Implementation of Value Stream Mapping to Reduce Waste at Buffing Panel UP PT. Yamaha Indonesia

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Abstract — **PT Yamaha Indonesia (YI), established in 1970, is one company that is engaged in the manufacture and assembly of piano. As one branch of Yamaha Corporation Japan Company, PT Yamaha Indonesia is required to compete with other branches and subsidiary companies with brands other than Yamaha piano in the world. With the increasing demand for piano, PT YI always trying to improve productivity so that the resulting output can meet the demand. However, problems occurred in the PT YI especially in parts of the buffing Panel upright piano (up) is still a waste that occurs in the production process it is characterized by the presence of a number of non-value added activity caused by transport and unnecessary movement and the presence of inventory which is not in accordance with the requirements. Value Stream Mapping is a tool used in this research. Results after the VSM 140 Pcs inventory, lead time 0.74 day, standard time 53.8, defect 3.19, productivity 1.96 and efficiency 47 %..**

Keywords — **Defect, Lead Time, Productivity, Value Stream Mapping, Waste**

I. INTRODUCTION

Along with the economic conditions which can not be ensured and a tight competition in world trading, every company should strive to anticipate a condition or circumstances that may threaten the company. The increase in workers wage for example, may force the company to spend more fee. However, problems arise when this cost increases are not offset by the increase in the company's productivity thus reducing profits. To be able to survive in the midst of these conditions, every company should have a competitive advantage to win the competition. Therefore, the company should always make a continuous improvement in every process in order to achieve optimal levels of productivity.

A. The aim of this research are :

Based on the formulation of the problems, research purposes can be determined as:
- Achieving a short lead time (waiting time) of its prior condition by decreasing the Inventory/Stock (work in process) on the buffing panel UP.
- Identifying waste and analyze its causes.
- Give suggestion to increase efficiency.

II. LITERATURE

Value stream mapping is a lean-management method for analyzing the current state and designing a future state for the series of events that take a product or service from its beginning through to the customer. At Toyota, it is known as "material and information flow mapping".

Value stream mapping is a lean manufacturing or lean enterprise technique used to document, analyse and improve the flow of information or materials required to produce a product or service for a customer . It differs from the process mapping of Six Sigma in four ways :
- It gathers and displays a far broader range of information than a typical process map.
- It tends to be a higher level than many process maps.
- It tends to be used at a broader level, i.e from receiving of raw material to delivery of finished goods.
- It tends to be used to identify where to focus future project and or kaizen events.

Seven waste by Shigeo Shingo
- Waste from overproduction
  1. To produce sooner, faster or in greater quantities than the absolute customer demand
  2. Manufacturing too much, too early or "Just in Case"
  3. Overproduction discourages a smooth flow of goods or services
  4. Takes the focus away from what the customer really wants
  5. Leads to excessive inventory
     Caused by:
     a. MRP push rather than kanban pull
     b. Large batch sizes
     c. Looks better to be busy
     d. Poor people utilization
     e. Lack of customer focus
     Why one of the 7 wastes ?:
     a. Costs money
     b. Consumes resource ahead of plan
     c. Creates inventory
     d. Hides inventory/defect problems
     e. Space utilization
- Excess Transportation
  1. Unnecessary movement of parts between processes

2. Complex material flow paths
3. Poor close coupling
4. Wasted floor space
5. Unnecessary material handling
6. Potential damage to products
   Caused by:
   a. Badly designed process/cell
   b. Poor value stream flow
   c. Complex material flows
   d. Sharing of equipment
   Why one of the 7 Wastes ?:
   a. Increases production time
   b. It consumes resource & floorspace
   c. Poor communication
   d. Increases work in progress
   e. Potential damage to products

f. Excess Inventory
   Any raw material, work in progress (WIP) or finished goods which are not having
   value added to them
   Caused by:
   a. Production schedule not level
   b. Inaccurate forecasting
   c. Excessive downtime/set up
   d. Push instead of pull
   e. Large batching
   f. Unreliable suppliers
   Why one of the 7 Wastes ?:
   a. Adds cost
   b. Extra storage space required
   c. Extra resource to manage
   d. Hides shortages & defects
   e. Can become damaged
   f. Shelf life expires

- Waiting Time
  1. People or parts that wait for a work cycle to be completed
  2. Where are the bottlenecks?
  3. What are the major causes of lost machine availability?
  4. What are we doing to improve machine availability?
  5. Do people wait on machinery?
     Caused by:
     a. Shortages & unreliable supply chain
     b. Lack of multi-skilling/flexibility
     c. Downtime/Breakdown
     d. Ineffective production planning
     e. Quality,design,engineering Issues
     f. 'Black art' processes
     Why one of the 7 Wastes ?:
     a. Stop/start production
     b. Poor workflow continuity
     c. Causes bottlenecks
     d. Long lead times
     e. Failed delivery dates

- Processing Waste
  Processing beyond the standard required by the customer

By improving processing efficiency we ultimately use less resource to achieve the same customer satisfaction
Caused by:
a. Out of date standards
b. Attitude - 'Always done it like this'
c. Not understanding the process
d. Lack of innovation & improvement
e. Lack of standard operation procedures
Why one of the 7 Wastes ?:
a. It consumes resource
b. It increases production time
c. It's work above and beyond specification
d. Can reduce life of component

- Wasted Motion
  1. Adds cost
  2. Motion is the movement of "man"
  3. Waste motion occurs when individuals move more than is necessary for the process to be completed
     Caused by:
     a. No standard operating procedure
     b. Poor housekeeping
     c. Badly designed cell
     d. Inadequate training
     Why one of the 7 Wastes ?:
     a. It interrupts production flow
     b. Increases production time
     c. Can cause injury

- Waste from Production Defects
  1. A defect is a component which the customer would deem unacceptable to pass the quality standard
  2. Defects reduce or discourage customer satisfaction
  3. Defects have to be rectified
  4. Rectification costs money with regard to time effort and materials
  5. Defects in the field will lose customers
  6. Right first time is the key
     Caused by:
     a. Out of control/Incapable processes
     b. Lack of skill, training & on the job support
     c. Inaccurate design & engineering
     d. Machine inaccuracy
     e. Black art processes
     Why one of the 7 Wastes ?:
     a. Adds costs
     b. It interrupts the scheduled
     c. It consumes resources
     d. It creates paper work
     e. Reduces customer confidence

III. METHODS

Our research has been done at PT. XYZ located in Pulogadung Industrial District East Jakarta. Our research was done through six steps which contains determining the research purposes, observing and capturing data before Value Stream Mapping or shortly called VSM,as well as identifying an extravagance on the Buffing Panel UP, analyzing the problems with Fishbone Diagram, improvement, observing

and retrieving the data after the VSM, then analyzing the final result after the VSM, where the results should provide a benefits for the company.

IV. RESULT

A. Pre-Inventory before VSM

Inventory in WIP calculation is performed three times. This process is taken at each flow process: inventory before the process, while the process, and after the process. From the inventory process, will get the amount of lead time at the moment, as well as the parts that have bottle neck.

TABLE I
INVENTORY CALCULATION

No	Process Name	Cabinet Name	Inventory			Average	Max
			1	2	3		
1	8 Head Buff	Side Board	27	26	28	27	27
		Top Board	20	25	25	24	
		Top Frame	23	23	26	24	
		Fall Center	24	24	25	25	
2	Edge Buff	Side Board	32	31	28	30	30
		Top Board	31	26	28	28	
		Top Frame	27	28	27	27	
		Fall Center	31	28	29	29	
3	High Polish	Side Board	75	80	85	80	80
		Top Board	40	40	60	47	
		Top Frame	40	30	40	37	
		Fall Center	50	40	40	43	
4	Ryoto	Side Board	75	80	70	75	75
		Top Board	40	30	40	37	
		Top Frame	40	50	40	43	
		Fall Center	30	30	50	37	
5	Polisher	Side Board	15	20	25	20	20
		Top Board	20	20	10	17	
		Top Frame	15	20	15	17	
		Fall Center	20	20	15	18	
Total Inventory							232
Lead Time							1,23

In the calculation of inventory at the end of September 2014 at Buffing Panel UP PT. YI, the average inventory results are 232 Pcs. High polish process is a process with the highest lead time by 0:43 lead time throughout the day for a production capacity of 188 Pcs / day . Buffing mapping process before VSM panel these things:

1. The highest cycle time value are in the ryoto process by 14,86 minutes.
2. The highest lead time are in the high polish by 0,43 days.
3. Total cycle time 20,23 minutes.
4. Production demand 188 Pcs / day.
5. Total lead time 1,23 days and total inventory 232 Pcs.
6. Time between next operation 567,66 minute
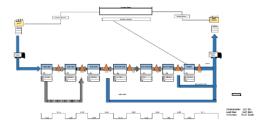
B. Mapping Before VSM

Fig.1 Mapping Before VSM

C. Defect Calculation Before VSM

Results of calculation section buffing panel defect UP before VSM implemented is quite high , which is need to be removed in order to increase the productivity section buffing UP panel . The following data defect before VSM implemented. The details as follows

- Defect surface 94 Pcs (2,3%)
- Defect edge 51 Pcs (1,2%)
- Defect other side 12 Pcs(0,3%)
- Broken 62 Pcs (1,6%)
- Defect Patern 4 Pcs (0,1%)
- Total defect 223 Pcs (5,41%)

The defect is caused by defect surface 94 Pcs equals 2.3 % of the total amount of production produced for 1 month . So that need another action which can decrease that defect

D. Waste Analysis Before VSM

We observed, analysed and recorded the waste of buffing panel UP, that is suspected as a cause of accumulated inventory and long- lead time and productivity is not good enough.

E. Proposed Improvements to Eliminate Waste

Proposed improvement through analysis and corrective actions carried out so that waste can be eliminated , the following steps are performed :

- Looking at the causes of waste
- Designing corrective action
- Perform the corrective action
- Socialize corrective action
- Evaluate the results of corrective actions

There are 7 improvements that have been done so that waste can be eliminated so that the inventory / stock decline and lead time (waiting time) shorter , these improvements include:

- Designing a High engine automatic polishing wax polish wax so basting was not much more safety measures and make the operator more productive

- Conduct periodic repair jig , jig so that the conditions are always in good condition .
- Making potential mapping Not Good (NG) high.
- Re-lay out the machine prior to its high polish that far apart between high polish
- Move the spot checks in accordance cabinet order process end there is no wastage of steps.
- Provide training to its special operators to new employees.
- Change the way the process can be stiffened once the process does not need to double the order for the process to be faster.

F. Inventory Calculation After VSM

*I*n the calculation of inventory in WIP performed three times . The calculation process is taken at each flow process, inventory prior to the process , while the process and after the process . The inventory will get the amount of lead time that occurs at this time , following the inventory after the VSM .

TABLE II
INVENTORY CALCULATION AFTER VSM

No	Process Name	Cabinet Name	Inventory 1	2	3	Average	Max
1	8 Head Buff	Side Board	20	15	25	20	20
		Top Board	18	19	21	19	
		Top Frame	25	10	15	17	
		Fall Center	20	20	20	20	
2	Edge Buff	Side Board	25	20	15	20	20
		Top Board	25	20	16	20	
		Top Frame	25	26	10	20	
		Fall Center	20	15	20	18	
3	High Polish	Side Board	40	40	40	40	40
		Top Board	30	40	30	33	
		Top Frame	30	40	40	37	
		Fall Center	40	20	40	33	
4	Ryoto	Side Board	50	50	50	50	50
		Top Board	30	30	30	30	
		Top Frame	40	40	40	28	
		Fall Center	30	50	30	37	
5	Polisher	Side Board	10	10	10	10	10
		Top Board	10	5	10	8	
		Top Frame	15	10	5	10	
		Fall Center	10	10	5	8	
Total Inventory						140	
Lead Time						0,79	

Inventory calculation results obtained after VSM 140 Pcs with lead times of 0.79 days , while the inventory calculation results obtained before VSM 232 pcs with a lead time of 1.23 days , so there was a decrease in Inventory 92 pcs and lead time of 0.44 days due to repairs -Fixes performed after VSM that affect the decline in inventory / stock so that the inventory / stock and lead time (waiting time) in the UP panel buffing reduced.
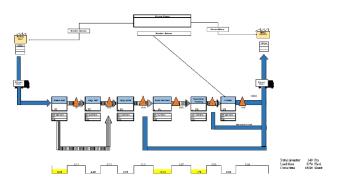

Fig. 2 Mapping after VSM

Mapping buffing process after VSM panel shows the following things :
- The highest value in the cycle time of 11.88 minutes Ryoto process
- Lead time value is highest in the Ryoto 0.26 days
- The total cycle time 16.86 minutes
- Request for the production of 177 Pcs / da
- Total Lead time is 0.79 days and the total Inventory 140 Pcs
- Time Between Operation Next , is the time it reached from one work station to work station after VSM
    1. 8 Head buff : 20/177 = 0.11 days = 50.6 minutes
    2. Edge buff : 20/177 = 0.11 days = 50.6 minutes
    3. High polish : 40/177 = 0.22 minutes = 103.95 minutes
    4. Ryoto : 50/177 = 0.28 minutes = 129.94 minutes
    5. Polyser : 10/177 = 0.05 days = 23 minutes

The calculation result of inventory and lead time in getting 140/177 = 0.79 days = 363.84 minutes

G. Defect Calculation after VSM

Results of calculation section buffing panel defect UP after VSM implemented gone down after the repair , where it is necessary in order to maintain increased productivity in buffing panel with data
From the calculation of defect after buffing panel VSM in the UP obtained the following percentages :
- Defect surface before VSM percentage of 2.3% to 94 pcs VSM findings after work and handling of the material or the surface of the cabinet so that defect can be scaled .
- Defect edge before VSM percentage of 1.4% to 51 Pcs its findings after VSM percentage dropped to 1.1 % with 41 Pcs finding that there was a decrease of 0.3 % with 10 Pcs its findings caused no kaizen to reduce defect edge .

- Defect other side percentage before and after the VSM VSM is still the same 0.3 % by the number of 12 findings but will need no special snacks that defect other side can be removed.
- Broken percentage before VSM 1.6 % to 62 Pcs its findings after VSM percentage fell to 0.2 % with 10 findings , so there was a decrease of 1.4 % with 10 Pcs findings
- Defect pattern percentage before and after the VSM is still the same because the same percentage of its findings with the findings of its 0.1 % 4 Pcs cabinet , but need to keep the defect pattern no longer exists.

H. Efficiency Calculations After VSM

Efficiency calculations after VSM conducted to determine the ability of any part of the panel buffing UP in providing products after some improvement. Efficiency results obtained by comparing the output to the input, the following is the calculation of the efficiency Buffing UP panel in December 2014:

Efficiency = TR (time required) / TA (time available) = (48420/102700) * 100 = 47%

TABLE III
THE RESULT OF THE COMPARISON BEFORE AND AFTER VSM

No	Item	Before	After	Result	Percentage
1	Inventory	232	140	Decrease	40%
2	Lead Time	1,23	0,79	Decrease	36%
3	Standard Time	57,44	53,8	Decrease	6%
4	Defect	5,41	3,19	Decrease	41%
5	Productivity	1,87	1,96	Increase	5%
6	Efficiency	45%	47%	Increase	4%

V. CONCLUSION

Conclusion of the research in the buffing process the panel are:

- Results of inventory before and after the VSM implemented namely Inventory decreased from 232 pcs to 140 pcs its percentage decline of 40%. and Lead Time at the UP panel buffing decreased from 1.23 days to 0.79 day.
- The identification of waste obtained 8 waste that occurs in the buffing panel among other things: Waste of Overproduction, Time Waits, Transportation, Processes, Waste of Inventory Excess, Waste of unnecessary Motion, and also defect.
- Do KAIZEN / continous improvement consistently.

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