Efficiency Distribution Analysis with Data Envelopment Analysis (DEA) Approach Fertilizer

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Distribution channels have an important meaning for achieving company success in the field of marketing so that company management is required to always be responsive and able to adapt to environmental changes. Input and output data processing is done by giving weights to the input and output using the DEA CCR primal model by maximizing the input-oriented-based objective function. The results of processing the efficiency scale show the relative efficiency level of the scale of each DMU in the company. The efficiency scale is obtained through the formulation of the DEA CCR primal model between each DMU input and output. If the DMU gets an input and output efficiency value of less than 100%, then the DMU is said to be relatively inefficient. Meanwhile, if the efficient value is equal to 100%, then the DMU is said to be relatively efficient. Of the 5 distribution cities, Sidoarjo, PaluKendari, Bandung and Lamongan which were analyzed, there were 2 cities that were inefficient or experiencing waste in their input and output variables, so the company needed to reorganize the level of use of inputs and outputs it achieved and utilize them optimally to get output that is optimal. targeted.

Keywords : Efficiency level, distribution channel, sales

1. INTRODUCTION

One of the obstacles that occur in product delivery, especially fertilizer products, is the distribution channel. This distribution channel has an important meaning in the field of marketing. Goods will reach consumers through distribution channels, either direct or indirect. The distribution channel is a set of organizational participants performed by all functions and is needed to deliver the product/service from the seller to the final buyer. For companies, competition can be an opportunity to develop a company or can be a threat to the company. Therefore, company management is required to always be responsive and able to adapt to continuous environmental changes so that they can survive in competitive competition, including developing effective distribution strategies and appropriate steps. This study aims to determine the efficient level of distribution channels in the company and to determine the inefficient distribution channels of the distribution area.

2. METHOD

Data Envelopment Analysis (DEA) is a tool used to evaluate and improve the performance of a manufacturing or service. DEA is widely applied in performance evaluation and benchmarking in educational institutions, hospitals, bank branches, production plans and others. The units used in the DEA are referred to as DMUs. This technique can be used to find out how efficiently a DMU is used with the utilization of existing equipment to produce maximum output. In the DEA model used, it is known as the Charnes, Cooper and Rhodes ratio (CCR) and is a non-linear equation.

In determining the number of distributors, producers are faced with two alternatives as proposed by BasuSwastha (Swastha, 1990) as follows:

a. Intensive Distribution, which can be done by producers by selling conventional goods. Manufacturers try to use dealers, especially retailers as much as possible to approach and reach consumers.

b. Selective distribution seeks to select a limited number of wholesalers or retailers in a geographic area. Usually this channel is used to market new products, shopping goods or special goods and industrial goods of the type of accessory equipment.

The formulation of the Farrel efficiency ratio is:

$$\text{Eficiency} = \frac{\text{number of outputs with a certain amount of weight}}{\text{number of inputs with a certain weight}}$$

This efficiency ratio is more widely used when a unit or process has one input or one output. In fact, a process or organizational unit has various inputs and various outputs (incommensurate). To overcome this, Relative Efficiency is used, namely the efficiency of an object is measured relative to the efficiency of similar objects with the notation used as follows

$$\text{Efisiensi unit j} = \frac{u_1 y_{1j} + u_2 y_{2j} + \ldots}{v_1 x_{1j} + v_2 x_{2j} + \ldots}$$

This method does not require a production function and the result of the calculation is called the relative efficiency value. DEA is a multifactor analysis method to measure the efficiency and effectiveness of a group of homogeneous Decision Making Units (DMU). Efficiency Score for multiple outputs and inputs can be determined as follows:

$$E \quad S \quad = \frac{\text{total output weight}}{\text{total input weight}}$$

In this study, we will measure the efficiency value of 5 cities for 6 months using a non-parametric approach. The efficiency score of this study was obtained from the results of the calculation process using the WinDEA software which is the relative efficiency score between each DMU in the object of research. This software gives a score of 0-1 which is then converted into a percentage of 0-100% for each DMU. This study uses an input-oriented approach to see how much input can be reduced so that the DMU becomes efficient. In addition to showing the efficient score, the WinDEA software will also show the target value. The target value is the value suggested by the DEA calculation to make the company more efficient.

3. RESULTS AND DISCUSSION

The DEA input variable uses the details of the number of shipments and the amount of distribution costs. To find out or calculate the efficiency value on the input variable in the WinDEA software, the only data that can be processed is monthly data.
Variables in calculating output at DEA using sales data from distributors, sales from customers, profits from distributors, and profits from customers, as well as input data in calculating output data also taken 5 samples of distribution cities, namely Sidoarjo, Palu, Bandung, Kendari, Lamongan.

Table 1. Data distributor

City	Shipping Quantity (kg)	Shipping Distribution Fee (Rp)	Number of	
			Distributors	Customers
Sidoarjo	120	550.000	4	25
Palu	7.060	8.900.000	7	46
Bandung	18.560	6.770.000	12	73
Kendari	5.060	23.300.000	5	33
Lamongan	5.350	2.700.000	10	68

Table2. Distributor Sales Data (Rp)

City	Manufacturer to distributors sales	Producer to consumer sales	Profit from	
			distributors	consumers
Sidoarjo	18.7550.000	25.000.000	6.250.000	6.250.000
Palu	105.900.000	162.380.000	35.300.000	56.480.000
Bandung	276.400.000	464.000.000	92.700.000	185.400.000
Kendari	75.900.000	111.320.000	25.300.000	35.320.000
Lamongan	64.500.000	113.750.000	26.750.000	53.500.000

The DEA method uses WinDEAP software, the calculation uses CRS which is oriented to the input approach. WinDEAP is a software or tool to calculate the efficiency level of the DMU. This software will give a score of 1.00 if the DMU's performance is efficient and vice versa if the DMU's performance is not efficient then the score is less than 1.00. Based on the results of efficiency calculations using DEA, the efficiency level of 5 cities can be seen in the following table:

Table 3. Distribution Efficiency Level

Periods	City				
	Sidoarjo	Palu	Bandung	Kendari	Lamongan
January	1.000	1.000	1.000	1.000	1.000
February	1.000	0.800	1.000	1.000	0.965
March	1.000	1.000	1.000	1.000	1.000
April	1.000	1.000	1.000	1.000	1.000
Mei	1.000	1.000	1.000	1.000	1.000
June	1.000	1.000	1.000	1.000	1.000

The results of processing using WinDEAP software, there are only 2 cities that are inefficient for 6 months, namely Palu and Lamongan, both are inefficient in February and less than 1.00..Palu City has an efficiency score of 0.800 and Lamongan city has an efficiency score of 0.965. While the city of Sidoarjo, Bandung, Kendari has a score of 1.00 out of 6 consecutive months. The following can be seen the level of waste or inefficiency in each city of Palu and Lamongan based on the input and output variables of the company:

Table 4.Calculation level of inefficiency city of Palu

Palu	Original Value	Projected Value	Radial Movement	Slack Movement
January				
Distributor Sales	30000000.000	30000000.000	0.000	0.000
Consumer Sales	46000000.000	46000000.000	0.000	0.000
Profit from distributors	10000000.000	10000000.000	0.000	0.000
Profit from consumers	16000000.000	16000000.000	0.000	0.000
Distribution fee	2450000.000	760000.000	0.000	-1690000.000
Delivery quantity	2000.000	2000.000	0.000	0.000
February				
Distributor Sales	15300000.000	15300000.000	0.000	0.000
Consumer Sales	23460000.000	25092000.000	0.000	1632000.000
Profit from distributors	5100000.000	5100000.000	0.000	0.000
Profit from consumers	8160000.000	9792000.000	0.000	1632000.000
Distribution fee	1275000.000	1122000.000	-153000.000	0.000
Delivery quantity	1020.000	897.600	-122.400	0.000
March				
Distributor Sales	30300000.000	30300000.000	0.000	0.000
Consumer Sales	46460000.000	50500000.000	0.000	4040000.000
Profit from distributors	10100000.000	10100000.000	0.000	0.000
Profit from consumers	16160000.000	20200000.000	0.000	4040000.000
Distribution fee	2525000.000	1010000.000	0.000	-1515000.000
Delivery quantity	2020.000	2020.000	0.000	0.000
April				
Distributor Sales	7500000.000	7500000.000	0.000	0.000
Consumer Sales	11500000.000	12500000.000	0.000	1000000.000
Profit from distributors	2500000.000	2500000.000	0.000	0.000
Profit from consumers	4000000.000	5000000.000	0.000	1000000.000
Distribution fee	750000.000	183333.333	0.000	-566666.667
Delivery quantity	500.000	500.000	0.000	0.000
Mei				
Distributor Sales	15000000.000	15000000.000	0.000	0.000
Consumer Sales	23000000.000	25000000.000	0.000	2000000.000
Profit from distributors	5000000.000	5000000.000	0.000	0.000
Profit from consumers	8000000.000	9960159.363	0.000	1960159.363
Distribution fee	1250000.000	5000000.000	0.000	-750000.000
Delivery quantity	1000.000	1000.000	0.000	0.000
Juni				
Distributor Sales	7800000.000	7800000.000	0.000	0.000
Consumer Sales	11960000.000	13000000.000	0.000	1040000.000
Profit from distributors	2600000.000	2600000.000	0.000	0.000
Profit from consumers	4160000.000	5200000.000	0.000	1040000.000
Distribution fee	650000.000	277333.333	0.000	-372666.667
Delivery quantity	520.000	520.000	0.000	0.000

The results of data processing using WinDEAP software show that for the city of Palu, the company has experienced corporate waste for 6 months. In January from the input variable, the number of shipments for the original value and projected value is efficient because they are the same. However, in the second input variable, namely production costs, the original value is Rp. 2,450,000 higher than the projected value which is only Rp. 760,000. So to get a more efficient value must be reduced by Rp. 1,690,000.

While the output variables of distributor sales, consumer sales, profits from distributors, profits from consumers in January show that the original value and projected value are the same, so it can be said to be efficient.

In February, the results of data processing showed inefficiency, as seen from the input variable for distribution costs and the input variable for the number of shipments. The distribution cost variable shows the original value of Rp. 1,275000. bigger than the projected value which is only Rp. 1.122.000. So in order to be efficient must be reduced by Rp. 153,000.

Meanwhile, in the second input variable, namely the number of shipments, the original value of 1020 Kg is greater than the projected value which is only 897,600 Kg. If the company wants to be more efficient in managing the number of shipments, it must be reduced by 122,400 Kg.

For the distributor's sales output variable and the distributor's profit, it can be seen that the original value and projected value have the same value, this can be said to be efficient. However, the consumer sales output variable and consumer profit are inefficient, it can be seen in the consumer sales variable that the original value is only Rp. 24,360,000. smaller than the projected value of Rp.25,092,000. so to get a more efficient value must be added by Rp. 1,690,000.

The second inefficient output variable is the profit from the consumer which has an original value of Rp. 8.160,000. While the projected value is Rp. 9,792,000. The original value of the consumer's profit is still less than the projected value, so to get an efficient value, it must increase the profit of the consumer by Rp.1.632.000 Likewise in the following inefficiency months, the problems and solutions are almost the same as in January and February.

Table 5.Calculation of the value of waste in the city of Lamongan

Lamongan	Original Value	Projected Valeu	Radial Movement	Slack Movement
Januari				
Distributor Sales	12000000.000	12000000.000	0.000	0.000
Consumer Sales	2000000.000	2000000.000	0.000	18000000.000
Profit from distributors	4000000.000	4000000.000	0.000	0.000
Profit from consumers	8000000.000	8000000.000	0.000	0.000
Distribution fee	400000.000	400000.000	0.000	0.000
Delivery quantity	800.000	800.000	0.000	0.000
Februari				
Distributor Sales	7500000.000	7631578.947	0.000	131578.947
Consumer Sales	12500000.000	12631578.947	0.000	131578.947
Profit from distributors	2500000.000	2543859.549	0.000	43859.649
Profit from consumers	5000000.000	5000000.000	0.000	0.000
Distribution fee	400000.000	385964.912	-14035.088	0.000
Delivery quantity	500.000	482.456	-17.544	0.000

Lamongan	Original Value	Projected Valeu	Radial Movement	Slack Movement
Maret				
Distributor Sales	1500000.000	15000000.000	0.000	0.000
Consumer Sales	2500000.000	25000000.000	0.000	0.000
Profit from distributors	500000.000	500000.000	0.000	0.000
Profit from consumers	1000000.000	10000000.000	0.000	0.000
Distribution fee	5500000.000	500000.000	0.000	-50000.000
Delivery quantity	1000.000	1000.000	0.000	0.000
April				
Distributor Sales	22500000.000	22500000.000	0.000	0.000
Consumer Sales	37500000.000	37500000.000	0.000	0.000
Profit from distributors	7500000.000	7500000.000	0.000	0.000
Profit from consumers	15000000.000	15000000.000	0.000	0.000
Distribution fee	550000.000	550000.000	0.000	0.000
Delivery quantity	1500.000	1500.000	0.000	0.000
Mei				
Distributor Sales	7500000.000	7500000.000	0.000	0.000
Consumer Sales	20000000.000	20000000.000	0.000	0.000
Profit from distributors	4000000.000	4000000.000	0.000	0.000
Profit from consumers	8000000.000	8000000.000	0.000	0.000
Distribution fee	400000.000	400000.000	0.000	0.000
Delivery quantity	800.000	800.000	0.000	0.000
Juni				
Distributor Sales	11250000.000	11250000.000	0.000	0.000
Consumer Sales	18750000.000	18750000.000	0.000	0.000
Profit from distributors	3750000.000	3750000.000	0.000	0.000
Profit from consumers	7500000.000	7500000.000	0.000	0.000
Distribution fee	400000.000	400000.000	0.000	0.000
Delivery quantity	750.000	750.000	0.000	0.000

The results of data processing using WinDEAP software show that the city of Lamongan experiences waste in February and March. Seen in the distribution cost input variable in February the original value of Rp. 400,000 was greater than the projected value which was only Rp. 385,964,912.

If the company wants to get more efficient value, it must be reduced by Rp. 14,035,008. while for the second input variable, namely the number of shipments, it can be seen that the original value of 500Kg is greater than the projected value which is only 482,456 kg.

So to be said to be efficient it must be reduced by 17,544Kg. while the distributor's sales output variable, sales from consumers and profits from distributors experience inefficiency.

The distributor's sales output variable has an original value of only Rp. 7,500,000, which is smaller than the projected value of Rp. 7,631,578,947. The original value of the distributor's sales variable is still less than the projected value.

So to get an efficient value, it must increase sales to distributors of Rp. 131,578,947. Consumer sales as the second variable has an original value of Rp.

12,500,000. While the projected value is 12,631,578,947, this situation is the same as the first output, therefore consumer sales must be increased by Rp. 131,578,947 if you want a more efficient figure.

The third output variable is profit from distributors, profit from distributors has an original value of Rp. 2,500,000 while the projected value has a value of Rp. 2,543,859,549, this situation is the same as the first and second output variables that the original value is less than the target value then to get a more efficient value must be added by Rp. 43,859,649.

For the month of March, the company only experienced inefficiency in the input variable. The input variable for distribution costs shows that the original value has a number of Rp. 5,500,000 while the projected value is Rp. 500,000. It can be seen that the projected value is lower than the original value, so that distribution costs can be efficient, it must be reduced by Rp. 500,000.

The results of the inefficient data processing of the two cities described above show that the city of Palu experienced a very significant waste in the input variable distribution costs, in January the value of the original value was Rp. 2,450,000 and the projected value was Rp. 760,000, then it has experienced a waste of Rp. 1,690,000. Likewise, in February the original value was Rp.1,275,000 and the projected value was only Rp.1.122,000, so in February there was a waste of distribution costs of Rp.153,000.

The solution to the problem of waste in the company's distribution costs is to utilize the input of distribution costs to a minimum so that it can reduce waste in these variables. Likewise, in March to June which is inefficient or wasteful in distribution costs, the problems and solutions are almost the same as in January and February.

4. CONCLUSION

From the results of calculations using the DEA method, the value of the efficient level of 5 cities in the distribution area of the company is as follows:

a. From the results of the calculation of the efficient level of distribution of the company for the cities of Sidoarjo, Bandung and Kendari for 6 months it has been efficient because the value of technical efficiency has reached 1.00 or 100%.

b. The calculation of the technical efficiency value for Palu city of 0.800 in February means that in February it is wasteful or efficient. Likewise with the city of Lamongan, the calculation of the technical efficiency value is 0.965 so that in February it is wasteful or inefficient.

Based on calculations using the WinDEAP software for the cities of Palu and Lamongan, it turned out to be inefficient or wasteful in the input and output variables. The input variable is more significant in distribution costs.

a. Palu City experienced the most waste of distribution costs, in January of Rp. 1,690,000, February Rp. 153,000, March Rp. 1,515,000, April for Rp. 1,515,000, May for Rp. 750,000 and June for Rp. 372,666,667.

b. While the city of Lamongan only in February experienced a waste of distribution costs of Rp. 14,035,088 and the number of shipments is 17,544 Kg, the input variables for distributor sales, sales to consumers, distributor profits and consumer profits experience inefficiency as seen in the original value and projected value are not the same. For the month of March only experienced a waste of distribution costs of Rp. 50,000.

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