Alternative of raw material's suppliers using TOPSIS method in chicken slaughterhouse industry

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Abstract. Chicken slaughterhouse industry is one of the fastest growing industries that depends on the freshness of raw materials. The raw materials quality arrive at the company depends heavily on the suppliers. Fresh chicken and frozen chicken meat are the main raw materials for this industry. Problems occurred by the suppliers are catering the amount of raw material needs that are not appropriate and also delay during delivery process. This condition causes disruption of the production process in the company. Therefore, it is necessary to determine the best suppliers to supply the main raw materials of fresh and frozen chicken meat on the slaughterhouse chicken industry. This study analyze the supplier's capability by using TOPSIS method. This method use to find out the best supplier. The TOPSIS method is performed using the principle that chosen alternative must have the shortest distance from the positive solution and furthest from the ideal solution of the geometric point by using the Euclidean distance to determine the relative proximity of the optimum solution alternative. TOPSIS method found the rank of best supplier's order is supplier A followed by supplier D, supplier B, supplier C, supplier E, supplier F, and supplier G. Based on the rank order obtained from each company, it will assist the company in prioritizing the order to the supplier with the best rank. Total supply from All suppliers are 885,994 kg per month. Based on the results of research, the top five suppliers have been sufficient to meet the needs of the company.

1. Introduction

In modern supply chain management, an appropriate evaluation of alternative suppliers' choices is the most common type of problem. The right suppliers will greatly assist the industry directly or indirectly. Supplier's choice is the first step in production activities from raw material purchases to delivery of finished products [1]. In big industries, the role of suppliers is not only limited to raw materials, but also a place for warehousing locations [2]. Therefore, suppliers are very important in most production activities. Most production activities depend on it. If the supplier is late to fulfill the demand, then the production activity will be disrupted. The selection of suppliers evaluated is a critical factor for the industry to win the competition in today's industry competition [3]. The study of many alternative selections have discussed in various studies. Starting from the selection of a car purchased [4], the most accurate selection of management factors [6], including alternative options in the energy field [7, 8, 9, 10, 11]. Study of suppliers' alternative selections in chicken slaughterhouse industry discusses by using TOPSIS method. In using TOPSIS, there are four major differences in the use of normalization [12, 13, 14]. The end result of TOPSIS may differ depending on the normalization method so it will impact on the alternatives order [12].

This result will select the alternative suppliers that supply raw materials to the chicken slaughterhouse industry.

2. Literature Review

One of the most popular in Multi-criteria Decision Making (MCDM) is TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). Based on the best chosen alternative concept not only has the shortest distance from the ideal solution, but also has the longest distance from the ideal solution. This method was first developed by Hwang and Yon [13] and has been widely applied in various research studies [12]. This concept is widely used on Multi-criteria Decision Making (MCDM) models to solve practical decision problems. The concept of TOPSIS method is simple and easy to understand; computing is efficient and has the ability to measure the relative performance of decision alternatives in simple mathematical form.

TOPSIS uses the principle that the chosen alternative must have the closest and furthest distance from a geometric point of view by using the Euclidean distance to determine the relative proximity of an alternative with the optimal solution. In general, TOPSIS procedure follows the following steps:

- Make a normalized decision matrix

$$r_{ij} = \frac{Xij}{\sqrt{\sum_{i-1}^{m} Xij^2}}, i = 1, \ldots, m; j = 1, \ldots, n \tag{1}$$

- Create a weighted normalized decision matrix

$$y_{ij} = wij, i= 1, \ldots, m ; j=1, \ldots, n \tag{2}$$

- Determine the matrix of positive ideal solutions and the ideal negative solution matrix

$$A^+ = (y_1^+, y_2^+, \ldots, y_n^+) \tag{3}$$
$$A^- = (y_1^-, y_2^-, \ldots, y_n^-) \tag{4}$$

- Determine the distance between the score for each alternative and the matrix of positive ideal solutions and the ideal negative solution matrix

$$D_i^+ = \sqrt{\sum_{j=1}^{n}(y_i^+ - y_{ij})^2}, i = 1, \ldots, m \tag{5}$$

$$D_i^- = \sqrt{\sum_{j=1}^{n}(y_{ij} - y_i^-)^2}, i = 1, \ldots, m \tag{6}$$

- Determine the preference value for each alternative

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \qquad , i = 1, \ldots, m \tag{7}$$

3. Methodology

This study was conducted in one of chicken slaughterhouse industry in North Sumatra. This study will produce an alternative supplier that will supply raw materials to the chicken slaughterhouse industry. To solve this problem used TOPSIS method. In general the procedure in TOPSIS method consists of five steps. At the beginning, it is necessary building a decision matrix that refers to the number of alternatives to be evaluated based on the number of criteria. The first step is making a normalized decision matrix, followed by the second step of weighting a normalized decision matrix. The third step is the determination of positive ideal solution matrix and ideal negative solution. The fourth step is the determination of the distance between the values of each alternative with the matrix of positive ideal solutions and the ideal negative solution matrix. The final step is the determination of the preference value for each alternative. Having obtained the value of preference for each alternative, then got the suplier alternative needed.

4. Result and Discussion

Based on the ranking order obtained from each company then this sequence will help the company in giving priority to the supplier who has the best ranking. Reservations can be made in accordance with the capacity that can be given the best supplier 1 for the next shortage is supplied from the best supplier

2 and so on until the capacity of the company can be met. Capacity of raw material capacity of each supplier can be seen in Table 1.

Table 1. Supplier Capacity

Supplier	Delivery Capacity (Times/ Month)	Capacity Each Delivery (Kg)	Capacity (Kg/Month)
Supplier A	23	10.838	281.783
Supplier D	20	8.128	186.942
Supplier B	20	5.419	119.216
Supplier C	19	5.419	113.797
Supplier E	17	5.419	102.959
Supplier F	17	2.710	51.488
Supplier G	9	2.710	29.809
Total			885.994

Based on Table 1 it can be concluded that the seven suppliers are able to supply raw materials of 885.994 kg / month. Production capacity of chicken slaughterhouse industry is 711.947 kg/month, based on the above data it can be concluded that the raw material capacity of the supplier is greater than the company's production capacity. Based on the results of the research has been obtained the best supplier order, therefore it is recommended that the company make an order to the supplier based on the order. To meet the company's production capacity of 711,947 kg/month, the selected supplier can be seen in Table 2.

Table 2. Optimum Raw Material Supplier Alternative

Supplier	Capacity (Kg/Months)
Supplier A	281.783
Supplier D	186.942
Supplier B	119.216
Supplier C	113.797
Supplier E	102.959
Total	711.947

Based on Table 2 it can be concluded that the capacity of the five suppliers ie 711.947 kg / month has been able to meet the needs of the company. The best supplier alternative distribution network for chicken slaughterhouse industry can be seen in Figure 1.
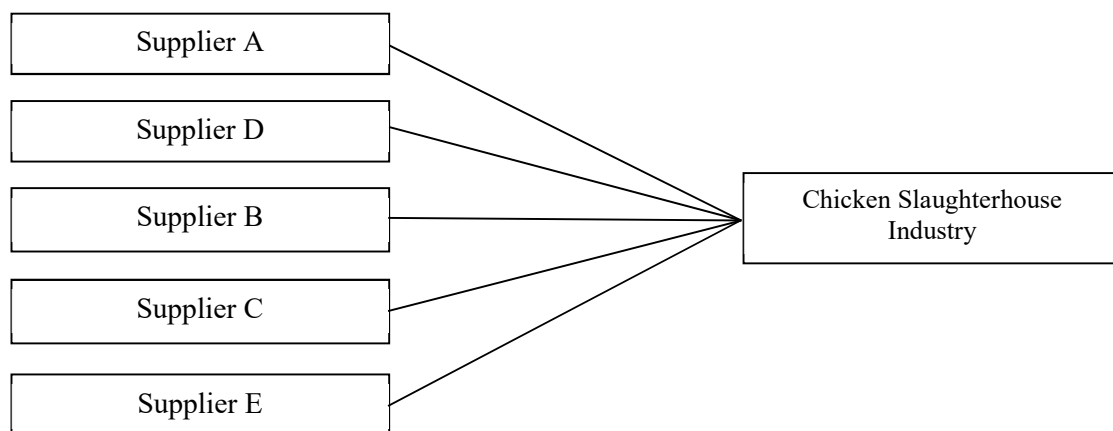

Figure 1. The Best Alternative Supplier Distribution Network for Chicken Slaughterhouse Industry

5. Conclusion
The conclusion in the research using TOPSIS Method on chicken slaughterhouse industry is the chosen supplier alternative for the fulfilment of fresh chicken raw materials needed i.e. Supplier A, Supplier D, Supplier B, Supplier C, Supplier E. While two more suppliers are not needed because the five suppliers There already meet the needs of industrial raw materials chicken slaughterhouse.

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