Increase Productivity in Manufacturing Area at ST

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Abstract

Lack of productivity is something that impact negatively to all industries. In a medical device industry it is important to hit the metrics of on time delivery (OTD) and reduce the potential to be in backorder. The primary focus is to help patients make their life better, so this is how important is to have the product always available. With lean six sigma methodology a manufacturing process was improved by identifying process waste, implementing line balancing and increasing workforce motivation. The impact of the process optimization eradicates the possibility to be in backorder, increase OTD and financial savings were achieved with around $300k annually.

Introduction

This paper focused on a process assembly optimization in a medical device company. Along with assembly process standardization and employee engagement and Lean Six Sigma improvements, the goal of increasing productivity should be achieved. By standardizing assembly process these production will be faster and therefore productive. Primary focus will be optimizing process without impacting the quality of the product by addressing the activities using Lean Six Sigma methodology and tools such as 5S implementation, Kaizen Events, Just-in-Time, etc.

The objectives of this project are focused to address the improvement of the manufacturing productivity at least ten percent (10%) for FY-15-QTR-3, reduce non-value added activities and increase workforce motivation. This opportunity aligns with this medical device company objective to continue in the direction or growth in areas of biomedical engineering, encourage continuous improvement culture and compliance business culture with the integration of quality and traceability in every product.

Analysis

In FY14 there was a non-value direct labor cost of $180,000 related to the non-productive paid hours. Non-productive paid hours means the total paid hours that the manufacturing team member was not productive. During FY14 there was a notable gap and high financial impact on meeting required output per year based on Annual Operating Plan (AOP) levels. This means that there is a gap short by $200,400 of absorption related to productivity impact. This business reported productivity results on February 28,015 which was 71% instead of 91% (goal).

Define

The manufacturing process are 100% manual which increase levels of fatigue and tediously, it is the reason why the manufacturing team members counts with a 17% of allowances that represents 6.65 available work hours per shift. Manufacturing productivity is calculated as follows:

$$\text{Productivity} = \frac{\text{Earned Hours}}{\text{Worked Hours}} = \frac{\text{Units} * \text{Standard Time}}{\text{Worked Hours}}$$

Actual production at this business is not meeting what management is expecting. The production of these products is not only performed in Puerto Rico, same business is located in the United States. This means that the productivity situation could lead management to transfer manufacturing activities to the US.

This medical device company has an opportunity to save around $200,000 annually of absorption related to productivity by the application of a lean six sigma methodology which will help to identify, describe and solve problems to improve the efficiency in every process and meet expected requirements of 81% for the current quarter.

Measure

In six sigma methodology the equation Y = f(x) shows that the response (output) is dependent on several variables (inputs/process variables). The purpose of identifying the critical variables is to have them to guide primarily on improving the cycle time of the process that will allow increasing the actual output and in turn increasing the productivity of the current process.

Effectiveness is an external measure of process related to the voice of the customers (VOC). The relationship between responses and the predictors with a high focus on quality needs and manufacturing customers (operators) is determined by the line capacity, optimum piece flow, non-ergonomic workstations and unbalanced lines. The actual process efficiency rating is 82%.

Figure 1 represents the flow process for a model assembles in the first manufacturing line and Figure 2 represents the manufacturing process at the fourth line. These process starts when the operator makes the setup of all machines of the line and then each process is performed by a designated operator.

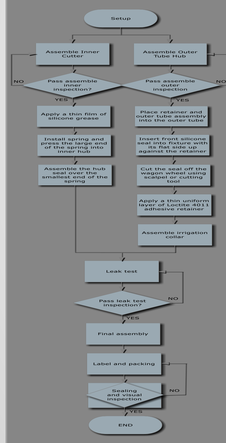

Figure 1
Process Flow Map Line 1

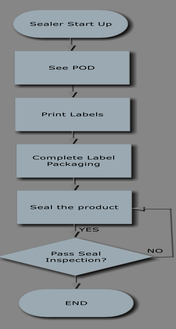

Figure 2
Process Flow Map Line 4

Time study enabled the opportunity not only to get familiarized with the process performance, it also provide the opportunity to create Value Stream Maps which allow the identification of other areas of improvement. Figure 3 below represents the Value Stream Map for manufacturing line 1 and Figure 4 represents manufacturing line 4.

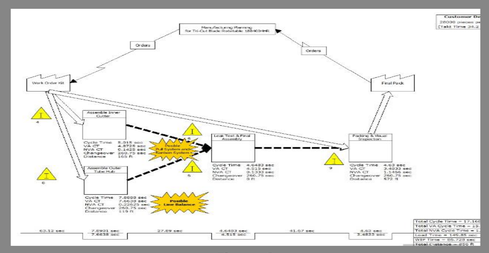

Figure 3
Value Stream Map Line 1

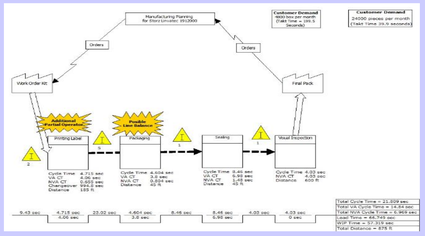

Figure 4
Value Stream Map Line 4

The simplest way to describe process waste is as something that adds no value. Removing all elements of waste from the process improve profits and reduce cost. Excessive travel between material station and work station impact this business. Figure 5 represents the actual waste of motion. Blue line represents the movement from manufacturing line 1 total distance traveled of 855.6ft per shift. Red line illustrates the movement from manufacturing line 4 with a total distance traveled of 786.7 per shift.

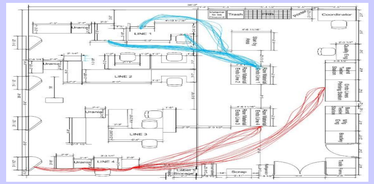

Figure 5
Spaghetti Diagram – Operator Motions

Analyze

The major offenders of the lack of productivity are denoted by unbalanced processes, process waste among others illustrated on Figure 6. An unbalanced process is one of the top offenders of manufacturing productivity. Line balancing will be top priority on the improvement plan since it is crucial to leveling the workload across all processes in a cell or value stream to remove bottlenecks and excess capacity. Figure 7 the actual state and proposed alternative for the first line balance. This is a powerful method that can guarantee positive results when increasing productivity.

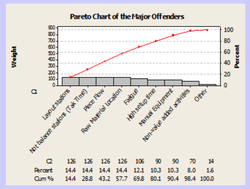

Figure 6
Pareto Chart – Productivity Offenders

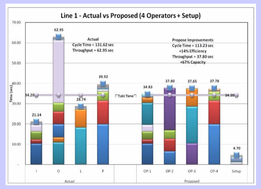

Figure 7
Line Balance Method

As result of measure and analyze phase the following solutions were recommended for the critical causes being denoted as potential solutions and partial solutions.

Unbalanced Lines:
Potential Solutions – Cross-training, line balance, one piece flow.
Partial Solutions – Improve capacity of the printer server to accelerate the printing process.

Non-Ergonomic Workstations:
Potential Solutions – Re-layout, relocate WIP inventory, designate space for raw material.
Partial Solutions – 5S implementation, eliminate unusual workstations.

High Setup Times:
Potential Solutions – Conduct Kaizen event to identify non-value added activities and its potential solutions that could lead to multiple projects.
Partial Solutions – Bring manufacturing resources prior the starting of the shift to perform line preparation.

Figures 8 and 9 illustrate the actual and proposed layout in order to reduce process waste and implement the line balance. The benefits of these improvements represent $44,106 on manufacturing line 1 and $290,000 on manufacturing line 4.

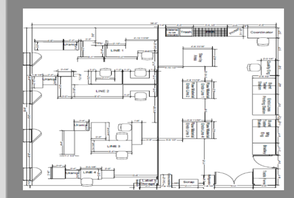

Figure 8
Actual Layout

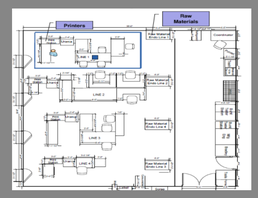

Figure 9
Proposed Layout

Improve

As all sustainable data was gathered and analyzed, the implementation takes place. It is important to denote that before implementing dramatic changes to any manufacturing processes line balance dry runs should take place with the manufacturing operators. Also, during all the journey of a Lean Improvement it is crucial to train operators and management in order to maintain the process performance as expected. The proposed line balance and re-layout will consists to add a partial operator to support two stations. With this improvement the manufacturing cycle time efficiency will improve 21%, while the throughput will increase 94% with 25% of an additional operator.

Conclusion

An engineering project should generate profits and a continuous flow. After implementing the mentioned recommendations the impact of this project in the company will be that the productivity will increase and the cost will be lower than actual production. With the line balance in line 1, the productivity will increase to 88% against the actual productivity of 71%, representing an increase of 21% with a financial benefit over $44k. With the line balance in line 4 the productivity will increase to 99% representing an increase of 49% with a financial benefit of $290k.

Control

An effective training plan was already implemented, this plan ensure the standardize process flow, document the new process, personal trained and create a plan to monitor the process. A control monitoring was implemented to illustrate and identify variance from historical data to alarm the supervisor and engineering to sustain the gains achieved as a result of the im[illegible]