Incoming Area Optimization for Servers Repair Site

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Abstract *— Continuous flow is a key in organizations with production lines and more than one working shift. The organization chosen for this project is a repair site for servers and server components seeking to optimize their internal processes as part of their lean strategies. It was decided to optimize the incoming area for this organization since improving the starting point on the process will guarantee the line will operate constantly without idle time or capacity loss. Decision was to reduce the incoming cycle time process from 80 minutes to 40 minutes. A kaizen event was conducted with subject matter experts to analyze causes affecting the cycle time. Major contributors were identified and addressed to achieve the desire state. The project took place for eleven weeks and the objective was accomplished. A systematic solution to measure cycle time was developed during the project as requested by management.*

Key Terms *— adjustments, cause and effect diagram, cycle time reduction, kaizen.*

INTRODUCTION

Objective

The purpose of this project is to optimize the incoming area by reducing the cycle time process for every unit received in the organization from 80 minutes to 40 minutes.

Cycle Time Process

Cycle time is defined as the total time from the beginning to the end of a process. Also, it can be defined as the time that elapses between one part coming off the process to the next part coming off [1]. Reducing cycle time is one of the targets of many companies today, especially if they are service oriented. Cycle time reduction is a management tool that has proven to eliminate waste or non-value added activities in order to increase efficiency [2]. Benefits from this tool are reduction in lead time, floor space, total quality cost, setup time among others [2]. By having a lean cycle time, the productivity, which is the ratio between input and output [3], will be higher as well. This means the inventory levels will be optimal which translates into savings for the company.

BACKGROUND

Organization

The organization chosen for this project is a repair site for servers' components. It is dedicated to repair defective material received from three regions (Americas, Europe and Asia-Pacific). This material is shipped back to the regions certified as new, providing to the customers continuous support, even on older products. Therefore, this organization manages all the spare parts inventory from the supply chain organization.

This organization was established in Puerto Rico on 2009 and it has been successful since then. However, there are always areas of opportunities to improve processes. There is considerable evidence that organizations with the shortest cycle times also have the lowest costs as well as the best service [4]. After some analysis with management, it was identified to work on the incoming area, the place where the material is received and moved to the repair line for processing. A time study indicated that the incoming process cycle time is currently 80 minutes per unit. Also, it was noticed that there were multiple unnecessary movements of inventory around the work area creating delays to the fulfillment process to the repair line. Finally, there was no systematic solution to measure complete cycle time for this area.

If the cycle time is improved at the beginning of the process, this will increase the material flow to the repair line, increasing productivity. Companies are focusing on cycle time reduction to gain a competitive advantage, including the spare parts inventory industry [5]. The major goal for the project is to reduce the incoming cycle time from 80 to 40 minutes and to provide management with a systematic solution to measure cycle time for this area. The current cycle time for the incoming area was measured by observation and sampling.

METHODOLOGY

Kaizen Event

The organization where this project was implemented is engaged with lean methodologies and a kaizen event was approved to work with the cycle time reduction. A kaizen is the practice of continuous improvement and is recognized as an important pillar of an organization's long term competitive strategy. Experts from different departments were gathered together towards the same purpose, to reduce the incoming cycle time. Different methodologies were used during the kaizen week to better understand the process and determine areas of improvement. If the cycle time is improved at the beginning of the process, this will increase the material flow to the repair line. Continuous flow is needed to maximize the utilization of the resources, this includes people and equipment.

Management wanted a systematic solution to measure the cycle time for this area, using the shoofloor system. The data to measure the incoming cycle time was not accurate. To achieve this, the shopfloor initialization process, currently performed on the repair line, should be moved to the incoming area. This will provide the systematic solution to measure their performance. Moving the initialization process for the units to the incoming area is considered a major change, however is the only available solution at the moment.

To initialize every unit received it is needed what is called a planned order. This is a sequential number used in the shopfloor system to track every unit received. Also, the planned order is used for shipping purposes since this process is performed by the shopfloor system. Currently, creating the planned orders was the last step on the incoming process. If units are to be initialized on the incoming area, the planned orders should be created first, at the moment the material arrives to the dock. This will help to reduce the cycle time for the planned orders creation, which is around 60 minutes.

A cause and effect diagram tool was used during the kaizen, which shows that method is the category with the most issues to solve. The team agreed to analyze and give ranking to the causes associated with this category to develop the action plan. Figure 1 shows the cause and effect diagram used by the kaizen team.

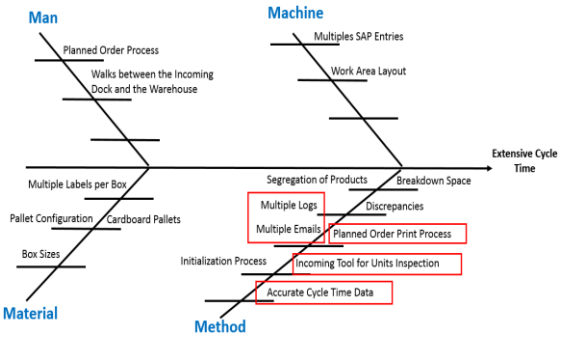

Figure 1
Cause and Effect Diagram

Causes to Address

Table 1 has the four causes identified to be addressed during and post kaizen. It also includes the baseline and target for the project.

Table 1
Incoming Cycle Time Results

Deliverable	Baseline	Target	% △
Planned Orders	60 min	20 min	66%
Multiple Logs/Emails	12	8	33%
Tools Consolidation	2	1	50%
Systematic Metric	N/A	1	100%

During the kaizen event, the team focused on the above causes to achieve the expected results. The first three are the most significant in terms of cycle time reduction. The fourth cause, not having a systematic solution to accurately measure the cycle time, is needed to have a metric for the subcontractor managing the incoming area. Also, to measure the incoming cycle time using the shopfloor system is the most effective way to proceed, since it will be embedded on the normal data collected. Below are the details on these four areas:

- **Planned order printing process:** The planned order printing process consists of 8 manual steps, takes 3 people to complete over 3 different locations (office, warehouse, dock). Estimated travel distance is 140 feet and it can take up to 60 minutes to complete this task. It is possible to have multiple occurrences per day based on incoming inventory frequency (up to 4 times a day). Also, there were multiple logs and emails performed by the incoming personnel causing the cycle time to increase. To improve this, the planned order request will now occur at carrier delivery time (dock). This request will come from the incoming personnel, allowing the incoming team to perform the initialization process. Due to this modification, the manual steps, the walking and the emails for this process were reduced. This should reduce the time to create the planned orders from 60 minutes to 20 minutes.
- **Reduce multiple logs and emails:** The modifications performed on the planned order printing process reduced the emails and logs from 12 to 10. However, the target was to reduce them to 8, meaning two additional reductions were needed. For this reason, the team investigated further and they were able to eliminate a log that was filled by the incoming personnel with data that nobody used. Also, the email sent by the incoming personnel when root cause analysis (RCA) units are received was eliminated. Instead, the share point alert process will be used for the notifications.
- **Consolidate incoming tools:** To perform the inspection of the units received, incoming employees were using two different tools. The first one has all the product families, except one, the oldest one. Since this tool has most of the families included a lot of effort was dedicated to update it. The second tool has the first product family that was introduced when the organization was established in 2009. This tool is very old and archaic. The solution was to modify the data for this old product family so it can fit on the newest inspection tool. This will consolidate all the information in one place, helping to reduce the processing time at incoming.
- **Systematic solution to measure cycle time:** There was no systematic solution in place to accurately measure cycle time for the incoming process. The ideal scenario was to use the shopfloor system to measure correctly the time it takes to process units from the moment of arrival to the time they are dispatched to the repair line. In order to use the shopfloor system to measure the cycle time, the planned orders should be created first. Decision was to create them at the moment of units' arrival. The incoming team will perform the initialization process for the units. The birth date when the planned orders were created is going to be used as the starting process point for the cycle time. The initialization process will be the second measure point, indicating how long it takes to segregate and inspect units. Third measure point will be performed once the material is delivered to the repair line, indicating how long the material was stored in the incoming area. This systematic entry is performed by the repair line and it is called "QUEUE". If the material was stored for too much time, this may indicate capacity issues or excess inventory, meaning inaccurate information on the forecast received. From this, adjustments can be done on the process to compensate and improve the situation.

RESULTS

Table 2 shows the results for the incoming cycle time from the different runs performed during the project. Cycle time taken manually prior to the kaizen event was included as reference. During the kaizen week the cycle time was improved to 50 minutes. Then, on week number one post kaizen, the cycle time increased by 10 minutes. Adjustments were done on the process and by week number two post kaizen, the cycle time was again at 50 minutes. Additional adjustments were completed by week number three post kaizen showing improvements almost close to the goal, 44 minutes. Final verification performed on week number five post kaizen showed a cycle time of 40 minutes

Table 2
Incoming Cycle Time Results

Run	Process	Planned Orders	Total Cycle Time
Pre-Kaizen	20 min	60 min	80 min
Kaizen Week	30 min	20 min	50 min
Post Kaizen, Week 1	35 min	25 min	60 min
Post Kaizen, Week 2	30 min	20 min	50 min
Post Kaizen, Week 3	24 min	20 min	44 min
Post Kaizen, Week 5	20 min	20 min	40 min

*From kaizen week incoming cycle time is measured systematically.

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As part of the analysis, a graph with the cycle time trend is shown in Figure 2. Project started with a positive trend until week one post kaizen. Adjustments were made on the process to reach the positive trend again, meaning the decreasing of the cycle time. A good trend continued until the final check performed on week number 5 post kaizen, where the objective was reached.

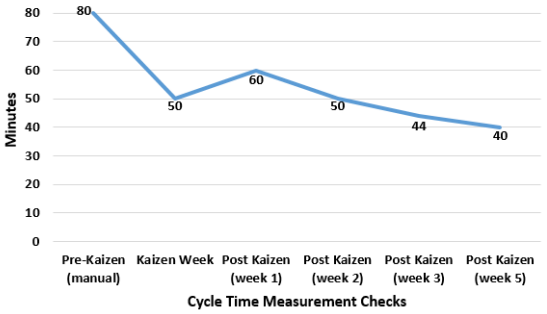

Figure 2
Incoming Cycle Time Trend

DISCUSSION

Adjustments were needed on the process to achieve the project objective. First one was on the planned order process, since only one person was performing such a critical task. This was causing delays on the process considering that the repair line has two working shifts. For this reason, after several discussions on the kaizen week about this topic, two resources were assigned for this task. If they are not available, the planners from the regions will be the responsible for this task as well. Now that the planned orders will be created at the moment the material arrives to the dock it is crucial to not have delays on this process.

One of the goals for the kaizen was to consolidate the tools used at incoming for units' inspection from two to one. However, during the first pilot run it was noticed that for the newest tool the incoming personnel needs to open 3 separate windows to verify product specifications. To accelerate the process, the inspection tool was modified to free space in the display window to consolidate all the information in the same window.

After the kaizen was completed, on the pilot run performed on week number one, it was noticed that some of the employees from the incoming area had hybrids shifts. This was causing that there were periods on the day when only one person was on the incoming area, delaying the processing time. After a meeting with management it was decided to eliminate the hybrid shifts and have three resources

on the first shift and three resources on the second shift, supporting continuously the repair line.

During the post kaizen checks it was discovered that carriers were delivering material to the dock from another building, adding to the walking distance from the incoming employees. During the investigation it was detected that the sign from the organization's dock was fade out, causing the carriers to not find the correct place for material delivery. An internal work order was created to cover for the expenses related to the painting of the dock sign. Now the carriers can clearly see the correct dock when delivering material for the repair activities of the organization.

Another modification on the process was the elimination of several logs and reports that were filled by the incoming employees for one product family. They were related to the warranty process performed on the products belonging to this product family. Since the initialization process is now performed on the incoming area and the employees are entering data into the shopfloor system, the information can now be gathered from it. There's no need to continue with this manual process, helping the cycle time reduction.

CONCLUSION

The objective for the project, which was to reduce the incoming cycle time from 80 to 40 minutes, was accomplished. Project was completed on time and although there were problems during the implementation, the adjustments performed on the process were successful. Also, the request from management to create a systematic solution to measure the incoming cycle time was completed as well.

The organization is satisfied with the results and management is already thinking in other areas of opportunity for process improvement. The kaizen team is still monitoring the incoming area to determine if changes are sustained. An excellent team work was the key to succeed on this project. With every process improvement achieved organizations are competing for a better position in the market while delivering the best customer service. It is important for companies to think out of the box to achieve greater results and improve internal processes, which translate into savings and profits. To stay in a comfort zone is not healthy for any company today and this organization made the right decision when they chose to make things different.

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