

Supplier Selection on Rendement Rate of Patchouli Leaf

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Abstract

The aim of research is to design the model of rendement rate by considering the criteria of patchouli leaf and designing a good supplier selection model to maximize the company profit by considering the acceptance of the patchouli oil rendement rate. The selection of suppliers discussed is to consider the quantity of goods offered by suppliers, demand, budget and acceptance limitation of rendement rate. To overcome these limitations, it is necessary to develop a supplier selection model that takes into consideration the quantity limitation of goods offered by the supplier and the acceptance of the rendement rate by using Linear Programming (LP) method. The result of the research shows that the determination model of the rendement rate developed to determine the percentage of Rendement Rate (RR) of each raw material supplied by the supplier so that the company can know the quality of patchouli leaf based on the type of patchouli leaf. The analysis result of numerical sample calculation shows that the selected supplier is not a supplier with good patchouli leaf criteria, the analysis result of parameter changes in oil demand and budget indicate that when oil demand is increased over the benchmark data, the model output is insensitive, but when demand is lowered below the benchmark data, the model output looks sensitive.

Keywords: Supplier Selection, Rendement Rate, Patchouli, Leaf.

1. Introduction

Patchouli oil is obtained from the the result of processing of patchouli plants[1]. The consumption pattern of patchouli oil in Indonesia is used as a fixative for fragrance (perfume) in order that the flavour of fragrance is more durable, the patchouli oil is also for mixture of cosmetics products (such as for making soap, toothpaste, shampoo, lotion, and deodorant), food industry needs (e.g. for essence or flavor enhancer), pharmaceutical needs (for the manufacture of anti-inflammatory drugs, anti-fungal, anti-insecticant, aphrodisiac, anti-inflammatory, antidepressant, antilogistic and decongestant), aromatherapy needs, compound raw material and preservation of goods, and various other industrial needs as well.

Based on the actual condition, the system of procurement of patchouli leaf applied to a company in fulfilling its raw material needs is still traditional and has no empirical data that affect the cost of production and quality of products as well. In the other hand, the limitation of open space to plant the pathouli is in considering for industries[2]. Proper supplier selection can reduce the cost of purchasing materials and improve the competitiveness of enterprises, so that many experts believe that supplier selection is the most important activity in a purchasing department[3-7].

The selection of suppliers discussed is to consider the quantity of goods offered by suppliers, demand, budget and acceptance limitation of rendement rate. The limitation of the goods quantity offered by the supplier is that where each supplier can not meet the overall demand of the firm, the demand limitation indicates the monthly oil demand from the consumer[8]. The limitation of budget indicates the capacity of funds owned by the company each month for the required patchouli leaves, while the

acceptance limit of the rendement rate indicates each leaf type criteria sent by the supplier can not meet the good criteria desired by the company[8-10]. To overcome these limitations, it is necessary to develop a supplier selection model that consider the quantity limitation of goods offered by the supplier and the acceptance of the rendement rate by using Linear Programming (LP) method[11]. The limitation of supplier capacity, demand, budget and acceptance of the rendement rate set by the company, it is expected that the supplier selection development model can generate optimal order quantity, selected suppliers and generate the maximum profit for the company.

2. Materials and Methods

2.1 Sample Preparation

The research method used is a multivariate method [12, 13] by using 2 models, namely:

- Model 1
Model 1 is a quality determination model of rendement rate. The model uses dummy regression method, is used to know how much the percentage influenced by the variables of patchouli leaf type criteria.
- Model 2
Model 2 is a supplier selection model that will produce a decision on the number of purchased orders, what suppliers percentage are accepted by the company, how many selected suppliers and how much profit generated from selected suppliers.

Characteristic of patchouli leaf that influential in determination of rendement rate, is described based on the observation result of past data review system of the company, that is in

2008-2009, then the dry leaf criteria used in this research are as follows:

1. Stem height: is the distance of patchouli rod from the ground surface until the stem of patchouli start branching (cm).
2. Leaf shape: there are two types of leaf shape that is the shape of small thick leaf and the shape of wide thin leaf.
3. Type of wrinkling of leaves: there are two types of wrinkling, i.e. dry leaf do not shrink but only rolling (flexible) and dry leaf shrinks, rolls and brittle.

Since the environment impact of waste and waste management of industries and its area in Indonesia have been informed in many reseach studies[14-20]. In this reserach, the waste of patchouli leaf is not include in the consideration or mesasurement.

3. Results and discussion

Based on its characteristics, the developed model is included into the Linear Programming (LP) model[21], because there are non linear variable equations on RR acceptance limitation. The problem solving of this LP model by using the assistance of Lingo computer version 9.0. The output of the Lingo Software can be seen in Figure 1.

The Company orders the patchouli leaf raw material to 5 (five) suppliers with the capacity limitation of oil demand of 200 kg, with a budget of Rp 40,000,000. The oil will be sold to customers with a selling price of Rp 250,000 per kg of patchouli oil. The supplier data is shown in Table 1 as follows:

Table 1. Supplier Data
The problem solving is done by using a developed model.

i	j								X3 (cm)			
	1		2		3		4		j			
	Vij(kg)	HBij(Rpkg)	Vij(kg)	HBij(Rpkg)	Vij(kg)	HBij(Rpkg)	Vij(kg)	HBij(Rpkg)	1	2	3	4
1	0	0	0	0	800	4200	400	3500	0	0	40	40
2	0	0	0	0	2480	4000	0	0	0	0	40	0
3	4710	6000	0	0	2495	4200	0	0	15	0	30	0
4	0	0	0	0	0	0	8500	3000	0	0	0	40
5	0	0	12300	5100	0	0	0	0	0	10	0	0

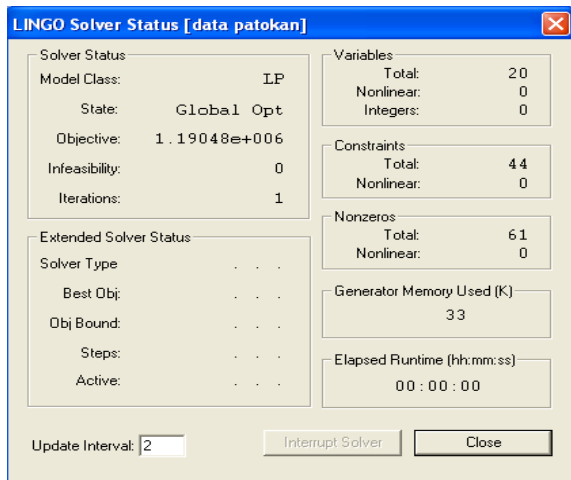


Figure 1. Data Processing Output Model of the Lingo Software

Sensitivity Analysis

Sensitivity analysis is performed to know the changes occurred in the model result due to changes in a parameter. The decision optimization model for supplier selection takes into account three factors, that is demand factor, and budget.

Sensitivity analysis is performed by using the following parameters:

- Demand of 200kg
- Budget of Rp 40,000,000
- Selling price of Rp 250,000

There are 5 (five) suppliers with 4 (four) types of patchouli leaves. As a benchmark, we use the parameter value that can be seen in the following Table 2.

The results of Lingo Software can be seen in tabel below:

Table 1. Data Processing Output Result

I	Oj(kg)			
	1	2	3	4
1	0	0	800	0
2	0	0	2480	0
3	1708.403	0	2495	0
4	0	0	0	1996.861
5	0	0	5000	0

The calculation results in Table 1, then it is obtained a profit of Rp 7,403,475

Table 2. Benchmark Supplier Data

i	j								X3 (cm)			
	1		2		3		4		j			
	Vij(kg)	HBij(Rpkg)	Vij(kg)	HBij(Rpkg)	Vij(kg)	HBij(Rpkg)	Vij(kg)	HBij(Rpkg)	1	2	3	4
1	3000	6000	2000	5000	5000	4200	4000	3500	10	15	30	40
2	3000	5800	2000	5000	5000	4000	4000	3000	15	10	30	35
3	3000	6000	2000	4900	5000	4200	4000	2900	10	20	25	40
4	3000	5700	2000	5200	5000	4200	4000	3000	15	10	30	40
5	3000	5800	2000	5100	5000	4000	4000	3000	15	10	30	40

Table 3. Data Processing Output Result

I	Oj(kg)			
	1	2	3	4
1	0	0	0	0
2	0	0	4615.385	0
3	0	0	0	0
4	0	0	0	0
5	0	0	5000	0

The calculation results in Table 3, then it is obtained a profit of Rp 11,538,460.

Change of Demand

Table 4. Change Sensitivity Analysis of Demand Parameter

D	sum O	i	j	Profit
500	5000	3	3	Rp10,148,810.00
	4523.81	5	3	
400	5000	3	3	Rp10,148,810.00
	4523.81	5	3	
300	5000	3	3	Rp10,148,810
	4523.81	5	3	
200	5000	3	3	Rp10,120,190
	4495.192	5	3	
100	4694.836	3	3	Rp5,281,690
50	2347.418	3	3	Rp2,640,845

The sensitivity analysis of the supplier selection optimization model by changing the demand parameter is presented in Figure 2.

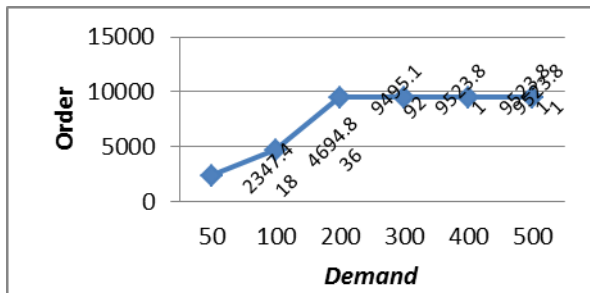


Figure 2. Decision Variable Sensitivity Graphs of Number of Buyers to Demand Parameter Changes (D)

Figure 2 shows the output sensitivity of the decision variable to the D value. The model output is not sensitive to the parameter value D is converted to be greater than 200 kg. The output is sensitive to parameter values if it is changed to be less than 200 kg.

Budget Change

Table 5. Sensitivity Analysis of Budget Parameter Changes

B	Sum O
Rp38,000,000	13557.03
Rp30,000,000	7245.905
Rp20,000,000	4875.25
Rp15,000,000	3625.25
Rp10,000,000	2380.952
Rp5,000,000	1190.476

The sensitivity analysis of the supplier selection optimization model by changing the demand parameters is presented in Figure 3.

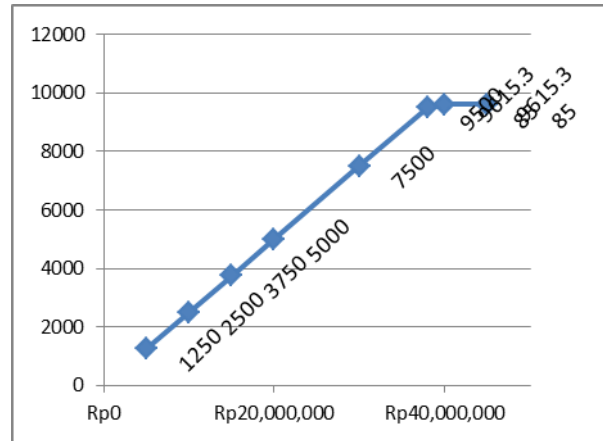


Figure 3. Decision Variable Sensitivity Graphs of Number of Buyers to Budget Parameter Changes (B)

In the figure above, to know the output sensitivity of the decision variable to the value of B. The model output is not sensitive to the value of parameter B is changed to be greater than Rp 38,000,000. The sensitive output of parameter values is changed to be less than Rp 38,000,000.

4. Conclusion

Based on the purpose of research, the results obtained in this research can be concluded as follows:

1. The determination model of developed rendement rate can determine the RR percentage from each raw material supplied by the supplier, so that the company can know the quality of patchouli leaf based on the type of patchouli leaf.
 2. The supplier selection model can only be used in the case of the same product, and the model is independent of a certain period.
- The result of numerical sample calculation analysis shows that the selected supplier is not a supplier having good patchouli quality criteria, that is supplier which has type 2 and 5 of patchouli leaves type. This happens because of the possibility of limited budget capacity factors.
- The analysis result of parameter change in oil demand and budget indicate that when oil demand is increased over the benchmark data, the model output is insensitive, but when the demand is lowered below the benchmark data, the model output model looks sensible. This happens because of the company's budget limitation. The result of the budget change analysis indicates that the higher the owned budget, the more insensitive, and otherwise, the budget under supply data shows the sensitive output. This happens because of the limiting capacity of the demand which in the case of the fact, the company can not store the ordered goods.
- The model result shows that a budget limitation, demand and acceptant of the rendement rate provides an input for the company to obtain the maximum profit that can be a consideration in conducting the selection of suppliers.

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