

Improve Process to Reduce Wastes in Production: Case Study of Agricultural Machinery Parts Manufacturing Company

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Abstract

The research aims to improve the efficiency of delivering products to customers on time, study the process of Shaft Rocking and to, apply the lean manufacturing principle and analyze by value stream map to find the waste that occurs in the process, Solve problems by applying ECRS principles, Improve production processes and eliminate unnecessary steps in the process, A combination of similar steps, the step arrangement is easier to operate, After improvement, the workflow has been reduced from 10 steps to 9 steps, Lead time before improvement 31.08 days left 23.93 days; as a result, the volume of products delivered on time to customers' failing has been reduced from 56% to 12% per month.

Keywords

Lean Manufacturing, Value Stream Map, and ECRS.

1. Introduction

The stat of the agricultural economy, which expanded in 2021, grew 1.5% by 1.5 percent and continued to expand until the first quarter of 2022 by 5.7 percent, resulting in the manufacturing of components and spare parts of agricultural machinery tend to increase accordingly because the production of agricultural machinery parts is quite large causing competition in the business sector to inevitably.

The case study is a contract manufacturing company and spare parts for the production line of automobiles, motorcycles, air conditioners, and agricultural machinery manufacturing industry parts. The company focuses on producing and delivering quality products to customers and delivering products according to customer schedules for a good image of the company by constantly improving work processing. From collecting information on the delivery of Shaft Rocking products, it was found that the average delivery of products was not on time by customers on average 56% per month. Furthermore, from the analysis of the production process, it was found that wastes occurred in the production processes that occurrence of redundant production steps, causing the production period to be more extended than necessary The researcher, therefore, chose to improve the production process to increase the efficiency of delivering the product on time according to the customer's specified date, by eliminating unnecessary steps from the production process combining similar steps and reorganization steps makes work easier.

1.1 Objectives

- (1) Increase the efficiency of delivering Shaft Rocking products to keep up with the customer's schedule, according to the company's department's KPI.
- (2) Reduce time and wasted steps in the production of Shaft Rocking products.

2. Literature Review

Improve its efficiency by reducing waste in the Tharnthip drinking water production in order to increase its efficiency, by analyzing lean concepts, application of principles 5W1H and ECRS principles (Wairut I. and Kanitsorn P. 2017), Improving the production of calico by using the ECRS principle to collect data by observing and using flow process chart before the improvement. There was a production process of five steps. After improvement, the production process can be reduced from 5 to 4 steps by combining the steps (Achara P. 2017). To improve the manufacturing process by reducing the wastefulness of overproduction and including the need to use more space at the work site to place things in production, then be improved by doing TPS activities, balance workloads with cycle times close to the production cycle time limit. By making the lead time as short as possible and using the least number of people, The results revealed that product delivery time was reduced by 33%, operation space increased by 83%, and the production workforce was reduced by 42% (Suchadee T. et al. 2016), With rapid growth and intense competition of the silver jewelry market, a sector in the Gems and Jewelry industry which generates significant revenue in Thailand, the entrepreneurs are forced to improve the efficiency and reduce wastes in their production processes by applying the lean manufacturing principle and value stream management technique. The results found that the production lead time and work-in-process were reduced by 56.50 and 71.00%, respectively, including the 88-meter shortened distance of parts transportation. The yield ratio of the production line was increased by 7.12 % per batch (Chark T. and Sinanor T. 2016).

3. Methods

The operation of research in this chapter has studied the current production process of Shaft Rocking products in order to know the problems that occur in the production process. The preliminary data used the Lean technical concept by analyzing the Value Stream map and to improve the problem by applying the ECRS principle to reduce wastes in the production process and reduce the number of products not being delivered on time by the customer's scheduled date with the following steps.

3.1 Study production process

Study the production process of Shaft Rocking products starting from cutting raw materials, then going to the forming process and exporting to the hardening process, then bringing it to the process of forming, checking, and packaging until it is completed. Finally, the product is ready to be delivered, as shown in Figure 1. showing the production process of Shaft Rocking.

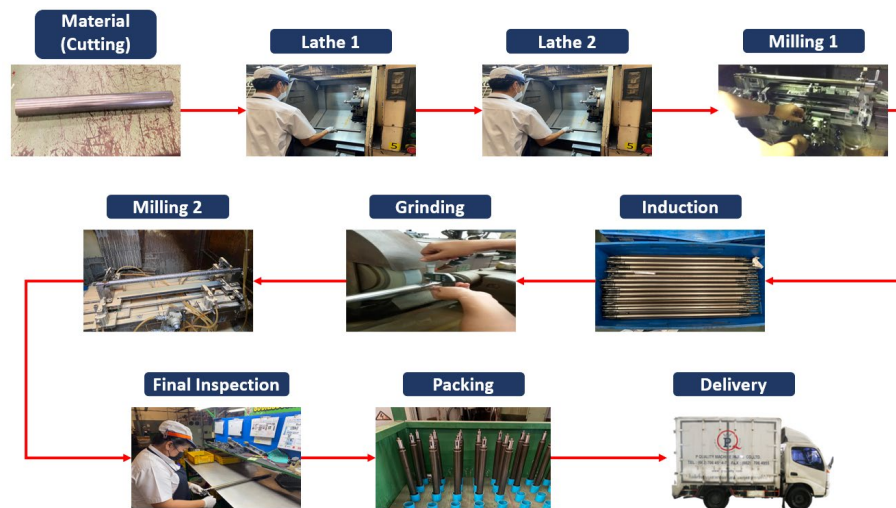


Figure 1. Shaft Rocking production process.

3.2 Analyze and Identify Non-Value Product Processes Using Value Stream Mapping: VSM.

Analyze the lean production process by analyzing the Value Stream Mapping (VSM) to find non-value added (NVA) activities, as shown in Figure 2—value streaming before the improvement.

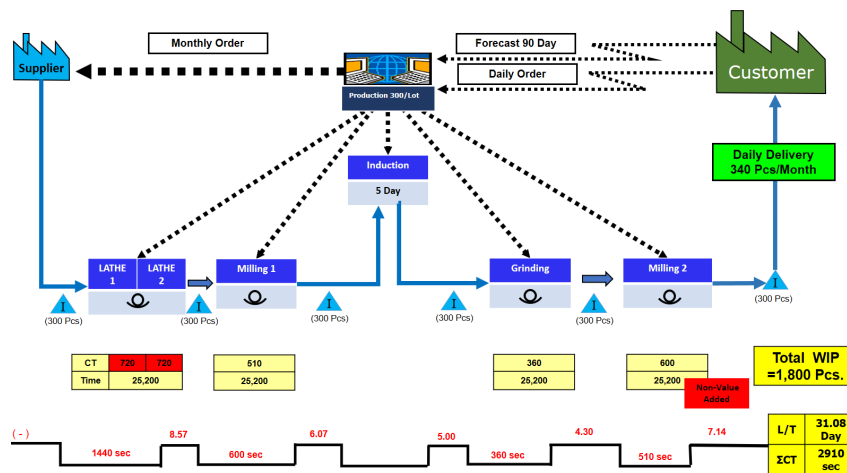


Figure 2. Value Stream Map before the improvement.

The analysis of the value stream diagram shows the production process from the beginning to the delivery of the product to the customer. It was found that there were six production processes, with four employees in total production, 31.08 days of production time per Lot, 2,910 seconds of total production time to, 1,800 pieces of work in the process, and from the consideration, it was found that the second milling process was a nonvalue added process because it was a repetition of the first milling. In the second milling process, the milling process must be re-milled to the same position as in the first milling process, causing difficulties in the operation of the operator and possible defects in the production process. This results in waste and costs. It also causes the production process to be delayed until it may affect the delivery of products on time for customers.

3.3 Implement process improvement using ECRS principles

From the analysis of the value stream diagram and identify Non-Value added Product Processes that also cause wastes, finding ways to eliminate unnecessary processes and reduce wastes occurring in the production process of Shaft Rocking products by applying ECRS. Principles to improve production processes, The aims of research E: Eliminate principles is the removal or cutting of unnecessary things from the work process to reduce the time and reduce production costs, the processes that are considered to be ineffective and cause losses in various fields is the second milling process because it is a redundant and unnecessary work. Therefore, this process was eliminated by adjusting the control value of the first milling to the second, showing the control value as shown in Figure 3—the control value set for both milling operations.

Process No.	Process	CT	Cap./day	Dimension 1
3	Milling 1	600	48	4.5 ±0.1
6	Milling 2	600	48	5 ±0.015

Figure 3. The control value set for both milling operations.

Once the controls are adjusted to customer specifications, data on the milling process are collected. Collecting the work value data before hardening to be analyzed whether it meets the requirements or meets the production standards or not collects 30 samples to be analyzed.

4. Results and Discussion

4.1 Analysis of Process Performance After Reduction of the Production Process

From the operation to improve the production process by using the ECRS principle to eliminate the second milling process after the process improvement, the production control data is analyzed to eliminate the second milling process. It was found that the pre-hardening and post-hardening control values were within the customer's specification, and none were out of specification. In addition, when analyzing the process performance, it was found that $C_p > 1$ means that the process performance is better than the product specification, resulting in less waste in the production process, and the post-hardening C_{pk} value is greater than 1. It is considered that the process performance of the process is satisfactory. It was concluded that the second milling process could be eliminated, and the production data was analyzed using Value Stream Mapping (VSM) in section 4.2

4.2 Analyze and compare production processes using Value Stream Mapping (VSM)

The production process analysis before the improvement in section 3.2 represents the entire production process from the beginning to the delivery of the product to the customer. As shown in Figure 3. the value stream map before improvement. There are six production processes, production per Lot up to 31.08 days, and up to 1,800 pieces of work in the process, which shows that the production period is extended. After improving and reducing the production process, Value Stream Mapping (VSM) can be created, as shown in Figure 4—value stream diagram after improvement of shaft rocking production process.

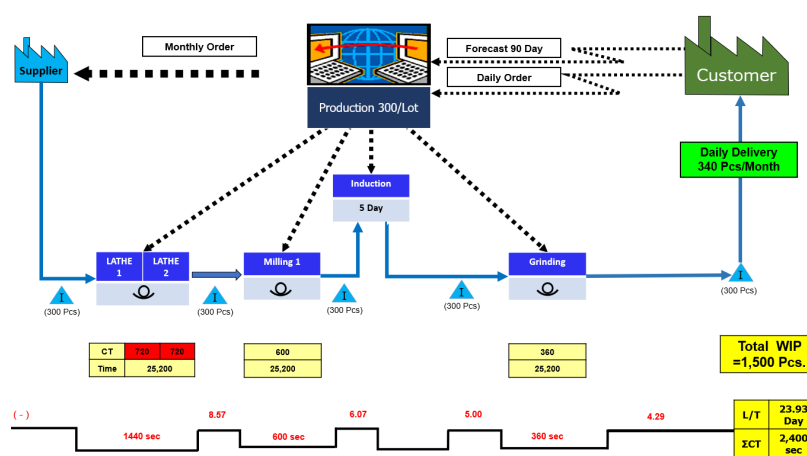


Figure 4. Value stream diagram after improvement of shaft rocking production process.

From Figure 4, the value stream diagram found that after the improvement, the second milling process after hardening was reduced, leaving only five production processes, and the number of employees in production reduced from 4 to 3 people. As a result, production time was reduced from 31.08 days to 23.93 days, and total production time was reduced from 2,910 seconds to 2,400 seconds and can reduce work in the production process from 1,800 pieces to 1,500 pieces, resulting in reduced production time. It can also deliver products on time according to the customer's schedule compared to the amount of work that cannot deliver on the customer's scheduled date, as in Figure 5. The amount of work that cannot deliver on the customer's scheduled date before and after the improvement.

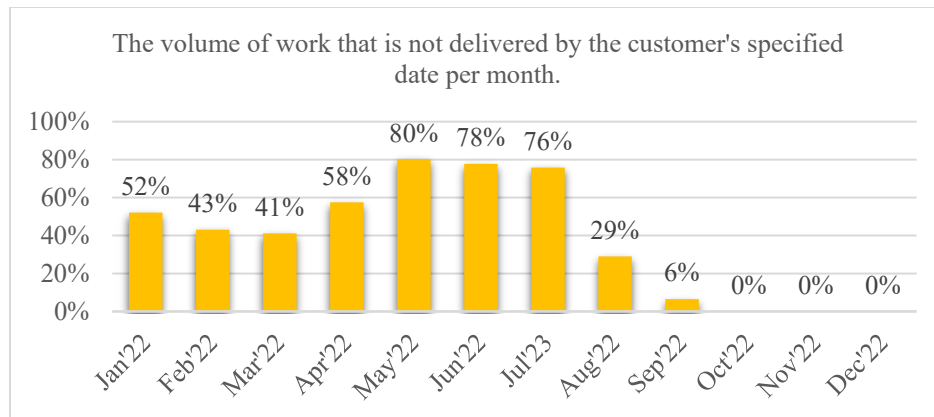


Figure 5. The amount of work that cannot deliver on the customer's scheduled date before and after the improvement.

From Figure 5, it can be seen that the amount of work that is not delivered on the scheduled date of the customer tends to decrease after the renovation is completed in August 2022. As a result, late delivery is reduced to an average of 12% per month.

5. Conclusion

From improvements to reduce time and wasted steps in the production of Shaft Rocking products and to increase efficiency in delivering Shaft Rocking products on time to customers according to the company's KPIs of the department, Able to reduce the working process from 6 steps to 5 steps, reduce the number of employees used in the production process from 4 people to 3 people and can reduce the lead time used in production from 31.08 days to 23.93 days. As a result, the volume of work not delivered by the customer's due date decreased from an average of 56% per month to 12% per month.

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Biography

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