Improvements in the Preventive Maintenance Program of an Automated Machine at a Manufacturing Line

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Abstract *— During the preventive maintenance execution of an automated machine in a medical device company, it was identified by the operators that the procedures lack required tasks that shall be documented properly. Therefore, the objective of the project was to improve the preventive maintenance procedures documentation. A Voice of Customer was performed on the operator mechanics to gain feedback. Based on the information provided, the procedures were revised to add the required tasks. It was identified that increasing the quantity of tasks to be executed does not impact the current time execution as these tasks were recommended to be included in the procedures and the operators were already executing the tasks based on their expertise with the equipment but did not have the instructions included in the procedures. The changes in the procedures were submitted into the documentation management system.*

Key Terms *— adequate, compliance, expertise performance.*

INTRODUCTION

A new automated machine was introduced at a manufacturing line in a medical device company. The automated machine was designed by implementing three non-continuous manual processes into a continuous automated process to manufacture a currently validated product. The preventive maintenance (PM) activities performed in the new automated machine were created by following the maintenance activities performed in the current non-continuous manual stations. However, the new automated machine required a more advanced maintenance procedure execution to improve machine performance and efficiency of the automated machine due to its complexity and variation between each of the three continuous processes.

The automated machine consisted of a variety of critical equipment that required proper maintenance to ensure compliance and quality. Therefore, as part of the areas of opportunities identified in the preventive maintenance of the automated machine, it was found that the current tasks performed under the planned maintenance routines are vaguely detailed in the instructions. Therefore, the project objective was to improve the preventive maintenance documentation to provide evidence that the machine is capable of meeting its expected performance. Consecutively, it will help the maintenance department to measure the machine's performance based on the reconciled data.

Based on the frequency that the preventive maintenance routine is performed, the operators dedicate an established time for execution. Providing adequate maintenance tasks will allow reducing mechanical intervention during the production process, since most of the mechanical issues can be addressed during the preventive maintenance execution within the current established time.

LITERATURE REVIEW

The preventive maintenance program is a broad area with many opportunities and improvements that will help achieve high efficiency and productivity in the industry. Most of the products that are found in the market for consumers and healthcare are manufactured through high-quality equipment that requires frequent maintenance execution to maintain or improve their performance and machine lifecycle. The preventive maintenance objective is to help the industry to acquire a high-quality product or process. Within the preventive maintenance program, many areas have been observed that lack direction,

standardization, and focus. This high-standard equipment requires proper maintenance to prevent failures if they are inspected with more dedication and frequently [1]. However, based on research, there are some mistakes or errors that the industry or preventive maintenance program tends to fail to address in its proper timeline. One of the biggest mistakes found in the preventive maintenance program is imprecise or unclear instructions. Each preventive maintenance procedure must guide the technician in a straightforward process for him or her to achieve a proper maintenance execution. Each PM procedure should include in their tasks all the tools, measurements, and step-by-step instructions to improve the documentation process and measure machine performance [1]. Including the proper PM tasks or instructions and tracking the machine's performance throughout its usage will be easier. Otherwise, keeping a record of the equipment efficiency will be difficult and it will be challenging to evaluate the equipment functionality [2].

Therefore, to improve the preventive maintenance program as Jonathan Trout and Pavol Luptak had established is to improve the preventive maintenance procedure to provide adequate tasks and instructions to complete properly to evaluate how efficient the equipment is functioning and determine if it is feasible to continue its usability to conserve manufacturing high-quality products.

Analysis Approach

To accomplish the objective of the project, the Kanban methodology was applied to help keep track of the activity's status, and the activities accomplishments. Once the essential tasks to be completed during the maintenance execution were identified, the Kanban methodology was implemented to help prioritize tasks, assign due dates, required resources such as operators, tools, and parts availability, and evaluate the level of impact and provide mitigation strategies if the tasks tend to get critical to be completed on time. The methodology helped to learn, understand, and manage the critical areas that required a rapid response to avoid any delays during the project execution.

The Kanban methodology included the high-priority tasks, which are those tasks that can directly impact the expected outcome of the project, and the standard tasks, which are those tasks that directly aid the completion of the high priority tasks, as supporting resources, material allocation, and system intervention.

Results

The automated machine has three preventive maintenance procedures required for execution in different frequencies. Based on the frequency, the equipment required a specific quantity of tasks for execution within an established time execution. For a biweekly execution, it mostly last 2 hours. However, for a quarterly execution, it mostly last 8 to 10 hours. Figure 1 shows the current quantity of tasks executed in the automated machine with the execution time per frequency.

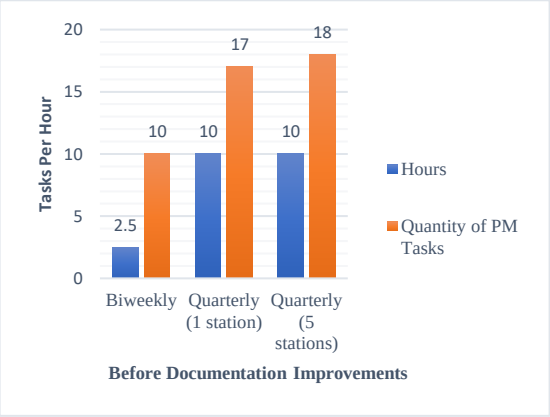

Figure 1
Current Preventive Maintenance Tasks and Execution Time in the Automated Machine

A Voice of Customer (VOC) was performed on the operator mechanics to gain feedback from their experience during the preventive maintenance execution. It was identified that these tasks were recommended to be included in the procedures as the operators were already executing the tasks based on their expertise with the equipment but did not have the instructions included in the procedures. Figure 2 demonstrates the number of tasks identified by the

operator mechanics. As shown in the figure, the quantity of tasks increased, in comparison with Figure 1. However, the expected time of execution did not change.

Figure 2
Expected Preventive Maintenance Tasks and Execution Time in the Automated Machine

It was identified that although the quantity of PM tasks increases, it does not impact the current time execution during the preventive maintenance performed in the automated machine. This happened because the PM tasks were identified as recommendations provided by the operator mechanics based on their knowledge and expertise with the equipment. The procedures were revised to include the tasks identified by the operators and were submitted into the documentation management system.

CONCLUSION

As the current preventive maintenance procedures of the new automated machine were revised to include the tasks identified by the operator mechanics, the objective of the project was met. Based on the feedback provided by the operator mechanics, more improvements can be found during the equipment lifecycle as it is a new complex automated process which has a lot of areas of opportunities for major improvements.

REFERENCES

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