_2*c_{Bi}}{0.66}+\frac{x_3*c_{Ci}}{0.72}}{28200} <= 1 \\ h_{ij} = k \times S_{ij} \times H_{ij} \\ 3 <= \frac{x_1}{h_{ij}'} + \frac{x_2}{,h_{ij}''} + \frac{x_3}{,h_{ij}'''} <= 402 \\ 28200 \times 240 - \sum_{i=1}^{240} \frac{x_1*c_{Ai}}{0.6} + \frac{x_2*c_{Bi}}{0.66} + \frac{x_3*c_{Ci}}{0.72} \geq 56400 \end{cases} \tag{25}$$

After analyzing the importance of the enterprise and solving the above model through Lingo, it is found that the supplier's satisfaction degree for the raw material orders ordered by the enterprise is 0.4924, which reflects the importance of the enterprise's production. The amount of A-type raw materials that the enterprise needs to order every week is 0.4616m^3, the amount of B-type raw materials is 0.5076m^3, and the amount of C-type raw materials is 0.1669. Then it is concluded that the number of suppliers supplying A, B, and C raw materials is 7, 155, and 369, respectively. Therefore, the proportion of suppliers providing A, B, and C raw materials is 0.013, 0.292, and 0.695, respectively. Therefore, in the selected 50, the ratio of A, B, and C suppliers is 1:14:35 in the enterprise.

3. Production Demand Analysis

3.1. The choice of at least how many suppliers the enterprise needs to meet production needs

The quantitative analysis method is used to analyze the transshipment strategy and the ordering plan [8], and it is found that both of them meet the standards of the production demand of the enterprise. The guarantee of production capacity of the enterprise is guaranteed. Under the premise of meeting the safety production guarantee of the enterprise, supplying raw materials with the minimum number of suppliers is the main economic goal pursued by the enterprise [5]. The objective function is established as follows:

$$\text{Min X} = X_A + X_B + X_C \tag{26}$$

The company should choose no more than 146 suppliers of Category A, 134 suppliers of Category B, and no more than 122 suppliers of Category C.

The constraints on the weekly production capacity of enterprises are expressed as follows:

$$Q_{ij} = c_i \times (1 - U_i) \times G_{ij} \tag{27}$$

Average weekly fluctuating raw material availability for 50 suppliers:

$$\overline{Q_\iota} = \frac{\sum_{j=1}^{240} Q_{ij}}{240} \tag{28}$$

Where $\overline{Q_{A\iota}}$ represents the weekly average raw material supply of Class A suppliers, $\overline{Q_{B\iota}}$ represents the weekly average raw material supply of Class B suppliers, $\overline{Q_{C\iota}}$ represents the average weekly raw material supply of Class C suppliers. The final constraint is:

$$\frac{X_A\overline{Q_{A\iota}}}{0.6} + \frac{X_B\overline{Q_{B\iota}}}{0.66} + \frac{X_c\overline{Q_{c\iota}}}{0.72} \geq 28200 \tag{29}$$

Using the storage theory [10], the economic order batch storage model with short replenishment time, and referring to the average storage quantity formula of storage theory, the constraints are obtained as follows:

$$\frac{[(\frac{X_A\overline{Q_{A\iota}}}{0.06}+\frac{X_B\overline{Q_{B\iota}}}{0.66}+\frac{X_c\overline{Q_{c\iota}}}{0.72})-28200]\times T_1}{T} \geq 56400 \tag{30}$$

Objective function:

$$Min\ X = X_A + X_B + X_C \tag{31}$$

The following constraints are met:

$$St.\begin{cases} 0 \le X_A \le 146 \\ 0 \le X_B \le 134 \\ 0 \le X_C \le 122 \\ \overline{Q_{ij}} = \frac{\sum_{j=1}^{240} Q_{ij}}{240} \\ Q_{ij} = c_i \times (1 - U_i) \times G_{ij} \\ \frac{X_A\overline{Q_{Aij}}}{0.6} + \frac{X_B\overline{Q_{Bij}}}{0.66} + \frac{X_C\overline{Q_{Cij}}}{0.72} \ge 28200 \\ \frac{[(\frac{X_A\overline{Q_{Ai}}}{0.06} + \frac{X_B\overline{Q_{Bi}}}{0.66} + \frac{X_C\overline{Q_{Ci}}}{0.72}) - 28200] \times T_1}{T} \ge 56400 \end{cases} \tag{32}$$

With the help of Lingo software, the optimal solution is obtained.

3.2. The most economical raw material procurement plan for the next 24 weeks

The objective function is established as:

$$\text{Min}CB_t = 1.2zS_{at} + 1.1zS_{bt} + zS_{bt} \tag{33}$$

The objective function is the sum of the purchase price and the order quantity required for the three materials.

The constraints are established as follows:

$$\begin{gathered} \frac{S_{at}}{0.6} + \frac{S_{bt}}{0.66} + \frac{S_{ct}}{0.72} \ge 28200 \\ 0 \le S_{at} \le 16920 \\ 0 \le S_{bt} \le 18612 \\ 0 \le S_{ct} \le 20304 \\ 1 \le \text{t} \le 24 \\ \text{Cb} \in \text{R}^+ \end{gathered} \tag{34}$$

According to the objective function and its function constraints, the optimal values obtained by Lingo software are shown in Table VI.

Table 6. Purchases of A, B and C materials in the first 8 weeks

Material classification	W001	W002	W003	W004	W005	W006	W007	W008
A	2006	1138	993	1027	1155	1175	1299	1786
B	1174	9067	2549	2137	18037	2359	1979	2563
C	3180	10205	3542	3164	19192	3534	3278	4349

The supplier allocation strategy of supplying raw materials (t=1…24, v=A.B.C, i=1…402), is expressed as follows:

$$G_{it} = fv_{iv}S_{vt} \tag{35}$$

Based on the impact of the loss rate of the forwarder, the comprehensive supplier allocates the amount of the forwarder to the raw material based on the minimum loss. Based on meeting production needs, select the minimum number of suppliers to complete the ordering requirements of the enterprise, and then select the enterprise ordering plan from the perspective of cost selection, and use the quantitative analysis method to solve and analyze the ordering plan, and calculate the 24-week average of the enterprise Material cost consumption. The most economical method is used to allocate raw materials based on meeting production needs. From the perspective of the loss rate of the forwarder, the loss of raw materials during the transfer process is considered, and the company outsources the raw materials to the forwarder in the process of ordering raw materials. The lower the value, the less the loss of goods transshipment, the greater the receiving volume of the enterprise, the

lower the cost loss, and the more conducive to the production of the enterprise [4]. The quantitative analysis method is adopted to consider the values of the transshipment plan and the order plan, which are all within the acceptable range of the enterprise, and meet the uninterrupted production capacity of the enterprise, ensure the production of the enterprise, and reduce the cost of the enterprise operation effect [7].

3.3. The dual objective function programming model

The objective function of establishing the minimum transportation cost is [6]:

$$\text{Min } GB_i = \frac{f_0 X_{A0}(\overline{Q_{Ai}}+\Delta a)}{0.6} + \frac{f_0 X_{B0}\overline{Q_{Bi}}}{0.66} + \frac{f_0 X_{C0}(\overline{Q_{Ci}}+\Delta c)}{0.72} \tag{36}$$

The unit storage cost of the three raw materials is equal, so the storage cost correlates with the quantity of the three raw materials. The lower the average storage volume under production conditions, the lower the storage cost of the enterprise, and the minimum storage cost objective function is established:

$$\text{Min } CC_i = \left(\frac{\left[\left(\frac{X_{A0}(\overline{Q_{Ai}}+\Delta a)}{0.06} + \frac{X_{B0}\overline{Q_{Bi}}}{0.66} + \frac{X_{C0}(\overline{Q_{Ci}}+\Delta c)}{0.72} \right) - 28200 \right] \times T_1}{T} \right) - 28200 \tag{37}$$

The supplier's supply of raw materials must ensure that the weekly production capacity of the enterprise is:

$$\frac{X_{A0}(\overline{Q_{Ai}}+\Delta a)}{0.6} + \frac{X_{B0}\overline{Q_{Bi}}}{0.66} + \frac{X_{C0}(\overline{Q_{Ci}}+\Delta c)}{0.72} \geq 28200 \tag{38}$$

The unit material transportation cost f_0 is regarded as a constant because no specific value is given, $f_0 \in (1 \ldots \infty)$.

Among the 402 suppliers, the number of suppliers supplying A material X_{A0}, the number of suppliers supplying B material X_{B0}, and the number of suppliers supplying C material X_{C0}, which are specific values that can be obtained.

$$X_{A0} = 146, X_{B0} = 134, X_{C0} = 122 \tag{39}$$

Objective function:

$$\begin{cases} \text{Min} GB_i = \frac{f_0 X_{A0}(\overline{Q_{Ai}}+\Delta a)}{0.6} + \frac{f_0 X_{B0}\overline{Q_{Bi}}}{0.66} + \frac{f_0 X_{C0}(\overline{Q_{Ci}}+\Delta c)}{0.72} \\ \text{Min} CC_i = \left(\frac{\left[\left(\frac{X_{A0}(\overline{Q_{Ai}}+\Delta a)}{0.6} + \frac{X_{B0}\overline{Q_{Bi}}}{0.66} + \frac{X_{C0}(\overline{Q_{Ci}}+\Delta c)}{0.72} \right) - 28200 \right] \times T_1}{T} \right) - 28200 \end{cases} \tag{39}$$

Restrictions:

$$\text{St.} \begin{cases} 0 \leq \Delta a \leq \max Q_{Ai} \\ 0 \leq \Delta c \leq \max Q_{Ci} \\ f_0 \in (1 \ldots \infty) \\ X_{A0} = 146 \\ X_{B0} = 134 \\ X_{C0} = 122 \\ \frac{X_{A0}(\overline{Q_{Ai}}+\Delta a)}{0.6} + \frac{X_{B0}\overline{Q_{Bi}}}{0.66} + \frac{X_{C0}(\overline{Q_{Ci}}+\Delta c)}{0.72} \geq 28200 \end{cases} \tag{40}$$

Through the solution of the above-mentioned dual objective function programming model, the values of Δa and Δc are obtained. Through changing the supply situation of the two raw materials of suppliers AC to reduce the transportation cost and storage cost, and substitute it into Lingo to solve, formulate a new The ordering scheme of (, the ordering scheme of the top twenty suppliers are shown in Table VII.

Table 7. Ordering plans of the top 20 suppliers

ID	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
S001	0	0	0	258	0	266	0
S002	0	0	89	0	78	0	0
S003	176	128	153	89	38	17	35
S004	0	14	25	0	0	0	0
S005	0	0	0	0	19	0	0
S006	0	0	96	0	0	0	0
S007	45	0	20	17	13	18	16

In order to test the rationality of the model, the sensitivity analysis was performed on the data using SPSS software. The results obtained are shown in Fig. 1.

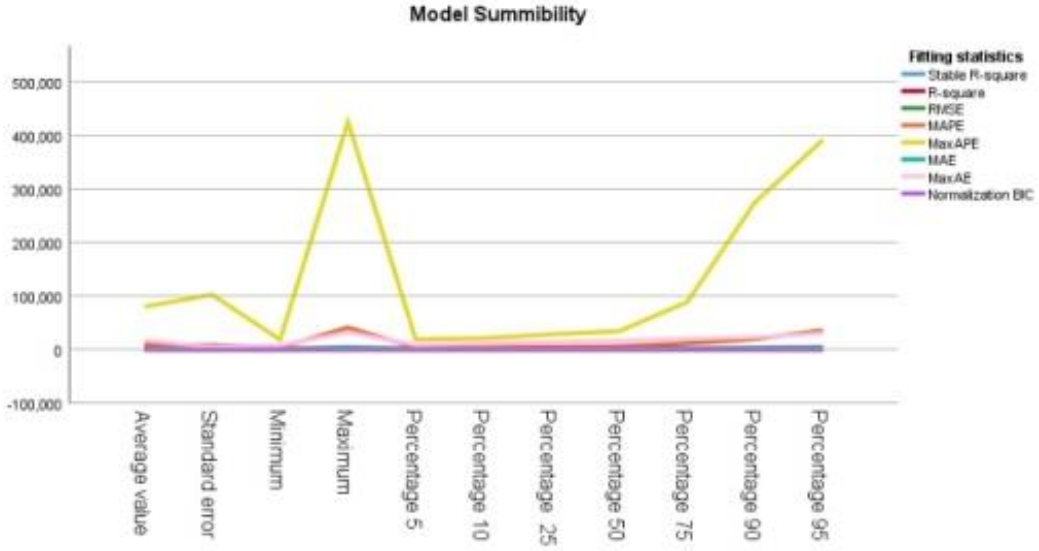


Figure 1. Fit analysis diagram.

4. Conclusion

This paper uses the entropy weight method combined with the multi-objective function method to determine the ordering and shipping plan. Six indicators are used to build the supplier's important measurement index system, and Lingo programming is used to establish the single-objective function to solve the supplier's important measurement index system. In addition, a dual-objective planning model for enterprise warehousing cost and transportation cost is established. Finally, using SPSS software to conduct sensitivity analysis on the obtained ordering and transshipment plan, it is found that the model has good stability and small fluctuation, which proves that the model has good stability and practicability.

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