

## PROPOSED METHOD TO INCREASE PRODUCTIVITY AT PT AMI

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*Abstract* — PT AMI is a bakeware manufacture located in Bandung and all its product is 100 percent export oriented. The products are exported to American and European markets. The type of business is based on jobs order or customers' orders. The company found that low productivity and high number of defects have caused the company to lose sales and profits. During the analysis the main problem regarding quantity lies in the Unit Press Shop, which has poor layout which causing the production unable to reach optimum level. While in the quality issue, the problem lies in the Unit Press Shop and Unit Painting. The problems are due to lack of knowledge of the operators. The methods that will be discussed in analyzing the roots of problems in PT AMI are the Lean Manufacturing concept with DMAIC methodology to identify the root of the caused and waste in the manufacturing area. The propose method in order to eliminate the problems are additional machines, new layout and the grouping of similar items and processes help to improve the capacity in production. The capacity improvement is about 85.5% compare to the existing system. Another proposes solution is to create training for the operators to improve the skill and knowledge regarding the impact of high reject to the company's growth. The first expectation after the training is the improvement of 20% compare to total reject in 2012. The implementation to improve the productivity will require the effort and team works form few departments. The timeline in applying the propose methods will takes about three months starting from January 2014.

Keywords: Lean manufacturing, productivity and optimum management.

### 1. Introduction

PT AMI is a kitchenware manufacturing company that established in 1991. The products are categorized into 9 basic items. In Production Unit, there are five different Process Units, which are Unit Blank, Unit Press Shop, Unit Treatment, Unit Painting and Unit Assembling Packaging. Since 2010, the demands from the customers have been increasing but the company unable to meet the demands.

## 2. Business Issue Exploration

The writer will be using this conceptual framework as the guidance:

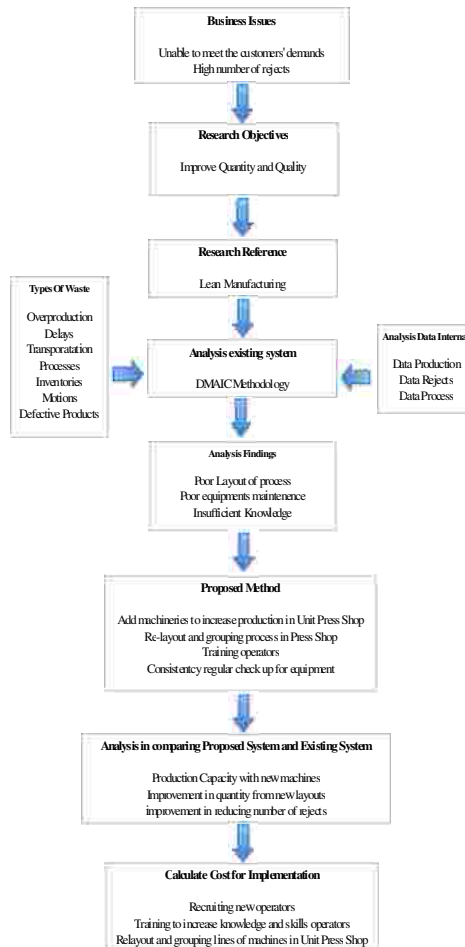


Figure 1 Conceptual Framework

The method from Lean Manufacturing will be used to identify and eliminate wastes that are happening during the process in continuous improvement. The writer will use such as data production, data process and data rejects will help the writer to understand the existing process of production, existing output of the production and the number of rejects. There are five principal in the Lean Manufacturing:

1. Identify product value based on perspective of customers
2. Identify the value stream of process mapping for every products.
3. Eliminate waste and process that has no added value.
4. Organize that material, information and products to flow continuously and efficiently
5. Continuously improvement tools and techniques.

In most common manufacturing companies in the world. The Seven Type of Waste are shown in table below:

Table 1. Seven Type of Common Waste in Manufacturing

Type	Waste
1	Overproduction
2	Delay (waiting time)
3	Transportation
4	Processes
5	Inventories
6	Motions
7	Defective Products

As the DMAIC method, the writer will concentrate on the Define, Measure, Analyze and Improve for the company, while Control will be done after the implementation of the proposed solution to the company.



Figure 2. DMAIC Cycle

Currently PT AMI only able to fulfill about 67.7% from the total of the Customers' demands and the defective products in year 2012 is about 2.13% from the total production in 2012.

Table 2. The Total Customers' Demands and Total PT AMI's Output

2012		
Period	Demand	Output
Jan	828,388	667,947
Feb	817,817	502,811
Mar	571,757	460,686
Apr	327,552	655,282
May	1,394,786	736,071
Jun	946,999	649,960
Jul	1,474,065	728,253
Aug	854,042	512,276
Sep	1,188,442	697,302
Oct	1,455,136	950,155
Nov	1,119,839	822,740
Dec	627,771	469,600
Grand Total	11,606,594	7,853,083

The data of rejects bellows shows that Unit Press Shop, Unit Painting and Unit Assembling Packaging have a high number of rejects.

Table 3. Rejects in each Unit Process Production

Month	REJECT IN EVERY UNIT PROCESS				
	B	PS	T	P	AP
January	146	3,841	236	11,996	3,347
February	42	4,617	207	8,930	2,416
March	82	3,117	196	6,526	2,336
April	138	3,470	295	5,762	2,055
May	100	4,870	386	9,999	3,413
June	114	4,809	300	6,000	3,877
July	65	3,502	214	4,810	4,521
August	87	1,711	107	3,098	3,401
September	157	3,984	250	3,747	2,791
October	131	5,343	232	9,516	3,677
November	162	3,984	367	4,637	3,291
December	80	2,115	194	7,320	3,735
TOTAL	1,304	45,363	2,984	82,341	38,860

From this two internal data the writer decided to focus initially on the aspects of layout and the aspect of quality.

### **Poor layout of machines in production floor**

The writer find out that the current existing areas do not concentrate on the similar items or process since many of the machines are scattered among the areas.

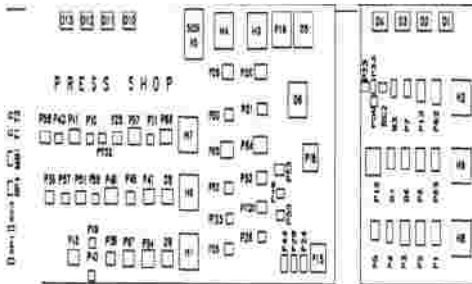


Figure 3. Current layouts in Unit Press Shop

The writer is then calculating the time loss for the production based on the worst scenarios where there is a need for jumping process from one area to another with average travelling time from each process is 3 minutes.

Table 4. Time lost during process

Item 12" Pizza		
Process	Qty in pcs	Existing system Time in min
Foming	80	10
Travel Time A	0	5
Trimming	80	10
Travel Time B	0	5
Bending	80	10
Travel Time C	0	1
Rolling	80	10
Total	80	51

From the calculation based on the lowest stroke of the machines requires about 51 minutes to produce 80 pcs with time-loss about 21.5% from the cycle time.

### **Insufficient training**

As for the high number of defects, the writer analyzes the roots of the cause of these is insufficient training since most operators are clueless regarding their responsibility in minimalizing the rejects. The writer find that that the roots of problems during the entire finding in this analysis in the table shown below.

Table 5. Category of Analysis

Category	Aspect
Low Productivity	<ul style="list-style-type: none"> <li>• Poor Layout in Unit Press Shop</li> <li>• Broken Machines</li> </ul>
High number of rejects	<ul style="list-style-type: none"> <li>• Poor equipment maintenance</li> <li>• Insufficient training</li> </ul>

## **3. Business Solution**

These roots of problems need to be eliminated and find a solution to reduce the waste from the problems above in order for the company to increase profits, productivity and quality.

### ***Improvement of the capacity***

The poor lay out of the machines causes the products process to jump from one area to the other area. The propose solutions are:

- Rearrange and grouping the position of the machines according to the processes of the products.
- Adding additional machines.



Figure 4. Proposed New Layouts of Machines in Unit Press Shop

### ***Improvement for the quality***

The writer proposed the training instead of other kind of solutions because the writer found that the operator still have a very little knowledge regarding quality and responsibility in maintenance of the equipment in reducing the defects. Therefore the are two proposed solutions to improve the quality are:

- Provide training for the operators in Unit Press Shop and Unit Painting
- Improving the equipment maintenance.

### ***Analysis in comparing Purposed System and Existing System in Quantity***

The writer will do the analysis of the improvement using proposed method with the existing system in:

- Capacity
- Revenue
- Minimalize Time loss

### ***Calculation Improvement in Capacity***

In the new lay out, the process arrangement is according to the characteristic similar items and process to eliminate the loss time during process form the jumping process in the existing system. In the past, the production lanes are only 8 lanes that produce the total capacity of 600,000 pieces per 2 shifts in a month. The categories of area can be seeing in the table below :

Table 6. Category of area with similar type of products

Area	Item Grouping	Category	Propose number of lanes in the Area
LB	Cookie Pizza	Shallow Depth	4
LF LG	Loaf Pan Round Pan Square Pan	Medium Depth	5
LE	Oblong Pan Roaster	High Depth	3
LA	Muffin	Area Muffin	4
LC	Spring Form	Area Spring Form	3
LH	Mixed Items and Trail Area	Mix Depth	2

Now with new rearrangement of the layout the capacity is based per area which making the production to measure easily.

Table 7. Calculation improve capacities

Area	No of Lanes	Capacity /hour	Capacity /shift	Capacity 2shifts/month	50% from theory
LB	4	1,920	13,440	672,000	336,000
LF LG	5	900	6,300	315,000	157,500
LE	3	540	3,780	189,000	94,500
LA	4	1,200	8,400	420,000	210,000
LC	3	1,440	10,080	504,000	252,000
LH	2	360	2,520	126,000	63,000
<b>Total</b>	<b>8,160</b>	<b>8,160</b>	<b>57,120</b>	<b>2,226,000</b>	<b>1,113,000</b>

Another comparison solution is shown on the table below regarding the improvement the capacity of the production.

Table 8. Improvement capacities with new layout

Type of Items	Previous Layout /shift	50% of New Layout per shift	Improvement
Cookie Pizza	12,000	6,720	Percentage Improvement calculate $= \frac{(22,260 - 12,000)}{12,000}$ 0.855
Loaf Pan Round Cake Square Cake		3,150	
Oblong Roaster		1,890	
Muffin		4,200	
Spring Form		5,040	
Mix Items		1,260	
Total Capacity		22,260	
	12,000	22,260	85.50%

The proposed method shows the visibility and validity to apply the method is valid and shows the improvement in the capacity by 85.5%.

#### **Calculation Improvement in Minimalizing Time-Loss**

The writer then calculate the improvement due to time loss from the existing process because of the jumping process and the propose layout without any jumping process to another area.

Table 10. Efficiency from the time loss

Item 12' Pizza				
Process	Qty in pcs	Existing system	Proposed system	Improvement
		Time in min	Time in min	Time in min
Forming	80	10	10	16%
Travel Time A	0	5	1	
Trimming	80	10	10	
Travel Time B	0	5	1	
Bending	80	10	10	
Travel Time C	0	1	1	
Rolling	80	10	10	
Total	80	51	43	

In the calculation above the time loss of the can be reduce from 22% to 16% during the process. Therefore in term of time-loss, there is an improvement of 27%.

#### Calculation Improvement in Revenue

The improvement to the company revenue due to the new improvement capacity will help the company to increase 78% of the revenue. This calculation is based on constant output from the new improvement to the existing items that sold to buyers.

Table 11. Improvement in term of Revenue

Month	Existing System		Proposed System		Improvement
	Production	revenue	Production	Revenue	Revenue
	Capacity	\$1	Capacity	\$1	in %
Jan	667947	\$ 667947.00	1,113,000	\$ 1,113,000.00	67%
Feb	502811	\$ 502811.00	1,113,000	\$ 1,113,000.00	121%
Mar	460686	\$ 460686.00	1,113,000	\$ 1,113,000.00	142%
Apr	665282	\$ 665282.00	1,113,000	\$ 1,113,000.00	70%
May	736071	\$ 736071.00	1,113,000	\$ 1,113,000.00	51%
Jun	649960	\$ 649960.00	1,113,000	\$ 1,113,000.00	71%
Jul	728253	\$ 728253.00	1,113,000	\$ 1,113,000.00	53%
Aug	512276	\$ 512276.00	1,113,000	\$ 1,113,000.00	117%
Sep	697302	\$ 697302.00	1,113,000	\$ 1,113,000.00	60%
Oct	950155	\$ 950155.00	1,113,000	\$ 1,113,000.00	17%
Nov	822740	\$ 822740.00	1,113,000	\$ 1,113,000.00	35%
Dec	469600	\$ 469600.00	1,113,000	\$ 1,113,000.00	137%
Total	7853083	\$ 7853083.00	13,356,000	\$ 13,356,000.00	78%

#### Calculation Improvement in Quantity

The writer will calculate the improvement in term of value from decreasing reject about 20% after the training. This calculation is based on assumption that the result will be achieved by 6 months after the training.

- Reject
- Value of rejects

Based on internal data from production, it showed the number of rejects in every month

Table 12 . Minimalizing reject by 20%

Improvement in Minimalizing Rejects by 20%				
Month	Reject	Improvement	Reject	Improvement
	Press Shop	20%	Painting	20%
Jan	3,841	768	15,343	3,069
Feb	4,617	923	11,346	2,269
Mar	3,117	623	8,861	1,772
Apr	3,470	694	7,817	1,563
May	4,870	974	13,412	2,682
Jun	4,809	962	9,877	1,975
Jul	3,502	700	9,331	1,866
Aug	1,711	342	6,499	1,300
Sep	3,984	797	6,538	1,308
Oct	5,343	1,069	13,193	2,639
Nov	3,984	797	7,928	1,586
Dec	2,115	423	11,055	2,211
Total	45,363	9,073	121,200	24,240

Assume that the training will improve the efficiency of reject products for about 20%.

$$166,563 \times 20\% = 33,312 \text{ pcs}$$

**The Efficient Value from Rejects**

The writer make assumption that the average sale price of an item is \$ 1.00, therefore the loss from rejects is shown in the table below .

Table 13. Efficiency from Reject

Description	No Of Rejects	Average \$ per item	Total Lost in \$
January	3,837	1	3,837
February	3,193		3,193
March	2,396		2,396
April	2,257		2,257
May	3,656		3,656
June	2,937		2,937
July	2,567		2,567
August	1,642		1,642
September	2,104		2,104
October	3,707		3,707
November	2,382		2,382
December	2,634		2,634
<b>Total</b>	<b>33,312</b>	<b>1</b>	<b>33,312</b>

Assume that the cost of each product is \$1.00, therefore the total save will be:

$$33,312 \times \$ 1 = \$ 33,312$$

As the calculation above show the company may be able to save \$33,312 in a year .

**Calculation Cost in Implementing Versus Profit from Proposed System**

The writer will calculate the cost in implementing and the profit from the proposed system .

**Cost for movement machine**

The company required allocating money for moving the machinery to the running facility. The total length of time to move requires about 6 days with re-layout the floor. The total cost is shown below for the transportation.

Table 14. Cost of Spending for Moving Machines

D e t a i l S p e n d i n g p e r d a y i n R p .	N o o f d a y s	T o t a l S p e n d i n g i n R p .
F o r k l i f t 10 T o n (2 U n i t s ) 7,500,000	6	45,000,000
C r a n e (1 U n i t ) 8,000,000	2	16,000,000
T r u c k s (3 U n i t s ) 4,500,000	4	18,000,000
<b>T o t a l</b>		<b>79,000,000</b>

The company needs to spend out is about Rp 79,000,000 for the total of 6 days for renting heavy equipment.

**Cost for additional People**

Addition new operators will increase the spending of the company in each month.

Table 15. Cost of Spending for Additional Operators

No of Operator	Cost of Spending in a month (Rp.)	Total spending in a month (Rp.)
48	Salary 1,400,000	67,200,000
	Health Insurance 50,000	2,400,000
	<b>Total</b>	<b>69,600,000</b>



From the table above if the production requires 2 shifts, therefore the spending will be Rp. 139,200,000 as show below.

Table 16. Additional spending for Operators

No of Operator	No of Shift	Total spending in a month (Rp.)
48	Shift 1 69,600,000	69,600,000
	Shift 2 69,600,000	69,600,000
	<b>Total</b>	<b>139,200,000</b>

***Profit from new improve system***

With the assumption that the company has net profit 3% from the sales of the items therefore each month the company has a profit of:

Table 17. The Profit from new system

Sales in month	Net Profit 3%
\$1,113,000	\$33,390

On the calculation above, the writer shows that the companies able to have profit of \$33,900 if the products are able to be sell.

***Efficient from rejects***

Assume the company able to minimalize rejects by 20% therefore the amount of money that can be save from efficiency is:

Table 18. Efficiency from rejects

Efficiency for Rejects	Efficient per month
\$33,312	\$2,776

The table below is comparing the spending and the income of the company when applying the purposed method.

Table 19. Comparison Spending

Spending in Rupiah		Income in Rupiah	
Movement machines	79,000,000	Improvement production	323,883,000
Additional employees	139,000,000	Efficiency	26,927,200
Total	218,000,000	Total	350,810,200
		<b>Profit total</b>	<b>132,810,200</b>

It shown that the proposed solution is valid in increasing capacity in production and improving the profit for the company.

#### 4. Implementation Plan

The proposed solution needs the efforts from few departments such as Unit Press needs to make sure the grouping of similar item and process and the machines that needs to do the in each process. Unit Maintenance needs to set up what the requirements to re-layout the machines. Purchasing Department needs to arrange with the company confirmation on rental service for heavy equipment to rent. Finance Department needs to be prepared in term of financial spending during the process since all the payment for the new components order have to be acknowledge and done by only the Finance Department. HRD needs to start recruit new employees for Press Shop unit to operate new machineries and provide training on how to operate the machines the safety needed while operating the machines to the new employees. QC needs to provide the training to improve the quality of the products in order to reduce number of defects, the QC department needs to be involve to educate the types of rejects in every units area and how to prevent such misfortune events. Production Departments needs to be involved together with QC for the training regarding how to improve the quality in every Unit in Production. Each of these Unit Departments has the responsibilities to manage the changes from the current system to the proposed method.

##### Timeline

The roadmap above is needed to have a timeline to make the whole process work on the right path. The timeline below is made with the hope that it will become guidance for each Department in maintaining their task in the progress as long as the company operates.

Table 20. Timeline for improvement

Department	Activities	2014											
		JAN			FEB			MAR					
		1	2	3	4	1	2	3	4	1	2	3	4
Unit Press Shop	Prepare new lay out and grouping												
	Prepare time for relayouting												
	Stop production for relayout												
Unit Maintenance	Prepare the requirement for the machines												
	Installing electrical components												
	Moving machines												
Purchasing Department	Laying out the machine												
	Rent Heavy equipment for moving												
	Order the electrical components												
Financial Department	Expenditure												
HRD	Recruiting												
	Testing												
	Selecting												
Production	Training Safety, operating machines and quality												
	Training Unit Press Shop												
	Train Unit Treatment												
QC	Training Unit Painting												
	Training Unit Assembling Packaging												

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