Improvement in the Inventory System and How to Reduce Waste

Author: Eddie Molina Ruiz
Advisor: Dr. Carlos González
Industrial and Systems Engineering Department

Abstract

Due to the recent pandemic, industries have confronted inventory problems because of all the backorders that exist with the suppliers. In consequence, industries have been lacking the necessary materials to continue their processes. To overcome the problem, this research is to improve the way inventory is managed by creating an evaluation system that keeps track of the current inventory and begins to order before it runs out, with optimal time so the new material arrives in time. This can be done by analyzing the inventory and how much of it is used for each process in the company.

Introduction

For every industrial, pharmaceutical, or biotechnology company, an essential part is its inventory management. Therefore, it became a challenge when the pandemic of COVID-19 stroke, and after three years of its beginning, it still has its effects on the inventory stocking of the companies. Some of the issues have been the stopping of delivery from vendors, detaining production lines, and raising costs at the time of restocking. This project was focused on improving the system of inventory of the company to avoid high costs and expenses and always maintain proper stock inventory.

Background

One of the most essential things any industry must possess is inventory and good management. Throughout the years since the invention of Lean from Toyota Production System (TPS)[1], many companies have followed their tools to reduce and eliminate the seven wastes of Lean, and inventory is one of them. Due to the recent impact of the COVID-19 pandemic, the global supply chain showed a significant vulnerability in transportation, inventory, and resource, affecting the Just-In-Time system by a lack of raw materials, reagents, materials, etc., in many industries.[1]

The problem of the company was the cumulative lead time of the suppliers, which is the total time elapsed that it takes a company to fill a new order from the date of entry to the delivery of the product.[2]

The opportunity that can be improved is that the inventory of the company has gone out of stock for some of the assays that are performed in the laboratory. When they order the material, it takes too much in arrived to plant. The strategy was to study the inventory of each assay and determine how much must be used by the assay.

Problem

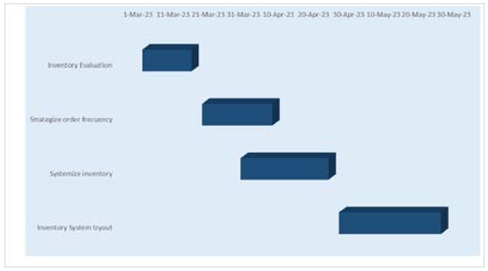
Because of the Covid-19 pandemic, it has been noted that there has been a problem for suppliers due to the high demand from client companies and increased traffic in the volume of materials and equipment. This creates a problem at the time of restocking because the vendors have some back orders or low inventory of their own. If the material is needed as soon as possible, it could cost triple its own price to make the vendor prioritize your order.

Methodology

This project's goal is to see the entire effects of the improvements between four to six months, to have the proper amount of inventory, and maintain it always well stocked for the laboratory of an industry. Also, developing a system that helps keep track of inventory automatically and make orders on time.

- ***Figure 1***: This graph allows visualizing the tasks to be completed of the entire goal.

Figure 1
Gantt chart



As seen in Figure 1, every material, reagent, and miscellaneous should be studied to determine how much in quantity is needed for solutions, tests, and daily use. This will give us data to know how often this inventory should be ordered to have the right amount of stock in time. After we have sufficient data, a strategy will be traced to set the logistics of the periods of how often these supplies must be ordered to arrive in time and deal with the backorders that are caused by the pandemic, natural disasters, and any other unexpected situation that could delay vendors to deliver our orders in time.

The DMAIC method of Lean Six Sigma is going to be utilized for the recompilation of problem causes, data, and improvement strategy. It is going to be used to determine the problem affecting the inventory and how it can be improved.

Figure 2

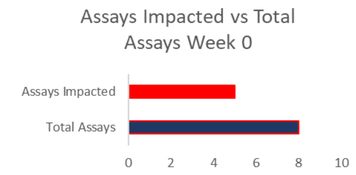
Having this data collected, a program software can be developed to track the current inventory and notify when each of our inventory materials or reagents is reducing, not waiting to finish, when it reaches a certain amount. This way, it can be ordered on time, and the company can run with what they have in stock until the new inventory arrives. After having the software developed, it must be tested to see that everything is running smoothly. The personnel should be trained on how to use the software so that every time they get and open something new from the inventory, they can lay it off from the system's inventory, so it can adequately do its purpose. When the material or reagent reduces from stock, the system will alert the corresponding personnel so they can start ordering new inventory. Also, to compare if this software functions appropriately, this can be done manually, documenting on an inventory logbook. Doing this will document the inventory needs faster by physically seeing them on their designated shelves.

Results and Discussion

As the time for optimization was during in-process tests, and we cannot start from zero on all tests, we could see the slow improvement of this new practice. We can notice in **Figure 3** that they were five of the eight assays were impacted by late-delivered supplies.

- ***Figure 3***: This graph shows the impact of late deliveries from vendors to the company at the beginning of the improvement process.

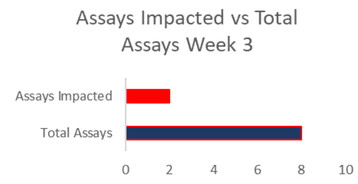
Figure 3



After three weeks, we saw a decrease in the impacted assay, as shown in **figure 4.** Here only two of the eight assays remained impacted, but one of them was still late because one of the reagents lots came with a problem from the vendor, and they recalled it. This got us into action, and a new strategy to follow is not just ordering the amount needed but also not ordering all the materials from the same lots.

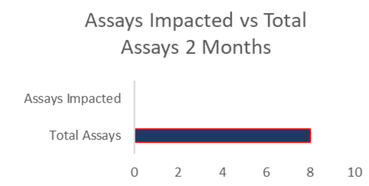
- ***Figure 4***: This graph shows the impact of late deliveries from vendors to the company in the third week of the improvement process.

Figure 4



By the end of the second month, they were not a single assay impacted by inventory, as shown in **Figure 5,** and every order it's been made just in time.

Figure 5



Another positive result was waste reduction and elimination, which helped not to raise unnecessary costs. Cost reduction in buying inventory has been noticed since the company does not have to pay extra to acquire them.

By doing this exercise with the inventory, we also get to know what materials and reagents are not required to have a lot of them stored. Having much quantity could lead to having to get rid of unused, expired materials, and with this we avoid that outcome.

Conclusions

This research has been a success thanks to the help of all the analysts that are ley off the materials out of the system. This could represent a problem if they stop doing this practice, as the system will be blind to the movement of the materials. Another positive outcome of the research was the problem we had with the defect Lot. This gave us the perspective to buy different lots from vendors to ensure that we do not have the same problem of lacking inventory. By utilizing the inventory tracking system, various wastes can be reduced and eliminated, such as; inventory, transportation, and waiting. Besides helping the economy of the company, it also helps boost its reputation. It is very hard, especially for a pharmaceutical or biopharmaceutical, to explain to a client or regulatory agency that some tests are delayed due to a lack of reagents. Our highest standard is to bring the most effective and professional results to our patients, and inventory should not be an excuse to deliver.

Future Work

Costs were reduced significantly because all materials and reagents were adequately available. Still, there's a chance that analysts stop scanning the materials when they take them to the laboratory, and the system will report false numbers. Therefore, a future strategy is to prepare a scanner and computer, where the inventory is stored, so that every analyst goes to pick something up, they are forced to scan it in order to use it.

Acknowledgements

I will want to document my sincere gratitude to all my master's professors through these two years. Also, I want to thank my design project mentor, Dr. Carlos Gonzalez, and my project reviewer, Daimarik Torres, for their help and guidance throughout this work.

References

[1] S. J. New, "Celebrating the enigma: the continuing puzzle of the Toyota Production System," in *International Journal of Production Research*, 2007, vol. 45, no. 16, pp. 3545-3554. DOI: 10.1080/00207540701223386.

[2] H. Shields, "Attacking Lean Wastes," in *Quality Progress*, 2006, vol. 39, no. 8, pp. 78-79.