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Optimization of Big Digger Unit Productivity at Gunung Turak Pit by Minimizing Delays in Packmeal Distribution and Enhancing Packmeal Quality at PT AMM MHU Site during the May - August 2025 Period

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Abstract

Background: Background: The productivity of the Big Digger unit at the Gunung Turak Pit of PT AMM Site MHU experienced a significant decline in the period January–April 2025, as indicated by a cumulative revenue loss of Rp27,940,329,803.70. Root cause analysis showed that this loss was caused by delays in pack meal distribution that coincided with rest periods and low food quality, triggering dissatisfaction (morale) and operational delays (delivery). Several incidents occurred in the mining industry during direct pack meal distribution.

Objective: This study aims to demonstrate the effectiveness of logistics interventions (delay minimization) and pack meal quality improvements on increasing the productivity of the Big Digger unit and its impact on QCDSM (Quality, Cost, Delivery, Safety, Morale) aspects.

Methodology: This type of research is quantitative descriptive. This activity was carried out from May to August 2025 at PT. AMM Site MHU. This activity consists of several stages, namely conducting cause and effect analysis, determining the root cause, planning corrective actions, implementing improvements, evaluating results, standardizing, and determining the next steps. The sampling technique used was purposive sampling, namely on workers directly involved in the process of providing, transporting, and distributing packmeal, including big digger operators, the Production Team, the HCGA team, and the SHE Team. Data were collected through interviews, observation, and documentation.

Results: Logistics and quality interventions proved highly effective. In the After period, revenue losses were successfully eliminated, and the actual productivity of the Big Digger unit returned to target. This performance improvement was supported by improvements in the Delivery aspect (centralized distribution without disrupting production time) and increased operator morale. Furthermore, improvements to the logistics system eliminated direct contact between officers and units, structurally minimizing the risk of Unsafe Conditions (KTA) and Unsafe Acts (TTA), supporting the S.M.A.R.T (Safety Management and Attitude Reinforcement Techniques) principle.

Conclusion and Recommendation: Packmeal optimization is a fairly holistic management intervention and has successfully stabilized Cost aspects and improved QCDSM. It is recommended that this packmeal intervention model be standardized as a permanent Standard Operating Procedure (SOP) with quality and timeliness monitoring of catering under the direct control of the Production Department, HCGA, and SHE, to ensure sustainable productivity and safety.

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Keywords: Packmeal, Loss Revenue; Productivity; Big Digger; S.M.A.R.T (Safety Management and Attitude Reinforcement Techniques); Delay; QCDSM

1. Introduction

Occupational Safety and Health (K3) in the mining industry has a crucial role in ensuring safe and efficient operations [1]. Technical explanations regarding how to implement good and correct mining principles are regulated in the Decree of the Minister of Energy and Mineral Resources No. 1827K/30/MEM/2018 concerning guidelines for implementing good mining engineering principles and the Decree of the Director General of Minerals and Coal No. 185.K/37.04/DJB/2019 concerning technical instructions for implementing mining safety and the organization, assessment, and reporting of SMKP Minerba [2]. Implementation elements in the Mining Safety Management System include good governance, organizational safety culture, resource availability, SMART (Safety Management and Attitude Reinforcement Techniques) planning and monitoring, management commitment and strategy, effective Occupational Health and Industrial Hygiene (OHS) management, compliance, and safety leadership [3].

The coal mining sector is the backbone of the national economy, where operational efficiency and unit productivity are key to business sustainability. At PT AMM Site MHU, the Big Digger unit, represented by Heavy Excavators (PC1250 and PC500), acts as a strategic bottleneck that determines the rate of overburden removal and the achievement of daily production targets. Failure to maintain Big Digger performance throughout the mining cycle has a significant impact on the operational and financial efficiency of mining companies. One of the main problems causing performance decline is the lack of optimization in the monitoring and control process. Research conducted by Supriyanto et al. shows that after implementing the Mocodesta application, there was an increase in cumulative performance of Big Digger PC productivity reaching 92.04% and 92.78% within a certain period [4]. This shows how important it is to use technology to monitor and improve heavy equipment performance to avoid delays in the mining cycle that can lead to financial losses.

Beyond the technical side, maintenance also plays a significant role in the continued performance of mining equipment. A study by Alaka et al. revealed that maintenance issues account for 79% of total downtime in the automotive industry, and this is particularly relevant in the mining context, where equipment failure can result in substantial financial losses [5]. The results of this study confirm that the application of failure mode and effects analysis (FMEA) can help companies identify the root causes of productivity losses and formulate appropriate corrective actions to minimize losses.

Furthermore, in the context of safety and risk in mining, the existence of a digital twin system can improve operational reliability. Jacobs and Laar explained that by using a digital twin system, companies can monitor and optimize mining ventilation systems, which directly impacts occupational safety and mining efficiency [6]. In this way, the risks associated with operational disruptions can be minimized, and have a positive impact on the company's productivity and revenue.

Failure to maintain performance can also result in broader risks, including safety and health risks. Research by Tubis et al. shows that sound risk assessment is crucial for anticipating a wide range of potential issues in the mining industry [7]. In this case, if performance failures are not addressed promptly, they can have far-reaching consequences, including workplace accidents that can lead to significantly greater financial losses due to compensation and a tarnished company reputation.

Although the Big Digger unit is a sophisticated asset at PT AMM Site MHU, performance data for the January–April 2025 period indicates significant productivity issues. The average productivity achievement of the PC1250 only reached 89.78% and the PC500 was 86.35%, placing it in the Need Improvement category (below the 90%–100% target). This failure had fatal consequences, with total revenue loss recorded reaching Rp27,940,329,803.70 during the first four months of 2025. This revenue loss was dominated by production loss on the PC1250 unit, reaching 7,400 tons in February 2025, which confirms that non-technical factors that disrupt unit productivity must be immediately identified and eliminated.

This study shifts the focus from technical breakdowns to Occupational Health and Safety (OHS) factors based on Workplace Welfare as the root of the problem. Based on the hourly productivity breakdown, it appears that the lowest productivity decline in PC1250 occurred near break times, namely at 11:00 AM for shift 1 and 11:00 PM for shift 2. The decreased efficiency in the process of distributing pack meals provided by the HCGA team resulted in non-technical waiting time (standby time) for operators, which disrupted their work rhythm. This phenomenon has direct consequences for the Non-Operation Rate (NOR). The study shows that inefficient time can contribute to lower

productivity in the field, impacting occupational safety and operator well-being [8]. Furthermore, Voice of Customer reports have revealed complaints from operators regarding food quality, which they believe does not meet their activity needs. This dissatisfaction highlights the importance of considering factors such as taste and nutritional value of the food served. One study emphasized that good nutritional intake is crucial for maintaining performance and workplace safety [9].

The proposed innovation through optimizing the distribution system and improving the quality of packmeal at PT AMM is expected to provide a holistic impact that goes beyond simply improving Physical Availability. Qualitatively, this intervention holds the hypothesis that improving the Delivery aspect (centralized and timely distribution) and Quality packmeal will directly restore the Morale and satisfaction of operators, which is proven to increase motivation and work loyalty. Furthermore, this system improvement will improve Safety by eliminating direct human contact (HCGA Team) with operational units, minimizing the potential for Mining Accidents and No Injuries. Therefore, this study aims to prove that an integrated welfare intervention is able to change the Before condition (productivity below target, loss of revenue, and low morale) to the After condition (productivity reaches the target, the company's profit target is achieved, and the level of occupational safety increases), making it a model of the success of the OHS program as a productivity investment.

2. Material and methods

This type of research is quantitative descriptive. This activity was carried out from May to August 2025 at PT. AMM Site MHU. This activity consists of several stages: conducting a cause-and-effect analysis, determining the root cause of the problem, planning corrective actions, implementing improvements, evaluating results, standardizing, and determining next steps.

2.1. Sampling Techniques

The sampling technique was carried out using purposive sampling, namely on workers who were directly involved in the process of providing, transporting and distributing packmeal, including big digger operators, the Production Team, the HCGA team and the SHE Team.

2.2. Data Collection

Data was collected through interviews, observations, and documentation to see the effectiveness of logistics interventions (delay minimization) and improving packmeal quality on increasing Big Digger unit productivity and its impact on QCDSM (Quality, Cost, Delivery, Safety, Moral) aspects.

3. Results

3.1. Distribution of pack meals and changes to catering vendor operating hours

Pack meal distribution is carried out at the beginning of the shift, for both shifts 1 and 2. Changes in operating hours of catering vendors to earlier to accommodate pack meal requirements. Pack meal distribution schedules are carried out before rest time. Adjustments are required by catering vendors to accommodate changes in operating hours that require earlier availability of pack meals than in the previous period.

Figure 1 Distribution of packmeal

3.1.1. Comparison of Productivity Before and After Intervention

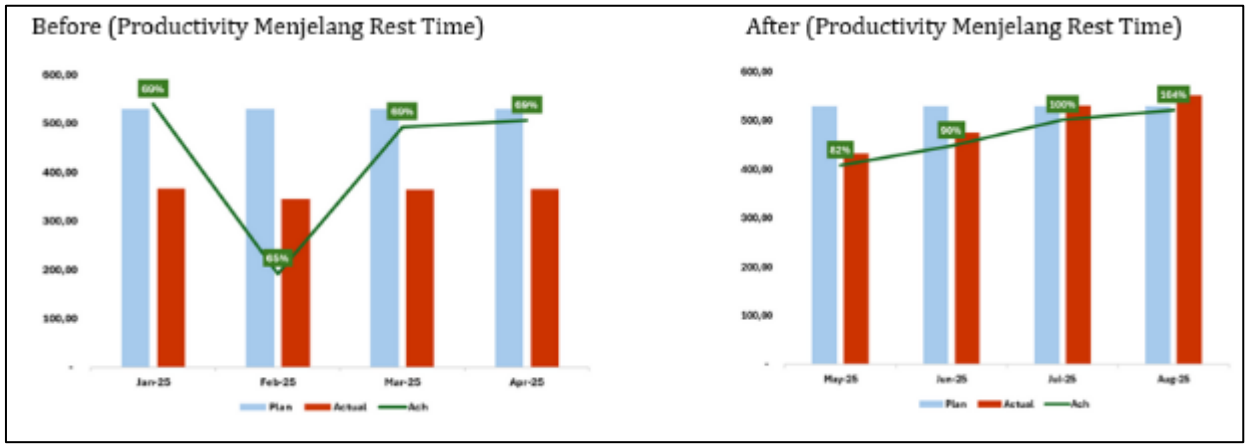

Figure 2 Comparison of Productivity Before and After Intervention

Figure 2, a comparison of Before (January-April 2025) and After (May-August 2025), visually demonstrates substantial and measurable performance improvements in unit productivity near rest time after the packmeal logistics intervention was implemented. In the period before the intervention, the unit's actual productivity consistently fell well below the target (Plan), with an average achievement of only 65% to 69%. The significant gap between Plan (blue bars) and Actual (red bars) over the four months confirms the study's initial diagnosis: that delays in distributing packmeals near rest time caused inefficient standby time, reduced effective working time, and collectively resulted in high production losses. After the intervention, which minimized delays in distributing packmeals and improved catering quality/operating time, the unit's performance showed a rapid and significant recovery trend. Although there was still a gap in May 2025 (82%), unit productivity surged past the target (100%) in July 2025 (reaching 100%) and peaked in August 2025 (104%). This improvement shows that eliminating or minimizing delays in packmeal distribution directly eliminates non-productive standby time, allowing the unit to operate closer to the specified plan time, thus empirically proving that well-managed workplace welfare aspects are critical variables that influence Physical Availability and operational profitability of the mine.

3.2. Reducing contact between HCGA teams and field units (Minimizing Unsafe Conditions and Unsafe Actions)

Before the intervention, several operating units were spread out at different distances in the pit. Therefore, the distribution of packmeal was carried out centrally (Centralized Meal Distribution Point) through Production manpower to facilitate supervision and time efficiency, although there were still challenges in the form of potential Operator queues when collecting packmeal. The distribution of packmeal was carried out centrally at the Production manpower. The PIC manpower checked the quantity of packmeal delivered by the HCGA team and carried out the handover.

Figure 3 Inspection of the quantity of packmeal

Comparison of HCGA team contacts with the unit before and after the intervention can be seen in the image below.

Figure 4 Contact Comparison

Based on Figure 4, it is known that centralized distribution also reduces contact between the HCGA team and units in the field and increases time efficiency in the packmeal distribution process.

3.3. Menu Variations in Packmeal

Packmeal budget limitations resulted in inconsistent raw material quality. Therefore, the company increased the packmeal budget by 17% to accommodate menu variations and raw material quality. Although the increase in catering costs has the potential to generate management resistance regarding the increase in non-technical costs.

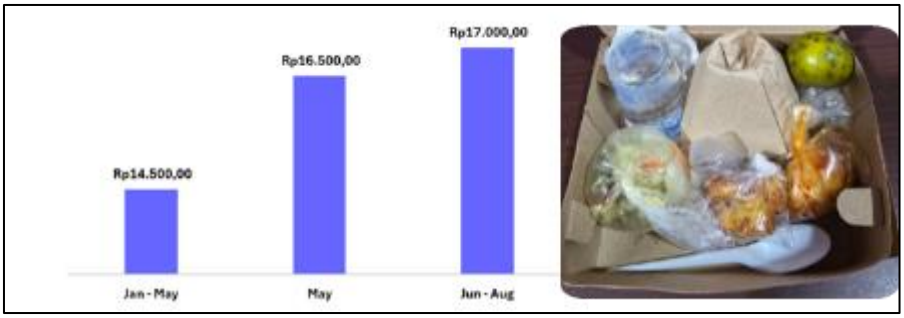

Figure 5 Budget Increase and Pack Meal Menu Variations

The packmeals distributed to operators contain a varied menu, with a list shared through the department admin. The packmeal price increased from Rp14,000.00 to Rp17,000.00. Based on a survey conducted among big digger operators,

the menu variations and packmeal portions before and after the packmeal budget increase can be seen in the image below:

Table 1 Variations and portions of packmeal

Before			
Menu Variations		**Portions**	
Satisfied	9%	Satisfied	6%
Quite satisfied	10%	Quite satisfied	23%
Not satisfied	81%	Not satisfied	71%
After			
Menu Variations		**Portions**	
Satisfied	91%	Satisfied	93%
Quite satisfied	6%	Quite satisfied	5%
Not satisfied	3%	Not satisfied	2%

Source: Primary Data (August, 2025)

3.4. Packmeal container changes

Before the intervention, packed meal containers were ineffective in maintaining quality. Therefore, the packaging was replaced with rice boxes to maintain food quality. Challenges faced included the catering team's readiness to adjust the packaging process and the additional time required for packaging.

Figure 6 Changes to packmeal containers

Changes in packmeal packaging from oil paper and plastic to rice boxes. The team conducted socialization regarding the purpose of changing packmeal packaging to Operators and gathered feedback from Operators to adjust the design or size of the box for more comfortable use. Based on a survey conducted on big digger Operators regarding food durability and comfort of consuming packmeal before and after the increase in the packmeal budget can be seen in the table below:

Table 2 Packmeal durability and convenience

Before			
Food Security		**Comfort**	
Satisfied	17%	Satisfied	33%
Quite satisfied	32%	Quite satisfied	25%
Not satisfied	51%	Not satisfied	52%
After			

Food Security		**Comfort**	
Satisfied	94%	Satisfied	88%
Quite satisfied	5%	Quite satisfied	10%
Not satisfied	1%	Not satisfied	2%

Source: Primary Data (August, 2025)

3.5. Productivity period January - August 2025 (approaching rest time)

In the period January - April 2025 (before repairs), the productivity of big diggers (PC1250 and PC500) at 11 o'clock (shift 1 & shift 2) had not reached the target.

Table 3 Productivity before rest time

PC1250 Productivity Approaching Rest Time			
	Plan	Actual	Ach
Jan-25	530	367	69%
Feb-25	530	346	65%
Mar-25	530	364	69%
Apr-25	530	365	69%
May-25	530	432	82%
Jun-25	530	475	90%
Jul-25	530	532	100%
Aug-25	530	553	104%
PC500 Productivity Towards Rest Time			
	Plan	Actual	Ach
Jan-25	230	165	72%
Feb-25	230	162	71%
Mar-25	230	143	62%
Apr-25	230	154	67%
May-25	230	173	75%
Jun-25	230	207	90%
Jul-25	230	226	98%
Aug-25	230	237	103%

Source: Primary Data (August, 2025)

Based on the Table on the implementation process of improvements until after the improvements, namely May - August 2025, it can be seen that there is an increase in productivity achievement at 11 o'clock (shift 1 & shift 2) with a peak in August 2025 of 104% for PC1250 and 100% for PC500. The increase in productivity is evidence of the significant impact of reducing unit operating delays in the hours leading up to rest time due to the distribution of pack meals.

4. Discussion

SMART (Safety Management and Attitude Reinforcement Techniques) Approach also emphasizes the importance of workforce involvement in creating a safe work environment. With clear and measurable indicators, workers can better

understand the safety standards that must be met. Data-driven systems also enable the identification of unsafe behavior in the workplace and provide immediate feedback to workers, either through wearable devices or digital notifications. This drives faster and more accurate decision making and builds a stronger safety culture at the mine. The successful implementation of the SMART Safety program has been proven in various industrial sectors, including mining (Amirudin et al., 2024).

In a broader context, evaluating improvement results is a crucial step in ensuring the effectiveness of a company's safety and operational programs, particularly in environmental protection and mining. By analyzing improvement results, managers can provide direct feedback to teams or individuals involved in efforts to increase efficiency and reduce downtime. This evaluation allows companies to identify successful strategies as well as areas that still need improvement to ensure the sustainability of safety programs and work efficiency. Furthermore, monitoring the idle time ratio or idle hours helps companies assess whether they are on track to achieve their targets or need to adjust their strategies [11].

The results of this study empirically prove a causal relationship between non-compliance with packmeal logistics procedures and operational financial losses (Loss Revenue). The period before the intervention showed that the actual productivity of the Big Digger unit was consistently below target, the peak of which was caused by delays in distributing packmeals before break times (11:00 and 23:00). Quantitative data confirms that this inefficiency resulted in significant revenue losses for the company, reaching a total of IDR 27,940,329,803.70 from January to April 2025.

The availability of quality meal services for workers has been shown to be a key factor in improving performance and productivity across various sectors. However, we found no research supporting specific claims regarding the direct influence of meal service quality on overall organizational performance. Therefore, we removed the citation from Nuryadi et al. [12] as it lacked proper relevance. It can be noted that when aspects of worker well-being, including meal services, are not well-met, this can negatively impact a company's productivity and finances. However, the reference in the context of proper cost management from François et al. [13].

The main intervention of this research focuses on improving the Delivery aspect, namely minimizing delays in packmeal distribution through changes in logistics procedures. Based on the results, the intervention proved very effective, where the loss of revenue that occurred in the Before period was successfully eliminated. This increase in productivity was achieved because the distribution system was now centralized without disrupting the production time of the equipment. In this context, the concept of industrial ergonomics becomes very important. Industrial ergonomics emphasizes the importance of work arrangements that optimize the interaction between humans and machines to increase work efficiency. Disruptions to work rhythms can have negative consequences, because the placement of inefficient systems in the supply chain can lead to wasted time and resources, which in turn impacts performance and financial results [14]. Research by John and Oyeyemi [15] highlights the important role of predictive systems in minimizing delays by identifying potential issues before they develop into bigger problems.

Furthermore, a study by Taufiq et al. [16] discussed the importance of monitoring heavy equipment operations, which can be done using a digital system and Android-based application that facilitates real-time reporting of equipment status. The use of technology not only helps in detecting and quickly fixing problems but also increases operational efficiency in line with better logistics system integration.

The interventions carried out in this study were not only related to time efficiency but also focused on aspects of work quality and morale. Initial findings revealed that complaints from operators regarding the taste, portion size, and quality of the pack meals contributed to low morale and work enthusiasm, which could trigger the possibility of human error. This aligns with research showing that good working conditions, including the provision of quality food, directly impact employee performance [17].

After the intervention, there was an increase in satisfaction levels among operators, which contributed to increased motivation and loyalty. This improved morale aligns with Occupational Safety and Health (OSH) goals, where workers who feel cared for tend to focus better on their work. According to Vitrano et al., active employee participation in decision-making processes and reporting hazardous situations is key to improving occupational health and safety conditions [18]. This shows that improvements in the welfare aspects of workers have a direct positive impact on the implementation of OSH policies in the field.

The intervention also demonstrated a positive impact on field safety by eliminating direct contact between the Human Capital team and operating units. This elimination effectively contributed to the reduction of accident-related risks.

Research by Macassa et al. shows that implementing good corporate social responsibility practices has the potential to improve employee health and well-being, as well as contribute to operational efficiency [19].

Other studies also emphasize the importance of good safety management in preventing accident risks. As revealed by Muallivasari et al., the implementation of proper OSH protocols can prevent accidents by stopping and eliminating hazardous elements [20]. Thus, this intervention not only serves to improve employee comfort and quality of life but also supports larger occupational safety goals, one of which is reducing the rate of workplace accidents. Evaluating the results of improvements in a company's safety and operational programs, particularly in the context of environmental protection and the mining sector, is a crucial step to ensure that the interventions are truly effective. According to Krajčovič et al., analyzing the results of improvements allows managers to provide direct feedback to the teams or individuals involved, thus creating opportunities to adapt and improve existing processes [21].

Interventions that focus on improving delivery processes and logistics procedures not only impact operational times but also contribute to staff satisfaction and safety. This is reinforced by Grover and Ashraf, who demonstrated that proper maintenance of logistics systems, including the use of autonomous mobile robots, is essential to prevent disruptions and safety issues, which in turn supports overall logistics performance [22]. Therefore, by evaluating the results of these interventions, companies can identify highly effective strategies as well as aspects that still need improvement.

Clear policies and procedures, combined with continuous evaluation, enable companies to not only meet production targets but also maintain the safety aspects that are crucial in the mining industry. As analyzed by Kim et al., efficient management will improve supply chain resilience and performance [23]. In this way, evaluation results can produce concrete guidelines for better decision-making in the future, which supports the overall effectiveness of a company's safety and operational programs.

5. Conclusion

This study concludes that the Big Digger Packmeal Unit Optimization proved to be an effective management intervention, directly eliminating the revenue loss that occurred in the Before period. This success was achieved through improvements in the Delivery aspect (minimizing delays with a centralized system) which returned unit productivity to target, as well as increased operator morale due to better food quality. A positive impact was also recorded on Safety, where the elimination of direct contact between the unit and logistics officers eliminated the risk of Unsafe Conditions (UC) and Unsafe Acts (UA), making this intervention aligned with the S.M.A.R.T Safety principles. The main recommendation is to standardize the After intervention packmeal system as a permanent SOP, by including quality control and catering timeliness as mandatory operational Key Performance Indicators (KPI) under the Production and SHE Department, not just welfare HCGA, to ensure the achievement of production targets and sustainable work safety.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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