Quality Project

Phase A-

A huge client of Textile Corporation, Mr. Ajay Rane, complained that almost 20 out of 150 sweatshirts they ordered are missing collar buttons, 4-5 sweatshirts are damaged pieces to the founder and manager of Textile Corporation, Mr. Shreeram Deshmukh and Mr. Ramesh Joshi respectively. Mr. Rane was supposed to export few sweatshirts to US based client yesterday but he couldn't because of these issues. He lost an export opportunity and paid heavy penalty to the clients for the same. This means that the quality performance of the materials of Textile Corporation was not as good as what they agreed upon. Due to this, Mr. Rane says that they are discontinuing this agreement and this was their last assignment to Textile Corporation. Mr. Rane was a very reliable client for Mr. Venkat and they lost a big client in him. Due to this fact, a precise Lean Six Sigma project was necessary to be conducted.

Phase B-

1. We understood the business case
2. We identified the external and internal customers from the business case. Critical to Quality factor was identified from the Voice of Customer.
3. We collected the Define phase data and analyzed it.
4. From the analysis, we prepared a project charter.
5. Using the tool SIPOC we constructed a snapshot of the process.
6. A high level process map was created.
7. We prepared a RACI matrix.
8. We set the Performance Standards.
9. We listed the potential causes for the problem.
10. We prepared a Ishikawa diagram using the list of potential causes
11. We prepared a CI matrix and sorted the potential causes into specific categories.
12. We prepared a data collection plan using the suitable sampling plan.
13. We collected and analysed the Measure data.
14. We performed Stability Analysis using the Run Chart on the collected data.
15. We performed Normality Analysis on the collected data.
16. We prepared a Capability Analysis Chart.
17. We prepared a Histogram for % Quality Score per day
18. We prepared a Box-Plot for all the listed potential causes, saved their graphs and analyzed them.

19. We performed Tests of Equal Variance(Bartlett's Test) for all the listed potential causes except for Wrong Stitching Techniques Used. We performed F test for Wrong Stitching Techniques Used.
20. We summarized the results of the tests of equal variance into a table.
21. We performed One-Way ANOVA Test on all the listed potential causes except for Wrong Stitching Techniques Used. We performed 2 sample t Test for Wrong Stitching Techniques Used.
22. We summarized the results of the tests into a table.
23. We prepared a summary table for listing the significant causes to make an impact on Quality Score.
24. We prepared a Solution Brainstorming Table.
25. Using the brainstormed potential solutions, we prioritized them in the Solution Refining Table.
26. We did Pilot Phase Planning.
27. We collected Improve phase data.
28. We performed Stability Analysis using the Run Chart on the collected data.
29. We performed Normality Analysis on the collected data.
30. We performed a Validation Test using the 2 Sample t Test and 1 Sample t Test on the collected data.
31. We prepared a Capability Test Table.
32. We compared the Phase-Wise sigma value of Measure Phase and Improve Phase.
33. We updated the Process Map.
34. We prepared a FMEA Chart.
35. We collected Control phase data.
36. We prepared a Control Chart on the data, suitable to the nature of the data.
37. We performed Stability Analysis using the Run Chart on the collected data.
38. We performed Normality Analysis on the collected data.
39. We performed a Validation Test using the 2 Sample t Test and 1 Sample t Test on the collected data.
40. We prepared a Capability Analysis Table.
41. We compared the Phase-Wise sigma value of Measure Phase, Improve Phase and Control Phase.
42. We prepared a Combined Individual Chart for Performance of Y.
43. We prepared a Monitoring Plan accordingly to the results.
44. We prepared a Response Plan accordingly to the results.
45. We received Project Sign Off approval from Process Owner, MBB and Finance Manager for project completion.
46. We ended the project.

Phase C-

1. We understand the business scenario to get the context of the background of the agreement between the company and the client. From this, we can understand the main problem more precisely and can conduct the project with much ease. We understand the need for the conduction of the Lean Six Sigma project.
2. This step is necessary to identify the Internal customer, External customer and the Critical to Quality factor. In this case, Mr. Ajay Rane is the External customers and he is complaining that

the quality performance of Textile Corporation is not as good as what they agreed upon to the Internal Customers, Mr. Ramesh Joshi and Mr. Deshmukh. The quality performance of Textile Performance is lower than the agreed Quality Score (≥91%).

3. We collected the Data of the Quality Score of shirts of each day and calculated how many days satisfy the target Quality Score.
4. We prepared a Project Charter to summarize the business case briefly. We made a Problem Statement in which we understand the Quality Score for 55 days out of 92 days is lower than the target Quality Score. We made a Goal Statement in which we declared the target Quality Score and the time it will be achieved. We made a Project Scope in which we understand the In-Scope(Fields to be worked on) and Out-Scope (Fields to be ignored). We clarified the members and their roles and prepared a Project Timeline.
5. SIPOC (Suppliers Inputs Process Outputs Customers). SIPOC is a scoping tool that views the process as a system of process steps, inputs and outputs. SIPOC allows the team to clearly define the process boundaries, link the stakeholders to process, and begin laying out the 'map' of the process itself, at a very high level.
6. A Process Map is a tool for graphically describing a process and used to identify project focus areas.

   A high level process mapping provides shared understanding between the team, a visual layout of the entire process for better communication, illustration of interrelationships of process to get an idea of the data versus the emotions of the customers and identification of bottlenecks and wastes to focus more on the project.
7. RACI matrix is a responsibility assignment chart that maps out every task, milestone or key decision involved in completing a project and assigns which roles are Responsible for each action, which personnel are Accountable and where appropriately, who needs to be consulted or informed. We identify the roles of every member in this project and hold them responsible for the task they are assigned. We make clear when the review meetings will be held.
8. The goal of a performance standard is to translate the customer needs into a measurable characteristic. It specifies the customer wants and a good process to give them what they want. The Defective here is any day with %Quality Score of shirts manufactured<91%.
9. We brainstormed the potential causes for low Quality Score and listed them.
10. We sort the list of potential causes into various groups and categories.This is called the Ishikawa diagram.

    The main categories are as follows:
    - Man/Personal related causes
    - Machine related causes
    - Method or policy related causes
    - Material related, measurement related causes
    - Environment related or external factors
11. The CI matrix gives us an idea of if the potential causes we listed are Controllable or Uncontrollable, High or Low Impactable and Measurable or Immeasurable. This gives us an idea of what causes we really need to focus on.
12. Data Collection Plan is a tool to collect data of causes. It describes exact steps as well as the sequence that needs to be followed. In gathering the data for the given Six Sigma project. Sampling method is decided according to the nature of the data.

13. We collected Measure phase data and listed the various X's and if they meet the SLA compliance or not.
14. We performed Stability Analysis using the Run Chart to find if the data is stable or not. There are 4 P-values in this test:
    - Approx P-Value for Clustering
    - Approx P-Value for Mixtures
    - Approx P-Value for Trends
    - Approx P-Value for Oscillation

    As all the P-Values are greater than 0.05, we can conclude that the data is stable.
15. We performed Normality Analysis to find if the data is normal or not. As the P-Value is greater than 0.05, we can conclude that the data is normal.
16. We prepared a Capability Analysis Chart where we stated that the Defective Definition is a day which has avg. TAT per day>180. We found out that out of the 20 units, 14 are defective and the short term sigma value (as the data is both stable and normal) is 0.948.
17. We prepared a Histogram as X is discrete and Y is continuous. The P-value>0.05 which indicates that the data is normal.
18. We prepared a Box-Plot for all the listed potential causes as X is discrete and Y is continuous. A Box-Plot summarizes information about the shape, dispersion and centering. It also helps spot outliers in the data set. We list all the X's which have a significant impact on Quality Score.
19. We performed Tests of Equal Variance(Bartlett's Test) for all the listed potential causes in which there are more than 2 groups and for Wrong Stitching Techniques Used, we performed F test as there are only two groups. Purpose of performing tests of equal variance is to check whether the observations of specific potential cause are significant enough to make an impact on Quality Score.
20. We summarized the results of all the tests of equal variance into a table as we can see the useful information in a glimpse.
21. We performed One-Way ANOVA Test on all the listed potential causes which have more than 2 levels of X. We performed 2 sample t Test for Wrong Stitching Techniques Used as there are only 2 levels of X. Purpose of performing One-Way ANOVA Tests and 2 sample t Test is to check whether the observations of specific potential cause are significant enough to make an impact on Quality Score.
22. We summarized the results of all the tests of equal variance into a table as we can see the useful information in a glimpse. P-values were less than 0.05 for Faulty Zippers, Improper Button Holes, Wrong Gradation of Sizes, Wrong Stitching Techniques Used and Wrong Colour Combination. The rest had P-values greater than 0.05.
23. We prepared a summary table for all the significant causes to have an impact on Quality Score as we need to work on them.
24. In Solution Brainstorming, we discuss the various possible solutions for the significant causes we have found out. In this step, all the team members sit down and discuss many possible solutions to each of the significant causes.
25. In solution refining, we check for possible cost of implementation, impact of solution, feasibility of solutions, client/senior management’s consent for the solutions we have discussed and listed out in the solution brainstorming session. We calculate the Solution Priority Index to short list the more effective and feasible solutions.

26. Piloting is preparation for the ‘unintended consequences’ of implementing change. It is a test of a potential solution on a smaller scale, in order to better understand the effects of X’s solutions , and to learn how to make the implementation more effective.Data is collected to ensure Y’s performance is under specification limit every day. To track the challenges in deployment and fix them. Cause log and Solution log are maintained simultaneously for fixing challenges. Weekly meetings with operations/production leaders are conducted for the smooth deployment.
27. We collected Improve phase data and listed the significant causes and their TAT.
28. We performed Stability Analysis using the Run Chart to find if the data is stable or not.
    As all the P-Values are greater than 0.05, we can conclude that the data is stable.
29. We performed Normality Analysis to find if the data is normal or not. As the P-Value is less than 0.05, we can conclude that the data is non-normal.
30. Validation tests are performed to ensure that target is achieved and applicable to the total population in improve phase. In the 2 Sample t Test, the P-value is less than 0.05 and therefore, improvement is accomplished for the total population. In the 1 Sample t Test, the P-value is more than 0.05 and therefore, improvement goal is accomplished in improve phase.
31. In the Capability Test Table, we defined Defective as Quality Score<91% and found out that 1 out of 30 units are defective. Hence, we use Short-term sigma value as the data is both stable and normal and get the value as 3.33.
32. We compared the Measure and Improve phase sigma value in a graphical manner and plotted their average.
33. After implementing the solutions, we updated the process map as per our new requirements.
34. The first thing we do in the Control phase is prepare a FMEA chart. FMEA (Failure Mode and Effect Analysis) is a tool to identify potential X’s by considering and quantifying the risks of failure. We calculate the RPN (Risk Priority Number). We rate the severity of the cause of failure and the frequency of occurrence. On the basis of the RPN, the resources are focused on the causes with highest RPN i.e. causes having highest severity.
35. We collected Control phase data
36. Statistical Process Control commonly referred to as SPC are the charts used to prevent overreaction to normal process variation. Control charts are made to test the consistency and the stability of the process. SPC graphically illustrates the difference between special cause and common cause variation. Provides quick detection of unintended process changes as we can see the data point lie outside of the control limit. Control charts are an effective medium to detect any changes in the unintended x’s as it works for both discrete and continuous types of data.
    As the Sample Characteristics are Low Volume and Data plotted is in individual data points, we use I-MR Chart .
37. We performed Stability Analysis using the Run Chart to find if the data is stable or not. As all the P-Values are greater than 0.05, we can conclude that the data is stable.
38. We performed Normality Analysis to find if the data is normal or not. As the P-Value is greater than 0.05, we can conclude that the data is normal.
39. We perform a Validation Test- 2 Sample t Test to check if mean of Quality Score across Measure Phase and Control phase are same or not. As the P-value is less than 0.05, we can conclude that improvement in % Quality Score is sustained.
    We perform a Validation Test- 1 Sample t Test to check whether the defined goal is met, sustained and whether the result is applicable for the total population in the Control phase. As the P-value is

greater than 0.05, we can conclude that we have sustained with the target of 93% in the control phase.

40. We prepared a Capability Analysis Chart where we stated that the Defective Definition is an unit where % TAT Compliance<43%. We found out that out of the 40 units, 8 are defective and the long term sigma value(as the data is non-normal) is 0.84.
41. We compared the Measure, Improve and Control phase sigma value in a graphical manner and plotted their average.
42. Combined individual control chart is made to compare the improvement in various phases i.e. the sole purpose of the combined chart is to track the improvement performance over time for Y over the various phases we have been through.
43. Monitoring plan helps to ensure that solutions that we have found are properly implemented.
44. Response plan is made to provide a response plan for each monitored Y i.e. % Quality score and X the causes.
45. We received Project Sign Off approval from Process Owner, MBB and Finance Manager for project completion.
46. We investigated the project again and checked if no mistakes are made. Then we ended the project and submitted it to the management.