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Research on Dynamic Scheduling Model Based on Priority Decision

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Abstract: In this paper, an improved optimization model and a matching algorithm based on priority decision are established to gradually optimize the ordering and shipping schemes, so as to achieve the purpose of reducing costs.First of all, topsis comprehensive evaluation model based on entropy weight method is established to determine the index weight, and the ranking of 402 suppliers is carried out. Finally, the top 50 most important suppliers are obtained through index scores.Then, the maximum capacity optimization model is established by constructing capacity threshold and referring to the maximum transshipment volume of the transporter and the supply quantity of the supplier. After calculation, the maximum capacity is 33,240 m^3, which is 17.87% higher than the initial capacity.

1. Introduction

With the improvement of market economy system, our country is stepping into the market - based competition mechanism[1]. In this environment, the competition in the construction market is increasingly fierce, and the profit space is becoming smaller.At the same time, on the basis of ensuring the smooth completion of construction projects to obtain higher economic benefits, which requires suppliers to provide low-cost, high-quality materials, so the optimization of cost expenditure is the key to improve economic benefits.

2. Model preparation and establishment

Combined with data characteristics, this paper aims to establish topsis comprehensive evaluation model based on entropy weight method to obtain the 50 most important suppliers. The steps of model establishment are as follows:

Step 1: Maximization of indicators.

This article selects seven indicators, respectively is the maximum supply quantity, supply frequency, supply quantity, supply rate, default rate, supply stability index and supplier substitution. This paper unified the indicators into maximization indicators [2].

Step 2: Normalization of indicators.

Before calculating comprehensive indicators, the forward indicators are standardized as follows:

$$x'_{ik} = \frac{x_{ik} - min\{x_{1k}, x_{2k}, \cdots x_{402k}\}}{max\{x_{1k}, x_{2k}, \cdots x_{402k}\} - min\{x_{1k}, x_{2k}, \cdots x_{402k}\}} \quad (1)$$

Step 3: Calculate the proportion of the ith supplier in the index of item k.

$$p_{ik} = \frac{x'_{ik}}{\sum_{i=1}^{402} x_{ik}} (i = 1,2 \cdots 402, k = 1,2 \cdots 7) \quad (2)$$

Step 4: Calculate the entropy value of item k.

$$e_k = -i \sum_{i=1}^{402} p_{ik} \ln(p_{ik}) \quad (3)$$

Step 5: Calculate information entropy redundancy.

$$d_k = 1 - e_k \quad (4)$$

Step 6: Calculate the weights of each indicator.

$$\lambda_k = \frac{d_k}{\sum_{k=1}^{7} d_k} \quad (5)$$

Step 7: Construct weighted normative decision matrix Z.

$$Z_{ik} = x'_{ik} \times \lambda_k, (\mathrm{i} = 1,2 \cdots 402, \mathrm{k} = 1,2 \cdots 7) \quad (6)$$

Step 8: Determine ideal solution and negative ideal solution, and calculate the comprehensive evaluation value. Suppose the ideal solution is Z^+ and the negative ideal solution is Z^-, then the comprehensive evaluation value is:

$$s_i = \frac{d_i^+}{d_i^+ + d_i^-} \quad (7)$$

Step 9: Evaluate the solution of the model.

MATLAB programming is used to find the importance of the descending ranking, and the most important 50 suppliers. The results are shown in the following table.

Table 1: Top 50 most important suppliers

1-10	11-20	21-30	31-40	41-50
S140	S308	S307	S364	S123
S348	S282	S194	S367	S266
S151	S340	S143	S346	S114
S229	S275	S352	S080	S314
S201	S329	S284	S294	S037
S361	S131	S247	S244	S338
S108	S356	S365	S218	S291
S374	S268	S031	S007	S086
S139	S306	S040	S150	S098
S330	S126	S055	S395	S076

Step 10: Finally, this paper normalized the scores obtained through Topsis and got the following figure.

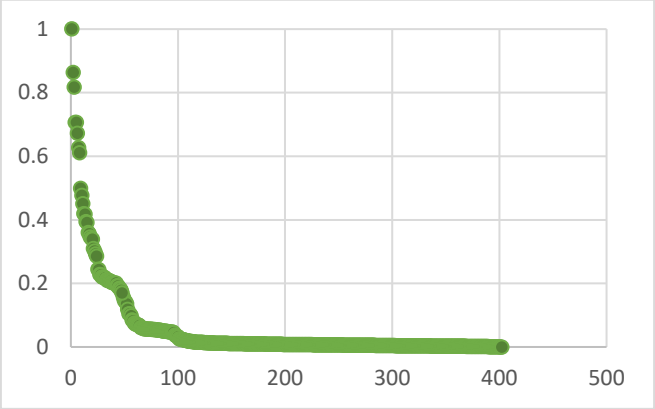

Figure 1: Normalized data

According to the distribution of each evaluation score, suppliers are ranked into four categories according to the distribution of score.The order of importance from large to small is (a) 1-8, (b) 9-42, (c) 43-96, (d) 97-402.

3. Model establishment and conclusions

3.1 Model establishment

Choosing the right supplier is an important way to realize the cost, quality and safety of construction projects, which is an important means to solve the low profit margin[3]. Therefore, in this paper, from the perspective of supplier selection, the production cycle and supply quantity of suppliers are regarded as quantitative indicators[4], which are given a weight of 0.5 after forward and standardized processing, and a maximum capacity optimization model is established.

1. Since this paper aims to obtain the maximum capacity of the enterprise, the threshold is set as F

2. In order to ensure a stable maximum supply, the weekly capacity constraint is obtained:

$$\frac{50}{30}\sum_{i=1}^{146}\bar{S}_i+\frac{50}{33}\sum_{i=1}^{134}\bar{S}_i+\frac{50}{36}\sum_{i=1}^{122}\bar{S}_i\geqslant F \tag{8}$$

3. Consider the supplier's production cycle and set cycle constraints:

$$P_i=[24(1-SF_i)] \tag{9}$$

4. Considering the upper limit of the transporter's transport capacity, the maximum transshipment volume constraint is obtained:

$$\begin{gathered}S_j=\sum_{i=1}^{402}x_{ij}s_i\leqslant 6000\times 8\\ x_{ij}=\{0,1\}\end{gathered} \tag{10}$$

To sum up, the ultimate enterprise maximum capacity optimization model can be obtained:

$$\text{s.t.}\begin{cases}\frac{50}{30}\sum_{i=1}^{146}\bar{S}_i+\frac{50}{33}\sum_{i=1}^{134}\bar{S}_i+\frac{50}{36}\sum_{i=1}^{122}\bar{S}_i\geqslant F\\ P_i=[24(1-SF_i)]\\ S_j=\sum_{i=1}^{402}x_{ij}s_i\leqslant 6000\times 8\\ x_{ij}=\{0,1\}\end{cases} \tag{11}$$

3.2 Matching algorithm based on priority decision

Considering the difference of weekly ordering scheme, this paper designs a forwarder matching algorithm based on priority decision.The specific steps are as follows:

Step 1: establish a 25*8 matrix of correspondence between 25 suppliers and 8 transporters.

Step 2: The intelligent priority decision algorithm traverses according to the time series.

Step 3: In order to achieve the purpose that raw materials supplied by one supplier are best transported by one transporter, for each supplier, 8 transporters are traversed, aiming to match the transporter with the lowest loss rate for the supplier.

Step 4: Considering the limited transportation capacity of the transporters, when there is no transporter with operational capacity that can transport independently among all the transporters, the algorithm will combine the transporters with lower attrition rate for its transportation.

Step 5: After matching all suppliers, generate corresponding charts automatically.

3.3 Model solving and conclusions

First of all, in order to explore the degree of capacity improvement, the initial capacity of 28,200m^3 is taken as the "basic capacity".In order to explore the maximum capacity, the "production capacity" is continuously improved by setting the range of "progress factor", and each "production capacity" is taken as the "learning sample".

This paper holds that when the "production capacity" is greater than the "basic capacity" and the "progress factor" is gradually reduced, the change of "production capacity" is small, it means that choosing this optimization scheme is more likely to obtain a better solution.When the "progress factor" gradually decreases so that the "production capacity" does not appear a larger value, the optimal solution can be considered to be found.

Finally, the maximum capacity is calculated to be 33,400 m^3, 17.87% higher than the initial capacity.

4. Evaluations of Model

4.1 Advantages

(1) Reasonable selection of indicators.This paper extracts indicators from three aspects respectively by consulting a large number of authoritative literatures and combining relevant knowledge of management and economics.

(2) The efficiency of Monte Carlo algorithm is improved by adjusting the "progress factor" in a clever way.

4.2 Disadvantages

(1) According to the particularity of individual suppliers, even if the data is five years, the information content is small and there are suspected outliers.

(2) According to the thesis, loss occurs during transportation, which is partly unprincipled.

References

[1] Wang Xuming.Research on optimal purchasing decision model of building materials in construction engineering [D]. Shenyang Jianzhu University, 2013.

[2] Ma Xiuli.Research on evaluation and selection of commodity concrete Suppliers of ANHUI DE Construction Company [D]. Anhui University of Science and Technology, 2020.

[3] Jiang Qiyuan, Xie Jinxing, Ye Jun.Mathematical Model (5th Edition) [M].Beijing: Higher Education Press.2018.
[4] Han Zhonggeng (eds.), Mathematical Modeling Method and Its Application, Beijing: Higher Education Press, 2005.