Fiber Drums Reduction in Weighing & Dispensing Manufacturing Process

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Abstract *– Achieving overall efficiency within the manufacturing processes is the key goal among many organizations. Reducing waste enables manufactures to save money and take production up a notch. LEAN manufacturing and DMAIC are tools that can be helpful to reduce costs by removing waste within an organization, increasing productivity, and addressing environmental impacts. In search of improving the manufacturing PV, opportunities for improvement were identified in the weighing & dispensing process that would bring multiple benefits. Nowadays, companies' principal goals are focused on costs, waste reduction and reduce production time. By implementing dedicated containers for a specific process manufacturing area has been able to reduce generated waste, reduce yearly costs and improve cycle time of processes. Because less is more.*

Key terms *– Capacity, Continuous Improvement, Cost Reduction, Waste Reduction.*

INTRODUCTION

Johnson & Johnson Consumer Healthcare Solid Dosage Manufacturing Puerto Rico Site, produces pain fever relief products. Due to the current global situation, product demand increased, driving a volume increase at the site. The Direct Compression Area was identified as a potential multiproduct growth for the company this year. Volume increase and area productivity are company's goals for the mentioned area. So, during an evaluation was identified that the Weighing and Dispensing processes of product "A" had some opportunities for improvements. Which would lead to meet the expectations, resulting in cycle time improvement, waste, and cost reduction. All this by just making a change in the designated container for the storing of the pre-weighted components per lot.

It's amazing how the change of a designated container can have a big impact (value add) in multiple improvements opportunities. Also, when we apply the use of tools and methodologies that helps maximize value addition and minimize waste in a process.

In this project, from the options for improvements implementation process related activities (validated) were put out of scope due to the time and resources needed for re-validation. In scope are the tasks related to process flow for product "A" that will be analyzed to identified improvement opportunities (Figure 1).

During the current weighing & dispensing process of product "A" in Direct Compression manufacturing area, four raw materials are weighted using fiber drums for each component 1, 2, 3 and 4 (raw materials) by lot. These drums are used once during the whole process and doesn't get damaged because the Standard Procedures specify that a plastic bag should be use (put) in the drum before starting the weighting process (transfer of raw material to the fiber drums). Each one of the drums are completely new before each use and these are discarded after the dispensing process is completed. A total of 7 drums are used per lot with an estimate of 268 lots per year are manufactured from Direct Compression area and the cost per fiber drum is $25.19/ea.

Discarding fiber drums behavior results in waste generation, environment problem and a lot of expenses in purchases per each processed lot.

The objective of this research is to reduce and improve the usage of fiber drums during weighing and dispensing activities. Implementing the use of dedicated plastic reusable containers per raw material per lot. Also optimize the actual use for

"component 4" per lot (four fiber drums are currently used per lot for this component).

LITERATURE REVIEW

Organizations are always looking for continuous improvement opportunities, which leads them to different tools such as Lean, Six Sigma, DMAIC (Define, Measure, Analyze, Improve and Control), etc. Also have been seeking to maximize quality thought their process improvements and finished products. Chosen methodology is applied with the expectations of positive results. DMAIC specifically is also defined as a methodology to solve problems by analyzing people behavior and process or product trends. Also, Lean is widely practiced by organizations to increase productivity, reduce waste, and address environmental impacts [1].

Six Sigma and Lean concept have become two of the most popular methodologies for improving quality, productivity, and business performance. These concepts can be applied to any company, including pharmaceutical and manufacturing industries, for continuous improvement of processes.

Manufacturing industry's main goal after the use of one of these tools, is the integration of the continuous improvements methodologies and the people grow/development (maximize value addition). Some investigators and authors consider that these tools need to be part of the base of a company [1]. DMAIC is not only a set of phases to structure a project or a process improvement strategy. It includes data behaviors, customers need, process changes, training, people development and company growth, among others. Also, Lean Six Sigma provides a standardized approach to challenge problems, identify root causes, simulate potential solutions, runs pilots and implement the solutions that is more aligned to the business need and expectations [2].

The proper used of these methodologies create a unique environment in the industry in which the people participate in the business decisions, in the process changes and impulse the innovation pillar which is a clear path to continuous improvement and business evolution [3].

METHODOLOGY

The methodology selected for this project is the Lean/Six Sigma Continuous Improvement projects and which phases are: Define, Measure, Analyze, Improve and Control (DMAIC), to ensure that the process is fully analyzed in order to determine the causes to the problem using qualitative and quantitative data if available.

At the Define phase, it is defined the project impact to the business and your customers and include problem and goal statement, scope and objectives. These tools will be included as part of the Define Phase as Project Charter (Figure 2) and Process Flow Map (Figures 1 & 4). The project scope is:

- Establish the use of dedicated plastic containers during weighing and dispensing activities.
- Optimize the actual use of containers for component 4.

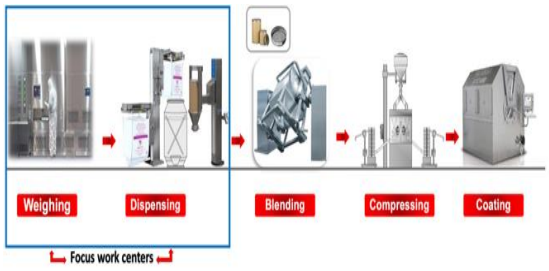

Figure 1
Product "A" Process Flow

At the Measure phase, visualize the process current state. Tools that will be included as part of the Measure Phase are Data Collection (including cost, time study, drum capacity qty, etc.). A process flow was developed to understand the actual use of the fiber drums and identify the opportunities during the process (Figure 4). Also, time study was performed to study the possible time improvement during Dispensing process (Figure 3).

At the Analyze phase, it is determined the problem root cause. We will determine the equipment capacity for this change. Due to the change of gal of drum containers.

At the Improve phase, looking for was that eliminate the problem or improve the process. Tools that will be included as part of the Improve Phase are Implementation Plan, "To Be" Process Map and Projections of results. In order to make the improvement possible, some SOPs revisions, risk assessments and equipment tests were necessary to perform.

At the Control phase, establishes methods that will remain the improvement. Tools that will be included as part of the Control phase are Process Monitoring, Financial Benefits Analysis, Environmental Benefits Analysis and Project Closure.

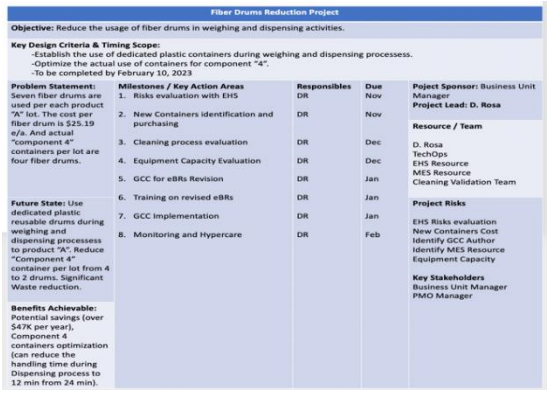

Figure 2
Project Charter Used during Project Execution

RESULTS AND DISCUSSION

Following the DMAIC Methodology, looking into the project stages, an evaluation was performed, and the results obtained were the following:

Containers Optimization for Component 4

First thing for the container's optimization was to identify the new plastic containers, the manufactured material (that complies with specific regulations), and the purchase of them. This also required a cleaning process evaluation to identify a campaign length standard before a major cleaning is required. These containers will be useful up to 180 campaign lots and then it will automatically require a major cleaning to be available for use again. For this project I ran a time study during Dispensing phase to evaluate and determine the actual time of execution of this activity. Also, simulated the results with the containers improvements for Component 4 resulting in an optimization of 12 min from 24 min (half the actual time); considering that this phase consists of multiples steps as: Setup, Dispensing, Delumping, Charging, Dispensing and Closeout. Previous weighted components are charged to the designated bin using a drum lifter and a quick sieve taking an estimate of 1.9 hr. per lot. Component 1 takes 15 min, Component 2 takes 20 min, Component 3 takes 30 min and Component 4 takes 24 min.

Figure 3
Flow Diagram – Dispensing Phase

In addition, this achievement was possible only with the replacement of the 19-gal fiber drums to the dedicated plastic drums of 15-gal and 40-gal. This to sizes were needed due to the difference of quantity required of raw material for each component. The 15-gal are good to replace the container of component 1, 2, and 3 but for the last component required more capacity if we wanted to reduce the quantity of drums used per lot. These results reducing the qty of drums per lot from 7 fiber drums to 5 plastic containers. This improvement was possible thanks to the equipment capacity evaluation positive results. The drum lifter was capable of managing a 15-gal and 40-gal container unlike the 19-gal fiber drum.

Table 1
Fiber Drums required per Raw Material Component

Component	Raw material Kg	Required fiber drums
1	2.34	1
2	18.9	1
3	39.1	1
4	35.8 (two portions)	2 per each portion = 4 drums

Waste Reduction

Product A has been a growing product during the last years. Where 268 lots can be manufactured by year. If we traduce that total in quantity of fiber drums used per year is equivalent to 1,876 drums (7 drums per lot). That's why optimizing the use of drums for component 4 was also an important objective of this project not only the change of the material itself. Reducing to 2 drums from 4 for Component 4 per lot. Each fiber drum weights approximately 3.5 kg (7 pounds). With these improvements of containers, we will be capable of reducing a total of 13,132 pounds of waste that ended up in the dump. From this perspective, a EHS risk evaluation was performed to ensure the ergonomic environment to our operators during the managing of the new containers, to evaluate the impact during manufacturing processes and the impact to the natural environment.

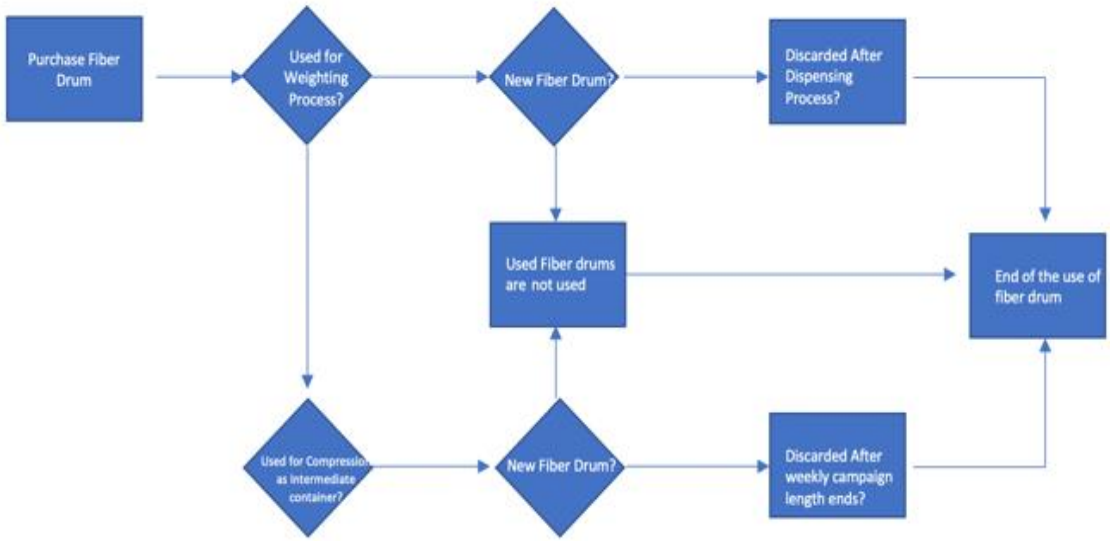

Figure 4
Fiber Drums Process Flow

Cost Reduction

When talking about costs, things get a little bit more serious. Every company wants or seek of doing more with less. So, projects for improvements, cycle time reduction, waste reduction and cost reduction are always performed on the daily basics. This project wasn't the exception. When thinking about replacing one container for other maybe cannot see the whole picture. But when identifying specific objectives and studying the results, this simple change became a completely different perspective. Beginning with the cost of each fiber drum at $25.19 ea. It means that the project was capable of creating a saving wave of 47K approximately (Figure 5).

Estimated Savings ($) Per Year

7 fiber drums x 268 lots a year = 1,876 drums
1,876 drums x $25.19 = $47,256.44 per year

Figure 5
Estimated Savings per Year

The whole project requires a series of revisions and risk assessments evaluation to ensure the compliance with our standard processes, the regulations of FDA, maintain the quality of the product and keep the safety during operators' performances of the requires taks. Standard Operations Procedures were revised and updated with the new containers for each one of the raw materials. Every employee was given a training to ensure the acknowledgement of the improvement

implementation and how they will be managing these. Then, the SPO revised were officially implemented to start the next manufacturing plans with the new procedures. After all these months of hard work, now we keep monitoring the flow of the containers per campaign to ensure the weekly capacity.

CONCLUSIONS

Looking into the results for the whole project, it was observed that the optimization and implementation of the new containers results better than imagine. Solving 3 problems at the same time, with just a change. The numbers of waste reduction, the time saving, and the cost reduction demonstrate an increasing potential for the company and the manufacturing area that keeps growing and growing. Opening new points of opportunities in the process. Initial week of implementation includes the impact of the learning curve since people are handling with more precautions the new containers and are learning the equipment (drum lifter &quick sieve) behavior.

Some remarks to highlight, and as a recognition for a great effort during the project execution, are directed to the experts that were key during the design of the solution and in the implementation helping the team with the cleaning process evaluation for the new containers, environmental potential, equipment capacity evaluation, SOP revision, training and hypercare strategy. Also, the technical team was committed to the project from the beginning to the end ensuring the proper implementation and within the time goal defined.

Since the principal goal was achieved with extraordinary results, we look forward to evaluating the Direct Compression area minimum quantity of plastics containers to ensure maintain a healthy Kan Ban lots between shifts and during weekends. Also, is important to keep looking for this type of change in the other manufacturing areas where fiber drums are also consumed during their processes and throw it out with just one use.

Collaboration from the project team and process monitoring are required to ensure that the containers are handled correctly and that there's no issues with the equipment's. Area Performance PV will be the key to monitor and ensure that the time saving in Charging system is giving the expected results. Also, the finance department report for the next quarter will reflect the cost and waste saving generated from this initiative.

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