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Optimization of Chicken Feed Distribution Using Least Cost and Modified Distribution Method at PT. Mabar Feed Indonesia

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ABSTRACT

The optimization model is one of the systems analysis models identified with operation research. The transportation method is part of a linear program that is used to organize and distribute resources that provide products to places where they are needed to achieve transportation cost efficiency. The working principle of the Least Cost method is to give allocation priority that has the smallest unit cost (the smallest unit cost). The MODI (Modified Distribution) method is a method of solving transportation cases developed from the Stepping Stone method. This research was conducted at PT. Mabar Feed Indonesia which is engaged in the feed sector. This study aims to determine minimizing transportation costs at PT. Mabar Feed Indonesia which will later become input for the company. The results showed that the transportation cost before minimization was Rp 48.044.800 . Then the costs incurred after using the Least Cost method in the initial solution amounted to Rp 43.819.300 . After using the Least Cost method, the final solution is to make MODI more optimal and the total transportation cost is Rp 35.850.800 .

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1. INTRODUCTION

The process of production, distribution and marketing of products is part of the Supply Chain. Supply Chain includes the entire flow of activities that are interconnected with the aim of changing goods and services that were originally raw materials into finished goods until they reach the end user. Products that are distributed need to arrive on time at the designated place smoothly, safely and safely.

The distribution process is also very important in a company and is also a component that affects the advantages of a company, so it is necessary to improve the performance of the distribution system in a company. This is because the products that are distributed need to arrive on time at the designated place smoothly, safely and safely. In order for this distribution activity to run more effectively and efficiently, the company establishes a route schedule in transportation.

Transportation problems that often arise in everyday life, are a separate class in linear programming problems. The transportation problem was also first formulated as a special procedure to obtain the

minimum cost of distributing homogeneous units of a product over a number of supply points (sources) to a number of demand points (destinations). All are placed at geographically different sources and destinations.

PT. Mabar Feed Indonesia is one of the livestock feed products for laying hens and meat. Other products produced by PT. Mabar Feed Indonesia in the form of shrimp and other animal feed. In meeting these targets, there are several obstacles faced by the company, namely in the process of distributing animal feed which is irregular in determining distribution channels which results in expensive distribution costs, resulting in a distribution that is not optimal. To overcome this, it is necessary to allocate an optimal distribution of goods with consideration of low distribution costs but still pay attention to the number of requests in the delivery of distribution of goods.

To achieve the optimization target, a method is needed that can overcome these problems. The method used to examine the above problems is to use Least Cost and Modified Distribution. The Least Cost method will look for the initial solution while the Modified Distribution will find the optimal solution.

2. RESEARCH METHODE

1. Transportation Method

The transportation method is a method used to regulate the distribution of sources that provide the same product, to places that need it optimally. The transportation method can also be used to solve other business problems, such as problems involving advertising, capital financing and allocation of funds for investment, location analysis, assembly line balancing and production planning and scheduling.

A transportation model is said to be balanced (balanced program) if the total amount between supply (supply) and demand (demand) is the same, mathematically written:

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j \quad (1)$$

A transportation model can be formulated as follows:

$$Z = \sum_{i=1}^{m} x_{ij} = \sum c_{ij}\, x_{ij} \quad (2)$$

Together with

$$\sum_{i=1}^{m} x_{ij} < a_i ; i = 1,2,3,...m \text{ (offer limit)} \quad (3)$$

$$\sum_{i=1}^{m} x_{ij} < a_i ; j = 1,2,3,...m \text{ (request limit)} \quad (4)$$

$$x_{ij} < 0 \quad (5)$$

With objective function:

Minimize:

$$Z = C_{1,1}X_{1,1} + C_{1,2}X_{1,2} + C_{1,3}X_{1,3} + ... + C_{10,7}X_{10,7}$$

Obstacles:

$$X_{1,1} + X_{1,2} + X_{1,3} + ... + X_{1,7} = a_1$$

$$X_{2,1} + X_{2,2} + X_{2,3} + ... + X_{2,7} = a_2$$

$$X_{10,1} + X_{10,2} + X_{10,3} + ... + X_{10,7} = a_{10}$$

$$X_{1,1} + X_{2,1} + X_{3,1} + ... + X_{7,1} = b_1$$

$$X_{1,2} + X_{2,2} + X_{3,2} + ... + X_{7,2} = b_2$$

..

$$X_{1,10} + X_{2,10} + X_{3,10} + ... + X_{7,10} = b_7$$

The transportation model is basically looking for and determining the planning of delivery of goods (single commodity) from the place of origin to the destination, with minimal total transportation costs. Therefore, in total transportation costs there are 3 (three) variables, namely as follows:

a. The number of goods available at the place (source) of origin, namely the delivery capacity.
b. The capacity of the area or destination, namely the capacity of the destination.
c. Transportation costs per unit of goods to be delivered.

2. Determination of Initial Solution

Least Cost Method

The Least Cost method is to find and fulfill the one with the smallest cost first. This method is more efficient than the North West Corner (NWC) method. The working principle of this method is to give priority to the smallest unit cost (the smallest unit cost).

The steps for the Least Cost method are as follows:

a. Form the initial table of transportation by entering data that has been obtained from existing problems, such as filling in small boxes with transportation costs, adding total commodities to supply and demand, and so on.
b. Select a small fee or value in the small boxes from the transport table box. If there is a similarity in the value of the small box, then select the most total commodity from supply and demand by taking into account the balanced condition of the cargo of transportation commodities.
c. After the cost or small value in the small transportation box is selected, then fill in the value of the commodity in the transportation box which contains the small box. This box is filled in by considering the total supply and demand for commodities.
d. If the transportation box is filled with adequate commodities, then the row or column is crossed out through the transportation table box according to the balance of supply and demand using a straight line.
e. Return to the second step by selecting the smallest cost or value in the remaining transport boxes where a straight line or column does not exist.

3. Optimality Test

Modified Distribution Method (MODI)

The distribution modification method or the abbreviation of the MODI method, is very similar to the stepping-stone method except that MODI is more efficient at calculating the repair index of blank cells.

MODI tests the optimization of the table by calculating the opportunity cost in cells that are not affected by distribution allocation. If the empty cells have a positive opportunity cost, then according to this method, it is said that the table is not optimal because there are still distribution alternatives that will give a lower total distribution cost.

Then for cells apply:

$$O_{ij} = (U_i + V_j) - C_{ij}$$

The MODI method can be summarized in the following steps:

a. Determine value U_i for each row and values V_j for each column using the relationship $c_{ij} = U_i + V_j$ for all base variables and keep a value of zero for U_i.
b. Calculate cost change C_{ij} for each nonbasic variable using $C_{ij} = C_{ij} - U_i - V_j$.
c. If there is a value of C_{ij} negative, the solution is not optimal. Choose a variable X_{ij} with value C_{ij} the biggest negative as the entering variable.
d. Allocation of goods to entering variable X_{ij} according to the stepping stone process.
e. Back to step (i), optimality testing with the MODI method. Until you get the desired result.

4. Researched Variables

The variables studied in the preparation of this thesis are distribution costs, distribution sources and distribution objectives for chicken feed in June 2020 at PT. Mabar Feed Indonesia.

5. Research procedure

The stages or steps used in this research are:

a Formulate the problem.

b Collecting references in the form of books, texts, documents and various journals related to Least Cost and Modified Distribution Methods.

c Collecting data by recording data from several delivery destinations regarding the number of goods sent and the distribution costs of chicken feed at PT. Mabar Feed Indonesia.

d Data processing

The data that has been obtained is arranged into a transportation table.

Processing data using the Least Cost method.

Performing optimality testing with the MODI method.

e Conclusion.

3. RESULT AND ANALYSIS

To analyze the problem of optimizing transportation costs at PT. Mabar Feed Indonesia requires data on the capacity of animal feed products and data on demand for chicken feed products. PT. Mabar Feed Indonesia also has several warehouses with a certain capacity located in the North Sumatra Region, including Mabar, Sei Rampah and Trading with a total capacity of 36,000 tons. Then PT. Mabar Feed Indonesia also has several destinations with the number of requests each still located in the North Sumatra region, including Gunung Tinggi, Tj. Morawa, Tebing Tinggi, Siantar, and Kisaran with a total demand of 17,300 tons.

The type of transportation in distributing animal feed products at PT. Mabar Feed Indonesia uses truck and box car transportation services. Then the transportation costs at PT. Mabar Feed Indonesia include travel costs or oil (rupiah) which will distribute chicken feed products to destinations that have been determined by the company. Before using the transportation method the cost of transportation is IDR 48,050.00 and after using the transportation method the cost is IDR 48,044,800. Then to overcome the cost of transportation costs problems can use the least cost method which is able to minimize these costs.

The Least Cost method has several stages. Where from stage 1 to stage 8, namely choosing the smallest distribution cost until the total load is met. After the total load is met and the previous transportation costs have become more optimal than the previous ones. To optimize transportation costs, the Least Cost method can be optimized using the Modified Distribution method.

The final result of the Modified Distribution method is where Mabar distributes to the destination of Gunung Tinggi with the transportation cost per tonne which is 3,500 and the cargo contains 3,200 tons. Then Mabar also distributes to Tj. Morawa with the transportation cost per tonne which is 1,666 and the cargo contains 3,500 tons. Furthermore, Sei Rampah distributes to the Tebing Tinggi destination with a transportation cost of 1,500 per tonne and a cargo of 3,300 tons. Furthermore, Trade distributes to the destination Siantar with a transportation cost per ton which is 2,272 and the cargo contains 3,600 tons. Then Trade also distributes to Kisaran with transportation costs per tonne which is 1,538 and the cargo contains 3,700 tons.

Based on data analysis that has been carried out the distribution process using Least Cost and Modified Distribution Methods can save transportation costs at PT. Mabar Feed Indonesia from IDR 48,044,800 to IDR 35,850,800 and can increase profit or income by IDR 12,194,000. So that the use of the Least Cost method and the Modified distribution method in the distribution of chicken feed at PT. Mabar Feed Indonesia can be said to be optimal.

4. CONCLUSION

Based on the discussion in the previous chapters which explain about the Least Cost method and the Modified Distribution method, it can be concluded that at PT. Mabar Feed Indonesia can save distribution costs then the calculation results that have been obtained that the optimal distribution transportation costs are Rp 35.850.800

Based on data analysis that has been carried out by the distribution process using the Least Cost and Modified Distribution Method, it turns out that it can save or minimize transportation costs on animal feed from Rp. 48.044.800 to Rp 35.850.800 and can increase profit or income by Rp 12.194.000

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