

OPERATION AND SUPPLY CHAIN MANAGEMENT**Choiril Firmansyah**

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Abstract

Productivity is known as the result of comparing output with input. The greater the output with minimal input, the greater the profit for the company. As a mining service company, PT GSP must be able to provide equipment in accordance with the production target given by its customers. After analyzing the design process, the next problems are that the company will still insist on using all the tools available. The next problem is how to accommodate all the tools and maximize their performance. From periodic improvement that has been done, evaluation of the results was performed and it showed a significant development. The results of the improvement on the front loading area made the delay time of the loading equipment decrease significantly as a result of the improvement and increased the productivity of the equipment significantly.

Keywords: opration, supplay chain, management**INTRODUCTION**

PT Gelora Sukses Pratama (GSP) is a coal mining contractor operating in Jambi Province, Indonesia. In 2021 GSP become the primary mining contractor at Batu Hitam Sukses. In 2022, PT GSP had a good year, achieving its production target of 1,200,000 MT of coal, exceeding the target of 1,080,000 MT by 111%. This was one of PT GSP's best achievements during its project with PT BHS as the mining concession owner. However, some points needed attention, including the lack of effectiveness and efficiency in the work results, as evidenced by the productivity of the work (Jacobs & Chase, 2018).

Productivity is known as the result of comparing output with input (Copacino, 2019; Troutt, Ehie, & Brandyberry, 2007). The greater the output with minimal input, the greater the profit for the company. According to the company's internal calculations, the production result of 1.2 million MT could have been produced from 3 production units, but the actual result was 1.2 million MT produced from 4 production units (Posadneva & Malinovskaya, 2017). This was inefficient since 4 production units should have been able to produce a much larger output. Generally, the business process of PT GSP as a mining service provider is to provide services to customers, namely assisting in the coal extraction process (coal production), and the services are carried out in accordance with good mining practices (GMP).

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Figure 1 PT GSP Business Process

(Source: PT GSP, 2021)

As a mining service company, PT GSP must be able to provide equipment in accordance with the production target given by its customers. PT BHS as a customer has given its trust to PT GSP to be able to provide the best service in providing equipment and also mining process. PT BHS does not care how many tools will be used by PT GSP to achieve the targeted production, because PT BHS will pay PT GSP from the amount of coal produced by PT GSP.

PT GSP looks for quick solutions to resolve production inefficiency by adding more production equipment. Although this is the simplest solution, it will increase cost per activity. The main mistake made in 2021 and 2022 was the poor arrangement of equipment, both for loading and transportation, leading to excessive spending with insufficient revenue, also known as living beyond one's means. The main issue lies in the productivity of both loading and transportation equipment.

(Jacobs & Chase, 2013) define efficient as "doing things in a way that uses the least amount of resources possible". The work done by PT GSP in the form of work given to its customers is not a problem, because customers still get what they want, which is the coal extraction service, which is the product of its customers, namely PT BHS. However, conceptually what is described by Jacob and Chase in their book, which is doing something in a way that uses the least possible resources, is not applied well by PT GSP, so that the results obtained are not optimal, making good achievements in terms of production results not followed by company profits.

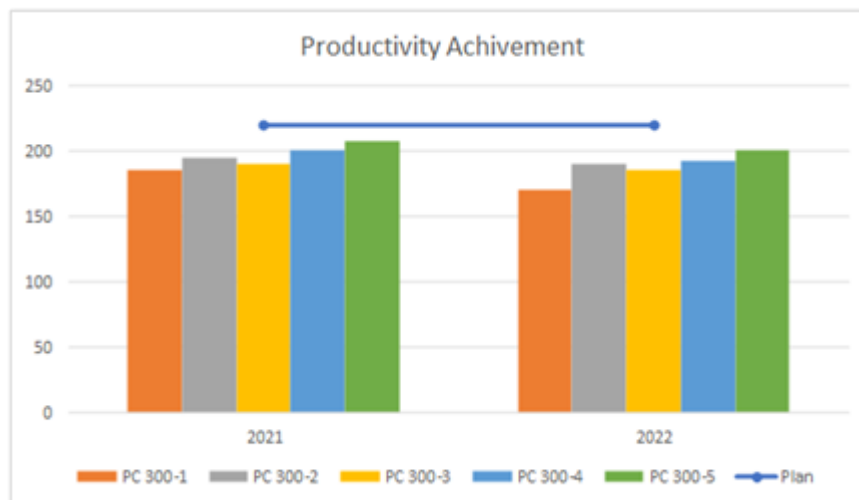
Problem Identification

Although PT GSP has achieved well in production, PT GSP hasn't maximized the capacity of their tools so that the achievement is only a number and not the quality of work, caused by the un-maximum performance of their tools that made PT GSP used a solution by increasing the number of tools to reach the targets given by customers (Qi, Huo, Wang, & Yeung, 2017). Increasing the number of tools is not an appropriate solution because every production tool has its production capacity so by increasing the tools the production capacity should increase too (Santos, Wysk, & Torres, 2014). It should be underlined that the conformity between the usage of loading and transport tools, which this case, PT GSP hasn't maximized their tools' capacity (Yalcin, Shi, & Rahman, 2020).

After the evaluation, several key areas have been identified for GSP to focus on to enhance performance Fleet Capacity: capacity conformity will give a maximum advantage for the company. Fleet Productivity: This tools' productivity is the productivity of loading tools and transport tools per time unit. Production efficiency: After the tools capacity has been maximized in line with its capability and the tools productivity has been reached, the usage of the tools will be evaluated.

Problem Relevance

The matter discussed in the previous sub-chapter has significantly discussed that there is an inconsistency of PT GSP's performance as a mining service contractor company in providing services to its customers, namely PT BHS. The inconsistency is not in the achievement and work results in the form of production achievement from the target set by the customer, but in its implementation which is not optimal, so that in the evaluation, even though the production target is achieved, the performance of the production equipment is not in accordance.



(Source: PT GSP, 2023)

The performance of production tools is still far below the target and this causes losses to the company. PT GSP increases the number of tools to 5 from previously only 4 tools to pursue the production target given by the customer. The capacity of 4 tools can already reach the production target of 1.2 million MT per year, but PT GSP with the number of tools, namely 5, can only reach a production of 1.2 million. This clearly shows the inefficiency of PT GSP's work results.

RESEARCH METHOD

In general, the business process carried out by PT GSP has been quite good with the achievement of production targets even exceeding production targets. However, it can be seen from the optimization of the existing production equipment capabilities that there is still a need to re-evaluate so that the company can get more benefits for the sustainability of the company.

Fleet Capacity Design

The heavy equipment used for production by PT GSP is an excavator with 30-ton class, a Caterpillar product with the unit type Cat 330 GC. The Cat 330 GC has a standard bucket size of 2.2 cubic meters, but PT GSP has made an improvisation by increasing it to 2.5 cubic meters or a weight of 3.25 tons. Increasing the bucket size is a good step which will have a positive impact on the production results. Then for the transportation equipment, PT GSP uses a Scania product with the product type being P380. The load is 12 cubic meters or 15 tons in weight. Looking at the combination of loading and transport equipment, PT GSP has done the right thing by calculating the vessel load carried below 5 passes and above 3 passes. However, in the process, there are several obstacles that occur. Such as the lack of equipment and the number of transportation equipment provided is not appropriate. The impact of this will trigger the failure to achieve the productivity target of the equipment, which will result in the failure to achieve the production target and the main goal of mining business, which is to make a profit.

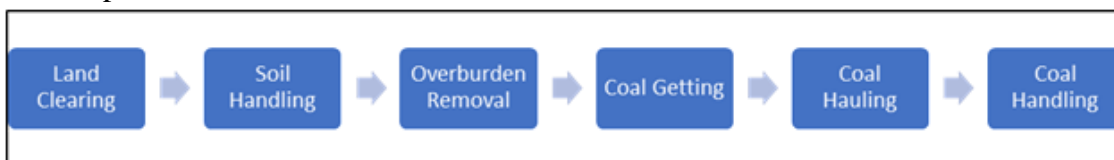


Figure 4 Design Process of Coal Mining Activity
(Source: Author, 2024)

In the process of removing overburden and extracting coal, many production tools are involved. So many tools must be managed in such a way that they can produce the main objective, which is to produce coal according to the target and not to forget the core objective of the mining process, which is to make a profit and avoid losses.

Fleet Productivity Design

In every activity, planning is carried out in the selection of the equipment and the process involves calculations based on the equipment capacity so that the equipment selected for the job is the right equipment (Hassan, Siadat, Dantan, & Martin, 2010). For example, the equipment for land clearing activities must use a small excavator to facilitate its movement and can also use a Dozer to clear land that does not have a steep slope. Then in the selection of equipment for soil handling activities, a small unit loader is used to minimize the sinking of the unit due to the relatively soft soil. From the soil handling stage to coal hauling, there are special calculations to determine the compatibility between the number of loading equipment and the number of hauling equipment. For loading equipment, the company will determine the productivity target for the equipment so that this productivity target will be a reference for the suitability of work in the production process so that if there is a failure, the cause of the problem will be immediately investigated and follow-up will be carried out (Mukherjee, Mitchell, & Talbot, 2000). The parameters for determining the productivity of loading equipment include the size of the bucket which will be multiplied by the target cycle time (for 1 passing). The target cycle time depends on:

1. Swing Angle

2. Material
3. Operator Capability

The company must determine each of these parameters to be the reference parameter in determining the target productivity of the equipment. After determining the productivity figures, the next stage is how to determine the suitability between the loading equipment and the hauling equipment. The parameter that most influences the determination of the ratio of the number of loading equipment and hauling equipment is the hauling distance parameter. The farther the hauling distance, the more hauling equipment is needed.

Fleet Optimization Design

After determining the compatibility between the number of loading and unloading devices, the next step is to ensure that the number of tools used is in accordance with its capacity (Slim et al., 2003). Optimization is carried out to achieve the best results from each of the activities or input. PT GSP management does not cut down the tool because there is currently no option to transfer it to other site so that the number of the tools used remains as 5. Given that it is bad for the tool not to be operated in long run, a policy to use all the tools is made even though the productivity of the tool improves (Radnor, Holweg, & Waring, 2012). Both in terms of the number of loading and transport equipment or dump trucks and other heavy equipment (McCann, 2006). It has a risk of swelling in the use of tools so that companies must take strategic steps to overcome this problem.

Table 1 Matching Fleet Between Exc 30 Ton vs DT

Matching Flat		
DIST	DT	RIT/DT
0.1	2	11
0.2	2	11
0.3	2	11
0.4	3	8
0.5	3	8
0.6	3	8
0.7	3	6
0.8	4	6
0.9	4	6
1	4	6
1.1	4	6
1.2	5	5
1.3	5	5
1.4	5	5

(Source: Author, 2023)

Based on the calculation of equipment capacity, it is known that a 30-ton excavator unit can generate production of up to 300,000 tons per annum with a PA parameter of 90% and a UA of only 20% with the total available time and a target productivity of 250 tons/hour. With this target, PT. GSP only needs 4 units to achieve a production of 1.2 million tons per annum, more than the target set by PT BHS, which is only 1.08 million tons per annum.

RESULT AND DISCUSSION

After analyzing the design process, the next problems are that the company will still insist on using all the tools available. The next problem is how to accommodate all the tools and maximize their performance. The population of the number of dump trucks and excavators before the improvement was as follows.

Table 2 Unit Population in PT GSP

Dump truck	Excavator 30 TON
30	5

Source: PT GSP, 2023

From this combination, it is known that routine checks and repairs will occur periodically, so the active units for dump trucks are around 27 units by considering the target PA of 90%. If a comparison is made, 1 excavator will be side by side with 5 dump trucks, but there are 2 dump trucks that will not be used and the PT GSP management asks for all tools to be maximized to operate and produce products for the company. Therefore, it was determined that the most feasible option is to continue using all the tools and for the loading equipment, it will use a support tool, the 20-ton excavator (Bimha, Hoque, & Munapo, 2020; Tsipoulanidis & Nanos, 2022).

Another problem arises when there is a long bucket hanging time during the loading process, a lot of time is wasted when the dump truck unit maneuvers, so the queue is re-engineered by implementing a two-sided loading system so that every dump truck that has reached the front loading area can immediately position its equipment for the next loading, so the loading equipment will continue to move without any delay.

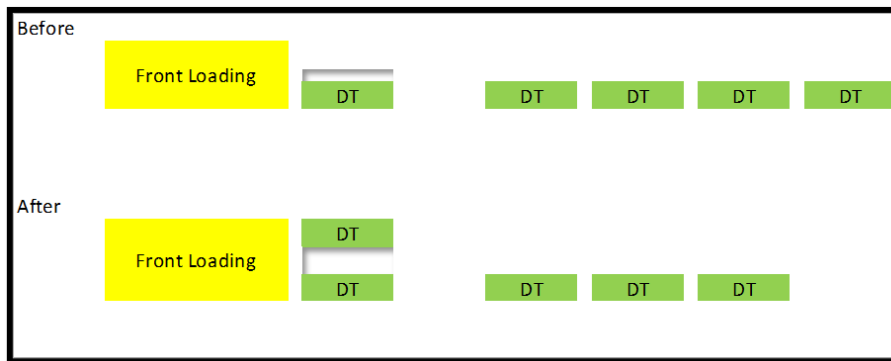


Figure 5 Double Side System
(Source: PT GSP, 2023)

CONCLUSSION

From periodic improvement that has been done, evaluation of the results was performed and it showed a significant development. The results of the improvement on the front loading area made the delay time of the loading equipment decrease significantly as a result of the improvement and increased the productivity of the equipment significantly. From the graph in Figure 6, it is shown that the results of the improvisations made have a significant impact, which has led to an increasing productivity of the production equipment that had decreased in

2022 and managed to increase in 2023. These positive results were followed by significant improvements in the company's profits, making the accomplishment a success.

The author recommends that a re-analysis of the need for equipment should be carried out because forcing the process with the use of supporting equipment to carry out production activities is not a good solution because supporting equipment also has a vital function in all existing business processes, so it would be better to optimize the equipment that is already available and for the excess to be utilized if the production target really increases so that it is possible to use all of the equipment.

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