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Optimization Analysis of Petroganik Fertilizer Distribution at PT Petrokimia Gresik

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Abstract
The purpose of this study was to evaluate the company's initial distribution channel for distribution optimization to reduce the high distribution costs of PT Petrokimia Gresik. Petroganic fertilizer is one of the company's products, which currently increases its production, so it is necessary to implement a good distribution system to optimize transportation costs. The analytical tool used is the transportation method, where the company's initial allocation is recalculated using the Least Cost method, double-checking to find out whether it is optimal with the Modified Distribution (MODI) method. From the results of this study, it is known that the company's initial transportation costs incurred by the company when using the Least Cost method, there is cost transmission and optimization with the Modified Distribution method resulting in an optimal cost reduction value. The difference in distribution costs was obtained by 11.7% of the total costs incurred. The suggestion is that companies can consider transportation methods as a decision-making policy to optimize costs in their distribution system.

Keywords*— Distribution, Transportation, Least Cost Method*

Abstrak
Tujuan dari penelitian ini adalah untuk mengevaluasi saluran distribusi awal perusahaan untuk optimalisasi distribusi guna menekan biaya distribusi yang tinggi di PT Petrokimia Gresik. Pupuk petroganik merupakan salah satu produk perusahaan yang saat ini semakin meningkat produksinya, sehingga perlu diterapkan sistem distribusi yang baik agar dapat mengoptimalkan biaya transportasi. Alat analisis yang digunakan adalah metode transportasi, dimana alokasi awal perusahaan dihitung ulang menggunakan metode Least Cost, pengecekan ulang untuk mengetahui apakah sudah optimal dengan metode Modified Distribution (MODI). Dari hasil penelitian ini diketahui bahwa biaya transportasi awal perusahaan yang dikeluarkan perusahaan saat menggunakan metode Least Cost, terdapat biaya transmisi dan optimasi dengan metode Modified Distribution menghasilkan nilai pengurangan biaya yang optimal. Selisih biaya distribusi diperoleh sebesar 11,7% dari total biaya yang dikeluarkan. Saran agar perusahaan dapat mempertimbangkan metode transportasi sebagai kebijakan pengambilan keputusan untuk mengoptimalkan biaya dalam sistem distribusi mereka.

Kata Kunci*: Distribusi, Transportasi, Metode Biaya Rendah*

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INTRODUCTION

The current industrial development has increased. Industrial development which is increasingly advanced is now experiencing a very rapid increase. So, from the existing phenomena regarding the competition that occurs between one company and another, the distribution of goods or services is an important part of the activities of a government agency or certain company. Supply Chain Management (MRP) is a determining factor for the success of a company, supply chain management is a series of activities needed to plan, control and run product flows. Heizer (2012) This includes the process of obtaining raw materials, the production process, and the distribution of products to end consumers most efficiently.

The problem faced in distribution is making decisions about the path that can optimize the distance or cost of travel, travel time, the number of vehicles to operate, and other available resources. Transportation reflects or describes how quickly and precisely a product can move from one place to another (Raharja, 2013). In activities to improve the distribution process, companies are always required to distribute goods promptly and in any quantity. So that the distribution system is good by arranging transportation from the company where the production is located to the warehouse. Danny (2012) delivery of goods from factory to warehouse requires transportation both owned and rented, both of which require shipping costs. Knowing the importance of proper distribution, it is interesting for researchers to evaluate the organic fertilizer distribution channels of PT. Petrokimia Gresik in the Gresik Regency area. Using the initial Least Cost solution which serves to minimize distribution costs, and checks the optimal value with MODI to determine the distribution costs of petrochemical fertilizers by choosing the right distribution pattern for optimal distribution.

The transportation model is one part of the product distribution in the company. In addition, the better the company's transportation system will also increase profits because it can streamline the transportation needed by the company to distribute its products to consumers. Wijaya (2013) Choosing a transportation model is an important step for companies to achieve the production targets set by the company and minimize delays in the delivery of goods to consumers. Where to minimize the cost of the initial solution used is the least cost, this method is more efficient than the northwest corner method. Using the least-cost model will be more precise because the calculation in this method is based on the lower cost of the total load on each trip from one factory to the destination warehouse (Taha, 2010). Followed by the final solution with the modified distribution (MODI) where the optimization using MODI is more efficient rather than the stepping stone method.

PT Petrokimia as a state-owned company is one of the providers of organic fertilizer products called petrogenic fertilizers. To fully support the government's program, the company must ensure distribution from factories to buffer warehouses so that there is no shortage of organic fertilizers. Selection and processing of transportation means is an important factor so that the product does not experience delays but also to obtain optimal distribution costs. So far, the distribution system process that is run by the company uses PO. Where each factory is given a different PO based on the production capability of each factory itself. The distribution channel is ineffective because the factory sends the seven destination warehouses, there are no distance considerations, even remote warehouses are sent. where the existing distribution system makes costs uncontrollable. Based on the foregoing, the researcher is interested in research to evaluate the distribution channel of petroganic fertilizers at PT Petrokimia Gresik to optimize costs related to transportation. The method used in this study to complete the company's initial allocation in the transportation method is the Least Cost Method and to test the optimization using a Modified Distribution.

LITERATURE REVIEW

Heizer (2020) In the business world, Supply Chain Management is also a determining factor for the success of a company, supply chain management is a series of activities needed to plan, control and run product flows. This includes the process of obtaining raw materials, the manufacturing process, and the distribution of the product to the final consumer, most efficiently and cost-effectively. The definition of Supply Chain Management is a broad and complex business that depends on every partner from suppliers to manufacturers and beyond to run well. Supply chain management aims to maximize customer value and gain a competitive advantage in the market (Novianti, 2019). Heizer (2012) To achieve this, various efforts are needed, both business strategy and certain software.

The definition of distribution or delivery is the process of procuring shipping goods by prioritizing customer satisfaction so that the goods received can reach the consumer until the delivery process takes place on time, on quality, on target (Soetanto, 2015; Febriana et al, 2017). The main objective of the distribution strategy is to place the product as close to the consumer as possible. So whenever consumers need them, they can buy them easily. The transportation method that the company can choose depends on the consumers it wants to go to. According to Heizer and Render (2012), the transportation method is a technique or method used to find the cheapest way of sending goods from various sources to several destinations. Meanwhile, according to Sarjono (2010) the transportation method is one of the management techniques in distributing products from warehouse to destination.) This study aims to produce satisfying tools in the form of goods and services to meet community needs. The method used is the transportation method by implementing a linear program to solve problems regarding the allocation of optimal solutions.

Further research by Ibnas (2017) to find the most optimal transportation costs at PT Granedia with the MODI method, the linear programming method is a linear program transportation model that can be solved by the ordinary simplex method. But its special structure allows the development of a finishing procedure called transport. This research is sourced from a description of the warehouse and branches located in each warehouse, along with the supply obtained by each warehouse and the number of requests for each branch. There are several transportation methods, namely the Nort West Corner (NWC) Method, the Vogel's Approximation (VAM) Method, and the Least Cost Method. Researchers focused on the Least Cost method because this method has the advantage of being more efficient than the NWC method and easier to understand so that it is liked by the general public. According to Siswanto (2010), the definition of the least cost method is a method of preparing an initial table by allocating the distribution of goods from source to destination starting from cells that have small distribution costs.

In addition, there are two kinds of transportation algorithm optimization tests, namely the Stepping Stone Method and the Modified Distribution Method (Mulyono, 2017). The MODI method is a stepping-stone algorithm with subtle techniques to calculate the index to be raised. The difference between Stepping Stone and MODI lies in the steps used to solve a problem where there is a closed path to trace. The Modified distribution calculates the index to be scaled without describing all traces covered. The MODI method is sufficient for tracking one closed path. Similar to the stepping stone method or the stepping stone and North West Corner method, the MODI method rules the northwest corner. After this step, then proceed with the MODI method by completing steps sequentially. The steps are as follows (1) First, perform a slump test, the test tool tests whether (m + n - 1) equals the number of filled cells where "m" is the number of sources and "n" is the number of destinations. This is done by focusing on cells that are already filled, where the following formula applies:

$$Ai + Tj = Cij \quad (1)$$

Where:
Ai = Row index
Tj = Column index
Cij = The price of each filled cell (i, j)

The next step is to calculate the increasing index or unfilled cells. This step is performed after the row and column prices are calculated using the already filled cells. This step can be done with the formula:

$$Iij = Cij - Ai - Tj \quad (2)$$

Where:
Iij = The index to be increased for any unallocated cells
Cij = Unallocated costs in row I and column j
Ai = Line i
Tj = Column to j

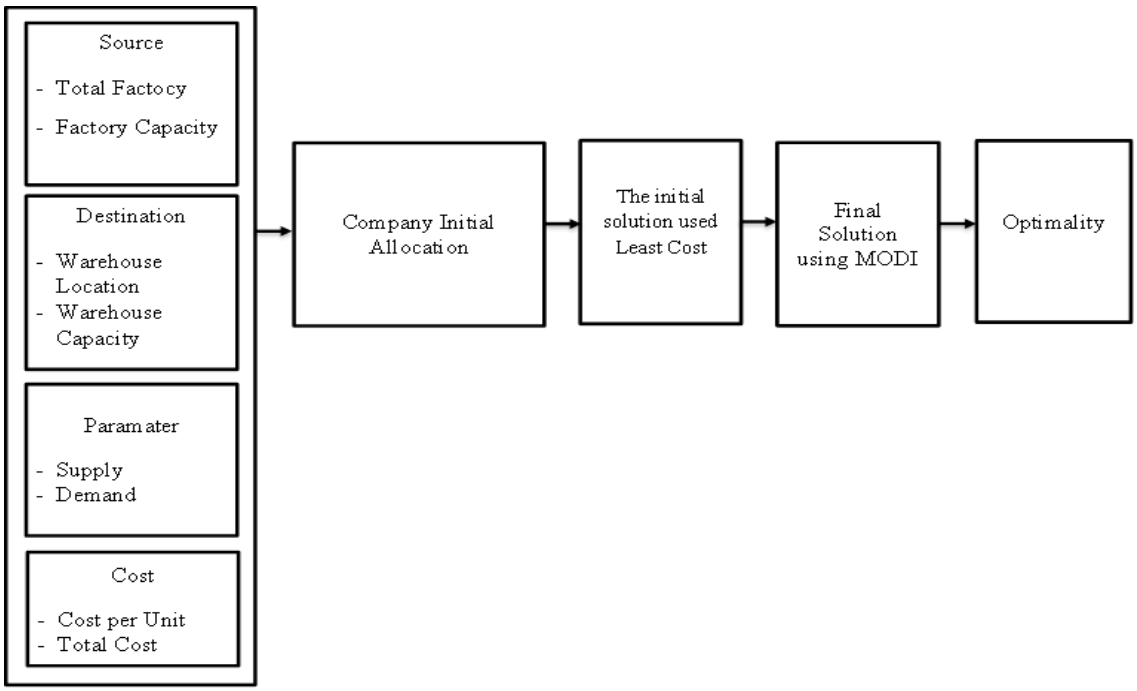

Figure 1. Research Framework for Analysis of Distribution of Optimization of Petroganic Fertilizer by Heizer & Reinder (modified)

Based on Figure 1, the transportation system is important in a manufacturing company because distribution plays an important role in the development of the company where if the transportation system is bad it can cause high costs (Karundeng et al, 2018), conversely, if the transportation system can be managed properly it will generate profits. going high. Before calculating transportation costs for one month with the transportation model, make a matrix table to find out the data on source capacity and warehouse capacity which will be followed by calculating one by one with the transportation model to find the right solution and continue with calculations. to get the most optimal cost after calculating the allocation of transportation costs and costs that have been calculated looking for comparisons after using the transportation method with before using the transportation method.

RESEARCH METHOD

The location of this research was conducted at PT Petrokimia Gresik which is located at Jl. General A. Yani Gresik, East Java. The location was chosen because the location is where the company's operational processes are located. This type of research conducted at PT Petrokimia Gresik is applied research. According to Armanto (2012), applied research is research that presses and solves practical problems. This study aims to solve the problem. By using this type of evaluation research, it means researching at each stage, whether in research, planning, implementation, and the results of the research under study. The type of data used in this study is primary data supported by secondary data. In conducting the research, it is known that there are five distribution points, namely Wotan Panceng, Gresik Industrial Estate, Panceng, Kebomas, and Wadeng. When the research was conducted the authors obtained data that the distribution of the product was carried out several times in one period/month. Where product availability at the source point will always include the total demand at the center of demand where is the distribution area as in the table below:

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Tabel 1. Data from the Distribution Source Area

Source	Location	Capacity (Ton)
I	Wotan Panceng	1300
II	Kawasan Industri Gresik	1030
III	Panceng	910
IV	Kebomas	780
V	Wadeng	780
Total		4800

Source: PT Petrokimia Gresik November (2020)

In conducting the research, it is known that there are five distribution points, namely Wotan Panceng, Gresik Industrial Estate, Panceng, Kebomas, and Wadeng. Where is the distribution area as in the table below:

Tabel 2. Data for Distribution Destination Areas

Brand	Marketing Location	Capacity (Ton)
Petroganik Fertilizer “ PT Petrokimia Gresik “	Warehouse GMG	1110
	Warehouse Bojonegoro	1020
	Warehouse Pucuk	630
	Warehouse Jenuh	630
	Warehouse Palang	540
	Warehouse Pusri	450
	Warehouse Weru	420
Total		4800

Source: PT Petrokimia Gresik November (2020)

RESULT AND DISCUSSION

There are two kinds of transportation algorithms, two kinds of methods for compiling the initial table, one of which is the Least Cost Method.

Table 3.Table Transportation Using Least Cost

Ke / Dari	TUJUAN G.GMG	G.BOJONEGORO	G.PUCUK	G.JENUH	G.PALANG	G.PUSRI	G.WERU	SUPPLY
WOTAN	400	40000 ⑦ 1020	550	500 ⑩ 190	500 ⑨ 90	450	450	1300
KIG	450	45000	400 ⑤ 630	550 ⑪ 400	550	500	500	1030
PANCENG	400	50000	400	400 ⑥ 40	450	400 ③ 450	350 ② 420	910
KEBOMAS	400 ④ 330	55000	500	550	450 ⑧ 450	500	500	780
WADENG	350 ① 780	45000	400	450	500	400	400	780
DEMAND	1110	1020	630	630	540	450	420	4800

Based on the table above, it is known that the total transportation cost for distributing petrochemical fertilizers from factory to warehouse obtained by the Least Cost method is IDR 197,050,000. Calculating the final solution for the transportation method to determine the initial data optimization using the MODI (Modified Distribution) method. It takes 5 times iteration to get the data optimization. The following is the final iteration of this research.

Table 4. Final Optimization Results "Iteration 5" Using MODI

Ke / Dari	TUJUAN G.GMG	G.BOJONEGORO	G.PUCUK	G.JENUH	G.PALANG	G.PUSRI	G.WERU	SUPPLY
WOTAN	40000 540	40000 760	55000	50000	50000	45000	45000	1300
KIG	45000	45000 260	40000 630	55000 140	55000	50000	50000	1030
PANCENG	40000	50000	40000	40000 490	45000	40000	35000 420	910
KEBOMAS	40000 240	55000	50000	55000	45000 540	50000	50000	780
WADENG	35000 330	45000	40000	45000	50000	40000 450	40000	780
DEMAND	1110	1020	630	630	540	450	420	4800

To calculate the optimal cost in table 4, the following objective function equation can be used :

$$Z = \sum_{i=1}^{m} (\sum_{j=1}^{n} (x_{ij} \text{ x } b_{ij}))$$

Based on the table compiled above, the total transportation costs for the distribution of petrochemical fertilizers from one source to the destination obtained by the MODI method are:

Z = IDR 11,550,000 + IDR 14,700,000 + IDR 9,600,000 + IDR 25,200,000 + IDR 19,600,000 + IDR 30,400,000 + IDR 24,300,000 + IDR 7,700,000 + IDR 21,600,000 + IDR 18,000,000 + 11,700,000 = IDR 194 .350,000

Optimization using the Least Cost and MODI method approaches can be seen in the table below:

Method	Minimum Cost
Initial Company Allocation	Rp 217.100.000
Least Cost Method	Rp 197.050.000
Modified Distribution	Rp 194.350.000

Based on the research results, it is known that the company's initial transportation costs to be incurred compared to the company costs when using the transportation method can be seen in the initial allocation of PT Petrokimia Gresik to pay Rp. After being calculated using the transportation method, the cost is Rp. 194,350,000. The difference in distribution costs was obtained at 11.7% of the total costs incurred. From the results of the research that has been done, researchers are looking for solutions to get the optimum distribution costs to save the total cost of shipping petroganic fertilizer from a factory to a destination warehouse. The initial distribution system that was run by the company was only based on the PO given to each factory, the absence of a clear distribution allocation resulted in high distribution costs. So that the transportation method used in this study is to solve an existing problem with the initial Least Cost solution. And to test whether the results are optimal or not, the researcher uses the final solution of the MODI (Modified Distribution) method. From the change in the path based on the use of transportation methods, distribution costs are obtained that are more optimal. Where the initial cost incurred by the company for distribution is Rp. 217.100.000, and after the transportation method approach is carried out there is a change in distribution channels where the initial distribution line of all sources sends all existing warehouses to a more effective distribution channel change which can optimize costs to IDR 194.350.000. The difference in distribution costs obtained is 11.7% of the total costs incurred.

Research conducted by Shoffa (2016) from the results of this study it can be concluded that the application of the North West Corner and Least Cost method in the delivery of goods produced by PT Coca Cola Amatil Indonesia Surabaya, will help the company, especially the delivery department in determining the route of delivery of goods because by using the North West Corner and Least Cost methods can calculate the lowest transportation costs from one storage warehouse to the destination. In addition, between the two methods used in this study, the calculation using the Least Cost method will be more precise because the calculation in this method is based on the lowest cost of the total load on each trip from one storage of goods (depot) to the destination. Research conducted by Apriani (2016) and Kertiasih (2010) to find out the solution to transportation problems by using one of the transportation method solutions and checking its optimality with MODI (Modified Distribution) in the distribution of its products using the transportation method so that the distribution of goods runs as optimally as possible with a reasonable cost allocation. minimum to optimize the total distribution costs. It turns out that the initial approach method can provide optimal results in determining new distribution channels. With these results, it is still carried out to check for optimization tests again with MODI (Modified Distribution) by having a better distribution cost difference. Therefore, it has been proven that calculations using the transportation method can optimize distribution costs and can provide greater benefits to the company. In addition, the company must change the delivery allocation path following the calculation of the transportation method to make it more optimal. So that the company avoids the risk of overloaded warehouses and warehouses that lack goods resulting from poor distribution.

CONCLUSION

The total transportation cost for distributing petrochemical fertilizers from factory to warehouse obtained by the Least Cost method is Rp. 197,050,000. The result of the cost optimization test from the initial calculation of PT Petrokimia Gresik's Least Cost using the MODI method is Rp. 194,350,000. and the costs incurred by the company so far are Rp. 217,100,000. Thus it is proven that the calculation using the transportation method can improve the optimal distribution path/pattern, seen from the difference in distribution costs obtained by 11.7% of the total costs incurred. So it can be said to be optimal and provide greater benefits for the company PT Petrokimia Gresik.

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