

# The analysis of manufacturing cycle effectiveness (MCE) in reducing non added-value activities (Empirical study at PT. Bhirawa Steel Surabaya)

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## ABSTRACT

The Increases of demand from costumers and the number of competitors lead companies to reduce the cost of non value-added activities. Manufacturing Cycle Effectiveness (MCE) is commonly used as an analytical tool for production activities as well as to see how the non value-added activities are reduced and eliminated from the manufacturing process. Companies can reduce and eliminate non value-added activities to maximize the value the companies. The purpose of this study is to provide empirical evidence about the application of MCE as a measuring instrument in improving production efficiencies and in controlling non value added activities at industrial enterprises. Based on the analysis of the MCE, the result shows that the company is not able to reduce non-value-added activities after rejuvenation of machines because there is a lot of grunt work. The production process is still not running smoothly because a lot of improvements still need to be done. Improvements during the production process resulting in decreased production process and waste a lot of waiting time. However, with the rejuvenation of machines, the company can reduce the moving time and inspection time.

## 1. INTRODUCTION

Competition in the global business environment is getting tougher as the number of competitors increase. In this condition, companies are required to create value for their customers. Therefore, they should be able to survive and grow. In doing so, they need to find a way to make improvements to increase the effectiveness and efficiency of the production process. Every company is striving to provide a better value for its customer better by having a lower cost than that of the competitors or by creating the same value with a lower cost than that of the competitors (Hansen and Mowen 2006).

A traditional measure of performance is the cost efficiency, i.e. how efficient an activity using resources in generating output. According to Mulyadi (2003), the less inputs an activity uses to produce a given outputs then the more efficient the activity is. In other words, the more outputs can be produced by a given inputs, then the more productive the activity is.

Changing in methods used by management to

manage the company leads to changes in the cost information they need. The concept of cost efficiency is replaced by a concept deriving from original sources using analytical tools of manufacturing cycle effectiveness (MCE).

The paradigm shift to customer value resulted in the concept of cost effectiveness or known as the manufacturing cycle effectiveness (MCE), it is the ratio between the processing time to the cycle time. Manufacturing cycle effectiveness (MCE) is a measure that indicates the percentage of value-added activities contained in an activity that is used by companies to generate values to their customers (Saftiana 2007). Manufacturing cycle effectiveness is used to calculate the percentage of how much non-value added activities can be reduced and eliminated from the production process in the manufacture of products or services.

Reduction of non-value added activities will increase the effectiveness and efficiency of the company. Performance, efficiency and effectiveness of the company can be achieved by optimizing the

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value added activities through continuous improvement, especially for PT Bhirawa Steel Surabaya.

Companies that survive in the world of business are companies that are capable of producing a quality product at a relatively cheap price. According to Mulyadi (2003), an activity is the cause of costs so that it is necessary to manage it in order to reduce or eliminate the costs.

PT Bhirawa Steel is an industrial company engaged in the management of the steel. The resulting product is a plain round bar and deformed Bar. The Company faces tough competition so that it has to focus on improving the quality of products that enable it to produce quality products or even better than that of its competitors. The company has increased the quality of its products by implementing quality control and developing consistent production capacity to meet the ever increasing demand in the domestic market.

Quality control is an activity to maintain and to direct the quality of product as planned. According to Hansen and Mowen (2003: 411), in order to create a quality product, a company must make products that meet or exceed the expectations of customers. In the effort of satisfying its customer need regarding quality products, PT Bhirawa Steel has implemented SNI standard in planning and controlling its products.

The increases of demand from customers and the number of competitors require the company to add value so that the customers' satisfaction and quality can be maintained. PT Bhirawa is a manufacturing enterprise that process raw materials into finished products. Therefore, manufacturing cycle effectiveness is very important to be applied to the company to enable it to reduce the cost of non value-added activities. By controlling and lowering the production cost, the company will have a lower selling price compared to its competitors, while it is still able to guarantee to the quality of products. Manufacturing Cycle Effectiveness is used as an analytical tool for production activities as well as to see how much non-value-added activities reduced and eliminated from the processing of products. Companies that are able to reduce and eliminate non value-added activities will maximize the company's value added activities, and therefore the manufacturing cycle effectiveness (MCE) will be optimal.

Based on the discussion above, the authors are interested to analyze how effective activities used in the production process to achieve cost-effective and reduce non-value-added activities using Manu-

facturing Cycle Effectiveness (MCE). Therefore, the purpose of this study is to examine the application of MCE in reducing *non value added activities* at PT Bhirawa Steel Surabaya.

## 2. THEORETICAL FRAMEWORK

### Manufacturing Cycle Effectiveness (MCE)

Manufacturing cycle effectiveness (MCE) is the percentage of value added activities that exist in the activity of the production process used by companies to generate value for the customers (Yulia Saftiana 2007). According to Mulyadi (2007), MCE is a measure that indicates the percentage of value added activities in an activity used as measured by how much non-value added activities reduced and eliminated from the process of making the product.

MCE is an analytical tool for the production activities, such as how much time is consumed by an activity ranging from the handling of raw materials, products in processed to finished product (cycle time). MCE is calculated using the data of cycle time or throughput time collected. Selection of cycle time can be done by performing activity analysis. According to Mulyadi (2007), cycle time is divided into two components, namely value added activities and non-value added activities. Value added activities consist of processing time only, while non value-added activities consist of schedule time, inspection time, moving time, waiting time, storage time.

Mulyadi (2007) formulates *cycle time* used to calculate MCE as follows:

*Cycle Time* = *Processing Time* + *waiting time* + *moving time* + *inspection time*,  
and

$$MCE = \frac{\text{Processing Time}}{\text{Cycle Time}}$$

Manufacturing Cycle Effectiveness Analysis (MCE) can increase the performance and efficiency of a company through improvements directed to achieve cost effectiveness. The analysis is performed directly on the company's activities formulated in the form of time data used by each activity. Time activity reflects how many resources and costs used by these activities and can be used as the basis for assessing the performance and effectiveness of the company. Manufacturing Cycle Effectiveness Analysis is dealing with decision to reduce production costs.

According to Mulyadi (2007), when a process of generating product has a cycle effectiveness of 100 percent, this means that non value-added activity has been eliminated in the processing of the product. Therefore the product does not burden

with the customer costs for activities that are not value-adding. If the production process produces a cycle effectiveness of less than 100%, then the product still contains processing activities that do not add value to the customers. The ideal production process will result in the cycle time equal to processing time.

### **Non Value-Added Activities**

Activities that are not essential to the business, so they are considered as activities that are not necessary, referred to as non-value added activities. According to Emi Rahmawiti (2008), non-value added activities are activities that are not necessary and should be removed from the business process as it hampers the performance of the company.

According to Hines and Tailor (2000), non-value added activities are all activities in providing products or services that do not provide added value in the eyes of consumers.

According to Hansen and Mowen (2006), non value-added costs are costs caused by non value-added activities or inefficient performance of value-added activities. Mulyadi (2007) describes a non value-added activities is the activity that does not add value in the processing of inputs into outputs from the customer's point of view. An operating philosophy applied throughout a company is to eliminate waste by identifying and eliminating non-value-adding activities.

Opportunities available for the company are trying to reduce or eliminate non value-added costs without reducing the satisfaction of its customers. Costs that are caused by activities that are not value-adding are not cost effective in the production process.

Activities that should be retained in the business called value added activities. According to Emi Rahmawiti (2008), value-added activities are activities required to run business operations, so as to generate value and increase its profit. Hines and Tailor (2000) define value-added activities as all activities in providing products or services that provide added-value in the eyes of consumers. Value added activities are activities that are from the customer point of view add value in the processing of inputs into outputs (Mulyadi 2007). Value-added activities can be created by increasing the quantity and quality of the products that meet customer needs. According to Lalu Sumayang (2003), a value-adding activity is a manufacturing method that strives to eliminate waste in the process.

Value added activities should include the fol-

lowing conditions, namely activities that result in changes, such changes cannot be achieved by previous activities, and these activities allow other activities can be carried out (Mulyadi 2007). Once the value-added activities identified, the costs incurred by value-added activities can be defined. According to Hansen and Mowen (2003), value-added costs represent costs to perform value-added activities with perfect efficiency.

### **Productivity Theory**

Productivity is the ratio between the effectiveness of the achievement of a certain quality level (output) and the efficient use of resources (inputs). The use of unit time is a measure of productivity. According Singgih (2010), productivity is seen as the concept of efficiency and effectiveness. Tolentino (2004) explains that the increase in the today's productivity must consider values rather than just the efficiency of input use. A high value of productivity process indicates a good production process. High productivity can be achieved through an efficient and effective process. Efficiency refers to the utilization of resources. Yet, effectiveness refers to the output or result of the implementation of the work (Mulyono 2004).

According to Mulyadi (2007) productivity is associated with the production of output efficiently and directed to the relationship between output and input used to produce the output. The productivity of the company increases when the non-value added activities can be reduced and eliminated in the production process. In the production process, there is a concept known as Manufacturing Cycle Effectiveness (MCE). The ideal MCE ideal should be equal 1, meaning that the company can eliminate the time of non-value added activities and optimize the timing of value added activities. Conversely, if the MCE is less than 1, then the company still requires a non-value added activities. In other words, it could not eliminate non value-added activities in the production process.

### **Activity Analysis**

Activity analysis is a valuable tool for companies to classify activities into value-added activities and non value-added activities. Activities that are effective in a production process are value-added activities for the company (Yulia Saftiana 2007). Analysis of activity is associated with the elimination of waste that occurred during the production process resulting in high production costs.

According Gespersz (2006), efforts to increase efficiency through cost reduction program con-

stantly will be very effective so as to reduce the cost per unit of output and obtain a more competitive price. Cost reductions follow the elimination of waste. Waste is caused by non value-added activities that will affect the overall production time (cycle time). These activities will affect the efficiency of time, thereby causing a longer moving time, inspection time, waiting time, and storage time. This condition affects the manufacturing cycle effectiveness (MCE) and will eventually affect the company's production costs. Therefore, waste should be reduced and eliminated in the production process of the company.

The core of the process value analysis is the analysis activities. Activity analysis is the identification, description, and evaluation activities undertaken by the company. The analysis of activities suggests four results, namely what activities to be done, the number of people involved in the activity, the time and resources required to perform the activity, and the calculation of the value of the activity for the organization, including the recommendation to select and retain just the value-added activities (Hansen and Mowen 2006). The last factor is important for charging. This factor determines the added-value of the activities related to cost reduction, rather than charging. Thus, analysis of the activity tries to identify and ultimately eliminate all unnecessary activities and simultaneously improve the efficiency of necessary activities for the company.

### **Identification of Activities**

Activity in the manufacturing process consists of five activities, namely processing time, inspection time, moving time, waiting time, and storage time.

According to Yulia Saftiana (2007), the production process requires cycle time, which is the overall time needed to process from raw materials into finished goods. Cycle time consists of five elements, namely:

### **Processing Time**

Processing time is the time required by each step of handling or processing raw materials, products in process, and finished goods. As for all the time taken from raw material to a finished product are not all part of the processing time.

### **Inspection Time**

According to Mulyadi (2003), inspection time is the total time consumed by activities that aim to keep all the processed products be produced in accordance with established standards. This is the activ-

ity where time and resources spent to ensure that the product meets the specifications (Hansen and Mowen 2006).

According to Yulia Saftiana (2007), this activity is a monitoring activity to ensure that the production process has been done correctly despite the fact that there is no additive value to the products that will be acceptable to consumers.

### **Moving Time**

The moving time is the activity that uses time and resources to move the raw materials, products in process and finished products from one department to another (Hansen and Mowen 2006).

Specific moving timing is sometimes needed in every production process. But, it is necessary to organize the activities, tasks and applications of the technology correctly, so as to eliminate the moving time significantly.

### **Waiting Time**

Mulyadi (2003) defines the waiting time as the activity in which the raw materials and products in the process use the time and resources in waiting for the next the process. Gazpersz (2007) defines the waiting time as the time interval when the operator does not use the time to perform value-added activities due to waiting for the flow of product from the previous (upstream).

According to Yulia Saftiana (2007), if in the waiting needs resources, then the costs arising from the use of such resources are not value-adding costs because benefits cannot be perceived by the customer.

### **Storage Time**

Storage is an activity that uses time and resources, during products and raw materials are stored as stocks (Mulyadi 2003). The storage time incurred due to the process of storing both raw materials before starting the production process or finished goods stored in the warehouse as inventory

### **Kaizen Costing**

According Gaspersz (2006), Kaizen is the Japanese term that can be interpreted as continuous improvement. Effort to lower the cost of existing products and processes is the concept of kaizen cost (Hansen and Mowen 2006). Kaizen costing is used to ensure the implementation of continuous improvement as the products completely finished designed and developed until discontinued (Mulyadi 2003). The Key element of kaizen is the cost analysis activities. Management of activities pur-

sued by way of improving the efficiency and effectiveness of the implementation of value-adding activities and reducing and eliminating the non value-adding activities (Mulyadi 2003).

Activity analysis can reduce costs in four ways, namely:

#### **Activity Elimination**

Elimination activity focuses on non value-added activities. Once the non value-added activities identified, then actions must be taken to prevent the company from the activity (Hansen and Mowen 2006).

Activities that do not have a customer or the customer does not benefit from the cost object generated by these activities is the main target of elimination (Mulyadi 2003). Elimination of activity is a long-term strategy pursued by the continuous improvement of the activity (Yulia Saftiana 2007).

#### **Activity Reduction**

Cost reduction can be achieved by reducing non-value-adding activities. Reduction of activity is short-term strategy adopted in the continuous improvement of the activity (Yulia Saftiana 2007).

#### **Activity Selection**

Activity selection involves of choosing among different activities caused by competing strategies. Thus, different strategies lead to different activities (Hansen and Mowen 2006).

Cost reduction can be achieved by the selection of the activity of a series of activities required to implement competitive strategies. Company's management should choose a strategy that requires less activity with the lowest cost (Yulia Saftiana 2007). Thus, the selection of the activity has an influence on the cost reduction and removal.

#### **Activity Sharing**

Activity sharing is primarily intended to manage value-added activities. By identifying value-added activities that still have not been fully utilized and then take advantage of the event to produce a variety of other cost objects (cost object), the company will increase the productivity of the activity utilization in generating cost object (Yulia Saftiana 2007).

Activity sharing improves the efficiency of activity necessary using economies of scale. In particular, the quantity of the cost driver is improved without increasing the total cost of the activity itself. This reduces the cost per unit of cost drivers and the amount of costs that can be traced to products using the activity. Therefore, by using existing components and the activities associated with this component the company must avoid creating new activity (Hansen and Mowen 2006). Mulyadi (2003) describes the removal and reduction of activities

implemented in the management of non-value added activities. While selection and sharing applied to value-added activities.

#### **Implementation of Manufacturing Cycle Effectiveness (MCE) Analysis**

After completing the analysis of manufacturing cycle effectiveness (MCE), we can see the percentage of value-added and not value-added activities. The success can be reflected in the decrease in costs within a certain period (Yulia Saftiana 2007). Agustina (2007) explains that the reduction in non-value added activities and relative costs will increase the efficiency of the company by producing products with lower price. Given the quality products and low prices, the company will able to compete with competitors and create value for the customers.

To reduce or eliminate non value-added activities, inspection time can be reduced by developing the concept of total quality control (TQC) and zero defect manufacturing. Moving time can be reduced by developing the concept of cellular manufacturing. Waiting time and storage time can be reduced by developing the concept of JIT inventory systems (Mulyadi 2003). According to Machfud (2003), there are many benefits from the implementation of Just In Time system such as reducing inventory, improving quality, reducing costs, reducing space, shorten lead times, improve productivity, increase flexibility, better relationships with suppliers, simplifying scheduling and control activities, increase capacity, and better use of human resources. Liker (2006) explains that the Just-in-time system implemented by the company seeks to eliminate activities that are not value-added for the product (see Figure 1).

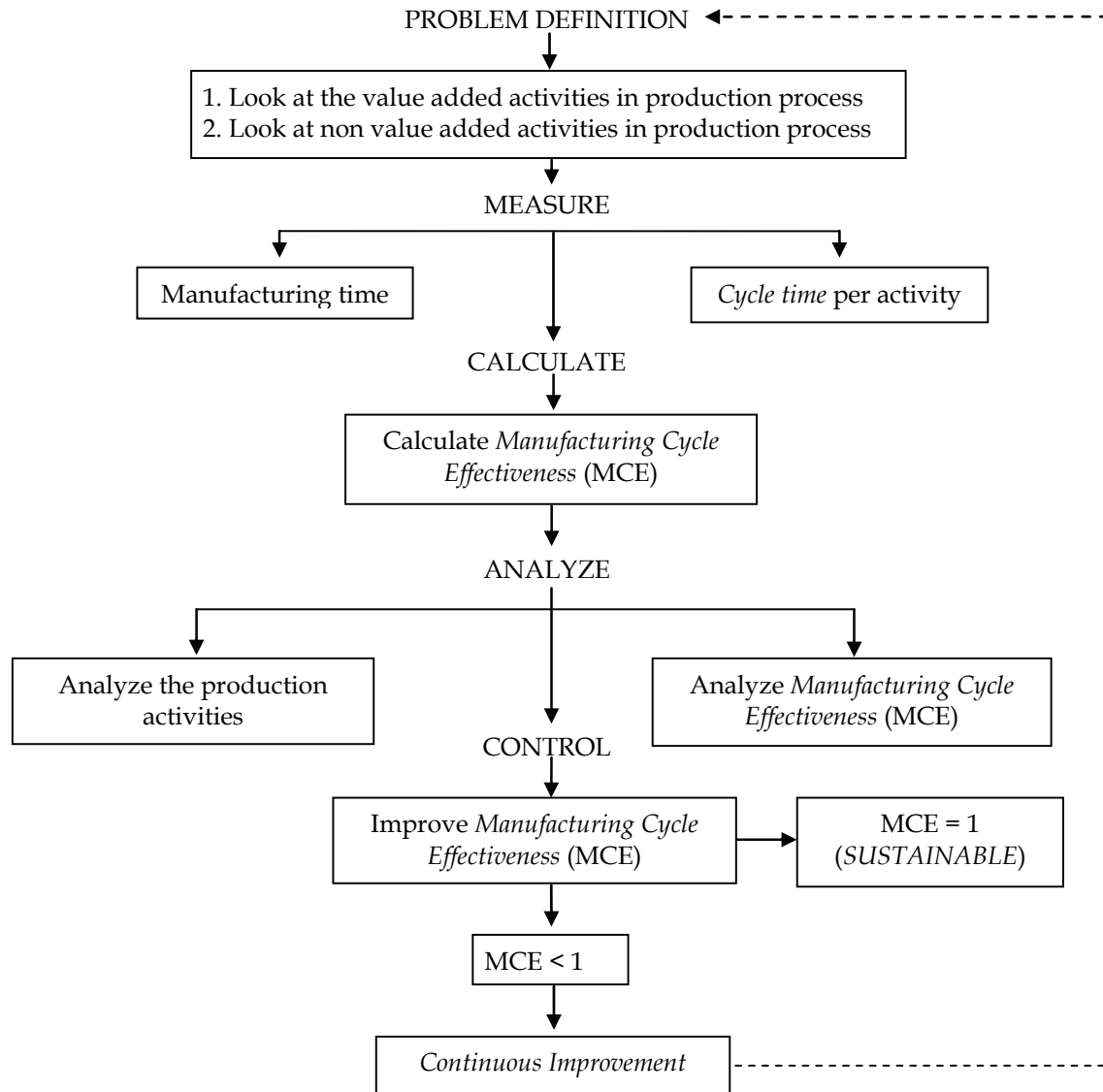
### **3. RESEARCH METHOD**

This study is a qualitative study using a descriptive approach as it aims to evaluate Manufacturing Cycle Effectiveness in reducing non-value added activities in PT Bhirawa Steel Surabaya. Qualitative approach chosen in order to obtain an outcome that is closer to reality.

#### **Research Focus**

The focus of the study are: (1) to identify the problem by looking at the value-added activity and non value-added activities in the production process, (2) to calculate the cycle time and factory production time per activity during the months of January to July 2010 and the month of January to July 2012, (3) to calculate the Manufacturing Cycle Effectiveness

**Figure 1**  
**Research Framework**



(MCE) during the months of January to July 2010 and the month of January to July 2012, and (4) to analyze the activity of production and Manufacturing Cycle Effectiveness (MCE)

#### Data Source

The Data obtained from Mr. Robbi Bakhtiar as one of the production staffs, and Mr. Ir. Adrianto as the Chief PPC-QC Supervisor who understands the activity flow process associated with the production of PT Bhirawa Steel Surabaya.

#### Data Validity

Steps of gathering evidence or data in the study cover several sources, namely:

##### *Use of Four Sources of Evidence Documentation*

Document plays a very important role in the data

collection of an empirical study. Systematic search for relevant documents therefore crucial for the data collection plan (Yin 2009: 105). Documents used in this study are the data of cycle time including processing time, waiting time, moving time, and inspection time in January to July 2010 and in January to July 2012.

#### Recording

The usefulness of archival footage varies across case studies. In some studies, the recording is so important that it could be the object of retrieval and extensive analysis (Yin 2009: 107). Archival footage collected may include vision, mission, goals, organizational structure, production processes, and cycle time, which includes the processing time, waiting time, moving time, and inspection time.

### Interview

One source of information that is very important is the interview. We conduct in-depth interviews with Mr. Robbi Bakhtiar as one of the production staffs and Mr. Ir.Adrianto as the Chief PPC-QC Supervisor to examine the impact of value-added activities and non value-added activities on the company performance.

### Direct Observation

Observation method is a technique of data collection done by directly observing the operational activities of the company. From the results of these observations we can add information related to the manufacturing cycle effectiveness in reducing non value-added activities in PT Bhirawa Steel Surabaya.

### Analysis of Evidence

This study analyzes the data used to develop a descriptive framework to better organize the case study. This strategy is less preferable than the use of a theoretical proposition but it could be an alternative when there is no theoretical proposition (Yin 2009: 137). The descriptive approach helps appropriately to identify reciprocal link needs to be analyzed qualitatively, and even perhaps quantitatively. Here are the steps of this study:

#### Data Collecting

We conduct the study on PT Bhirawa Steel Surabaya, especially is in the production. The required data is data regarding the cycle time, including the amount of consumption time on processing time, inspection time, moving time and waiting time. Then it is proceed with interview, archival footage, and documentation.

#### Data Processing

After obtaining all the data, we then perform the calculation to determine the reduction in non value-added activities using the analytics tool of manufacturing cycle effectiveness (MCE).

$$\text{Cycle Time} = \text{Processing Time} + \text{waiting time} + \text{moving time} + \text{inspection time} \quad (1)$$

$$\text{MCE} = \frac{\text{Processing Time}}{\text{Cycle Time}} \quad (2)$$

### Analysis of Production Activities

Furthermore, we conduct descriptive analyzes to determine the reduction in on value-added activities According to Mulyadi (2007), when a process of generating product has a cycle effectiveness of 100 percent, then the non value-added activity has been eliminated in the processing of the product. Consequently, the product does not burden with the customer costs for activities that are not value-adding.

If the production process produces a cycle effectiveness of less than 100%, then the product still contains processing activities that do not add value to the customers. The ideal production process will result in the cycle time equal to processing time

### Discussion and Conclusion

After analyzing the production activities at PT Bhirawa Steel Surabaya, we conduct in-depth discussion of the results of the analysis of manufacturing cycle effectiveness in reducing non-value added activities as well as interviews with some informants to supplement the evidence and to make the conclusion.

### 4. DATA ANALYSIS AND DISCUSSION

During September to November 2011, the company is not in production, there is rejuvenation of machines. This Rejuvenation is made to increase production and reduce the amount of activities non value-added activities. Therefore, we conduct a study in PT Bhirawa Steel by comparing the date before and after rejuvenation of machines. The company does not operate again as there are some improvements to be done to smooth the process of production in August 2012 and operates again in November 2012. So that the study is not done for a year, but only seven months in 2010 and seven months in 2012. The data used in this study covers the month of January and July of 2010 and the months of January and July 2012.

#### Inspection Time

Inspection time is an activity where time and resources spent to ensure that the product meets the specifications (Hansen and Mowen 2006). Inspection activities conducted by the department of PPC-QC (quality Control) in the process of Cooling Bed regarding rod weights and rod dimensions adjusted to a standard of PT Bhirawa Steel. Inspections carried out during the process of Cooling Bed using sampling of products.

Table 1 shows that total hours of inspection time from January to July 2010 amounted to 96 hours, while from January to July 2012 amounted to 52.8 hours. This condition indicates that the company has been trying to reduce non value-added activities with a reduction in inspection time. Reduction activity is done by reducing the amount of inspection time. The new engine is used by companies to reduce the time of inspection on sampling products. The Rejuvenation of machines leads the company more efficient in using time. The solution to reduce non value-added activities by using more

**Table 1**  
**The Result of Inspection Time January-July 2010 and 2012**

| <b>Inspection Time</b> | <b>Unit</b> | <b>2010</b> | <b>2012</b> |
|------------------------|-------------|-------------|-------------|
| January                | hour        | 15.5        | 7.7         |
| February               | hour        | 8.5         | 7.2         |
| March                  | hour        | 13.0        | 7.8         |
| April                  | hour        | 14.0        | 7.6         |
| May                    | hour        | 15.0        | 7.3         |
| June                   | hour        | 14.5        | 7.5         |
| July                   | hour        | 15.5        | 7.7         |
| <b>Total</b>           | <b>hour</b> | <b>96</b>   | <b>52.8</b> |

Source: PT Bhirawa Steel, processed.

**Table 2**  
**The Result of Moving Time January-July 2010 and 2012**

| <b>Moving Time</b>                                  | <b>Unit</b> | <b>2010</b> | <b>2012</b>  |
|---|-------------|-------------|--------------|
| Raw material warehouse to <i>Billet Preparation</i> | hour        | 306.1       | 213          |
| BHP to finished goods warehouse                     | hour        | 218.9       | 102.4        |
| <b>Total</b>  | <b>hour</b> | <b>525</b>  | <b>315.4</b> |

Source: PT Bhirawa Steel, processed.

sophisticated technology leads to reductions in inspection time.

#### ***Moving Time***

Activities included in the moving time are the transfer of raw materials from warehouse to the billet preparation. The next activity is transfer of Bar Handling Plant (BHP) to finished good warehouse. There are 3 shifts a day.

Table 2 shows that total hours of moving time from January to July 2010 amounted to 525 hours, while from January to July 2012 amounted to 315.4 hours. This condition indicates that the company has been trying to reduce non value-added activities with a reduction in moving time. More advanced technology is capable of reducing the activity on moving time. The movement of each station with the use of new machines become increasingly fast and make smooth production process, so that it can reduce the moving time. The existence of rejuvenation of engine makes the activity on moving time be more efficient.

#### ***Waiting Time***

Gazpersz (2007) defines the waiting time as the time interval when the operator does not use the time to perform value-added activities due to waiting for the flow of product from the previous (upstream).

The activity waiting time in PT Bhirawa Steel occur during the production process takes place. If there are obstacles or problems in the engine, the

production process will cease for repairs. This can interfere with the production process and lead to a longer waiting time.

Table 3 shows that total hours of waiting time from January to July 2010 amounted to 59.9 hours, while from January to July 2012 amounted to 548.6 hours. In other words, the waiting time of the company increase remarkably. Therefore, the company has not been able to reduce non value-added activities in the activity of waiting time. The existence of rejuvenation of engine has not been able to make the company reduced activity on waiting time.

#### ***Processing Time***

Processing time is the time required by each step of handling or processing raw materials, products in process, and finished goods. Activities undertaken in the processing time is a series of very important processes because each process will add value to the product.

PT Bhirawa Steel production process is a continuous production. Machine should not be stopped or suspended, except if it is found any defect product.

Table 4 shows the calculation of production process in January to July is 24 hours a day minus waiting time and maintenance time of 90 minutes a day.

$$\begin{aligned}
 \text{Production time} &= 24 \text{ hours} - \text{maintenance} \\
 &= 24 \text{ hours} - 1.5 \text{ hours} \\
 &= 22.5 \text{ hours/day}
 \end{aligned}$$

**Table 3**  
**The Result of Waiting Time January-July 2010 and 2012**

| Waiting Time | Unit        | 2010        | 2012         |
|--------------|-------------|-------------|--------------|
| January      | hour        | 7.1         | 148.1        |
| February     | hour        | 1.5         | 106          |
| March        | hour        | 2.9         | 43.5         |
| April        | hour        | 5.0         | 48.9         |
| May          | hour        | 15.0        | 116.2        |
| June         | hour        | 6.1         | 47.7         |
| July         | hour        | 22.3        | 38.2         |
| <b>Total</b> | <b>hour</b> | <b>59.9</b> | <b>548.6</b> |

Source: PT Bhirawa Steel, processed.

**Table 4**  
**Production Time January-July 2010 and 2012**

| Month        | Unit        | 2010       | 2012       |
|--------------|-------------|------------|------------|
| January      | hour        | 31         | 31         |
| February     | hour        | 17         | 29         |
| March        | hour        | 26         | 31         |
| April        | hour        | 28         | 30         |
| May          | hour        | 30         | 29         |
| June         | hour        | 29         | 30         |
| July         | hour        | 31         | 31         |
| <b>Total</b> | <b>hour</b> | <b>192</b> | <b>211</b> |

Source: PT Bhirawa Steel, processed.

Production time in January – July 2010  
 = days of production 2010 × hours of production  
 = 192 days × 22.5 hours  
 = 4,320 hours

2010 = Production time – waiting time  
 = 4,320 – 59.9  
 = 4,260.1 hours

Production time in January – July 2012  
 = days of production 2011 × hours of production  
 = 211 days × 22.5 hours  
 = 4,747.5 hours

2012 = Production time – waiting time  
 = 4,748 – 548.6  
 = 4,198.9 hours

Processing time activities are value added activities. Table 5 shows the processing time within the company. Results of this study show that the amount of processing time in January to July 2010 amounted to 4,960.1 hours, while the total of processing time in January to July 2012 amounted to 4,198.9 hours.

#### **Manufacturing Cycle Effectiveness (MCE)**

Manufacturing cycle effectiveness is the percentage of value-added activities that exist in the activity of the production process used by companies to generate value for their customers by reducing and eliminating non value-added activities. Activities in

the production process can be divided into measured value-added activities, namely the processing time, and measured non value-added activities, namely inspection time, moving time, and waiting time.

According to Mulyadi (2007), when a process of generating product has a cycle effectiveness of 100 percent, then the non value-added activity has been eliminated in the processing of the product. Consequently, the product does not burden with the customer costs for activities that are not value-adding. If the production process produces a cycle effectiveness of less than 100%, then the product still contains processing activities that do not add value to the customers.

The calculation of manufacturing cycle effectiveness can be done by dividing processing time with the cycle time. Cycle time includes processing time, waiting time, moving time, and inspection time.

#### **Cycle Time**

*Cycle Time = Processing Time + waiting time + moving time + inspection time*

*Cycle Time 2010 = 4,260.1 + 59.9 + 525 + 96*  
 = 4,941 hours

*Cycle Time 2012 = 4,198.9 + 548.6 + 315.4 + 52.8*  
 = 5,115.7 hours

**Table 5**  
**The Result of Processing Time January-July 2010 and 2012**

| Processing Time | Unit         | 2010           | 2012           |
|-----------------|--------------|----------------|----------------|
| <b>Total</b>    | <b>Hours</b> | <b>4,260.1</b> | <b>4,198.9</b> |

Source: PT Bhirawa Steel, processed.

**Table 6**  
**The Result of MCE January-July 2010 and 2012**

| Description                       | Unit        | 2010         | 2012           |
|-----------------------------------|-------------|--------------|----------------|
| <i>Value Added Activities</i>     |             |              |                |
| Processing Time                   | hour        | 4,260.1      | 4,198.9        |
| <i>Non Value Added Activities</i> |             |              |                |
| Inspection Time                   | hour        | 96           | 52.8           |
| Moving Time                       | hour        | 525          | 315.4          |
| Waiting Time                      | hour        | 59.9         | 548.6          |
| <b>Total</b>                      | <b>hour</b> | <b>4,941</b> | <b>5,115.7</b> |
| <b>MCE</b>                        | <b>%</b>    | <b>86.22</b> | <b>82.08</b>   |

Source: PT Bhirawa Steel, processed.

#### **Manufacturing Cycle Effectiveness**

Manufacturing Cycle Effectiveness (MCE) =  
Processing Time

Cycle Time

$$\text{MCE January-July 2010} = \frac{4,260.1}{4,941}$$

= 86.22 %

$$\text{MCE January-July 2012} = \frac{4,198.9}{5,115.7}$$

= 82.08 %

Table 6 shows that *Manufacturing Cycle Effectiveness* (MCE) from January to July 2010 is 86.22 percent, while from January to July 2012 is 82.08. This means that the MCE has decreased during that period. This indicates that the company experiences a decrease in value added activities due to the production process in 2012 has not run smoothly. Instead, the company experienced an increase in non-value added activities due to the increased waiting time for repairs during the production process.

#### **Analysis of MCE**

This section will discuss the theoretical analysis of the findings. PT Bhirawa Steel rejuvenated its engines in September 2010 to November 2011 to improve the effectiveness and efficiency of time and increase production capacity. The Company does not undertake production operations during the rejuvenation. The company has a stock of goods to meet customer demand. Although the company stopped its production due process of rejuvenation, the company could still provide service to the customer.

This study uses data from January to July 2010 and January to July 2012. The use of 2010 and 2012 period aims to compare the before and after doing the rejuvenation of machines. The results of the calculations of the inspection time in Table 1 shows a decline of 43.2 hours (52.8 hours - 96 hours) in inspection time from January - July 2010 to January - July 2012. Inspection of finished products is done by taking a sample of the cooling bed. Product inspection is done by examining the chemical composition test, tensile test, and the product dimension. The inspection of finished products is done by QC PPC department. The operations of the new machines decrease inspection time. The decrease in inspection time indicates that the company seeks to reduce non-value added activities that occur in the production process. The non added-value activities are activities that are not necessary and should be removed from the business process as they hamper the performance of the company. This finding is line with that of Rahmawiti Emi (2008).

Table 2 also shows a decline of 209.6 hours (315.4 hours - 525 hours) in moving time from January - July 2010 to January - July 2012. This means the company has been able to reduce and eliminate the non value-added activities in the production process. The fluency of production process at each station is affected by the machinery of production and labor activities. Rejuvenation of machines made by the company is a solution to increase production capacity and time efficiency. Table 3 shows the overall amount of time in the waiting time. It can be seen that there has been a considerable increase in the waiting time from January - July 2010 (59.9 hours) to January - July

2012 (548.7 hours), a difference of 488.7 hours. The increase in the waiting time is caused by a lot of cobble in the use of new machines. From the early to mid 2012, the company still made some new engine repairs leading to the production of not running smoothly. The use of a new engine with more advanced technology but without adequate human resources expertise leads to ineffective production. The Company must conduct prior trainings for its employees to handle the new machine. This is one of factors that inhibit the optimal production process. The improvements usually take a long time, causing waiting time in January to July 2012 increase remarkably. Waste of time also occurs when replacing a roll mill. Reduction of non value-added activities in this activity can be done by providing training for the employees. It is expected that a technologically advanced engine coupled with a capable human resources will reduce the waiting time because it will not require much time for repairs when problem occurred. The decrease in the waiting time will cause the production process runs smoothly and the production increase.

Table 5 also shows a decline of 488.7 hours (4,261.1 hours - 4,198.9 hours) in the processing time from January - July 2010 to January - July 2012. This is caused the rejuvenation of machines so that they are not optimal yet. A lot of maintenances done during the production process are also the trigger of processing time decrease. The increase in waiting time also effects processing time because PT Bhirawa Steel adopts continuous production process. Although there are still many improvements made during the production process on the new machine in January to July 2012, production capacity increases.

The results of Manufacturing cycle effectiveness calculation (MCE) in Table 6 show that from January to July 2010 the company uses 13.78% (100% - 86.22%) of its resources to run non value-added activities, while from January to July 2012 it uses 17.92% (100% - 82.08%) of its resources to run non value-added activities. The increasing use of non-value added activities in the company is due to process of rejuvenation, causing the production process is not optimal. Unqualified human Resources are also the trigger of not optimal production process. Advanced technology without capable human resource will hamper production. The company needs to train its employees in handling and using the new machines, so that the production process runs smoothly and becomes optimal.

From the early to mid-2012, the rejuvenation of machines increase the production capacity despite

still experience problems in production. This indicates that the company does continuous improvement with the new engine rejuvenation. The rejuvenation process of engines is still in the trial process in 2012, resulting in the production process does not run optimally. Companies in the process of rejuvenation machine also does trainings are given to the workers, so that human resources are high and advanced technology to optimize production. Once the improvements have been completed engine and trainings conducted by the company has been given to the workers, the production process will run smoothly back and waiting time is reduced. Waiting time is reduced and the maximum production processes can reduce the non-value added activities. Inspection time and moving time on production activity has decreased. This indicates that companies reduce non-value added in this activity. The company also trains its employees during the rejuvenation process. After finishing the maintenance of the machines and training of its employees the production process will run well and the waiting time will decrease. The decrease in waiting time and the optimal production process will reduce the non value-added activities. The inspection time and moving time have decline, meaning that the company reduce the non added value activities.

### **Control of MCE**

Companies can perform short-term activities to reduce and eliminate the non value-added activities. This study supports the research conducted by Yulia Saftiana (2007) that the reduction of activity is a short-term strategy adopted in the continuous improvement of the activity. Mulyadi (2003) describes the removal and reduction of activities is implemented in the management of non value-added activities. Selection and distribution of activities is applied in the management of value added activities.

PT Bhirawa Steel has been making changes for the betterment of the company. The rejuvenation of engines is one way to increase production capacity. This is one of continuous improvement method adopted by PT Bhirawa Steel. If the company still uses the old machine and do not replace them with more sophisticated machines, the manufacturing cycle effectiveness will decline more due to increase in non value-added activities that occur in the production process. One factor that could also facilitate the process of production of the company is the health and safety. Health and safety factors should not be ignored, as they are the right of employees

and the obligation of the company. In addition, if an employee got an accident then the company should be responsible. With the rejuvenation of machines, accidents in the process of production will be reduced

## 5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

This study aims to provide empirical evidence regarding the effectiveness of manufacturing cycle (MCE) implemented in a company in order to reduce and eliminate non value-added activities. Analysis of manufacturing cycle effectiveness (MCE) generates a percentage of value-added activities in any activity done by the company to create value for its customers. Cost effective and cost reduction can be achieved by increasing the performance and efficiency of the company.

Based on the analysis of manufacturing cycle effectiveness (MCE) of PT Bhirawa Steel, the company has not been able to reduce non value-added activities after the rejuvenation of machine because there are many cobble happened. The production process is still not running smoothly because many improvements still to be done. Improvements and maintenance during the production process lead to decrease in production process and waste a lot of waiting time. However, with the rejuvenation of the engines, the company is able to reduce the moving time and inspection time. Manufacturing Cycle Effectiveness (MCE) in the month of January to July 2010 amounted to 86.22% and the company still runs 13.78% non value-added activities. In the January to July 2012, the percentage of Manufacturing Cycle Effectiveness (MCE) is 82.08% and the company still runs 17.92% non value-added activities.

Companies can conduct election of activities, reduction of activities, distribution of activities, and elimination of activities that can be exercised over the non value-added activities. Distribution of these activities is expected to improve the company's activities by choosing the effective and relevant actions for continuous improvement.

This research is far from adequate. Therefore, it is suggested for future research to add variables.

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