SIX SIGMA IMPLEMENTATION IN A MANUFACTURING ORGANIZATION

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ABSTRACT

Six Sigma was initially developed and implemented successfully by Motorola in 1987. Afterwards its implementation in Allied Signal and GE gave an enormous energy to its expansion in American firms, followed by the rest of world. Firstly when it was developed for manufacturing sector and then it gave very profitable results in service sector (Hospital, finance, Hotels etc.) also, it became a company wide strategy for business excellence. With all these favorable results in America, Europe and other countries, still many companies are susceptible for its implementation especially in developing countries. The point of view of many of these countries' managers is that it is another management tool in new clothing and nothing to do it with our business improvement except burden. This paper presents a practical case study of Six Sigma, in a manufacturing industry and benefits attained through its implementation. In addition problems associated with its implementation are appended.

KEY WORDS: Six Sigma, Manufacturing Organization

INTRODUCTION

Six Sigma, a breakthrough strategy was developed by Motorola to control variations and attack its root causes. Six is the number of sigma measured in a process, when the variation around the target is such that only 3.4 outputs out of one million are defects under the assumption that the process average may drift over the long term by as much as 1.5 standard deviations [9].

The potential benefits of the Six Sigma approach are [10]:

- Cost reduction
- Productivity improvement
- Market share growth
- Customer retention
- Cycle-time reduction
- Defect reduction
- Culture change
- Product/service development

Three criteria's for the selection of Six Sigma projects are [10]:

- There is a gap between current and desired/needed performance.
- The cause of the problem is not clearly understood.
- The solution isn't predetermined, nor is the optimal solution apparent.

SIX SIGMA MOVEMENT IN PAKISTAN

Thai Limited is implementing Six Sigma, since 2000, the first company that initiated Six Sigma implementation in Pakistan. Before Six Sigma implementation a formal Training was conducted for top management, middle

management, supervisors and working staff. Up to now, Thai Limited has successfully completed 25 projects and continually improving their business, increasing profit margins, getting more and more customer satisfaction and increasing productivity of the plant. Other company which carried out in house Six Sigma training was Crescent Textile, in 2002. Now PIQC, in collaboration with SQII, is providing Green and Black belt training. Many organizations are sending their quality professionals for training and they have started implementing Six Sigma in their organizations. Companies are taking interest in its training and implementation.

SIX SIGMA CASE STUDY

Up to now there are many case studies of Six Sigma in Pakistan with much potential benefits. Here only one case study from manufacturing sector will be described for review.

THAL ENGINEERING CASE STUDY

Thai Limited formerly known as Thai Engineering, an industrial unit, was setup by the House of Habib in 1995 as a division of Thai Jute Mills, to progressively manufacture car air-conditioners & Wiring Harness. The Company employs modern management practices and all the employees are professional including the Chief Executive. The average age of the employees is 30. The Company is service oriented. It has taken upon itself the market discipline of 'total solution provider' and has established a 3S centre in the activity hub area, besides being in daily contact with the automakers. Thal Engineering is the producer of automobile air conditioner manufacturers. Along with they are also producing wire harness for some automotives. In air conditioner one item is "Insert Hose Bind". This is used for the supply and reception of refrigerant in compressor. During its manufacturing some faults were observed which were taken as Six Sigma project and corrected with some potential savings. Insert Hose Bind is shown in Figure 1.

Figure 1. Insert Hose Bind

DEFINE PHASE, Project Charter

A project charter is the first step in the Six Sigma methodology. It takes place in the Define step of DMAIC, and the charter can make or break a successful project[6]. It can make it by specifying necessary resources and boundaries that will in turn ensure success; it can break it by reducing team focus, effectiveness and motivation. So what pieces are necessary and what are some tips people

have learned over the years? Alright, let's get down to business. Here are the major project charter areas that are necessary. Author will start with an explanation of each, and then at the end of the article you'll find a template that you can download, print and use today. Project Charter of this project is shown in Table 1.

TABLE 1. Six Sigma Project Charter

Project Name	Increase Productivity of Insert Hose Bind. Number: 2005-03
Goal /Mission	Increase Productivity of Insert Hose Bind up to 40% by June 2005.
Metric for Success	Fulfill the daily requirements
Problem Statement	Production Targets do not meet due to low productivity, poor process capability and high rejection.
Business Case (Bottom-Line Impact)	Production department is our internal customer who gets affected. To produce the hoses on time and defect free, to deliver the consignment on time to our customer.
Deliverables	Revised procedures, processes flow and manufacturing method to increase the productivity up to 40%.
Stakeholders	Production Team Member and OEMs

MEASURE PHASE

The Measure Phase is the second step of the DMAIC improvement cycle and the first step towards the project goal defined in the Define Phase. This Section describes the formulation of the improvement group, measurement of the existing process and the results of a Cause and Effect Diagram.[3]

a. Process Capability

Process capability represents the performance of a process in a state of statistical control or is a measure of the uniformity of quality characteristics of interest. Process capability ratio measured for existing process was 0.79.

b. Control Chart

Control Chart plots a selected quality characteristic, found from subgroups of observations, as a function of sample number. Control charts are some times referred to as Shewhart Control chart, because Walter A.[8] Shewhart first proposed its general theory. Figure 2 shows control chart used to measure lengths of Insert of hose bind and hence shows their trend. These charts were created using “Minitab” software.

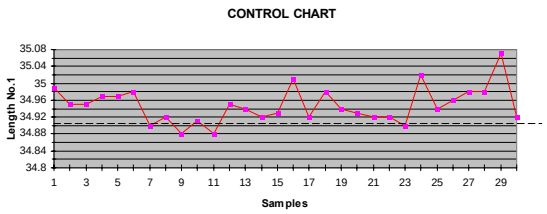

Figure 2. Control Chart

c. Histogram

The first 'Statistical Process Control' SPC technique is the histogram. It describes the variation in the process. The histogram graphically estimates the process capability and, if desired, the relationship with the specification and the nominal (target). Histogram of existing process, generated in Minitab is shown in Figure 3.

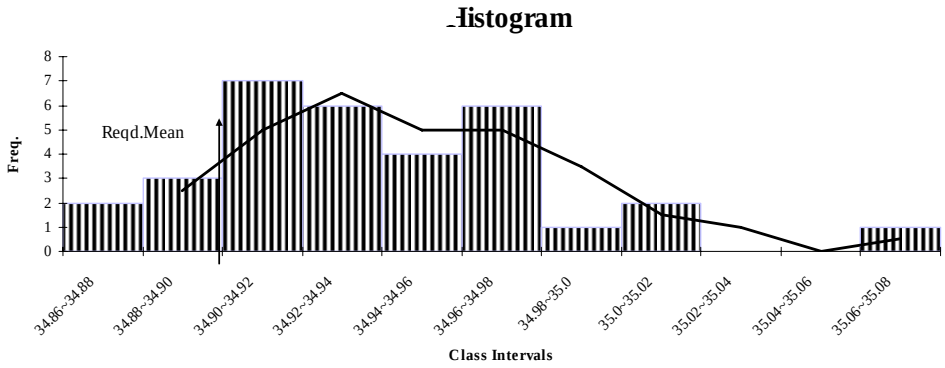

Figure 3. Histogram of Insert Hose Bind Measurements

d. Process Mapping

A process map is considered to be a visual aid for picturing work processes which show how inputs, outputs and tasks are linked. Soliman [3] also describes it as being the "most important and fundamental elements of business process re-engineering". The Process Map of the existing process was viewed and revised by the improvement group assembled in the Measure Phase[2] In the existing process three workers were doing the job and average time for the job completion was 12 minutes. The Process Map is presented in Figure 4.

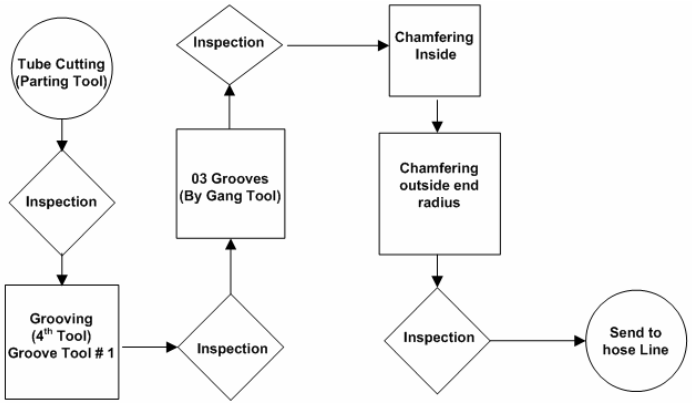

Figure 4. Existing Process Map

IMPROVE PHASE, Process Map

After Tree Diagram Rating of different Options and Poka Yoke,[1] the authors have devised a new improved process flow chart that is shown in the Figure 5.

CONTROL PHASE, Results

After successful implementation of Six Sigma and DMAIC project very good results which include increase in productivity, increase in profit margins, and reduction in errors. These results are key indicators for any industry to follow Six Sigma Implementation.[4] The results are summarized in Table 2.

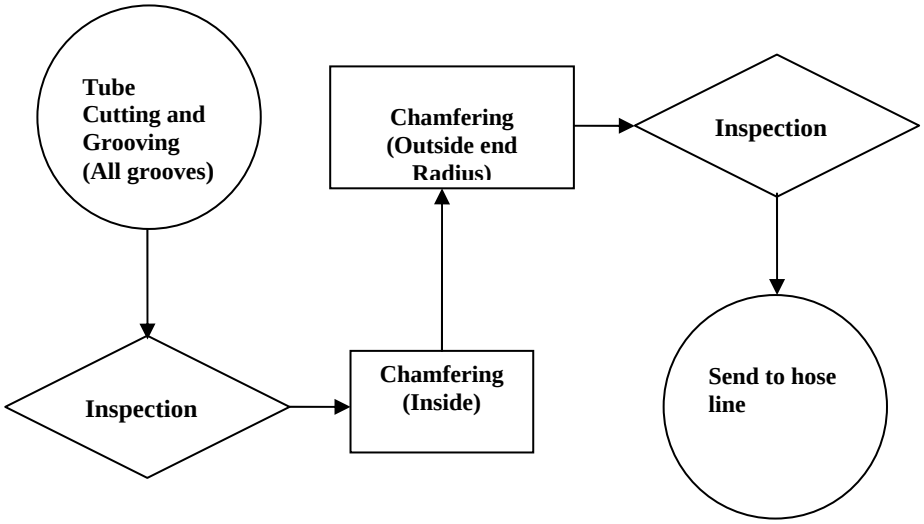

Figure 5. Improved Process Map

TABLE 2. Result achieved through SS Implementation

ELEMENTS	BEFORE SS IMPLEMENTATION	AFTER SS IMPLEMENTATION
Cost per piece (Rs)	13.65	Rs. 2.72
Manpower	3	1
Cp	0.79	2.07
Rejection (%)	4	0
Time per piece (min)	12	04
DPMO	33,333	8
Sigma Level	**3.334**	**5.806**

CONCLUSION

The Six Sigma methodology that has produced such good results for industrial concerns can be modified slightly and applied to service sector also. As in industry, the emphasis must be on the customers' needs. However, as in industry, we recognize the need to justify projects through data collection, communication and potential financial reward to the industry. Although some persons are resistant to promoting projects because of potential financial benefit to the organization, many engineers recognize that we no longer live in ideal conditions in which projects and programs are implemented without regard to cost. Above all, good Six Sigma projects can provide industry administration with the data they need to make effective changes in programming and policy. Above all top management must take keen interest and show commitment in Six Sigma implementation other wise all the efforts will be ruined.

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