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ANALYSIS OF PRODUCTIVITY OF DIGGING TOOLS AND TRANSPORTATION EQUIPMENT IN STRIPING SOIL LAYERS USING THE SIMPLEX METHOD

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Abstract:
One operation in mining coal is transfer layer cover (overburden). To increase capacity handling burden, necessary planning needs equipment, machine mechanical form tool load, And tools capable of transporting operate optimally depending on the situation And condition in the field. Demolition layer land cover (overburden) begins with excavation of the front and transportation to the disposal area with tool mechanical excavator PC 2000 with a capacity of 123 buckets and Komatsu HD 785 dump truck capacity of 603. Calculations use a tool calculated, the simplex minimization method And are processed using POM software. On study this obtained results with four iterations obtained results 7,728 and If compared to with manual calculations obtained 7.1 then tools needed. In 1 fleet there are 7 HD units for production can be fulfilled.

Keywords: Coal, Tools mechanical, Simplex method

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INTRODUCTION

Indonesia is a country rich in coal resources, and coal is currently an alternative energy source (Kholiq, 2015). Coal is an energy source and is an important mining asset in Indonesia, which will be increasingly sought after in the utilization of this energy source (Haryana, 2017). Along with the development of global industry at this time, this has also caused an increase in oil prices worldwide, resulting in a significant increase in the need for fuel for industrial purposes, which is increasing in vast quantities. Coal is a non-renewable natural resource, meaning that if the mining material is used up, it cannot be recovered. Coal mining, like mining in general, consists of a series of operations which include the stages of general investigation, exploration, feasibility studies, construction, mining, processing and refining, transportation, sales and post-mining; mining activities are very complex and risky business activities involving high technology, capital intensive and legal regulations by applicable regulations. (Didik Suyadi, 2013) . Then, in coal mining, there are several types of soil layers, namely the first layer and the second layer. The first layer is topsoil and subsoil, the second layer is sand and overburden, and the last layer is coal. In this case, the overburden is one of the operations carried out by the contractor to obtain coal. Overburden covers all layers of soil and rock above and directly covers the excavated layer of valuable material, so it must be removed first before the valuable material can be excavated. Stripping of overburden begins with excavation at the front and transportation to the disposal area using mechanical equipment in the form of a PC 2000 excavator with a bucket capacity of 123 and tool transport Komatsu HD 785 with a volume of 603 with a mining area at PT Satria Loud noise Means This capable create field Work And become source income for public And the surrounding area.

Linear Programming is a method of math in allocating source limited power to reach something objective like maximizing profit And minimizing cost (Anti & Sudrajat, 2021). Linear

Programming is applied in problem economics, industry, military, social and others. Desired results Possible showed as maximization from some profit, sales And welfare, or minimization on cost, time And distance. Problem optimization This can resolved with Linear Programming.

Linear programming is related to explaining something case in the world as a mathematical model consisting of A function linear goals with several linear constraints (Astuti et al., 2013). Linear Programs are part of Special mathematics applied For finish related issues _ with determination (Aprilyanti et al., 2018) :

1. Amount input variables used in something problem.
2. Combination input variables that must be provided or a combination of outputs that must be generated.
3. The amount of output required generated to reach specific goals, to reach optimization from something problem, for example, To achieve maximum profit or minimum costs.

In 1947, one expert in math from the United States found a method for solving linear programming problems with the "simple method" (Alam et al., 2021). Method simplex is Wrong. One technique solution in the linear program is used for making decisions in related problems with the allocation of source Power optimally (Susdarwono, 2020). Method simplex is used to look for the optimal value of the linear program involving lots of constraints and lots of variables (more from two variables). Invention method This is a leap giant in research operation And is used as a procedure solution from every computer program completion problem optimization with method simplex based on technique elimination (Suryanto et al., 2019). Determination of optimal solution is carried out by inspecting point extreme one by one with method iterative calculation (Shawma & Setyono, 2014). So, the determination of the optimal solution with simplex is done step by step with iteration. Iteration -I only depends on iteration previous (i-1) (Aprilyanti et al., 2018).

METHOD

The type of research used in this research is quantitative. The method used in a study that is descriptive and explains something circumstances, conditions, or other things then will pour in form report research. Location PT Satria Bahan Sarana located in Tanjung Enim, District Mace South, District estuary Enim, South Sumatra with distance ± 168 km Southwest centre Palembang city. Regional area permission business PT Satria Bahan Sarana located on position LS-4o47'30"LS and 103o45'BT – 103o50'BT or line longitude 9,583,200 – 9,593,200 and latitude 360,600 – 367,000 in system coordinates international. Research data This uses primary data and secondary that will processed by objective or direct research. Primary data required in the study, namely the Average Cycle Time of the Tool Load Komatsu PC 2000 digging time, swing load time, dumping time, swing empty time, Average Tool Cycle Time data Transport Komatsu HD 785 manoeuvre empty time, loading time, hauling load time, manoeuvre load time, dumping, hauling empty time while secondary data Bulk data rain amount data tool And specifications, geological data, and supporting data others.

RESULTS AND DISCUSSION

Cj	Basic Variables	1 X1	1 X2	0 artfcl 1	0 surplus 1	0 artfcl 2	0 surplus 2	Quantity
Phase 1 - Iteration 1								
1	artfcl 1	71,56	0	1	-1	0	0	531,547
1	artfcl 2	0	71,56	0	0	1	-1	531,547
	zj	-71,56	-71,56	1	1	1	1	1.063,094
	cj-zj	71,56	71,56	0	-1	0	-1	

Figure 1 Solution Iteration 1

Phase 2								
1	X1	1	0	0,014	-0,014	0	0	7,428
1	X2	0	1	0	0	0,014	-0,014	7,428
	zj	1	1	-,014	,014	-,014	,014	14,856
	cj-zj	0	0	0,014	-0,014	0,014	-0,014	

Figure 2 Solution Iteration 2

Iteration 3								
0	X1	1	0	0,014	-0,014	0	0	7,428
0	X2	0	1	0	0	0,014	-0,014	7,428
	zj	0	0	2	0	2	0	0
	cj-zj	0	0	-1	0	-1	0	

Figure 3 Completion of Iteration 3

Iteration 2								
0	X1	1	0	0,014	-0,014	0	0	7,428
1	artfcl 2	0	71,56	0	0	1	-1	531,547
	zj	0	-71,56	2	0	1	1	531,547
	cj-zj	0	71,56	-1	0	0	-1	

Figure 4 Solution Iteration 4

If some of this data is known, then it can be determined how to determine production efficiency so that production achievements are met by reducing production costs efficiently by calculating equipment requirements (match factor) using the simplex method.

Problem-Solving

Production target = 1,250,000 Bcm/month (effective days 30 days). So the targets that must be achieved:

Dailv target $= \frac{target\ produksi}{hari\ kerja\ efektif}$

$= \frac{\mathbf{1.250.000}}{\mathbf{30\ hari}} = 41.666{,}6\ Bem/day$

Hourly $= \frac{daily}{available\ work\ hours}$

$$\frac{41.666{,}6 Bcm/day}{20{,}5\ hours}$$

= 2,032.517 Bcm/hour

To achieve production according to the specified target, the tools needed in 1 fleet are:

$$\frac{hourly\ target\ (\frac{Bcm}{hours})}{Bcm/HD}$$

$$=\frac{2.032{,}517\ Bcm/hours}{286{,}27 Bcm/hours} = 7{,}1$$

The number of dump trucks required in 1 fleet with a transport distance of 2,900 meters

Problem-Solving With POM Software

X1 = 71.56 ⟶ (Q.HD)
X2 = 0
X3 = 531,547 ⟶ (Q. loading digging equipment)
Then, the function x;
1X1 + 1X2 <531,547
7156 + 0 <531,547

This function was entered into the POM software with linear program calculations using the simplex minimization method from data processing, which was carried out using POM software, carried out four iterations and obtained a result of 7.428. When compared with manual calculations, the value obtained is 7.1, so the tools needed are one fleet 7 HD units are needed to achieve production.

CONCLUSION

In problem-solving, the production target is 1,250,000 Bcm/month (effective days 30 days).

In problem-solving with POM software using a linear program using the simplex minimization method with four iterations, the result was 7.728. If compared with manual calculations, it was 7.1, so the tools needed in 1 fleet are 7 HD units so that production can be met.

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