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Lean Manufacturing Approach to Minimize Waste Production Parts STN Wfx000 RIB at the Prismatic Medium Machine 2 in PT X

Afferdhy Ariffien[1]*, Deby Rosminingsih[2]

[1]School of Logistics Management Indonesia (STIMLOG) Jl, Sariasih No 54 Bandung 40151, Indonesia, [2]Industrial Engineering University of Sangga Buana YPKP, Indonesia. *Email: afferdhyariffien@yahoo.com

ABSTRACT

In the aircraft industry, generally 75% of the material used to make an aircraft component will be garbage, so we need a system efficiency of production on the other side. The efficiency of production systems that run very influential on the performance of the company. Thus, elimination or minimization of waste that occurs is one solution. The approach can be used to eliminate or minimize waste in a production system is lean manufacturing company. Lean manufacturing is a systematic approach to identify and find the cause of the waste and then minimizing or even eliminating it. This study aims to minimize waste in the production process RIB AT STN WFX000 part name in the area of medium prismatic machine 2. The results of the analysis of waste relationship matrix obtained two types of waste that is inventory and waiting, each of which has a weight 7,143 and 6,28 with detailed mapping tools are chosen process mapping activity with the score 198,286 and supply chain response matrix with a score of 139,429.

Keywords: Lean Manufacture, Value Stream Mapping, Value Stream Analysis Tool, SCRM
JEL Classifications: L11, L15, L61

1. INTRODUCTION

Competition in the industry both service industry and manufacturing industry is currently very fast at all, so it requires the company to improve the quality of products made. Improving the quality of the product will provide a guarantee to consumers that the company provides the best services to meet consumer demand at competitive prices in the market. Sales of a product may be affected by the price of the product. There are several factors that determine the price of a product, one of which is waste or waste that occurs when the product was manufactured. Waste or waste is any activity the use of resources (resources) that do not provide added value (VA) in the product. Thus, one of the efforts to achieve overall production efficiency is to eliminate waste or waste that occurs.

PT X is a company that produces various types of aircraft such as the Nxxx (Aircraft Full Development), Military CNxxx (Aircraft Joint Development and Production), and Airbus Axx0 (Subcontract Program). However, the manufacture of such products often wasteful, for example, is a waste of defect that occurs in one part name RIB AT STN WFX000, thus causing the product must be regenerated.

2. LITERATURE REVIEW

According to Taiichi Ohno, the inventor of the Toyota Production System, lean manufacturing are all activities until manufacturers earn cash. The focus of lean manufacturing is to reduce the time line by eliminating waste that does not add value non-VA (NVA). Lean manufacturing or equal to the Toyota Production System is essentially a production system that aims to eliminate waste (waste) in all aspects of production, from the flow of raw materials from suppliers until the flow of finished products to the consumer, through the method of continuous improvement so as to increase output and productivity.

Jaiprakash and Kuldip (2014) stated "theory verification through empirical and exploratory studies has been the focus of research in LM. Automotive industry has been the focus of LM research, but LM has also been adopted by other types of industries also. One of the critical implementation factors of LM is simultaneous adoption of leanness in supply chain. LM has become an integrated system composed of highly integrated elements and a wide variety of management practices."

Sundara et al. (2014) stated "the successful implementation of lean the organization had to focuses on all the aspects such as value stream mapping (VSM), cellular manufacturing, U-line system, line balancing, inventory control, single minute exchange of dies, pull system, Kanban, production leveling, etc. In this paper, an attempt has been made to develop a lean route map for the organization to implement the lean manufacturing system."

3. METHODOLOGY

3.1. Stages of Research Method

a. Preparation of VSM, conducted to determine the flow of physical and information flows, and shows the relationship between them, find out where the waste, understand the principles of lean thinking, assist in the determination of lean implementers team.
b. Completing a map or image flow and the physical flow of information is done by adding lead time and value adding time under the image stream created.
c. Identification of waste with VSM. In this stage, the weighting of waste that often occurs in the value production stream, where the weighting is based on the seven wastes in the VSM.
d. The result of the weighting of waste then does the right research tool by using value stream analysis tool (VALSAT).
e. Analysis of the data processing, at this stage of the analysis of the data processing.

4. DATA COLLECTION AND PROCESSING

4.1. VSM

VSM is a tool or a tool that is ideal as a first step in the process for change in the condition of lean manufacturing or lean enterprises (Womack and jones, 1996) for more details can be seen in Figure 1.

4.2. Waste Relationship Matrix

Waste relationship matrix is an analytical measurement criteria are collated in a matrix. This matrix waste aims to determine the most influential as shown in Table 1.

From the results of Table 1, it can be obtained scores of each type of waste. More results can be seen in Table 2 are as follows.

In accordance of the results in Table 2 score of each waste, the obtained value of the weight of each type of waste. More results in accordance with Table 3 are as follows.

The weight of waste inventory and waiting to have the weight values, each of which are 7143 and 6286. The results of the assessment above show the waste ratings dominant and highly influential on other waste.

4.3. VALSAT

After getting the final result of the weighting process, the next step performed is the selection of mapping tools that are appropriate to the type of waste that occurs in the company. This selection process is done by using the VALSAT; Determination of the tool is done by weighting VALSAT. Correlation is worth a modest scale, the scale was worth three and high-value scale of nine (Hines and Rich, 1997).

Based on the calculation of VALSAT, it can be seen from the rank of each VSM tools detail; the result can be seen in Table 3 are as follows.

Table 3 shows that process activity mapping (PAM) ranks first with a score of 198,286 and the percentage stood at 33.51% and responsive supply chain matrix ranks second with a score of 139,426 and the

Table 1: Waste relationship matrix

F/T	O	I	D	M	T	P	W
O	A	A	I	E	I	X	E
I	O	A	U	I	I	X	X
D	E	A	A	I	I	X	E
M	X	U	E	A	X	E	I
T	U	I	O	O	A	X	I
P	O	U	I	I	X	A	I
W	U	A	U	X	X	X	A

Table 2: Weight waste

Waste	Score	Weight
O	30	4.286
I	50	7.143
D	38	5.429
M	40	5.714
T	28	4.000
P	18	2.571
W	44	6.286

Table 3: Rangk and personates VALSAT

Types of tools	Total weight	Rangk	Percentage
PAM	198.286	1	33.51
Supply chain responsive matrix	139.429	2	23.56
Production variety funnel	35.429	6	5.99
Production filter mapping	55.714	3	9.42
Demand amplification mapping	96.000	4	16.22
Decision point analysis	55.714	5	9.42
Physical structure	11.143	7	1.88
Total	591.714		100.00

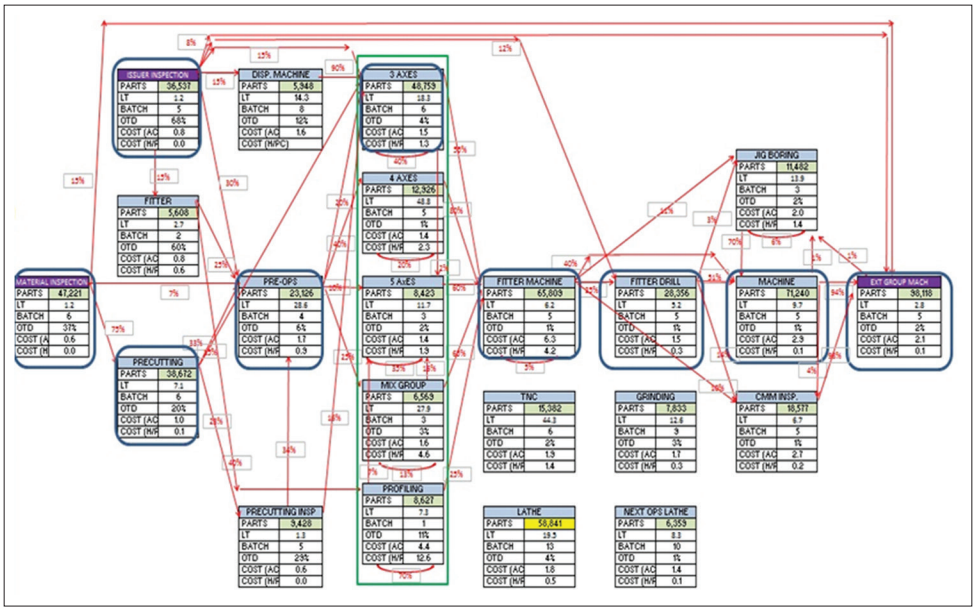
VALSAT: Value stream analysis tool, PAM: Process activity mapping

Table 4: Grouping VA, NVA, the amount and timing NNVA AQ4

Classification	The number of	Time (h)	Percentage	AQ5
VA	5	12.29	57	
NVA	2	1	5	
NNVA	13	8.09	38	
Total	20	21.38	100	

VA: Value added, NVA: Non-value added, NNVA: Necessary non value added

Figure 1: Value stream mapping



Source: PT. X, 2014

percentage stood at 23:56%. In this study, the authors limit the use of tools that are on the VALSAT only two major rankings.

4.4. Making Supply Chain Response Matrix

Supply chain response matrix is a graph illustrating the relationship between inventory with a lead time which can be used to identify and evaluate the increase and decrease in inventory levels and the long lead time in each area of the supply chain.

4.5. Data Cumulative Arrival of Raw Material

Data cumulative manufactured components in the production process part RIB AT STN WFX000 name in the area of medium prismatic machine 2 in the form of WIP.

In the early stages, we make a part name RIB AT STN WFX000 using one type of raw material, namely, aluminum plate with a type code 7050T7651 ABM 3-1029. The raw material comes to it from a supplier which AIRBUS A320. The average requirement and the material making aluminum plate are 12 units per week, while the lead time is 2 days.

Table 6 describes the days of physical stock and lead times for raw materials.

In the production of spare production process RIB AT STN WFX000 name in the area of medium prismatic machine 2 then the product is shipped to steel fitter area cell and undergo further processing up to final inspection and then delivery. From the data held by PPIC average WIP in the system is 3:05, while the lead time of WIP to be processed in steel fitter cell requires 2 days as can be seen in Table 6.

Furthermore, the data that have been obtained make supply chain response matrix graph like Figure 2.

From the chart above illustrated that the lead time in the supply chain of spare production area RIB AT STN WFX000 name is for

Table 5: Days physical stock and lead time raw material AQ4

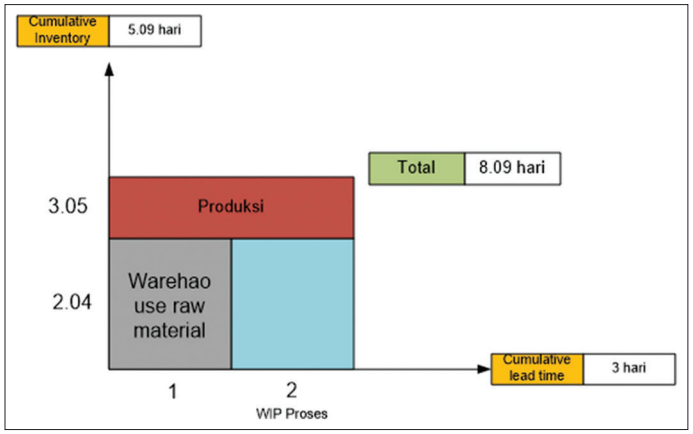
Raw material	Days physical stock	Rate lead times
Aluminum plate	2.4	1

Table 6: Days physical stock and lead time WIP RIB AT STN WFX000

Name component	Days physical stock	Rata-rata lead times
RIB AT STN WFX365.514	3.05	2

Source: PT X, 2014

Figure 2: Graphic supply chain response matrixes



3 days while the duration of inventory in the system is 5.09 days. Illustrated that the lead time WIP generates most of this is directly proportional to the existing inventory in the system that forced the company to create a WIP for 3:05 today.

4.6. Occurrence Cause Analysis Waste

4.6.1. Overproduction

Overproduction is happening on the production floor is a product workmanship that occur more than once because of defects

resulting from product, thus making the production process, producing more than it should be produced. The cause of overproduction waste is as follows:

1. Less labor focus to the work being done.
2. The lack of thoroughness of labor performed during the production process is ongoing.
3. Maintenance of equipment, machines and tools that is less good.

4.6.2. Defect

Defects that occur on the production floor are the problems that occurred on the quality of the resulting product. The quality of the resulting product does not match the standard of the product is a reject product and the production process, this product does not recognize the term rework so that if the product quality does not match the standard of the product is a product reject. The cause of the defect waste is as follows:

1. Errors that occur during the process
2. The failure to check the tool being used
3. Machine maintenance is not good enough.

4.6.3. Unnecessary inventory

Inventory is happening on the production floor is a pile of material existing on each machine in the area, especially MPM2 three machines used to make the part name RIB AT STN WFX000. The cause of waste inventory is as follows:

1. The equipment is not reliable (unreliable equipment)
2. The flow of work is not balanced
3. A large batch sizes
4. Long change-over time (the time change is long).

AQ4 **Table 7: Weight high waste**

Waste	Weight
Inventory	7.143
Waiting	6.28

AQ4 **Table 8: Matrix VALSAT selected**

Matrix VALSAT	Score
PAM	198.286
Supply chain response matrix	139.429

VALSAT: Value stream analysis tool, PAM: Process activity mapping

Table 9: Personates activities VA, NVA, NNVA

Activities	Personates (%)
VA	57
NVA	5
NNVA	38

VA: Value added, NVA: Non-value added, NNVA: Necessary non value added

Table 10: Time to need for every activity

Activities	Time (h)
Operation	14.11
Transportation	6
Inspection	0.27
Delay	1
Total	21.38

4.6.4. Inappropriate processing

Inappropriate processing that occurs on the production floor is inefficient processes that lead to unnecessary movements performed by the operator as too much checking tool that is being used by the engine, causing a process to be a bit longer. Inappropriate waste processing can result in processing time becomes longer resulting in a long WIP and lead to inventory your system to accumulate. Inappropriate causes of waste processing are as follows:

1. Inaccurate use of equipment
2. Maintenance of the equipment is not good
3. Failed to combine the operations work
4. Perform unnecessary labor movement.

4.6.5. Excessive transportation

Excessive transportation in the production floor is creating inefficient transport resulting in increased material handling time. It also can lead to waste in the form of a waste of time, effort and expense due for excessive movement of people, information, product, or material. The cause of excessive waste transportation is as follows:

1. Poor layout
2. The lack of coordination in the process
3. Poor house keeping
4. Poor work place organization.

4.6.6. Waiting

Waiting that occur in the production floor is the worker who only observe the automatic machine is running or standing waiting for the next process step or just idle due to run out of material, machine broken, or delay occurs due to the nontechnical things unpredictable.

4.6.7. Unnecessary motion

Motion happening on the production floor is unused workers movement while doing his job to find, reach and so forth, so it will affect the use of time that does not add value to the product or process. The cause of waste motion is as follows: Poor work place organization, poor layout and working methods inconsistent.

5. CONCLUSION

Based on data processing and analytical problem solving done in this study and then take the conclusion that:

1. Based on the relationship matrix waste obtained two most dominant types of waste that is.
   By using the selection matrix VALSAT the importance of the two-detail mapping tools were used to analyze the waste that occurs.
2. In accordance with the identification and analysis using PAM, the results obtained are in Tables 9 and 10.
3. From the analysis of supply chain response matrix that the total lead time in the supply chain of spare production lines RIB AT STN WFX000 name in the area of medium prismatic machine 2 is for 3 days while the duration of inventory in the system is 5.09 day so the total supply in response time 8:09 system is during the day. This illustrates that the WIP process produces the most substantial lead time and proportional to

the existing inventory in the system that forced the company to create a WIP for 3:05 today.

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Author Queries???
AQ4: Kindly cite Table 4,5,7,8 in the text part.
AQ5: Kindly provide column head.