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BREAKEVEN POINT AND INCREMENTAL ANALYSIS IN DECISION MAKING OF LEASE-PURCHASE OPTION OF HEAVY EQUIPMENT AT NICKEL LATERITIC ORE MINING

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ABSTRACT

Production and cost planning were several important things to be considered in making decisions for development of a company production. Revenues from production process of lateritic nickel ore mining in PT. ANTAM (Persero) Tbk, UBPN Sultra last few years only provided profit that did not reach the company's target. The costs greatly affected economics of production and corporate profits, one of which was the cost of procurement of heavy equipment. The company was still using heavy equipment leasing services to carry out production activities. Based on these problems, it was necessary to do an analysis about production and decision making procurement of heavy equipment with a lease-purchase alternative for year 2016 to 2020. The data used were costs, data company's production and price data from factors that affected the heavy equipments operation. Production was analyzed by using breakeven point analysis, whereas for deciding on leasing or purchasing was using incremental analysis and sensitivity analysis. Based on data processing and analysis, it was indicated that laterite nickel ore production in 2012-2015 would still be in a state of breakeven. Estimation results of production in 2016-2020 to maintain the safety limit production showed that production of nickel laterite ore would also still be in the breakeven point. Based on the analysis of incremental and sensitivity, when the heavy equipments lifetime lasted for five years, the procurement of heavy equipment by purchasing was more efficient compared to the lease option.

Keywords: cost, profit, internal rate of return, present value, sensitivity.

INTRODUCTION

Break-even analysis is widely used as a management method to analyze the relationship between the sales volume and the profit of the firm (Laitinen, 2011). In other words, break-even analysis is an analysis that shows the level of company production that does not earn a profit or suffer a loss. This analysis can provide information about minimum level of sales that has to be achieved in order to avoid a loss. The minimum level is considered as a break-even point. Break-even point is the point of sales or amount of sales or revenues to be generated in order to equal to its expenses (Sharma, 2014). In addition, the company also can determine how low the planned sales volume may decrease by using break-even analysis. In analyzing mining companies in Indonesia, application of analysis of the break-even point was affected by ups and downs of the industry due to several factors. The ups and downs phenomenon identified a significant change to company income (Soehardi, 2002).

Another important thing in production planning is production costs. One of the costs that affect economic rate of mining production is costs of heavy equipment. PT. ANTAM (Persero) Tbk, UBPN Sultrais currently still using heavy equipment leasing services to carry out production activities. There is high possibility that mining life time of UBPN Sultrais still long, then purchase option can be an alternative to be considered in order to be more efficient.

To do a proper production planning, this study is to analyze the breakeven point of production and decision making with an alternative procurement lease and purchase of heavy equipment. Decision-making must calculate changes that may occur when there is an increase or decrease in factors that affect the stability of the company's cost management using sensitivity analysis. All of this analysis can be used as a material consideration in the decision-making production management. Therefore, this study was conducted to determine the best alternative between leasing and purchasing option based on breakeven analysis and incremental production.

LITERATURE REVIEW

Break-even point analysis

Break-even point of production was calculated to overview condition and stability of production in the year 2012 to 2015. Production cost of the year 2016 to 2020 was estimated to calculate the breakeven point of production. Break-even point of the year 2016-2020 was then used as a consideration in overseeing nickel laterite ore production.

The break-even point was calculated by using equation 1 and 2 (Soehardi, 2002).

$$\text{BEP (Unit)} = \frac{FC}{(P-V)} \quad (1)$$

Where:
BEP = Break-even Point
FC = Fixed cost
P = Sales/unit
V = Variable cost/unit

$$\text{BEP (Rp)} = \frac{FC}{(1-VC/S)} \quad (2)$$

Where:
BEP = Break-even Point
FC = Fixed cost
VC = Variable cost
S = Sales

Incremental analysis

Incremental analysis could be defined as examination of differences between alternatives. This analysis was conducted by calculating Internal of Return (IRR) and Present Value (PV) between leasing and purchasing cost of heavy equipments. Internal Rate of Return (IRR) may be defined as the rate that equates the initial investment with the future value of the resulting cashflow (Torries, 1998). This value was calculated for choosing the best alternative between leasing or purchasing heavy equipment. IRR was calculated using Equation 3 when NPV = 0. If the calculation result was greater than the payback target, then the best alternative would be the alternative with the greatest cost.

$$\text{NPV}= 0 = \left[\sum_{t=1}^{n} \frac{CF_t}{(1+i)^t}\right] - I_0 \quad (3)$$

Where:
NPV = Net Present Value
CF_t = Cash flow in the year t
I_0 = Investment in early year
i = Discount rate (IRR)
n = Project year

The present value (PV) of each alternative was calculated first and then compared to the value of all alternatives. If cost is taken into account, then the selection of the best alternative is based on the smallest PV costs or expenses. If it is the reception that is considered, then the selection of the best alternative is based PV greatest acceptance. Present value can be calculated by using equation 4 (Blank and Tarquin, 1989).

$$\text{PV} = -I_0 + A\,(P/A, i, n) - S(P/F, i, n) \quad (4)$$

Where:
PV = Present Value
I_0 = Investment in early year
A = Annual value
P = Present value
F = Future value
S = Salvage value
i = Discount rate(IRR)
n = Year/period

Sensitivity analysis

Sensitivity Analysis allows the study of how uncertainty in the output of a model can be apportioned to different sources of uncertainty in the model input (Saltelli, 2002). This analysis was conducted to determine sensitivity of IRR and Present Value on the factors that affected them. Sensitivity analysis wascarried out by creating 8 scenarios of production cost, which were:

a) All of cost parameters were escalated by 5% and depreciation cost was calculated with equipment lifetime for 3 years.
b) All of cost parameters were escalated by 5% and depreciation cost was calculated with equipment lifetime for 10 years.
c) All of cost parameters were escalated by 5% and the purchase of equipment was made at once in the beginning with the lifetime of 3 years.
d) All of cost parameters were escalated by 5% and the purchase of equipment was made at once in the beginning with the lifetime of 5 years.
e) All of cost parameters were escalated by 5% and the purchase of equipment was made at once in the beginning with the lifetime of 10 years.
f) All of cost parameters were escalated by 10% and depreciation cost was calculated with equipment lifetime for 3 years.
g) All of cost parameters were escalated by 10% and depreciation cost was calculated with equipment lifetime for 5 years.
h) All of cost parameters were escalated by 10% and depreciation cost was calculated with equipment lifetime for 10 years.

MATERIALS AND METHODS

This research was conducted at the nickel laterite ore mining, PT. ANTAM (Persero) Tbk. UBPN Sultra, Pomalaa, Kolaka, Southeast Sulawesi. Geographically, the study area was located on 121°31’ BT - 121°40’ BT dan 4°10’ LS - 4°18’ LS. Data used in this research were data costs to calculate the total cost of production, the company's production data for the evaluation of production and price data from the factors that affect equipments operation.

Processing and data analysis were conducted at the Laboratory of Mine Planning and Valuation using Microsoft Excel 2013.

RESULTS AND DISCUSSIONS

This research only counted the costsof nickel lateritic ore mining process and did not count the processing cost of ore into metal ferronickel. UBPN Sultra’s Production target in 2016was amounted to 380 thousand tons of overburden and 358 thousand tons of high grade ore. In the year of 2016, there were six main heavy equipments that supported mining actitivities. Type and quantity of equipment application in 2016 were shown in Table-1.

Table-1. Type of heavy equipment in mining activities (Mine Operation, 2016).

Kind of Equipment	Type	Quantity (Unit)
Excavator	Komatsu PC-200	5
Dump truck	Hino FM260TI	12
Bulldozer	Komatsu D85E-SS	4
Grader	Komatsu GD505	1
Breaker	Komatsu PC-200 HRB	1
Water Tank	Hino FM260TI	1

Breakeven point of production

Based on the production and cost information, breakeven point was calculated with assumption that the company made sales of raw nickel ore without passing through ferronickel processing. The calculation results of breakeven analysis in 2012-2015 were shown in Table-2.

Table-2. The results of breakeven analysis in 2012-2015.

Year	2012	2013	2014	2015
Fixed Cost (Rp)	133.206.356.723	140.319.710.509	58.639.030.591	85.796.410.656
Variable Cost (Rp)	219.347.373.165	232.476.280.795	39.645.578.297	46.509.630.788
Sales (Rp)	709.141.896.000	1.361.788.848.000	253.315.524.000	135.388.000.000
Break Even Point (cost) (Rp)	192.860.891.582	169.205.428.572	69.519.261.177	130.693.267.090
Break Even Point (ore) (ton)	489.534	347.906	164.662	482.662
Contribution Margin (Rp)	489.794.522.834	1.129.312.567.204	213.669.945.702	88.878.369.211
Contribution Margin Ratio (%)	69	83	84	66
Margin of Safety (%)	73	88	73	3

In order to avoid losses, there were two ways to do, which were by increasing the number of production or by increasing the grade ore. Data used were the production costs in the year of 2015 which then was escalated 3% for every year, then the cost was estimated for the calculation of breakeven analysis for the year of 2016 to 2020. The estimation results of the breakeven analysis were shown in Table 3.

Table-3. The estimation results of breakeven analysis in 2016-2020.

Year	2016	2017	2018	2019	2020
Fixed Cost (Rp)	88.370.302.975	91.021.412.065	93.752.054.426	96.564.616.059	99.461.554.541
Variable Cost (Rp)	47.904.919.712	49.342.067.303	50.822.329.322	52.346.999.202	53.917.409.178
Sales (Rp)	195.055.942.000	272.424.500.000	272.424.500.000	272.424.500.000	272.424.500.000
Break Even Point (cost) (Rp)	117.139.197.701	111.153.811.492	115.253.187.607	119.533.196.953	124.004.050.227
Break Even Point (ore) (ton)	214.994	204.008	211.532	219.388	227.593
Contribution Margin (Rp)	147.151.022.287	223.082.432.696	221.602.170.677	220.077.500.797	218.507.090.821
Contribution Margin Ratio (%)	75	82	81	81	80
Margin of Safety (%)	40	59	58	56	54

Achieved revenue values were greater than revenue value of breakeven analysis, then it was indicated UBPN Sultra production was still in state of breakeven. Conversely, if the achieved revenue values were smaller than revenue value of breakeven analysis, then UBPN Sultra would suffer losses. This estimation could maintain safety limit of production volume of nickel ore to keep the company from suffering losses.

Needs of heavy equipment

Quantity of heavy equipment affected cost budgeting. The amount of costs was an important consideration in the decision making lease-purchase of heavy equipment. The amount of heavy equipment was calculated based on the company's production target with production volumes that could be produced by the equipment for every year (Table-4).

Table-4. Quantity of equipment of 2016-2020.

Kind of Equipment	Quantity				
	2016	2017	2018	2019	2020
Excavator	5	6	6	6	6
Dump truck	12	20	22	24	24
Bulldozer	4	6	6	6	6
Grader	1	2	2	2	2
Breaker	1	2	2	2	2
Water Tank	1	2	2	2	2

Incremental analysis

Lease option

PT. ANTAM (Persero) Tbk, UBPN Sultra was currently conducting nickel ore production by using rental equipments from one contractor in Pomalaa, namely PT. Satria Jaya Sultra (PT. SJS). In order to anticipate increasing costs, rental costs were escalated 5% every year. Total cost of lease option in the years 2016-2020 were shown in Table-5.

Table-5. Total cost of lease option in 2016-2020.

Kind of Equipment	Lease Option (Rp)				
	2016	2017	2018	2019	2020
Excavator	4.534.737.822	7.618.359.541	7.999.277.518	8.399.241.394	8.819.203.464
Dump truck	8.851.250.514	20.652.917.867	23.854.120.136	27.323.810.337	28.690.000.854
Bulldozer	4.862.115.161	10.210.441.839	10.720.963.931	11.257.012.127	11.819.862.734
Grader	748.893.774	2.096.902.568	2.201.747.696	2.311.835.081	2.427.426.835
Breaker	1.170.821.758	3.278.300.923	3.442.215.969	3.614.326.768	3.795.043.106
Water Tank	575.787.242	1.612.204.278	1.692.814.492	1.777.455.217	1.866.327.977
Total	20.743.606.272	45.469.127.015	49.911.139.742	54.683.680.924	57.417.864.970

Purchase option

Purchasing cost was consisted of two types of cost, which were owning cost and operating cost. Owning cost had to be spent whether the equipment was operated or not. Owning cost was consisted of depreciation cost, capital interest cost, tax, and insurance. Operating cost was the cost occurred when the equipment was operated. Operating cost was consisted of maintenance cost, fuel, lubricant, and tire cost. Equipment leasing was conducted without counting the owning cost because it was already included in the rental fee. Purchasing plans for 2016-2020 were calculated based on the amount of equipment and price which were escalated by 5% every year. Total cost of purchase option in 2016-2020 were shown in Table-6.

Table-6. Total cost of purchase option in 2016-2020.

Cost Classification	Cost (Rp)				
Year	2016	2017	2018	2019	2020
Purchasing cost	40.291.000.000	23.481.150.000	2.440.935.000	2.562.981.750	-
Depreciation	8.058.200.000	12.754.430.000	13.242.617.000	13.755.213.350	13.755.213.350
Capital interest, tax, and insurance	90.654.750	143.487.338	148.979.441	154.746.150	154.746.150
Maintenance		5.051.946.240	11.198.480.832	12.377.268.288	13.645.938.288
Fuel	1.309.210.805	1.832.895.127	1.924.539.883	2.020.766.877	2.121.805.221
Lubricant	368.222.040	843.862.320	945.953.467	1.056.144.073	1.108.951.277
Tyre	406.459.872	917.140.224	1.000.516.608	1.083.892.992	1.083.892.992
Total	50.523.747.467	45.024.911.248	30.902.022.232	33.011.013.481	31.870.547.278

Decision making for procurement of heavy equipment between leasing or purchasing option were conducted by incremental analysis. This analysis compared the costs between two alternatives by calculated the IRR and PV. IRR was calculated by looking at the differences between purchasing cost and leasing cost of the heavy equipment every year. PV of the leasing cost and the purchasing cost could be calculated individually or

could be calculated by determining differences between the both costs. Based on a minimum ROR of 15%, results of the incremental analysis for lease-purchase options of heavy equipment were shown in Table-7.

Table-7. Incremental analysis.

Year	Lease option (Rp)	Purchase option (Rp)	Purchase - Lease (Rp)
2016	-20.743.606.272	-50.523.747.467	-29.780.141.195
2017	-45.469.127.015	-45.024.911.248	444.215.767
2018	-49.911.139.742	-30.902.022.232	19.009.117.511
2019	-54.683.680.924	-33.011.013.481	21.672.667.443
2020	-57.417.864.970	-31.870.547.278	25.547.317.693
Total	-228.225.418.924	-191.332.241.705	
IRR (%)			31
PV (Rp)	-145.048.894.211	-133.017.024.938	12.031.869.272

Cost difference between lease and purchase of heavy equipment was calculated and value of the difference was used in calculation of the IRR and PV. Negative sign indicated that the numbers used were expenditure figures (costs). Result of the analysis in Table-7 showed the IRR was 31% which was greater than the targeted rate of return, showed that the best alternative was the purchasing option.

The PV of purchase option - Rp133.017.024.938 was smaller than the PV of lease option - Rp145.048.894.211, then the best alternative was to purchase the heavy equipments. If the PV had been calculated by using different cost, it should be considered whether the result was greater than 0 or less than 0. The PV obtained was Rp12.031.869.272, indicated the best alternative was decision to purchasing the heavy equipments.

Sensitivity analysis

The sensitivity analysis was conducted by analyzing the parameters affecting to see the possible changes that may occur. Values were analyzed in this study consisted of two variables, which were Internal Rate of Return (IRR) and Present Value (PV). Results of IRR and PV for each of five scenarios, each of which was calculated by incremental analysis, were shown in Table 8.

Table-8. Sensitivity analysis.

Scenario	Incremental Analysis		Alternative Choices
	IRR (%)	PV (Rp)	
Scenario 1	0,5	-32.122.706.741	Leasing
Scenario 2	34	12.027329.861	Purchasing
Scenario 3	2	-7.261.355.376	Leasing
Scenario 4	52	33.985.275.898	Purchasing
Scenario 5	30	11.363.131.263	Purchasing
Scenario 6	6	-3.597.100.916	Leasing
Scenario 7	68	43.715.169.616	Purchasing
Scenario 8	52	26.358.115.371	Purchasing

Based on this analysis, factor which was most affecting sensitivity of IRR and present value was equipment's lifetime. This analysis provided some considerations that the lifetime greatly affected the cost. Different lifetime of equipment whether for 3 years, 5 years, and 10 years would result in different machine condition. Equipment with lifetime of 5 and 10 years would be more in need of repair and maintenance compared with equipment that lasted for 3 years. In this case, the operator skill and the maintenance affected the equipment's ability to survive and operate properly. Therefore, in deciding between renting or purchasing the equipment, one important thing to be considered was the lifespan of the equipment used. The better the way we used the equipment, the longer the life of the equipments. The longer the life of the equipments, the higher cost efficiencies could be achieved.

Comparison of lease-purchase option

Incremental analysis was conducted by looking at the Internal Rate of Return and Present Value between lease and purchase options. It could be seen that the procurement of heavy equipment by purchasing would be more efficient than leasing when the heavy equipments lifetime lasted for 5 or 10 years. However, 10-year old equipment would have costlier repairs. Therefore, equipment that lasted 5 years would be more efficient to be used. Based on the incremental analysis in Table-7, then comparison chart of lease and purchase option was shown in Figure-1.

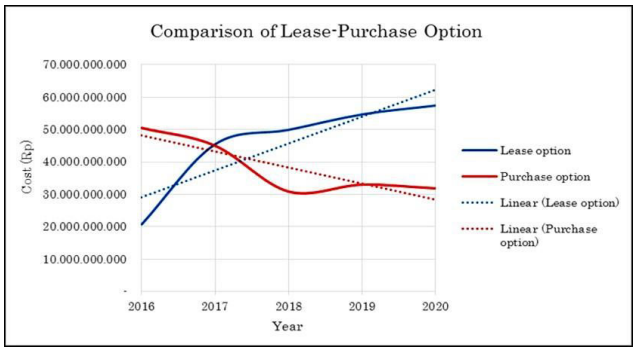

Figure-1. Comparison chart of lease-purchase option.

The line graph showed that the costs for leasing option increased significantly compared to the costs for purchasing option that showed a decreasing line with smaller level of vertical difference. IRR was relatively high and larger than the target's rate of return, therefore the purchase option was still better option. Based on the incremental analysis using prices that have been calculated, it was indicated that the cost of purchase option was greater than the lease option. Based on the value of IRR which was greater than 15% and the value of PV was positive (+) or more than 0 then buying the heavy equipment was still better option than renting.

CONCLUSIONS

Data processing and analysis of this research provide some conclusions, i.e., production and sales of nickel ore mining at PT. ANTAM (Persero) Tbk, UBPN Sultra in the year 2012 to the year 2015 reached the breakeven point of production and was still in a stable condition.

Break-even estimated results for nickel ore mining in 2016 to 2020 showed that the nickel laterite ore production in UBPN Sultra was still in breakeven point. The estimation results could maintain safe limits nickel

ore mining production volume so companies did not suffer losses.

IRR and PV in the sensitivity analysis showed that if using equipment with lifetime of 5 years, then it was better to make purchasing option, while using equipment with lifetime of 3 years, then the lease option was the best alternative.

The best alternative procurement of heavy equipments for the production of nickel ore mining was the purchasing option with a service lifetime of 5 years.

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