Graduate School

Process Workflow Optimization and Redesign for Packaging Line at a Medical Device Company

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Abstract

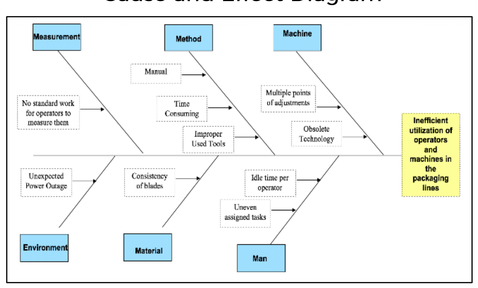
This design project describes the process of workflow optimization and redesign using Lean Six Sigma tools to better understand the Ivers Lee packaging lines (IL#1 and IL#2) issues and create alternatives to improve them. This is the case of two (2) packaging machines that were built in the 1960's and are currently packaging approximately seventy-three (73) million surgical blades per year. This is a manual filling, packaging and labeling process that implicates significant intensive labor tasks. This area currently faces several challenges. The main challenge is to increase the labor usage while balancing operator tasks. As project goals, these include increasing process consistency, improving capacity and utilization of resources to optimize production and maximize efficiency.

Introduction

This study aims to improve the productivity and efficiency of Ivers Lee packaging lines (IL#1 and IL#2) in a medical device company. The medical device company is named Aspen Surgical, a surgical division of the Hill-Rom company, and was established twelve (12) years ago in Las Piedras, Puerto Rico. It's a world leader in the manufacture of blades, scalpels and other surgical instruments. This company manufactures 110 million knives per year for different procedures, ranging from surgeries to specialized microsurgeries.

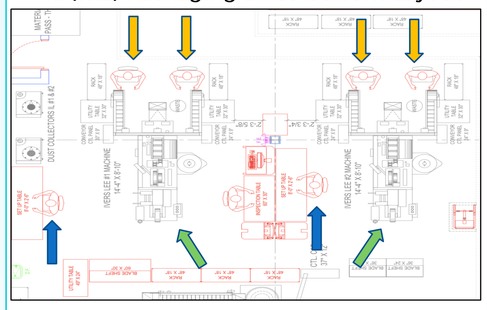
However, this study covers only the Ivers Lee packaging lines for the product with the highest demand which is are conventional blades. Data collected through observations, interviews and documentation study and identified the main problem related to productivity is that the tasks assigned in the packaging lines are unbalanced. The cause of the problems are related to man, machinery, material, method, measurement, and environment is presented in the form of cause and effect diagram, also known as Ishikawa diagram as shown. This situation causes the inefficient utilization of operators and machines in the packaging lines. This problem affects the company's packaging capacity to achieve daily demand.

Cause and Effect Diagram



Background

IL (1&2) Packaging Lines Current Layout



The packaging lines (IL#1 and IL#2) consist of three (3) main stations, which are: The Feeder Station #1 and #2, the Set-Up area #1 and #2, and the Folding/ End of the line (EOL) packaging area #1 and #2. The tasks of each operator are described as follows:

Feeder Operator #1 and #2

Packaging lines (IL#1 and IL#2) have two (2) feeder operators per line, where the feeder operator is tasked with turning blades so that the stamp or print of the packaging foil is facing upwards when opening the package. This is done because the blades come from the manufacturing area with its edge facing the left side, so the operator has to turn them to the right side. This task has to be done on both sides Left and Right for both packaging lines (IL#1 and IL#2) constantly. The Feeder, while waiting for the machine mandrels to empty, is also tasked with assembling "dispenser boxes" which are the boxes that carry the foils with the blades inside. In addition to that, the Feeder operator is tasked every half an hour (30 min) to realize two types of quality tests, these are the "Burst Test" and the "Functional Test". These tests are performed to inspect the foils and the liners containing the blades to verify if they comply with certain specifications.

Set Up Operator #1 and #2

Packaging lines (IL#1 and IL#2) have two (2) Setup operators per line. Machine setup operators ensure that the machines they are responsible for work properly and efficiently. This job requires extensive knowledge of the machine or machines for which the operators are responsible. When the machine is working properly, they are tasked with giving support to the Feeder by assembling "dispenser boxes", turning blades and feeding the machine.

Folding/ End of the Line Packer Operator #1 & #2

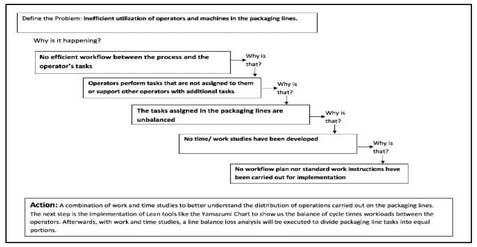
Packaging lines (IL#1 and IL#2) have two (2) end of the line (EOL) operators per line a total of four (4) operators, where the EOL packer operator is tasked with the receiving of the product (Blade) on it primary package. Each packed blade goes into a dispenser box which contains fifty (50) blades per dispenser. Those dispensers are packed into a folding carton with a capacity of holding three (3) dispensers' box each. In the end, the operator is responsible for the packing of a hundred and fifty (150) units on each folding. They examine and inspect containers, materials, and products in order to ensure that packing specifications are met.

Methodology

Define

Opportunities for this project were defined using the Five Whys, sometimes written as "5 Whys" analysis method to get to the root of a problem quickly.

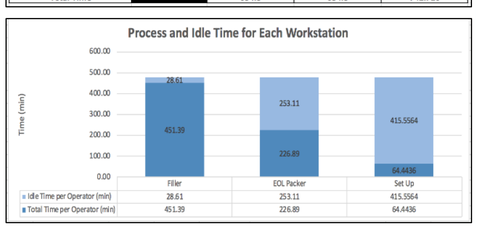
5 Whys Diagram



Measure

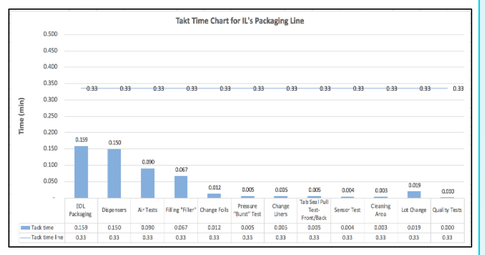
During the observation of each process in different stations, direct time study was carried out. Time study was used to establish the standard time for each workstation. A histogram was carried out to illustrate the distribution of workload between the workstations. It shows that the workload between the stations are not balanced.

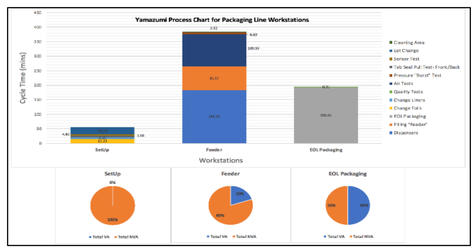
Standard Times per Operator Tasks				
Process Tasks	Operator Assigned per Task	Mean Cycle Time (min) per Task	Normal Time (min) per Task	Standard Time (min) per Task
Dispensers	Filler	183.29	183.29	214.4493
Filling "Feeder"	Filler	81.97	81.97	95.9049
EOL Packaging	EOL Packer	193.61	193.61	226.5237
Change Foils	Set Up	15.23	15.23	17.8191
Change Liners	Set Up	6.2	6.2	7.254
Quality Tests	EOL Packer	0.31	0.31	0.3627
Air Tests	Filler	109.93	109.93	128.6181
Pressure "Burst" Test	Filler	6.69	6.69	7.8273
Tab Seal Pull Test- Front/Back	Set Up	5.66	5.66	6.6222
Sensor Test	Set Up	4.8	4.8	5.616
Lot Change	Set Up	23.19	23.19	27.1323
Cleaning Area	Filler	3.92	3.92	4.5864
Total Time		**634.8**	**634.8**	**742.716**



Analyze

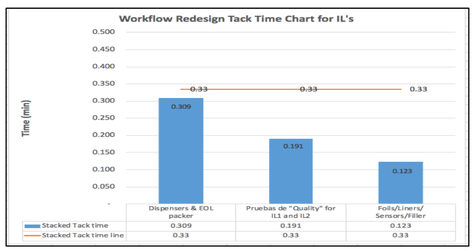
In this phase, the data that was collected in the previous step was analyzed for waste root causes. We proceeded with further process analysis by conducting takt time analysis. Subsequently I was able to display it using a Yamazumi Chart.





Improve

Station/ Process Step	# of Resources Before	# of Resources After
Feeder/ Filler	1 per line= 2	1 for both lines
Set Up	1 per line= 2	1 for both lines
Folding/ EOL Packer	2 per line= 4	4 for both lines
TOTAL	8 for (IL#1 and IL#2)	6 for (IL#1 and IL#2)



Improve

Appropriate documentation and training will be needed to sustain the proposed improvements. Standardized operating procedures (SOPs) will need to be created for the new roles for each of the operators; which will include step-by-step instructions that will act as guidelines for employee processes. When employees follow the (SOPs) for each particular job, we will ensure they are realizing their assigned task and supervisors can use the SOP framework to develop target ranges and make assessments of individual performance

Conclusion

For this project the method selected to improve these lines was a combination of work and time studies to better understand the distribution of operations carried out on the packaging lines. These proposals for improvements will eliminate two (2) full time operators' employees for the (IL#1 and IL#2) packaging lines, equivalent to sixty-two thousand and four hundred **($62,400)** dollars per year in savings. And helped achieve the main challenge which was to increase the labor usage while balancing operator tasks.

References

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