Application of Six Sigma DMAIC methodology in a Merchandise Receiving Process at Burlington Store

Wilmarie Marrero-Santiago
Master of Science in Competitiveness Manufacturing
Maria Garcia, PhD
Industrial and Systems Engineering Department
Polytechnic University of Puerto Rico

Abstract *— With the intent of decreasing the cycle time of the merchandise process receiving, the unloading and scanning step and the sorting step were identified as a labor cost opportunity. Through 3 kaizen events done across site, it was determined a requirement of 15% total cycle time reduction for receiving merchandise process. DMAIC methodology and Lean manufacturing principles was used to develop this project and successfully decreased the receiving process cycle time. With the reassignment of employee's positions in the different steps and the identification of the work areas, the improvement on the process was significantly noted. This project achieved an improvement of 75.27 minutes per pallet down to 52.46 minutes per pallet, which represents a 30.30% decrease of cycle time on this process, which at the same time, represent a reduction of approximately $10,927.42 on payroll cost for the company.*

Key Terms *— DMAIC, Lean manufacturing, Retail store, Receiving process.*

PROBLEM STATEMENT

Research Description

Burlington is a company that has more than 670 stores in 48 states and Puerto Rico. Burlington stores has remained successful by making value a top priority. Through strategic purchasing, they can offer the latest in branded clothing, shoes, accessories, baby products, and home furnishings with great savings.

The Burlington store located in Elizabeth, New Jersey has been presenting problems on the merchandise receiving process. Is important to perform this process in the shorter time possible to be able to maximize the representation of merchandise on the sales floor. This store receives merchandise every night, which must be processed and represented the same night to maximize the sales for each product. Currently, on this store, the merchandise is not being processed and fully represented on each shift. The store's goal is to process and represent all merchandise the same day it is received.

Objectives

- Identify factors that are increasing the receiving processing time.
- Increase 15% the speed of the merchandise receiving process to achieve the daily work goal.
- Reduce in 10% the overtime work.

Contributions

This project will contribute to the improvement of the merchandise receiving process during the overnight shift. This process will identify the factors that are influencing to the completion of the daily work goal. By identifying these factors, opportunities for changes will be presented during the project to improve the processing time without affecting the quality of the process to be able to complete the receiving process for all the merchandise on an 8-hour shift. The improvement of time on this process will increase the opportunity to sell the items since presenting the merchandise on the same receiving day will increases visibility of these products to the customers. On the other hand, it will help the store to comply with the weekly assigned payroll hours, since with the

improvement of the process it is expected to avoid overtime to fulfill the incomplete work.

Project Scope

On this project, the DMAIC methodology will be used to analyze the merchandise receiving process at Burlington stores located in Elizabeth, NJ. This would imply identifying the failures of the process to improve the time in which the merchandise is processed to follow the assigned work hours to the overnight shift and at the same way, achieve the daily goal which is to receive and process all the merchandise received daily.

LITERATURE REVIEW

Inbound receiving is one of the largest areas of opportunity for retailers to gain efficiencies. Most retailers receive several daily shipments, and inbound receiving is where they can make some big improvements in efficiency. Several factors influence the specific mode of delivery: number of shipments per week, size of back room, and accessibility to store location. While most merchandise arriving at a retail store comes from the retailer's own Distribution Center, store personnel still can be making several trips a day to the back room - for a ground or expedited parcel, vendor-direct shipments, and even the occasional "emergency" shipment. These different modes of delivery are driven primarily by a trade-off in higher weights per shipment vs. lower cost, but there are store-level implications. Labor staffing for receiving shipments is one initiative great retailers vigilantly try to improve. Store managers are challenged with scheduling enough team members to balance their front-of-the-store and back-of-the-store duties [1].

To complete a process improvement project and assure every possible opportunity of the process is identified, the DMAIC Methodology should be used. DMAIC is an acronym that stands for the five (5) major phases the project should have: Define, Measure, Analyze, Improve, and Control. Through these phases, the team should be able to answer at the Define phase, what is important; at the Measure phase, how are we doing; at the Analyze phase, what is wrong; at the Improve phase, what needs to be done; and at the Control phase, how do we guarantee performance [2].

METHODOLOGY

To determine the best ways to improve the process, the Six Sigma DMAIC tool was used on this project. This tool is meant to decrease the processing cycle time on the receiving merchandise process by identifying and improving specific areas. Overall, Six Sigma is a quality improvement tool, employed in a systematic project-oriented fashion through five steps: Define, Measure, Analyze, Improve, and Control [3]. In the Define phase, an interview technique with employees and management was used to understand problems or issues at the store. During this process, the scope and problem statement was confirmed with the project champion.

On the Measure phase, the current process cycle time was measured. Also, a value stream map was developed as a tool to identify waste, opportunities and reduce process cycle times. In addition, a spaghetti diagram was used to have a visual representation of the process using a continuous flow tracing the path of a merchandise through the process.

On the Analyze phase was used the root cause analysis though prioritizing causes on a fishbone analysis. Then a prioritization matrix was developed to demonstrate effect on the problem of every potential causes prioritized. Also, an analysis of each element of the

receiving process to identify which are non-value-added, value-added, or required-non-value-added.

On the Improve phase, was generated the solution ideas and implementation requirements. It was defined and execute the implementation plan with the changes on the areas that demonstrated more effect on the process. Before the changes were executed, the ideas and solutions were discussed with the management team.

On the Control phase, were developed different forms to monitoring the process and to have data of the new implementations which will be discussed on the monthly team meetings. A monthly team meeting was established as part of the following up of the new implementations. And a new opportunity of improvements was identified to achieve the project goal.

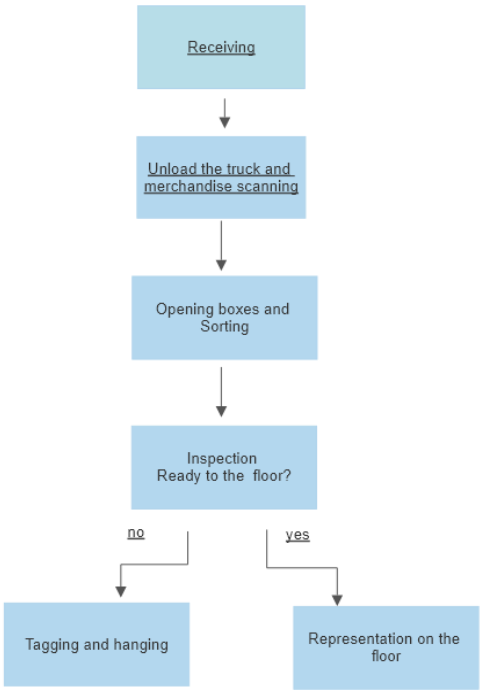

Figure 1

Flow chart

Measure Phase

The receiving process operation flow, shown in Figure 1, consists of 4 workstations: Unloading and scanning area, sorting and opening area, inspection area and hanging; and tagging area. The first two areas are connected by one conveyor which is used to transport the boxes to one station to another.

As part of the Measure phase of the project, the current times were measured for the receiving process operations. This process was evaluated using the time that a pallet is processed. For this project, was measured the time since a pallet is unloaded from the truck until this merchandise is on the inspection area. A sample of 30 pallets was taken, the process of two pallets per 15 days were observed. Per Figure 2, the receiving operation has a total average time of 75.27 minutes/pallet, out of which 7.68 minutes are on waiting time at the between every workstation.

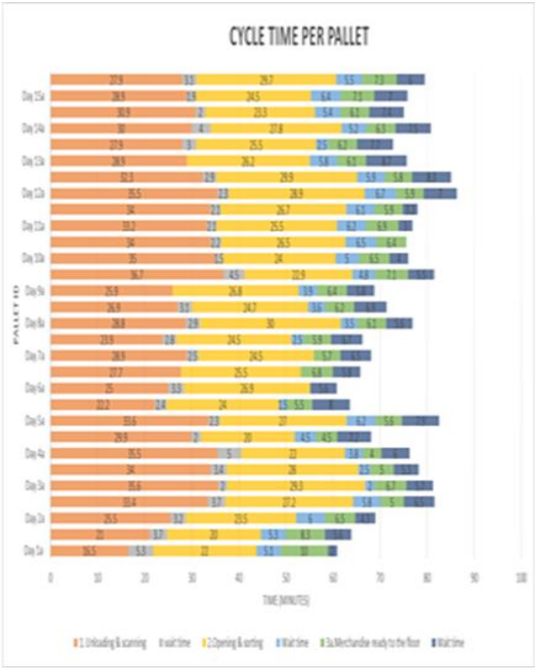

Figure 2

Cycle time

Through the Value Stream Map (VSM), developed and shown in Figure 4, it was easier to see the flow of every step/element of the operations in scope. Most importantly, the discussion of the VSM with the employees and supervisor of the process was fundamental to identify wastes of the current process.

Table 1

Descriptive statistics for cycle times

	Average	Std.Dev	Coefficient of variation
Unloading & Scanning	29.65	4.83	16.28%
Wait time	2.93	0.94	32.19%
Opening and sorting	25.58	2.68	10.47%
Wait time	4.75	1.49	31.47%
Inspection-Merchandise ready to the floor	6.09	1.59	26.11%

The most consistent waste discussed was the waiting time between each workstation and the long walk on the sorting step. The waiting time were measured and a total of 7.68 minutes per pallet is wasted on waiting time. As shown on Table 1, this wait time presents a standard deviation of 0.94 and 1.49, and coefficient of variation of 32.19% and 31.47%, which means that process during the wait time is variable and present a non-consistent process. Also, the steps with the most consuming time during the process were the unloading and scanning step (29.65 min) and the sorting step (25.58 min). The standard was calculated for these two cycle times, 4.83 minutes for the unloading and scanning step and 2.68 for the sorting step, which represents that even when the employees take a long time on this process are consistent with their execution.

Another kaizen identified during an interview with the night shift supervisors was the weekly schedule, where was mentioned that because of the lack of communication between the management team, most of the time the schedule does not match with the necessities of the workload. To be able to observe and follow the walk of the employees during the sorting process, a spaghetti diagram (Figure 3) was developed. This diagram demonstrates the issue of organization or identification on the sorting station. One of the most notable issues was when the employees walk around the workstation placing merchandise in different bins crossing their ways one to another.

Analyze Phase

With the purpose of identifying potential root causes of receiving process cycle time, a cause-and-effect analysis was completed and documented using a fishbone diagram, as shown on Figure 5. As part of the Analyze project phase, the potential causes identified in the diagram were prioritized with the Priority matrix in Table 2, analyzing the cost and importance of every cause.

The causes with higher importance were evaluated through the Analyze project phase, Figure 3. These assessments evaluate each high-ranked cause from the fishbone analysis and provides the evidence on the evaluation of the effect each of these has on the project. Out of the 13 causes brought to the Analyze phase, 5 causes will be taken to the next project phase, Improve, due to the proven effect these have on the project.

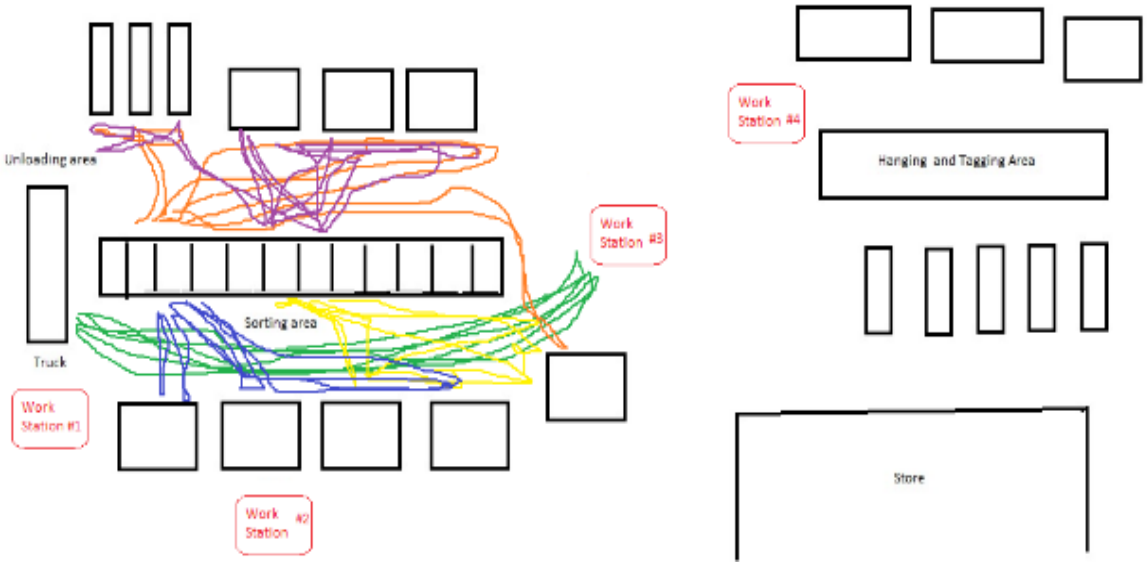

Figure 3

Spaghetti diagram for the sorting process

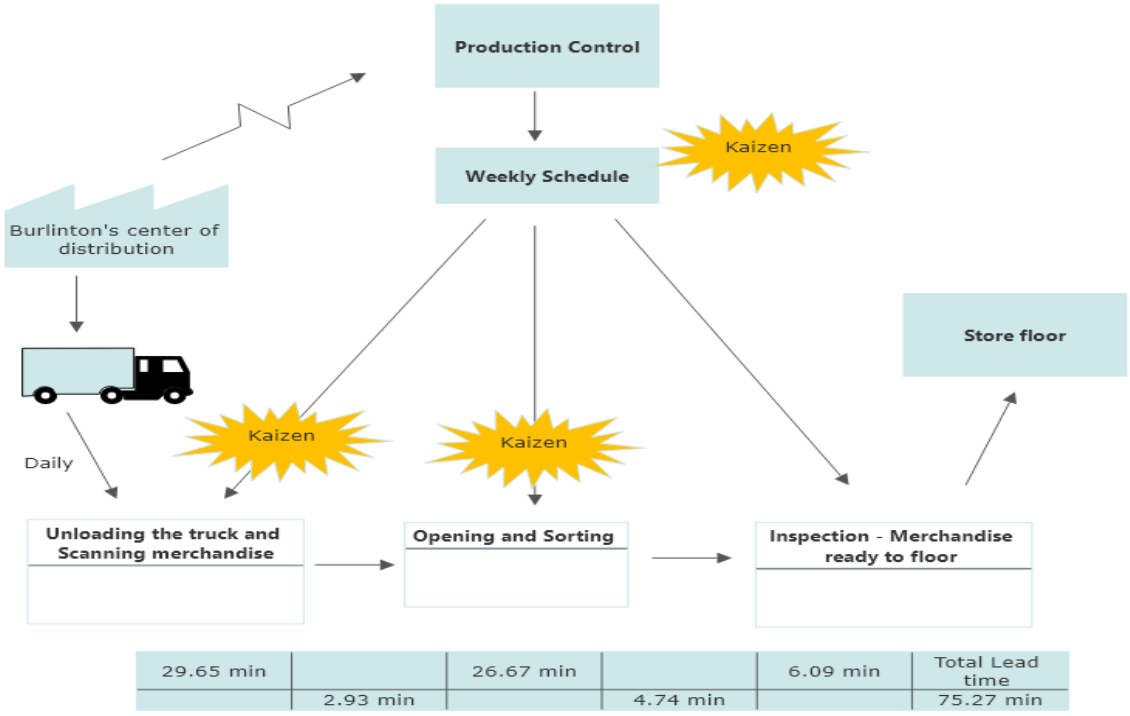

Figure 4

Value stream map for the operations contained in the scope of this project

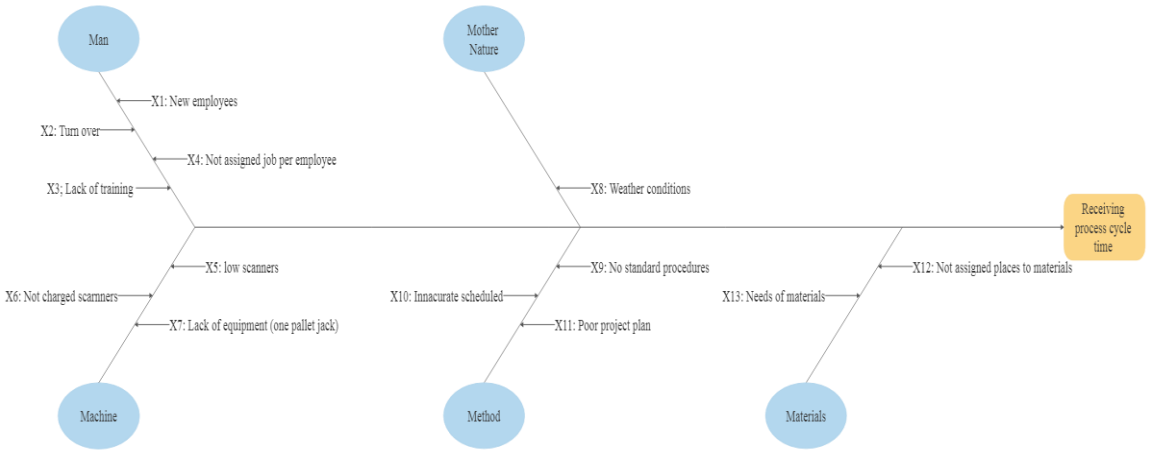

Figure 5

Fishbone diagram for the Cause-and-Effect analysis

Improve Phase

Through the Improve project phase, each cause was evaluated to understand the value-added of each. Each element of the Receiving process is described and additional identified causes with the proposed improvement:

- X4: Not assigned job per employee:

At the beginning of every shift, it was observed that the employees took a long time to organize themselves at the workstations. It was observed that a reassignment of positions was necessary to achieve speed in the process. To eliminate the time that the employees use to organize themselves at the beginning of every shift, the night shift supervisor will oversee posting the tasks assigned by employee on a blackboard. The number of employees per workstation will be reassigned to ensure that every workstation has the necessary employee support.

- X6: Not charged scanner:

During the walk-in place (GEMBA walk), it was observed that at the beginning of the shifts, the scanners were not charged. This cause delays on the receiving process by having to wait for the equipment to get charge. Employees assigned to this area were trained how to charge the scanners. A monitoring form was created to collect the employees sign every time they used a scanner, this to make them responsible for returning the scanner to the corresponding place after every shift. A "Charge me" sticker was also placed on the scanners to remind employees to return the equipment to the charging station.

- X10: Inaccurate Schedule:

During an interview with the night shift supervisors, it was identified that the hours and number of employees were not always effective for the workload. Lack of communication between management members was identified when creating schedules and communicating employees on schedule. An email account was enabled for the supervisors on duty to maintain direct communication between the management team since a lack of communication was identified due to the difference in schedules. This will allow them to communicate shift needs more directly, so the store manager can make the necessary changes to the schedule.

- X12: Not assigned places to materials:

It was observed that at the beginning of every shift, employees spent time just trying to find work materials. Additionally, it was identified that in the sorting area the employees found difficult to identify the correct place of the merchandise because the areas were not identified. An area in the warehouse was created to organize the work tools. Identified bins were created to divide the tools by category. The sorting station was also reorganized by department and each bin was identified with the

name of the corresponding department to facilitate the sorting process.

- X13: Needs of materials:

It was observed that the employees shared their work tools, which caused delays in their tasks and increased the processing time of the merchandise. A list of necessities was created to identify what materials were not available for employees. Materials were ordered to meet the shortage of materials.

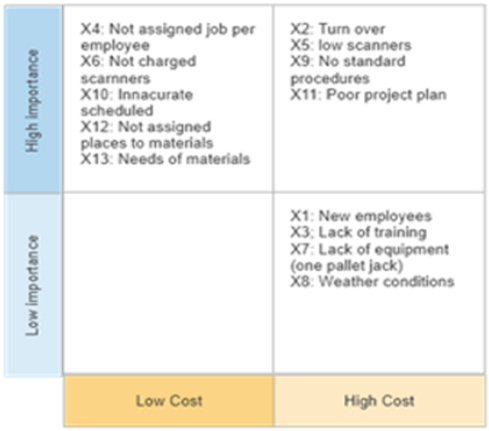

Table 3

Analyze assessment for high ranked causes on Fishbone

Control Phase

To maintain control of the new implementations in the project several measures were developed. To monitor the success of the implementations, a daily monitoring sheet to documenting how much work was completed per day was created. Likewise, another monitoring sheet was developed to ensure that no scanner is uncharged at the start of the shifts. These two forms will be monitoring for the night shift supervisor to maintain the compliance on these areas.

As part of the improve phase, a reassignment of positions was established in the workstations, to maintain control of this change, a scoreboard was created where the night shift supervisor would organize the team on different positions according to the need of the business or the workload.

Finally, as a commitment of the management to the project, monthly meetings will be held to verify metrics and progress of the implementation of the changes, ensuring that they will maintain weekly communication via email to communicate needs regarding schedules and number of employees needed per shift.

CONCLUSIONS

The receiving merchandise process, which was identified as a labor productivity opportunity, has been successfully leaned out. On this process, 3 kaizen were identify. The kaizen was located on the unloading and scanning step, sorting step and on the weekly schedule. Through the implementation of the improvement plan of this project, the sorting step was one of the areas that take more attention on this project since it was identify as one the most time-consuming step, with approximately 26.67 minutes per pallet during the process. Several actions were taken on this step to decrease the processing time such as: reassignment of employee's positions, creation of assign tools area, training of employees on the assigned work areas and identification of sorting bins by department. Refer to Figure 6 for the spaghetti diagram with the results of the walk path of every employee. On this diagram is observed the improvement of walk path of every employee; they no longer cross their ways anymore and with the identification of the bins, is easier to know where the item goes and is no longer necessary to walk around the floor to identify the correct bin to place the items.

The second kaizen was located on the unloading and scanning step. On this step was identify that at the beginning of the shifts the scanners were not charged. With the development of the monitoring form and trainings on this area the employees improved this behavior and understood the importance of place the scanners on the chargers after every shift. Also, was identified that only one employee was covering this step, which this contributed to the waiting time of 2.93 minutes by pallet between this step and the sorting step. A second employee was assigned to this area to be able to split the responsibilities and improve the processing time.

The third kaizen identified on the value stream map was the weekly schedule. On this area was identify a lack of communication between management team; an email was created to the night supervisor to be facilitate the communication with the manager that it is been affected because of the difference of schedule. Also, a monthly meeting will be scheduled to monitoring the progress of the new implementations. As shown on Figure 7, after the changes and training sessions to these areas, the improvement in the total cycle time was achieved from 75.27 minutes per pallet down to 52.46 minutes per pallet, which represents an improvement of 30.30%. This exceeds the project objective of improving the time by a 15%. This represents a reduction of 971.33 hours a year on the receiving merchandise operation, which will represent a reduction of approximately $10,927.42 on payroll cost.

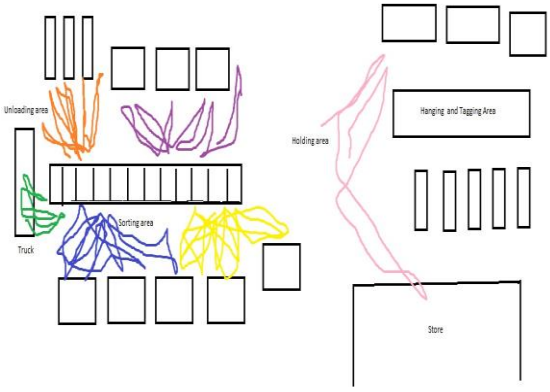

Figure 6

Spaghetti Diagram after new implementations

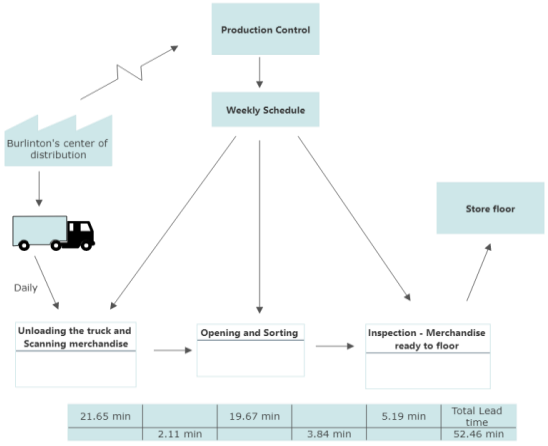

Figure 7

Value Stream maps after new implementations

Future Work

In the future, the same Six Sigma techniques will be used to:

- Analyze all the steps of the receiving process that were not covered on this project as tagging and hanging step.
- Develop a Standard Operation Procedure (SOP) for the receiving merchandise process.
- Analyze the causes of the high turnover on the night shift.
- Analyze the effect of the new implementations on overtime.

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