**Project 1: Situational analysis and root cause analysis to identify and reduce defects in the manufacturing process.**

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Different sorts of defects are common in manufacturing processes. In the manufacturing system, errors are a complete waste. Defects in the outcome of manufactured products negatively affect delivery times and the cost and quality of the products. Consequently, manufacturing companies face a difficult time dealing with their customers ( Vargas et al., 2018). Moreover, the defective products will not comply with the IPC-A-610E standard for the acceptability of components. A manufacturing company in Tijuana, Mexico, faces a similar situation. The company recently has an increasing demand for products they manufacture. Meantime, the company found an increase in several types of defects in the welding process of electronic boards and the components named Thru-Holes. Some of the defects they found include "the solder bridge, missing components, damaged components, lifted components, insufficient solder, and excessive solder." As a result, electronic tests and assembly issues are present in all electronic boards made available as finished goods. When electronic boards are ready with more final product components, fixing all defects is more complex and expensive. In addition, the company must comply with the IPC-A-610E standard for electronic components in which they cannot repair, modify, or make any changes to the final product. Thus, the only option left is to improve their manufacturing process. For this reason, we will perform an appropriate situational analysis and other problem-solving techniques like the Pareto chart and root cause analysis to meet the objective of this research. The two primary objectives are as follows:

1. "Reduce 20% of the defects generated during the welding process in the three double production lines of the Manual Finish area. "
2. "20% increase in the capacity of the three double production lines where electronic boards are processed, without increasing the percentage of defects.: ( Project Rubrics and Case Study.

**Highlights of the Defects: Major cause of the problem in different models and entire facility as obtained from our Pareto chart.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Models** | | | |
|  | 595407-XXX-00 | 595481-00X-00 | 595310-001-00 | Entire Facility |
| **Top**  **20% Defects** | 1. Solder bridge  2. Missing Component  3. Lifted Component  4. Damaged Component  5. Excessive Solder  6. Reversed Component | 1. Solder Bridge  2. Lifted Component  3. Wrong Component  4. Pin Damaged  5. Missing Component  6. Excessive Solder | 1. Excessive Solder  2. Solder Bridge  3. Damaged Component  4. Pin Damaged | 1. Solder Bridge  2. Excessive Solder  3. Missing Component  4. Lifted Component  5. Damaged Component  6. Pin Damaged |
| **No Defects** | 1. Component Broken  2. Pin Hole  3. Long Terminals | 1. Component Misalignment  2. Pin Hole  3. Long Terminals | 1. Billboarding  2. Trace Open  3. Component Broken  4. Long Terminals | 1. Long Terminals |

The table above for the major cause of the problem is reflected by the following Pareto charts for each model as well as the entire facility. The Pareto chart for Model 595407-XXX-00 clearly shows that most of the defects come from the Solder bridge, missing component, lifted component, damaged component, excessive solder, and reversed component. Here the maximum defects are seen on solder bridge and least on excessive solder and reversed components. The company can dedicate its time, effort, and money to these major defect areas to decrease the defects in the entire facility.

Chart

Description automatically generated

Below is the Pareto chart for model 595481-00X-00. The chart clearly shows that most of the defects come from the Solder Bridge, Lifted Component, Wrong Component, Pin Damaged, Missing Component, and Excessive Solder. Here the maximum defects are seen on solder bridge and least on excessive solder. The company can dedicate its time, effort, and money to these major defect areas to decrease the defects in the entire facility.

Chart

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Now, let us look at our third model. The Pareto chart for this model is presented below. Looking at the chart we can say the top 20% of the defects are contributed by excessive Solder, Solder Bridge, Damaged Component, and, Pin Damaged. Here the maximum defects are seen on solder bridge and least on excessive solder and reversed components. Here the maximum defects are seen on excessive solder and least on pin damage. The company can dedicate its time, effort, and money to these major defect areas to decrease the defects in the entire facility.

Chart

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Finally, let us look at the Pareto chart for our entire facility. The following is the Pareto chart for the whole facility. When we compare the entire facility with the individual models above, we see that all three models contribute to the entire facility. Most of the typical top defects in each model are also the common top defects in the entire facility. The next step in the process is to perform a hypothesis test to find the statistical difference in the number of defects between the production line to help find out which line has the highest number of defects so we can have those defects corrected.

Chart, histogram

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**Root Cause Analysis for Manufacturing Process Using the Fish Bone Diagram**

Now is the time to find all the possible causes of our manufacturing defects so that it will be easy for us to find the root cause of the problem. Our effect is manufacturing welding defects. We have identified the different possible causes of the problem. All the categories of causes of the problem are listed by their functions. Next, all the subcategories are listed under each category by brainstorming. The questions were asked regarding each category and subcategory to identify the root causes: Was there any wrong alignment, missed process steps, or wrong documentation in the manufacturing process? After asking questions about each category, we found that the root cause originates from the machine itself and not from any other categories. In the next step, we will perform the 5 “why” analysis to identify the root cause.

Diagram

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**5 Why Analysis**

Now let us ask “why” five times to find the root cause.

1. Why are there defects in welding?

Because of the failed capability of machines to perform welding functions properly.

1. Why is that?

Because the specified calibration failed during machine operation.

1. Why does that happen

Because there was a feed issue?

1. Why does that happen?

Because the alignment control of the electronic board and thru holes failed.

1. Why does that happen?

Because the welding fixture was malfunctioning.

Thus, we conclude that ‘the root cause of the manufacturing welding defect was a malfunctioning fixture. This is one of the improvement opportunities in which the defects could be reduced by replacing the fixture. This opportunity is implemented in the “ Do’ phase of the PDCA cycle, and we check if defects are reduced in the “ check” phase. Below is our why diagram and its reverse to check the applicability of the five whys correctly.

Diagram

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References

Project One Guidelines and Rubric, Project Case Study(n.d.). Retrieved September 19, 2021,

From <https://learn.snhu.edu/content/enforced/1119486-DAT-475-T6752-OL-TRAD-UG.22EW6/course_documents/DAT%20475%20Project%20Case%20Study.pdf?_&d2lSessionVal=Foky8IDox7lAMsimLyoJqBozN&ou=1119486>

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