Lean Manufacturing Concept: Minimizing Non-value Added Activities in Wood Manufacturing Process

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Abstract: PT. XYZ is a wood processing manufacturing company that produces household appliances. From the results of monitoring to the company, it is seen that in the production process there is still a lot of waiting activities and transport activities (non-value added activity) which leads to waste of processing time and resulting in the longer lead time production process. Based on the problems, the lean manufacturing approach is used to reduce non-value added activities. Through this method its analyze value-added activities and non-value added activities with Value Stream Mapping tool then to reduce non-value added activities used 5W and 1H principles. The study aims to eliminate non-value added activities through simplification of production processes in order to reduce production time. After doing this research, obtained the improvement of manufacturing lead time from the initial of 21471,76 seconds to 16352,76 seconds. Improvement by Lean Manufacturing method also caused Process Cycle Efficiency to increase by 22 % and to increase the average production per day by 42 units.

1 INTRODUCTION

PT. XYZ is engaged in processing wood into furniture of household appliances such as chairs, tables, cabinets, clothes hangers, wagons, shelves, and others. This company uses raw material in the form of wood brick from the wood of hull bought from other company.

From the results of monitoring to the company, it can be seen that in the production process there are still many waiting activities and transportation activities which is the non-value added activity that leads to waste of processing time and longer lead time production process. Therefore, it is applied to improve production process with a lean manufacturing approach to reduce the non-value added activities.

The lean principle is an ongoing effort to eliminate waste and increase the value added of the product (Gaspersz, 2007). The lean process is characterized by flow and prediction that overall reduces uncertainty and confusion in manufacturing plants (Liker, 2006). The concept of lean manufacturing was developed to maximize the source of utilization through minimizing disposal, then formulated in response to a fluctuating and competitive business environment (Sundar, 2014). Lean Manufacturing is a philosophy that maximizes efficiency, reduces costs, improves product quality, and also sees the importance of how people work in factories (Ali, 2015). Waste or waste is any human activity that uses resources but does not create added value (Haghani, 2015). Production at each process must be triggered by a request from the process that follows it (Das, 2014). Production Process of wood processing at PT. XYZ can be seen in Figure 1.

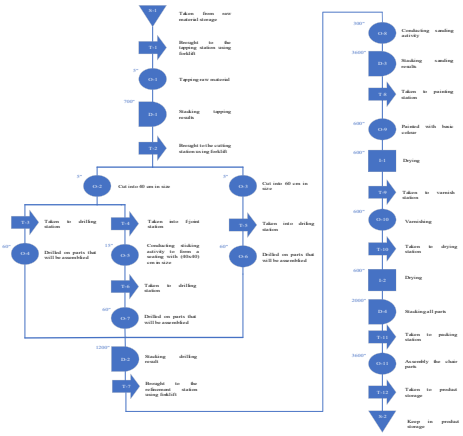

Figure 1: Wood Processing Process Chart

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2 RESEARCH METHOD

The research begins with the review and data collection at PT. XYZ. Data collected from company documents are the production volume, and description of the production process using direct observation and interviews directly in the field

The data processing steps in this research are as follows :

a. Current state map
   1) Constructing the value stream manager
   2) SIPOC Diagram (Supplier-Input-Process-Output-Customer)
   3) Calculation of Standard Time
   4) Waste Identification using Process Activity Mapping
   5) Map Creation for Each Process Category Throughout the Value Stream
   6) *Forming the Overall Factory Flow Chart*
   7) Calculating Process Cycle Efficiency
b. Analyzing Current State Map
   1) Waste Analyzing using 5W and 1H Method
c. Improvement using Lean Manufacturing
   1) Proposed Process activity mapping
   2) Constructing future state map

3 RESULT AND DISCUSSION

3.1 Constructing Current State Map

The paper Current state map is a description of the production process that takes place within the company covering material flow and information flow. The steps of forming the current state map are as follows

3.1.1 Deciding Value Stream Manager

In this research, the selected value stream manager is the production manager

3.1.2 SIPOC Diagram (Supplier-Input-Process-Output-Customer)

SIPOC Diagram (Supplier-Input-Process-Output-Customer) of the wood processing production process can be seen in Figure 2.

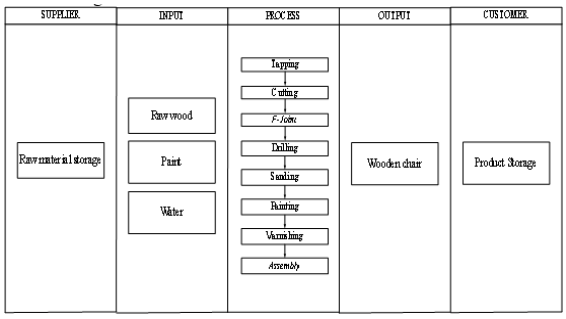

Figure 2: SIPOC Diagram of the Wooden Chair Production

3.1.3 Calculation of Standard Time and Normal Time

The example of standard time and normal time calculation for WC 1 is as follow (Sulataksana, 2005).

Normal Time =

$$Cycle\ Cycle\ \ time\ x\ rating\ factor \quad (1)$$

$$= 705 \text{ x } 1.04 = 733.2 \text{ sec}$$

Standard Time =

$$\text{Normal Time x } \frac{100\ \%}{100\% - \text{Allowance } (\%)} \quad (2)$$

$$= 733.2 \text{ x } \frac{100\ \%}{100\ \% - 17\%} = 883.37 \text{ sec}$$

3.1.4 Deciding Value Stream Manager

Through process activity mapping of wooden chair making above obtained the number of operation process, transportation, inspection, storage and delay along with its time can be seen in Table 1. (Vanany, 2005)

Table 1: Process Added Mapping

Symbol	Amount	Time (sec)	Percentage (%)
Operation	11	5340	29.84
Transportation	12	6260	34.97
Inspection	2	1200	6.70
Delay	4	5100	28.49

3.1.5 Map Creation for Each Process Category throughout the Value Stream

Mapmaking for each process category along the value stream uses the standard time data for each process plus other data such as processing time, and the number of operators. a preliminary process category map for the preparation of wooden chair production as shown in Figure 3 (George, 2005)

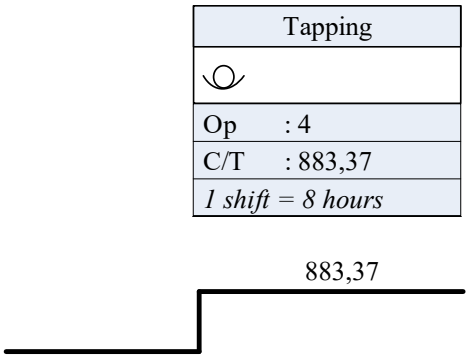

Figure 3: Map of Tapping Category

3.1.6 Forming the Overall Factory Flow Chart

Each process along the value stream is combined with material flow and information flow so that it becomes a single flow in the factory. After all, information is obtained, thus the current state map can be formed by placing all material and information flows into the folder.(Vanany, 2005). Current state map of wooden chair products can be seen in Figure 4.

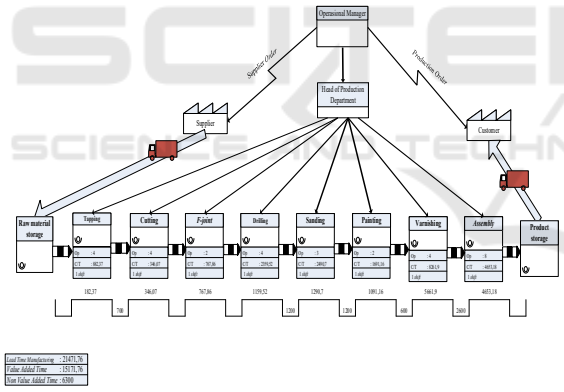

Figure 3: Current State Map of Wooden Chair Product

3.1.7 Calculating Process Cycle Efficiency

The calculation of manufacturing lead time is done to determine the condition of the original factory. Calculation of Process Cycle Efficiency which consists of manufacturing lead time calculation, process cycle efficiency. The manufacturing lead time is 21471.76 seconds. The calculation of process cycle efficiency is as follows

$$Process\ Cycle\ Efficiency = \frac{Value\ Added\ Time}{Manufacturing\ Lead\ Time} \quad (3)$$

$$= 15171.76 / 21471.76 = 0.7066 \approx 70.66\ \%$$

$$\text{Average Finishing Time} = \frac{Total\ Productin\ Year}{Amount\ of\ works\ days} \quad (4)$$

$$= 55200/312 = 176.92 \approx 177\ \text{unit/day}$$

3.1.8 Improving Activities using Lean Manufacturing

The activities included as non-value added activity and can be improved will be analyzed using the 5W and 1H method which can be seen in Table 2.

Table 1: Activities Analyzing using 5W and 1H Method

Num.	Analyze	Information
1	What	Stacking Results of the Tape
	Who	Operator
	Where	Work center I
	When	This activity is done before the result of the tape are brought to the cutting section
	Why	This delay activity is considered ineffective because it takes a long time, this activity occurs because the operator stacking the tapping results first before being transported due to the distance between the two remote stations
	How	Activity can be minimized by closer the tuning station and the cutting station where the operational manager gives direction to the operator so that the result of the tape can be directly brought to the cutting machine
2	What	Stacking Drilling Results
	Who	Operator
	Where	Work center IV
	When	This activity is done before the drilling results are brought to the refinement section
	Why	This delay activity is considered ineffective because it takes a long time, this activity occurs because the operator stacking the drilling results first before being transported due to the distance between the two remote stations
	How	Activity can be minimized by closer the drilling station and the refinement station where the operational manager gives direction to the operator so that the drilling results can be directly brought to the refinement station
3	What	Stacking Refinement Results
	Who	Operator
	Where	Work center V

	When	This activity is done before the refinement results is brought to the painting section
	Why	This delay activity is considered ineffective because it takes a long time, this activity occurs because the operator stacking the refinement results first before being transported due to the distance between the two remote stations
	How	Activity can be minimized by closer the refinement station and painting station where the operational manager gives direction to the operator so that the refinement results can be directly brought to the painting station

3.1.9 Future State Map Depiction

Future State Map based on the results of proposed improvements that have been made previously. Changes in time included are changes in time that can be observed or estimated from the current conditions, while for the reduced time that can be obtained such as a reduction of transport time and wood buildup due to the reduction of activities that can cause waste at the time of production. Future State Map can be seen in Figure 5 below

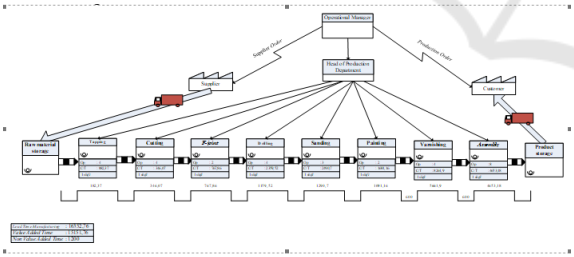

Figure 5: Proposed Future State Map

3.1.10 Calculating Improved Process Cycle Efficiency

The calculation of manufacturing lead time is done to determine the condition of the original factory. Calculation of Process Cycle Efficiency which consists of manufacturing lead time calculation, process cycle efficiency. The proposed manufacturing lead time is 16352,76 seconds. The calculation of process cycle efficiency is as follows

$$Process\ Cycle\ Efficiency = \frac{Value\ Added\ Time}{Manufacturing\ Lead\ Time}$$

$$= 15151.76 / 16352.76 = 0.9266 \approx 92.66\ \%$$

Efficiency increased = 92.66 % - 70.66 % = 22 %

$$\text{Production Improvement} = \frac{\text{Actual Manufacturing Lead Time - Proposed Manufacturing Lead Time}}{\text{Actual Manufacturing Lead Time}} \quad (5)$$

$$= \frac{21471.76 - 16352.76}{21471.76} = 0.2384 \text{ x } 177 = 42 \text{ units}$$

4 CONCLUSIONS

Based on the analysis result using Lean Manufacturing approach, the delay or non-value added the activity that occurs during the production process of wood making affects the productivity of the company. This can be seen where after the improvement with lean manufacturing approach there is a change in manufacturing lead time which initially equal to 21471.76 seconds become 16352.76 seconds. Improvements to the Lean Manufacturing method with improved results for Process Cycle Efficiency increased by 22 % and for an average daily production increase of 42 units to 219 units per day.

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