



Analysis of The Efficiency of The Hold Goods Production Process using The Single Minute Exchange of Die (SMED) Method at PT Kencar Sukses Investama

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Article Info	Abstract
<i>Kata kunci:</i> SMED; Production Efficiency; HOLD Product; Setup Time; Lean Manufacturing	This study aims to analyze the efficiency of the HOLD product production process using the Single Minute Exchange of Die (SMED) method at PT Kencar Sukses Investama. The research was conducted because the production process experienced high setup time, machine downtime, and a significant number of HOLD products, which reduced production efficiency and increased operational costs. The study used the Stopwatch Time Study method, Fishbone Diagram analysis, and SMED implementation to identify and reduce non-value-added activities. Data were collected through direct observation, production records, and operator performance assessments involving four production operators. The results showed that the Router process had the highest standard time of 15.38 minutes, while Bokaki reached 12.60 minutes. After SMED implementation, setup efficiency increased by 28.57% for Router and 28.50% for Bokaki. In addition, HOLD products and production costs decreased significantly. Therefore, SMED proved effective in improving production efficiency and reducing production waste.

1. INTRODUCTION

The development of the manufacturing industry has become increasingly competitive, requiring companies to continuously improve product quality, accelerate production processes, and reduce operational costs. In today's highly competitive industrial environment, companies are not only expected to produce high-quality products but also to manage production activities effectively and efficiently in order to meet customer demand on time (Heizer, Render, & Munson, 2017). Production efficiency is one of the most important factors in maintaining operational sustainability because it is directly related to productivity, resource utilization, and the company's ability to minimize waste during the production process (Slack & Brandon-Jones, 2019). Furthermore, according to Stevenson (2021), improving production efficiency can help companies enhance competitiveness, reduce production lead time, and increase customer satisfaction in the manufacturing sector.

In Operations Management, production efficiency refers to a company's ability to produce optimal output with minimum input usage. This efficiency is related to labor utilization, machine performance, production time control, raw material usage, and production flow management (Heizer, Render, & Munson, 2017). The more efficient the production process, the lower the waste generated, resulting in reduced operational costs and increased productivity (Slack & Brandon-Jones, 2019). Therefore, companies must organize production systems properly so that all production stages can run systematically, effectively, and according to company targets. According to Stevenson (2021), effective production system management enables companies to improve operational performance, optimize resource utilization, and maintain product quality consistency in manufacturing activities.

However, production processes often experience various obstacles that reduce operational efficiency. These problems include high machine setup time, production delays, excessive work in process, long waiting time, and the occurrence of defective or HOLD products. Such conditions cause the production process to take longer than the company's standard time, leading to increased production costs and decreased productivity.

According to the Lean Manufacturing concept, activities that do not provide added value to products are categorized as waste and should be minimized during production. These wastes include waiting time, inefficient material movement, rework activities, inventory accumulation, and excessive setup activities. (Purnamasari, 2015) stated that non-value-added activities reduce operational efficiency because they increase production time and operational costs without adding value to the final product. Therefore, companies need to identify waste-causing activities in order to improve production efficiency.

One of the common problems in manufacturing companies is the occurrence of HOLD or NOT OK products during production. HOLD products are temporarily detained products that cannot proceed to the next process because they require additional inspection, rework, or further quality checking before meeting company standards. These conditions are generally caused by product specification mismatches, operator errors, production process inaccuracies, machine failures, or inspection results that do not meet quality standards (Heizer, Render, & Munson, 2017). According to Montgomery (2019), defects in production processes are often influenced by variations in machines, materials, methods, manpower, and environmental conditions, which can reduce production efficiency and product quality. Furthermore, Shingo (1985) explained that ineffective production processes and poor quality control systems can increase the occurrence of defective products and rework activities in manufacturing industries.

A high number of HOLD products negatively affects the company's production performance. HOLD products increase waiting time, extend production lead time, increase rework activities, and require additional labor and machine usage. Furthermore, the handling of HOLD products also causes operational waste because the company must spend additional costs for re-inspection, product repair, additional raw materials, and machine operational costs during rework activities. If this condition continues, production efficiency will decrease and production targets will become difficult to achieve.

Similar problems also occurred at PT Kencar Sukses Investama, a manufacturing company that operates continuous production systems. The company requires production accuracy, product quality consistency, and efficient resource utilization. The production process includes several interconnected stages such as raw material preparation, main production process, quality inspection, HOLD product handling, and product storage. Therefore, smooth production flow in every stage is essential to maintain operational effectiveness.

Based on preliminary observations, the company still experienced several production problems that caused production time to exceed company standards. One of the main problems identified was the high setup time in the Router and Bokaki processes. These processes are important production stages that require machine setup activities before production begins. Long setup activities increased machine downtime and reduced production efficiency.

In addition, most setup activities in the Router and Bokaki processes were still conducted while the machines were stopped (internal setup). These activities included tool preparation, material searching, die positioning, work inspection, and returning setup tools after production. This condition increased machine idle time and slowed overall production flow.

Based on observations, material searching and returning setup tools were identified as the activities causing the greatest time waste during setup operations. Operators required excessive time to search for materials and tools because the storage layout was not properly organized and there was no standardized placement system. Moreover, die positioning was still performed manually, requiring additional adjustment time before machines could operate again.

These conditions caused production time to exceed company standards. High production time also increased machine downtime, delayed production completion, and increased the number of HOLD products due to unstable production processes. Furthermore, excessive setup time reduced labor and machine utilization efficiency, resulting in increased operational costs.

Each HOLD product has different defect characteristics caused by various production factors. HOLD products indicate inefficiency in production processes related to labor, machines, methods, materials, and work environment conditions. The higher the number of HOLD products, the greater the additional waiting time, rework cost, and production delay risk faced by the company. Therefore, quality control at every production stage is necessary to minimize HOLD products and improve production efficiency.

Production data from January to March 2026 showed that the number of HOLD products was still relatively high and fluctuated each month.

Source: Processed Data (2026)

The percentage of HOLD products gradually decreased every month. In January 2026, HOLD products reached 1,269 units or 7.84% of total production. In February 2026, HOLD products decreased to 991 units or 6.69%. Meanwhile, in March 2026, total production increased while HOLD products decreased significantly to 744 units or 4.47%. Although improvements occurred, the HOLD level remained relatively high, indicating the need for continuous production improvement efforts.

In addition to HOLD products, observations also showed that the Router and Bokaki processes had relatively high setup times compared to other processes. High setup time increased machine downtime and slowed the production process. Therefore, companies need improvement methods to reduce machine idle time and improve production efficiency.

One method that can be used to reduce setup time is the Single Minute Exchange of Die (SMED) method. SMED is a setup improvement method developed by Shigeo Shingo to reduce machine setup time by separating internal setup and external setup activities. Internal setup activities can only be performed when the machine stops operating, while external setup activities can be performed while the machine is still running. By converting internal setup into external setup, machine downtime can be reduced and production efficiency can be improved.

Several previous studies have shown that the implementation of the SMED method is effective in reducing setup time and increasing productivity in manufacturing industries. According to Shigeo Shingo (1985), the SMED method can reduce setup time dramatically by converting internal setup activities into external setup activities. Research conducted by Mileham et al. (2004) explained that SMED implementation significantly reduced changeover time through work standardization and improved operator coordination. Furthermore, Ulutas (2011) stated that SMED contributes to reducing machine downtime and increasing operational efficiency in manufacturing systems.

In addition, Sundar et al. (2014) found that SMED implementation increases production flexibility and reduces non-value-added activities. Similar findings were reported by Patel et al. (2018), who concluded that integrating SMED with lean manufacturing principles improves production performance and machine utilization. Therefore, SMED is considered an effective method for supporting productivity improvement and continuous improvement in manufacturing industries.

The implementation of SMED is expected to reduce setup time in the Router and Bokaki processes, minimize machine downtime, accelerate production flow, and reduce HOLD products during production. Furthermore, reducing setup time is expected to increase operator productivity, reduce non-value-added activities, and minimize production costs caused by rework and HOLD product handling.

Based on these problems, this study was conducted to analyze the efficiency of HOLD product production processes using the Single Minute Exchange of Die (SMED) method at PT Kencar Sukses Investama. This study is expected to provide production improvement recommendations in order to increase operational efficiency and minimize HOLD products.

2. METHODS

This section describes the stages of the research conducted in the production department at PT Kencar Sukses Investama. The research began with the identification of problems in the production process, particularly in the handling of HOLD goods, which still experienced several inefficiencies resulting in longer production times and increased production costs for the company. HOLD goods are products that do not meet the company's quality standards, such as dimensional defects, surface defects, color mismatches, or damage occurring during the production process.

The next stage of the research involved direct observation of the HOLD goods handling workflow, starting from the identification of defective products, product separation, classification of defect types, rework processes, and re-inspection by the Quality Control (QC) department. Furthermore, process time measurements were carried out using the Stopwatch Time Study method to determine the efficiency level of each work stage. Based on the measurement results, it was found that the HOLD goods handling process required 24% of the total production time, causing delays in the overall production process.

The research also included an analysis of the costs incurred due to the handling of HOLD goods. The analysis results indicated additional production costs in the form of wasted raw material costs, additional labor costs, and machine operating costs, with rework costs accounting for 12% of the company's total production costs. Afterward, a problem cause analysis was conducted using the Fishbone Diagram method to identify the main factors causing HOLD goods, which originated from labor, machines, work methods, materials, and the work environment.

Based on the analysis results, the researcher then proposed work process improvements using the Business Process Improvement (BPI) approach. The proposed improvements included workflow simplification, reduction of non-value-added activities, improvement of operator accuracy, regular machine maintenance, and enhanced supervision of raw material quality. The final stage of the research involved evaluating the success of the proposed improvements, which was measured through reduced production process time, a decrease in the number of HOLD goods, reduced production costs, improved product quality, and smoother workflow processes within the company's production department.

3. RESULT AND DISCUSSION

Level 1 Operator Performance Rating Analysis

The results of the performance rating assessment indicate that all operators had performance values above the normal standard (>1.00). This condition shows that the operators were able to work effectively and support the production process efficiently. The assessment was conducted by three evaluators consisting of the researcher, the operator, and the production supervisor, so the results became more objective and representative of actual working conditions.

Table 2. Operator Performance Rating Results

Operator	Average Total Rating	Performance Rating
Operator A	+0.24	1.24
Operator B	+0.17	1.17
Operator C	+0.13	1.13
Operator D	+0.27	1.27

Operator D obtained the highest performance rating value of 1.27 because the operator demonstrated better work skills, consistency, and work effectiveness compared to other operators. Meanwhile, Operator C obtained the lowest rating of 1.13, although the value was still above the normal standard. These results indicate that operator performance has an important role in supporting production efficiency, especially in reducing setup time and handling HOLD products.

Level 2 Production Time Analysis

The results of the Stopwatch Time Study showed that the Router and Bokaki processes had relatively high production times compared to other production activities. The high processing time was mainly caused by setup activities that were still performed while the machine was stopped, such as tool preparation, die adjustment, material searching, and work inspection activities.

Table 2. Time Study Results

Process	Ws (Minutes)	Wn (Minutes)	Wb (Minutes)
Router	12.45	13.07	15.38
Bokaki	10.20	10.71	12.60

The Router process had the highest standard time of 15.38 minutes, while the Bokaki process required 12.60 minutes. This indicates that the Router process contributed the most to production delays and machine downtime. Long setup activities caused production flow disruption and increased waiting time during the production process.

Level 3 Fishbone Analysis of Production Problems

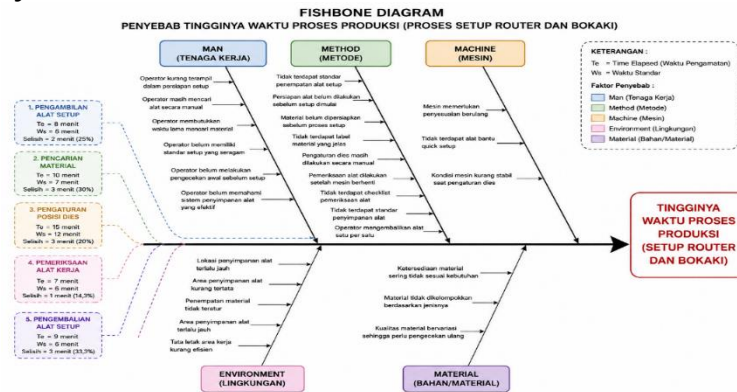


Image 1. of Problem Cause Analysis Using Fishbone Diagram

The Fishbone Diagram analysis revealed that production inefficiency was caused by several main factors, namely human, method, machine, material, environment, and measurement factors. Human factors were related to operators' limited setup skills and inconsistent work methods. Method factors were caused by the absence of standardized setup procedures and ineffective work systems.

Machine factors were associated with manual die adjustment and the absence of quick setup tools, causing setup activities to require longer processing times. Material and environmental factors were caused by poor storage layout, disorganized material placement, and inefficient work areas. These conditions increased setup time and contributed to higher machine downtime during the production process.

Level 4 SMED Implementation Analysis

The implementation of the Single Minute Exchange of Die (SMED) method successfully improved production efficiency by converting several internal setup activities into external setup activities. Activities such as tool preparation, material preparation, document checking, and cleaning activities were conducted before the machine stopped operating.

Table 3. Setup Time Comparison Before and After SMED

Process	Before SMED	After SMED	Reduction
Router	33.81 minutes	24.15 minutes	9.66 minutes
Bokaki	28.98 minutes	20.72 minutes	8.26 minutes

The Router setup process experienced a time reduction of 9.66 minutes, while the Bokaki process decreased by 8.26 minutes. These results indicate that the SMED method effectively reduced machine downtime and accelerated production setup activities.

Table 4. Setup Efficiency Percentage

Process	Efficiency
Router	28.57%
Bokaki	28.50%

The efficiency improvement proves that SMED implementation significantly reduced non-value-added activities during setup operations. Reduced setup time also improved production flow, minimized waiting time, and increased machine utilization efficiency.

Level 5 HOLD Product Reduction Analysis

The implementation of SMED also contributed to reducing the percentage of HOLD products during the production process. Better setup activities and more stable production processes reduced product defects and minimized rework activities.

Table 5. HOLD Product Reduction

Month	Before Improvement	After Improvement	Reduction
January	7.93%	7.40%	0.53%
February	7.57%	7.10%	0.47%
March	8.07%	6.95%	1.12%

Source: Processed Research Data (2026)

The largest reduction occurred in March with a decrease of 1.12%. This result indicates that SMED implementation successfully reduced the HOLD percentage below the company target of 7.0%. Reduced HOLD products also improved production stability and production quality control.

Level 6 HOLD Production Cost Analysis

The analysis of HOLD production costs showed that HOLD products generated significant operational losses for the company. The largest cost component came from wasted raw materials caused by defective products and rework processes.

Table 6. Total HOLD Product Costs

Cost Component	Total
Raw material cost	Rp12,000,000
Labor cost	Rp1,400,000
Machine operational cost	Rp1,750,000
Total	Rp15,150,000

The total HOLD production cost reached Rp15,150,000, with raw material costs contributing the largest portion. High HOLD products increased labor usage, machine operating time, and production expenses. Therefore, reducing setup time and HOLD products through SMED implementation proved effective in minimizing production waste and improving operational efficiency at PT Kencar Sukses Investama.

4. CONCLUSION

Based on research results at PT Kencar Sukses Investama, the application of the Single Minute Exchange of Die (SMED) method has been proven to increase production process efficiency by reducing setup time, machine downtime, the number of HOLD products, and production costs. Router setup process time decreased by 28.57% and Bokaki by 28.50%, while the number of HOLD products and production costs also experienced a significant decrease. Factors causing inefficiency include humans, methods, machines, materials, the environment, and measurements. Therefore, companies are advised to implement SMED continuously, improve SOP settings, increase operator training, and organize work areas to make the production process more effective and efficient.

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