System Performance Laboratory Optimization

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Abstract

This project seeks to optimize the efficiency of a medical device laboratory process applying tools of the Lean Six Sigma methodology and eliminating non-value activities to complete transfer of a new product avoiding convert the current process in a bottleneck. The main objective is increasing the efficiency and throughput rate from 1.7 to 2.2 lots per shift while focusing on reducing the variability in the lots lead time. The Lean Six Sigma strategy involves the use of statistical tools within a structured methodology for gaining the knowledge needed and achieve faster and less expensive quality improvements. The strategic goal is to continually improve processes that have a real impact on business metrics to become a world class company. In this case, the throughput rate was increased from 1.7 to 2.9 lots per shift due to increase technician's efficiency by 29%, while reducing the number of resources and the variability in the lots lead time from 1.26 to 0.81. The total project saving was $31,687 between reducing headcount and scrap cost saving.

Problem Statement

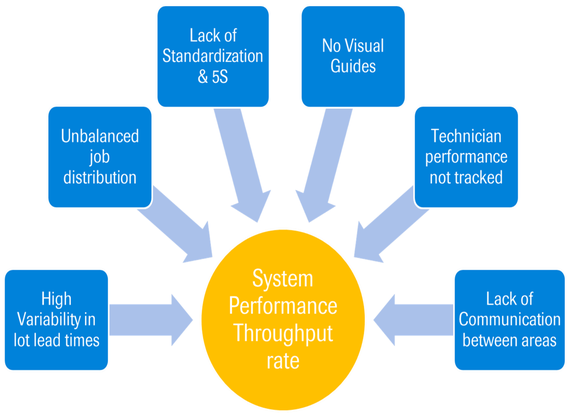
The aim of this project is to improve and increase laboratory output from 1.7 lots/day to 2.2 lots/day while focusing on reducing the variability in the lead time per lot. The company's approach is to prepare and improve the efficiency of the laboratory applying tools of the Lean Six Sigma methodology like DMAIC improvement strategy for when the new product arrives.

Why Selected?

The company wants to undertake this project in order to prepare the current laboratory output for when the new product arrives. The new product as a higher throughput rate, therefore the current system would become a bottleneck if problem is not solved.

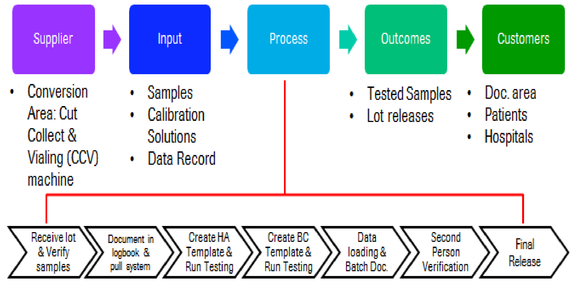
Original Status

After evaluating the original state, the following opportunities where found regarding the laboratory output:

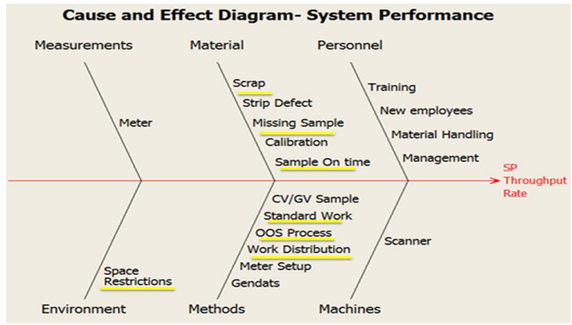


Analysis

First, a SIPOC diagram was constructed to understand who are the main customers of the process including their needs, requirements & constraints.

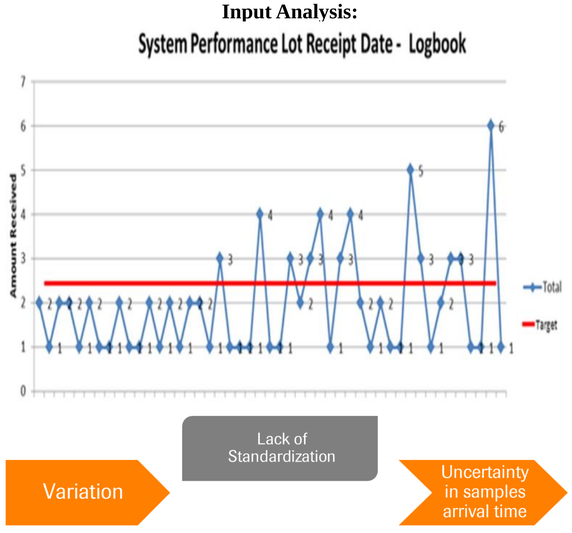


A cause and effect diagram was used to identify the drivers that were causing inefficiencies. The highlighted observations were the critical components that were addressed in this project.



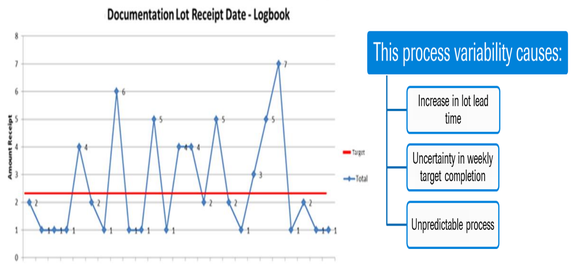
A Input/Output Analysis was developed in order to capture variations in the receipt rate of the lots in the laboratory (process input) and the release rate of the lots (output) to documentation area. The target is to receive and release 2.2 lots/day.

Input Analysis:



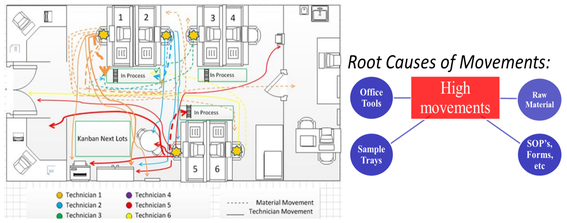
Analysis (cont.)

Output Analysis:

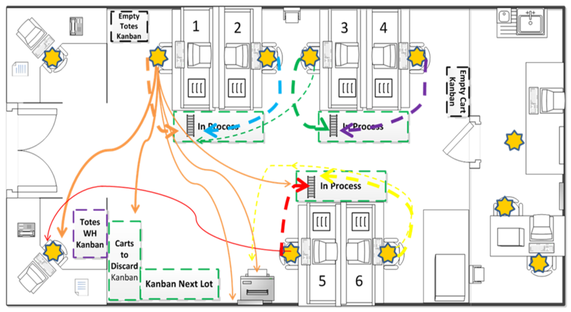


Actions and Discussion

In order to identify and reduce wastes due to excess movements a Spaghetti Diagram was developed :



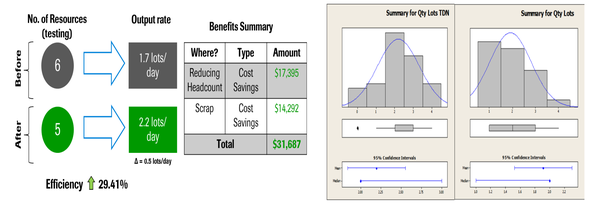
A re-layout and 5s was performed in order to reduce wastes due to excessive movement and unnecessary material transportation.



Other Actions taken:

- Time studies were used to propose a job distribution that would reduce lot lead time, minimize interruptions & increase amount of time spent in testing process.
- A standard work was designed in the CCV machine to assure that the samples being receipt at the Laboratory were organized, complete, correct and on time. This would lower input variation. Also, revisions to CCV sampling plan were made, reducing scrap.
- Development of efficiency tool to track performance of technicians in order to measure progress.
- Visual boards were designed to minimize non value added activities and interruptions.
- A spreadsheet was designed in order to keep track of lots between areas. Also, assigning the sample coordinator a phone can be considered to improve communication between processes.

Results



(A) Benefits Summary (B) Lab testing output

(A) Total project savings were $31,687 and an increase in the efficiency of 29%. Wastes that were caused by non value added activities were less frequent in the area.

(B) Some reduction in variability from 1.26 to 0.81 could be observed although there are more areas of opportunities regarding lot lead time variation. The recommendations given must be performed daily. However, there is a lack of on-time cart delivery from manufacturing area affects the laboratory output.

Problem Remaining

Assure conversion area delivers 2.2 lots/day continuously to System Performance. This is an issue because currently their throughput remains with variation and is not consistent with the target. Also, continuous tracking of lot flow and job distribution must be held to validate lot lead time reduction. Validation of the CCV standard work by verifying that samples are arriving on time, correct etc. should be considered.

Future Plans

A new layout will bring conversion and laboratory areas closer, facilitating communication. Also, continuous improvement of the tools developed in this project should be considered based on feedback.

Acknowledgements

I would like to acknowledge and dedicate this work to my family for support me unconditionally in all my projects and for trusting my dedication and passion, I say thank you. To my co-workers who were been part of this adventure, I say thank you too. I had the privilege to enjoyment and learning with them. Thank you to my advisor, Carlos Gonzalez that has been key instrument to complete this goal with success.

References

[1] F. W. Breyfogle III, *Implementing Six Sigma: Smarter Solutions Using Statistical Methods*. New York, NY: John Wiley & Sons, Inc., 1999.

[2] F. M. Gryna, et al. *Juran's Quality Planning & Analysis for Enterprise Quality*, 5th Ed., New York, NY: McGraw Hill, 2007, pp. 18, 67-107, 545-546,702.

[3] J. A. Defeo, *Juran's Quality Handbook: The Complete Guide to Performance Excellence*, 7th Ed., New York, NY: McGraw Hill, 2017, pp.157-162, 387-398,429-458.

[4] D. C. Montgomery, *Introduction to Statistical Quality Control*, 7th Ed., John Wiley & Sons, Inc., 2013, pp. 1-70, 355-387.

[5] J. P. Womack, et al. *Lean Thinking: Banish Waste and Create Wealth in your Corporation*. New York, NY: Free Press, 2003, pp. 15-28.