Multi-Site Spare Part Monitoring Plan at RM Manufacturing Puerto Rico

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Abstract *— At RM Manufacturing, increase in downtime was observed due to spare parts unavailability. Spare parts monitoring strategy plays a key role in ensuring a manufacturing plant's uptime. The objective of this project was to reduce the downtime due to spare parts unavailability. The areas of improvement identified were the standardization of information required for part creation, and re-ordering process approval flow. New information requirements were implemented in order to ensure key information is provided by the staff creating the new inventory item. Also, a risk-based process approval flow for each part was developed based on the risk they represent for the organization. The results attained were reducing order cycle time and overall department's overtime expenses, hence, developing a tailored spare parts strategy yielded great improvements.*

Key Terms *— Inventory Management, Lean Logistics, Waste Reduction, Process Improvement*

INTRODUCTION

RM Manufacturing is a Multi-National Pharmaceutical Company focused on Bulk Manufacturing of Drug Substances and Active Pharmaceutical Ingredients (API). The RM Manufacturing Puerto Rico location consists of six individual plants within the established location. These plants produce 80% of the overall company revenue. Additional smaller scale plants are located around the world which produces similar products but on a smaller scale. These smaller plants serve as a contingency plan to support demand variance.

The sites have been experiencing an increase in spare parts unavailability, contributing to an increase in downtime hours through the network. In addition, re-work has been observed by the inventory staff while assessing parts for ordering since there is no standard format for creating parts in the system. Furthermore, duplicity has been observed.

As the manufacturing run rate increases, a diminution in downtime tolerance is observed. Having the right parts on hand ensures the mitigation of downtime. Hence, this results in an overall site efficiency increase.

The objective of this project was to reduce the downtime due to spare parts unavailability. To accomplish this, it was intended to create uniformity on a network basis and establish a tracking tool in which users provide a timely response of spare parts that are found in the status of zero balance on hand. This would serve as a notification to the client and as a prioritization tool for inventory staff.

LITERATURE REVIEW

Inventory management systems play a vital role in ensuring the plant's uptime. Hence, the importance of assuring the correct spare parts and the correct number of spare parts is attained within the established time window [1]. As for inventory control, establishing an effective spare parts inventory information baseline, key details are crucial when performing entries on the system [2]. When controlling the inventory, one effective way is to match total entries with total exits per term [3]. Logistics play a vital role in establishing what time frame is needed to fulfill an order. Considering all steps required for fulfillment provides a more accurate result on when the parts will be available [4].

METHODOLOGY

The first step was evaluating the current inventory practices. The purpose of the evaluation

was to understand the life cycle of creating, purchasing, supplying, and refurbishing spare parts. During this evaluation, it was observed that multiple clients had a different definition of what is a spare part. Also, most of the system entries did not provide clear information that will be helpful for part identification. Due to the lack of information provided, the inventory staff had noticed that once quotes were received, they were quoting two items that are the same part. Parts are tracked utilizing a validated inventory system named Maximo.

Additionally, most of the clients cataloged all their parts as “High Priority”. When asked the rationale behind the classification, the response received was “to ensure we have available in case if needed”. During the purchasing process, once quotes were received, the inventory staff had to communicate with the subject matter expert and obtain approval prior to placing the order. This contingency control was placed with the intent of assuring correct parts are being purchased. Said interaction applied to all orders. A lack in response speed was observed which indeed slows down the ordering process. Based on the above-mentioned findings, it could be said that the major area of improvement is establishing what is a spare part, what is the basic information needed to create a spare part and how to expedite the ordering process base on a parts category with the intent of removing the subject matter expert approval.

Establishing what would be considered a spare part for a company will provide guidance to users on being selective with the entries. As part of this evaluation, a definition was developed. For RM Manufacturing, a spare part is any part that could possess the risk of impacting production if not available. Said spare parts must come from unique vendors, pose a long lead time, high failure rate, or be a dedicated item.

As for improvement, it was identified that the first area of opportunity is related to standardization when parts are created in the system. This means establishing an approach in which there is predetermined information needed to begin processing the spare part generation request. Said information requires the official spare part name, serial number, model, for which equipment will be utilized, where the equipment es located, who is the vendor, and approximated lead time established by the vendor. Once the information is received, the inventory staff will perform a search in the system to evaluate if there is a part that meets the given information by the requester. If a part is found that meets the requirements, the item number will be provided to the requestor, the where used field on the system updated, and the request closed. In the case there is no part found, the new item will be created in the system.

A risk-based matrix was developed for RM Manufacturing PR where parts are rated based on the financial risk, they might pose to the organization due to not being available. As shown in Figure 1, there are four levels in which spare parts could be cataloged in the RM Manufacturing Network. Levels are established based on tolerance to mitigate unavailability and the possibilities of losses with a monetary threshold. Once the risk level is established, the inventory staff can begin following the appropriate path.

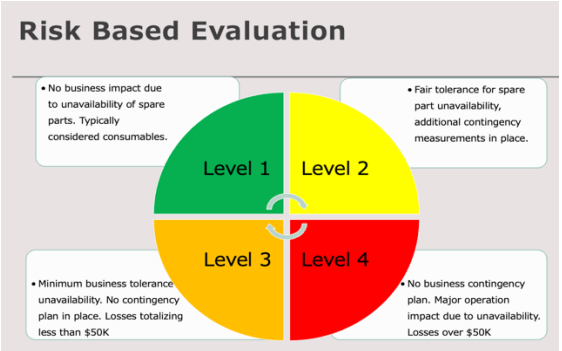

Figure 1
Risk-Based Evaluation Matrix

Once spare parts are already on the system, there are basic categories that govern a spare part. Spare parts in the system can be defined into two primary categories: Stock and Non-Stock. When a part is labeled as stock this means physical inventory will be available on site. On the other hand, non-stock parts are parts that are to be considered for specific instances and will be

ordered in advance. Hence, no physical inventory is on-site till requested by the customer. Once the part classification is completed, there are four additional statuses in which a stock part can be found in the inventory system. Said statuses are: Available, Zero Balance, Superseded, Pending Alternate. When a part is labeled as “Available” it resembles that there is an inventory on hand. The “Zero Hand Balance” means there is currently no inventory on hand but there is an order for the parts, the user should refer to the applicable lead time. When it comes to “Superseded”, parts have received a change in their model, serial number, or maker. During this stage, the responsible subject matter expert should exert judgment and approve or reject changes. Parts arrive at this status after a quotation with change notification is received from vendors. The “Pending Alternate” classification requires the most engagement from end users since once parts arrive at this status it means that vendors are notified that they are no longer carrying said item. This means the part is obsolete and has no replacement. Additional support from the responsible owner is required to identify possible vendors which might attain a similar part.

The current notification structures follow a complex flow in which every decision must pass through the subject matter expert for approval before ordering. Typical notifications are conducted via email in which a staff member from inventory gathers the required data for a decision to be made and sends the information to the applicable subject matter expert. As stated above, owners will provide feedback on Superseded and Pending Alternate parts. No notification is currently conducted for Zero Hand Balance parts.

As shown in Figure 2, previously all transactions required a subject matter expert intervention for order forward processing. After implementing the risk level classification only levels 3 and 4 will require a subject matter expert intervention. It is important to mention that their intervention would be made in the following scenarios: when a part is on Zero Hand Balance, when a part requires a decision for Pending Alternate or Superseded. Now in Zero Hand Balance, the notification will be made via email to notify of the instance to take the appropriate measurements in case the part is needed at a nearby time before its delivery.

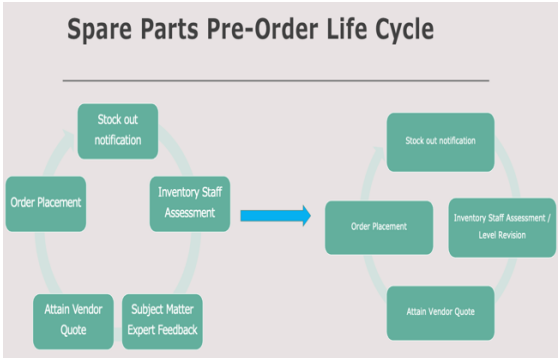

Figure 2
Spare Parts Pre-Order Life Cycle

Inventory staff is to conduct multiple interactions with vendors daily to ensure continuous operation of the spare parts inventory refurbishing. Staff must ensure the information supplied matches the received information before placing the order and in the event, discrepancies are observed, contact vendors to understand differences if any. This is with the intent of ensuring the right parts are ordered. In the instance, that a part is needed by one site and there is the availability of the part in another plant, inventory staff can request the expedited shipping of the part. Now as for inventory refurbishing, the site that requested the part must replenish the site which gave the part. The expense will be allocated to the requestor’s budget. This poses a great advantage for clients who have similar equipment across the network. The intent is to have local and global backup inventory and that all inventory staff has access to ensure the demands are met.

Since all parts are linked to which equipment they are utilized, the inventory staff can monitor each plant's inventory overall availability. This means that based on all the parts in the system that are charged against Plant A location composes the hundred percent. Now if they divided the total on hand versus the total parts in the system an overall inventory health position could be attained. In

addition to the overall health of inventory, staff will also monitor the order cycle time for fulfillment. This applies to inventory replenishment and parts ordered by clients. When it comes to additional parts' status such as zero hand balance, notifications will be sent to owners to attain input if there is a risk due to waiting for normal delivery or if the part is needed to expedite. Each cycle part that required expedite will trigger an action to revise inventory levels to ensure demand and risk correlates with the on-hand inventory.

In terms of improvement areas, it can be mentioned that the spare parts creation process was restructured in order to include key information about each item. In addition, the actual process flow of inventory staff while evaluating and placing orders was also improved. This is with the help of the risk category given to a part. This means that less additional interaction is required from functional areas prior to placing an order. As for monitoring, some guidance performance indicators were established in order to show how effective the staff is managing the process.

RESULTS

After implementing the spare parts management strategy, an increase in efficiency has been observed. A decrease in inventory staff personnel overtime has been experienced, as shown in Figure 3. The overtime decrease possesses two benefits for the organization: cost reduction and work-life balance for staff.

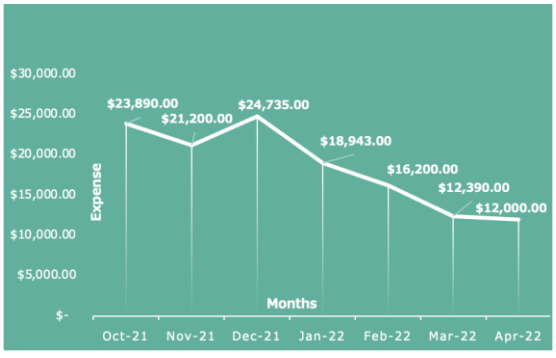

Figure 3
Global Inventory Staff Over Time Expense Tracker

In addition, order cycle time has also decreased, as shown in Figure 4. This shows that the new evaluation flowchart based on categories is indeed more effective and leaner than the previous strategy.

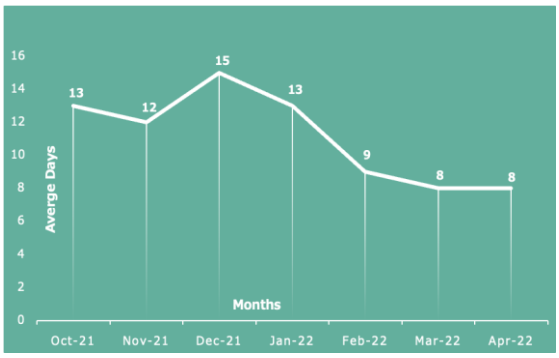

Figure 4
Order Processing Cycle Time

Additional findings noted during this evaluation were:

- Subject Matter Experts (SME) have also reported that since they are not involved in each order, they can refocus their efforts on additional tasks.
- Monitoring platforms are live under their first version and will be updated as deemed necessary in order to show the applicable data to spare parts and plant staff.

CONCLUSIONS

The project results suggest that an effective implementation was conducted. Furthermore, an increase in savings was observed due to overtime reduction on a network basis. As for parts availability, the reduction of order processing time shows that the team can place an order faster, which results in quicker delivery of the new part. Hence, minimum disruption of plant operations is to be expected related to parts unavailability. This only applies to parts that are already part of the inventory system.

Investing resources in understanding the system and establishing a strategy that fits the organization is considered a value-added activity. Furthermore, tailored strategies are suggested to

change during their life cycle since they must adapt to current business needs.

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