Improvement to the Manufacturing Process for Screens

Carlos J. Cardona Acevedo
Master in Engineering Management Program
Dr. Héctor J. Cruzado
Graduate School
Polytechnic University of Puerto Rico

Abstract *— A company that fabricates screens, among other products, is not very effective as the manufacturing time of screens is longer than it is desired. The company wants to make changes to the current process and layout, focusing on providing a greater and more efficient workplace for their employees. One of the biggest bottlenecks that can happen is that the suggestions for changes needed to improve are rejected or resisted. Two of the major goals the owners have are to reduce the execution time for the manufacturing of nylon screens and increase the manufacturing production. Cause and Effect Diagram, Five Whys and process capability tools were used to determine the issues in the manufacturing process of nylon screens. With the result obtained, the company was able to achieve their layout design utilizing a 5S tool, as well as to generate standardized procedures and work area. By achieving these goals, the company will be able to increase their income.*

Key Terms *— Layout Modification, Nylon Material, Process Improvement, Screens*

INTRODUCTION

Background

This project was conducted on a company located in Puerto Rico and that is dedicated to the manufacturing of aluminum doors, windows and other works. In this case, the focus will be on the manufacturing of nylon screens, which has been determined to be one of the highest causes for issues that the organization can address to bring a more efficient process with the support of their employees. To the company is very important to create a balance between flexibility and motivation that can help them reach their goals and compete against other companies.

Problem Statement

The organization is having issues with the manufacturing production of screens. Some of the issues they have mentioned is that employees take longer than expected on the manufacturing process. Other issues that was noticed is that they have too much residual of material and that employees use different methods for the manufacturing process of a screen.

One of the biggest issues in the business of manufacturing screen is that the cost varies. There is no published information regarding the exact value for manufacturing a screen due to the sensitivity and variability between them. It is very important to understand that, in this business, the value may depend on location, the supplier and the manufacturer of the product [1].

Objectives

The objectives of this project are to reduce the execution time of manufacturing nylon screens, increase the manufacturing production and increase profits. For this project, the company will not be taking into account the time for re-work manufacturing process and the re-use of material.

NYLON SCREENS

Vinyl coated fiberglass insect screening, also called vinyl coated glass yarn insect screening, refers to the fibrous glass yarn with vinyl chloride resin coating. It is a type of popular window screen material in all over the world. Vinyl coated fiberglass insect screen has excellent flame resistance and UV resistance performance. Additionally, it is corrosion, acid and alkali resistance to ensure the long service life. Vinyl coated fiberglass insect screen has simple but strong structure, which will not lose when it is cut into

pieces. It is convenient to install and replace and it is very easy to clean [2].

ANALYSIS

Data Collection

Data collection was performed on the manufacturing of twenty-two screens. The data collected were the time (in minutes) it took to prepare the materials and the time it took to prepare the screens. Table 1 demonstrates the data gathered by timing the employees perform the required tasks.

Table 1
Data for Material and Screen Preparation

Screen Number	Time Preparing material (minutes)	Screen Preparation Time (minutes)
1	14	8
2	16	7
3	18	7
4	15	9
5	20	7
6	15	9
7	16	8
8	15	9
9	17	10
10	18	8
11	17	8
12	16	8
13	13	9
14	14	7
15	15	10
16	14	7
17	16	8
18	15	8
19	17	7
20	15	8
21	16	7
22	14	7

Process Capability of current Process

When the data was analyzed using the process capability tool, the graphs generated provided objective evidence that their current process is capable. In addition, the current process may require some improvement to be consider a consistent process.

As shown in Figure 1, the material preparation process Cpk value is higher than one, therefore, it is considered a capable process. With this information it is determined that, with a minimum correction, it can be increased to a more consistent process. It can be seen in Figure 2 that the screen preparation process Cpk is higher than 1.33, therefore, it is considered a capable process.

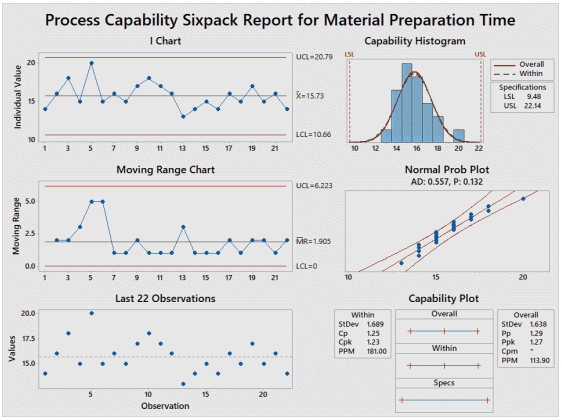

Figure 1
Process Capability for Material Preparation

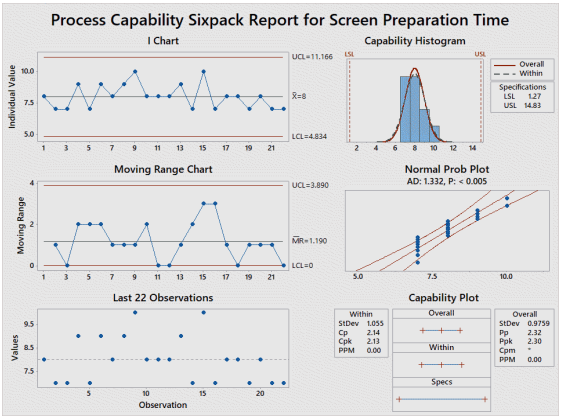

Figure 2
Process Capability for Screen Preparation Time

Cause and Effect Diagram

The cause and effect diagram is a tool utilized for the analysis which can help improve the organization with their issues, since it was determined that their current process is capable but not in control. The cause and effect diagram is meant to help identify various reasons that may affect the screen manufacturing efficiency. Figure 3 shows what are these reasons.

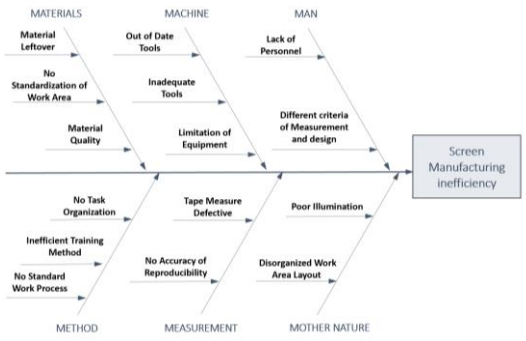

Figure 3
Cause and Effect Diagram

Five Whys

In addition, Five Whys was also executed to elaborate more on the issues of why there is a screen manufacturing efficiency and why is this issue occurring as displayed in Figure 4. This methodology will help develop a more detailed reason and solution to the problem.

Figure 4
Five Whys

RESULTS

After completing the Five Whys, it was determined that the major cause for the organization to have issues with screen manufacturing inefficiency is because they lack employees. The lack of employees is a major factor since this allows for the current employees to work at a faster pace and juggle between tasks more frequently. This in turn affects them negatively because it does not allow them to organize their work areas and forces them to exchange various tool from their corresponding area. This forces them to lose time trying to find the tools that are required in the specific working area and they are located in areas where the tools do not correspond.

Using the Cause and Effect Diagram sections and subsections, it can be determined what affects the process of nylon screen manufacturing. Some of the major reasons the employee affects the screen manufacturing is by having a disorganized work area layout, no standardization of work process, no standardization of the work area, limitation of equipment and lack of personnel.

DISCUSSION

Using the result obtained with the Five Whys and the Cause and Effect Diagram, the company created a new layout design which provides a better and faster manufacturing process and better handling of material and tools. The company also generated a new process standard operational procedure which helped its current employees set a new precedent to any new employee. This helps create a culture were the employees maintain a work area clean and organize to increase manufacturing output and create a new tool layout design, which will help with their tool arrangement that will allow a better and more efficient way to access and use for manufacturing process.

To help guarantee that these changes are followed and both, the employees and owner feel they can support each other and improve their culture the following course of action will need to be executed

- Verification of material stored in designated area
- Verification that equipment are placed in designated area
- Verification that employee process workflow is followed

In addition, to guarantee that the changes made to the manufacturing process are effective, a monthly audit will be performed to monitor the above areas and task.

CONCLUSION

This project has provided better insight on what has been going on in the manufacturing process to the company's organization and to its employees. With the implementation based on the results obtained the following benefits are noticeable in the work area: reduction in material stored, increase in production, increase in income, increase safety of

employees, a more comfortable working area, improve screen production cycle time, facilitate material and equipment handling and establish a stronger and different work culture.

If the employees and the managers avoid following the implemented process procedures and standardizations, this will lead the company back to their disorganization and incrementation of execution time (waste) of the manufacturing screen, in addition to any other aluminum work order in execution. Their work will also be affected and issues of finding the correct tools will also arise.

REFERENCES

[1] Tasiu Abdurrahman, U., Jack, A. and Schimd, F. (2018, January). "*Effects of Platform Screen Doors on the Overall Railway System*", Available: https://www.researchgate.net/publication/325937164_Effects_of_platform_screen_doors_on_the_overall_railway_system

[2] "*Corrosion and Chemical Resistant Vinyl Coated Fiberglass Insect Screen*", Available: https://www.wirescreen.org/window-screen/vinyl-fiberglass-insect-screen.html#:~:text=Vinyl%20coated%20fiberglass%20insect%20screening,in%20all%20over%20the%20world.