Productivity Improvement in Assembly Line by Reduction Cycle Time using Time Study at Automotive Manufacturer

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Abstract

Cycle time reduction has appeared as an important thing of improvement to produce a high productivity for a satisfaction of customer request. Time study is applied to measure the standard time of process. Manufacturing industry involve in this study to reduce cycle time in assembly line. This study to improve productivity in assembly line for reduced cycle time. Study to be conducted at PHN Industry Sdn. Bhd. Methodology for this study is using qualitative data such as observation method using stopwatch to calculate the process of cycle time have been using by manpower at work station. The result is cycle time reducing as much as 11.11% at each work station with new standard time

Keywords : cycle time, assembly line, productivity, time study

1. Introduction

Manufacturing industry is really focused on reducing cycle time. Cycle time is defined as the time it takes to do a process (Kazuhiro, 2004). Cycle time reduction is identifying and implementing more efficient ways to do things. Reducing cycle time requires eliminating or reducing non-value-added activity, which is defined as any activity that does not add value to the product. For examples of the non-value added activity in which cycle time can be reduced or eliminated include repair due to defects, machine set-up, inspection, test and schedule delays. Reducing cycle time will have a significant impact on a company's bottom line when implemented. Cycle time reduction is provides great benefit to a company. From the cycle time reduction the non-value added activity will be reduced or eliminated. Therefore, the situation of this production line and improvement of the cycle time using time study method is the main problem of this real case study research. An assembly line is a cycle of workstations at which task related to assembly of a product are performed (Becker and Scholl, 2006). It is because the company get a high demand of customer, cycle time reduction is important role to a high productivity towards customer satisfaction. Manpower in production line also play important role in order to make a production run as usual and to back up the production line that have robot.

2. Literature Review

Time is important in the manufacturing industry because it is used in the manufacturing process. It measured process derived from the start made to delivery to the customer. The time it takes to make a product will affect customers who have made a deal to the company. That will ensure the productivity produce by manpower will

get a higher demand from market. Time can be defined as a component used with measurements in the arrange activities of work, comparison of the length of time and distance, and detect the movement of an object.

2.1 Cycle time

The time required for the job to go through the factory is a job of the cycle time which is flow time or manufacturing lead time. Shortening the job cycle time is very important to the factory, according to Toly Chen (2013), for each job represents an opportunity cost for the factory. A long cycle time means it is difficult to convert the opportunity cost into profits in the short terms. Besides that, long job cycle time result in the accumulation of work in progress (WIP), Other than that, in a semiconductor manufacturing factoring, the risk that wafer is contaminated increases if the cycle time is long. According to Toly Chen (2013), this issue is related with cycle time, cost, and product quality. The survived continue to reduce the job cycle time, so as respond more quickly to changes in customer demand, and thus gain a competitive advance (Chien, 2012). A shorter job cycle time also means it is possible to commit an attractive due date to the customer (Toly Chen, 2013). Shortening cycle time, producing high quality products, on-time delivery orders, continual cost reduction, and improving efficiency were considered as the most direct and effective ways to create value for customers (Peng and Chien, 2003).

According to Nazzal et al, (2006) have tried to quantify the economic impact of reducing the job cycle time. First, the bottleneck machines in a semiconductor manufacturing factory that have a significant impact on the job cycle time were identified. Then, the production capacities of the bottleneck machines were increased. However, capacity expansion is a time-consuming task, and requires the cooperation of equipment suppliers. Cycle time is defined as the time it takes to do a process (Kazuhiro, 2004). It includes the time from when an operator starts a process until the work is ready to be passed on (Ahmad Naufal et al, 2016). Cycle time is the sum of activity durations, less overlaps between activities, plus the sum of queue times, consequently, cycle times can be reduced by reducing queue times, overlapping activities and reducing activity duration (Glen Ballard, 2001).

2.2 Process in production line

Production function is that part of an organization, which is concerned with the transformation of a range of inputs into the required outputs (product) having the requisite quality level (S. Anil Kumar and N. Suresh, 2008).

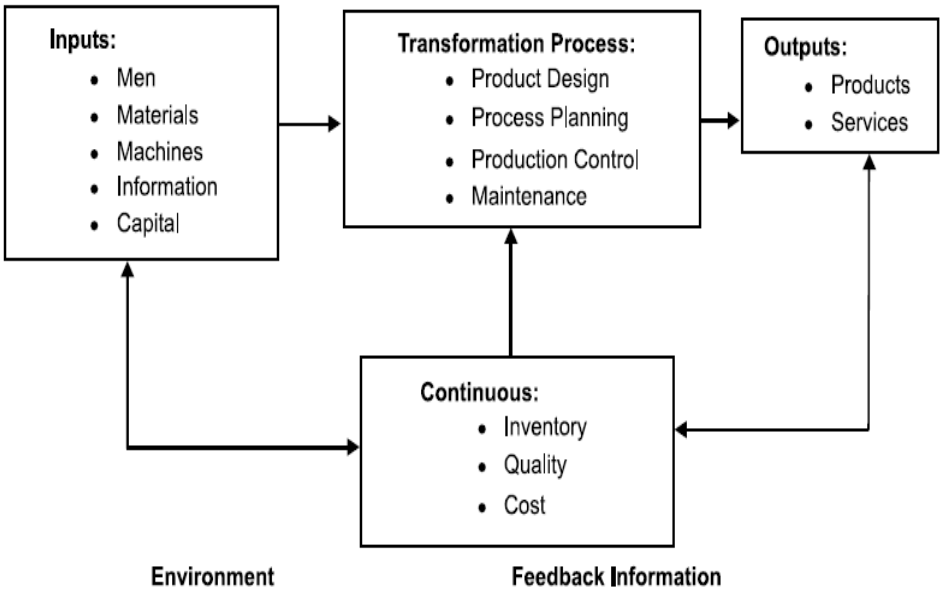

Figure 1.0: Schematic production system

Production system of organizations is that part of produces product to an organizations. The activities that following defined system are combined in a controlled manner to add value in accordance with the policies that have been communicated by the management. Production system has the following characteristic; production is an organized activity, so every production has an objective that need to achieve. There a feedback about activities which is essential to control and improve system performance. The system transformed the various input to useful products.

2.3 Time study

Frederick Winslow Taylor was pioneered, the application of science to businesses problem, with the use of time study method in standard setting and the planning of work. When aspects of time study contains a wide diversity of procedures to determine the amount of time required, under an excellent measurement of the state, for work associated with the human, machine, or a combination of both. It is has been introduced by Frederick W. Taylor since the year 1881, but is still widely used as a method of time study. Generally, time study is used to measure work. The decision results than the time study is the period in which a person in accordance with a job or task and fully trained to use specific method, will perform this task if the worker in the normal or expert. This is called the time standard for operation.

This is called the time standard for operation. Align the expert for a work may be made through several methods, where each method is used only in accordance with some specific circumstances. Time study is include using stopwatch, 'Predetermined Motion Time System or Synthetic Time System', and 'Work or Activity Sampling". However, in this study, only the time study using Stopwatch Time Study will be used in the time measurement. The time study was also allowed to deduct all boarders. Standardization is the objective to be achieved. In organizations that operate without expert time, 60% than the normal organization of achievement. These statistics may be proved by the work sampling operation. If standard set, performance improved to average 85%. This is a 42% increase in performance (Abdul Talib and Daiyanni Daim, 2010).

3. Research Methodology

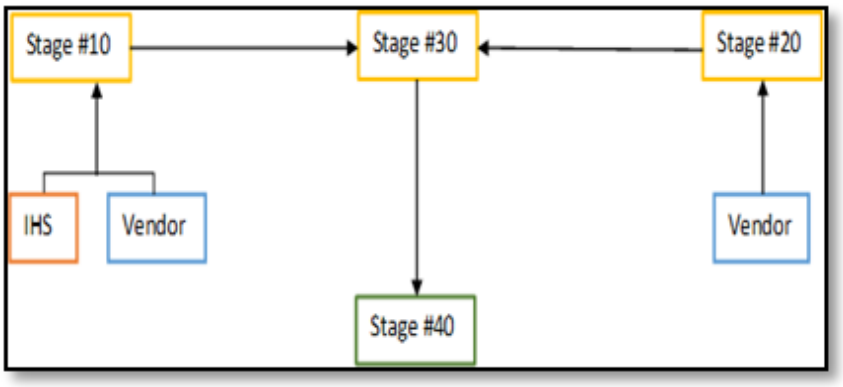

Figure 2.0: Diagram process in assembly line

Figure 2.0 show product produce from workstations 2 will go to the workstations 3, product that produce from workstations 2 also will sent to the workstations 3 to complete the product. Workstations 3 will complete the product output from two workstations.

4. Results and Discussions

Time study conducted for measuring work in process. Before making this time study each operation was broken into definite of work activities in every work station. The stopwatch time study is used to analyse a process by researcher with executive in department production in an effort to find the most efficient ways in terms of time. Moreover, this

method measures the time necessary for a work process to be completed using the best ways. The time was measured using continuous stopwatch equipment because it is easier and faster in data recording and using hand phone to record the activities. Moreover, this type of stopwatch is suitable for this research because it can provide accurate data. This allows the element times to be entered directly on the time study sheet without the need for subtractions. Observe operators performing a task and record time taken for each work activities, over several cycles. Our objective is to record the time taken to perform an activity. Determine appropriate work standards, with the objective to eliminate waste activities and to set a new standard time to calculate the standard time of each operation.

4.1 Time taken

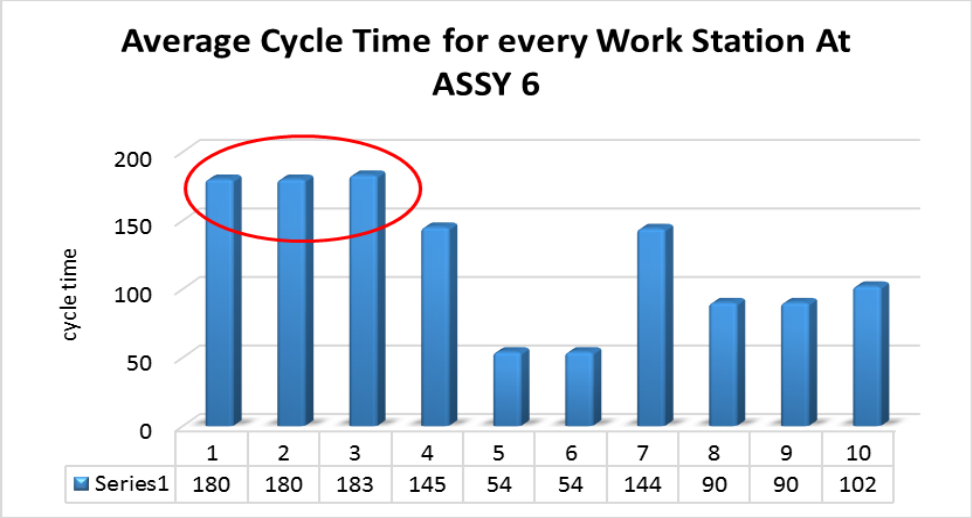

Figure 3.0: Before Improvement

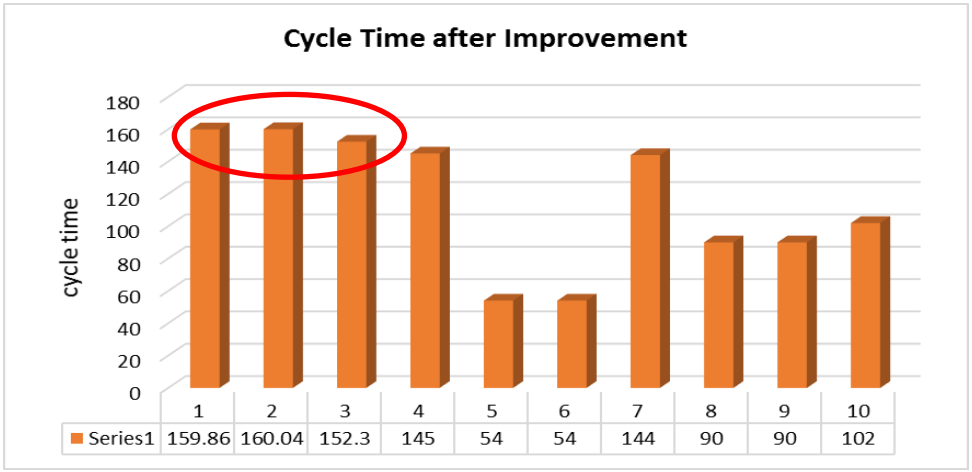

Figure 4.0: After Improvement

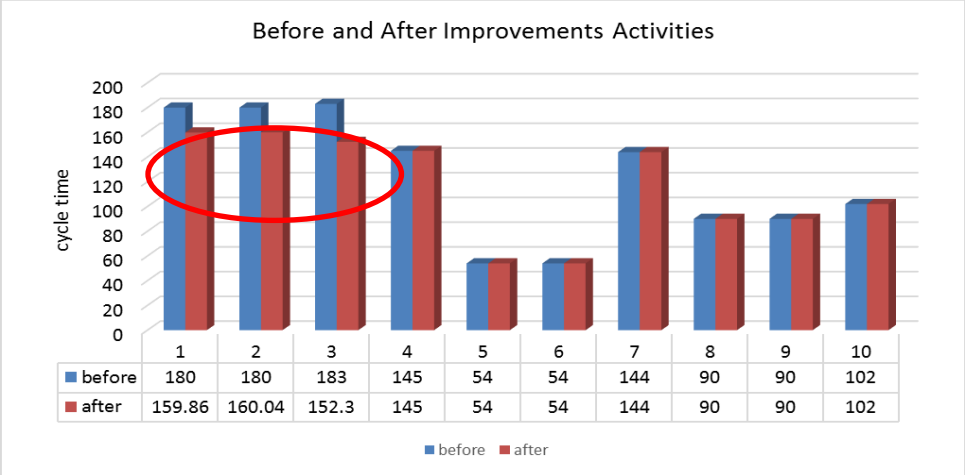

Figure 5.0: Before and After Improvement

Table 1: Improvement of Cycle Time

Work station number	Before (sec)	After (sec)	Reduce cycle time (s)
1	180	159.86	20.14
2	180	160.04	19.96
3	183	152.30	30.7

Based table 1, shown the cycle time reduction after do the improvement. Work station 1 showed that having reduction of cycle time as much as 20.14 second, the result after having reduction work station get 159.86 second. For work station 2, cycle time after improvement is 160.04 and having the reduction of cycle time as much as 19.96 second. Lastly, the work station 3, having reduction cycle time as much as 30.7 second, and the result of after improvement is 152.30 second.

4.2 Improvement activities

Table 2: Manpower Lack of Skills

Before	After
	

Special training provided to the new comer workers to avoid the highest of cycle time in assembly line. After the training workers more efficient in doing a job.

Table 3: Machine Set Up

Before	After
	

Add extra stud weld in this work station to make the cycle time become shorter. After adding a machines cycle time in this work station becomes decreases.

Table 4: Work station spaces

Before	After
	

Eliminate the rack that not been used to make area become broad. Only part that needed only placed nearby soas not to trouble the movement of workers to perform assemble. Some of the employee groups desist from any comment until after the methods and improvements have been established, taking action on disagreement through the criticism procedure. This technique may differ from the use of observers who merely check and suggest to trained personnel who make motion and time studies in cooperation with company engineers. Researcher used time study method to observation on activities in assembly line. Time study measures the time necessary for a job or task to be completed using the best method. Accumulative of time study is made for determining the new standards time. Task the researcher with executive is find the solution to establish reasonable productivity targets for experienced workers. Besides that, create productivity goals for training purposes to make sure the workers alert. Furthermore, find the useless activity to eliminate waste and its make processes more consistent. Lastly, applicable with objectives is to reduce cycle time and improve productivity of the company.

5. Conclusions

By making simple changes to the process, it can reduce the time taken for each work sequence to improve the process flow and speed it up the process flow. However, important of use time study method because the importance and uses of stop watch time study can be stated as under all this, determining schedules and planning work. Moreover, influential standard costs and as support in preparing budgets. Such information is of value in preparing offers and determining selling price. Other than that, determining machine effectiveness, the number of machines which one person can operate, and as an assistance in balancing assembly lines and work done on a conveyor. Furthermore, time standards to be used as a basis for labor cost control. Besides that, helps to know the labor productivity, labor efficiency, labor performance and overall time required to perform the task. Lastly its can helps to improve the process of operation. For the conclusion, cycle time is a key indicator of a process in manufacturing industry and equipment performance. Besides that, machining operations depends on consistent cycle times to schedule the production and allocated the workers.

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Biographies

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