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Defining Quality Management in Auto Sector: A Six-Sigma Perception

Amit Kumar Singh[a], Dr. Dinesh Khanduja[b]

[a]*Department of Mechanical Engineering, National Institute of Technology, Kurukshetra, Kurukshetra 136119, India*
[b] *Department of Mechanical Engineering, National Institute of Technology,Kurukshetra, Kurukshetra 136119, India*

Abstract

In present age of competition and economic turbulence, achieving manufacturing excellence through better quality and productivity is the new paradigm of the industries. All types of organizations are striving hard to control costs, maintain high levels of productivity, meet changing expectations of the customers and attain quality bench marks to sustain in the market. In this context, Six-Sigma can be a powerful world class quality improvement business strategy that enables companies to use simple but powerful statistical methods to define, measure, analyze, improve and control (DMAIC) processes for achieving operational excellence. On seeing the tremendous financial gains reaped through Six-Sigma programs in large manufacturing sector, it is urgently required to replicate this strategy in small scale automobile sector too. The contribution of small scale industries to the Indian economy cannot be ignored as this sector is strategically placed in the industrial population of the country and in the global economy as a whole.

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Keywords – Six Sigma; Quality; Quality Management; Automobile Industries

1. Introduction

Quality in business, engineering and manufacturing has a practical interpretation as the non-inferiority or superiority of something; it is also defined as fitness for purpose. Quality is a perceptual, conditional and somewhat subjective attribute and may be understood differently by different people. Consumers may focus on the specification quality of a product/service, or how it compares to competitors in the marketplace. In the present ever changing and highly competitive environment it is imperative that the companies continuously improve themselves for survival and growth. Quality and cost are the two key elements for the success of any manufacturing industry. Industries are adopting different systems such as ISO 9000, TQM, and etc. to improve quality. Numerous definitions and methodologies have been created to assist in managing the quality-affecting aspects of business operations. Many different techniques and concepts have evolved to improve product or service quality. There are two common quality-related functions within a business. One is quality assurance which is the prevention of defects, such as by the deployment of a quality management system and preventative activities like failure mode and effects analysis (FMEA). The other is quality control which is the detection of defects, most commonly associated with testing which takes place within a quality management system typically referred to as verification and validation.

* Corresponding author. Tel.: +91-9802792087.
*E-mail address:*amitsingh54321@gmail.com

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The business meanings of quality have developed over time. Various interpretations are given below:

American Society for Quality (2008): "A subjective term for which each person has his or her own definition. In technical usage, quality can have two meanings:

a. The characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

b. A product or service free of deficiencies.

ISO 9000: "Degree to which a set of inherent characteristics fulfills requirements." The standard defines requirement as need or expectation.

Genichi Taguchi (1992), with two definitions:

a. “Uniformity around a target value.” The idea is to lower the standard deviation in outcomes, and to keep the range of outcomes to a certain number of standard deviations, with rare exceptions.

b. “The loss a product imposes on society after it is shipped.” This definition of quality is based on a more comprehensive view of the production system.

Gerald M. Weinberg (1991) "Value to some person".

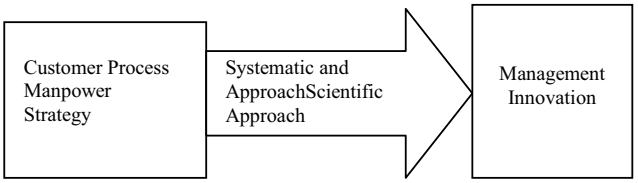

Fig. 1 Systematic and Essence of Six-Sigma

Six-Sigma is viewed as a systematic and scientific approach for management innovation by the integration of four elements; customer, process, manpower and strategy as shown in figure 1.

2. Quality Management Tools

The term quality management has a specific meaning within many business sectors. This specific definition, which does not aim to assure 'good quality' by the more general definition, but rather to ensure that an organization or product is consistent, can be considered to have four main components: quality planning, quality control, quality assurance and quality improvement. Quality management is focused not only on product/service quality, but also the means to achieve it. Quality management therefore uses quality assurance and control of processes as well as products to achieve more consistent quality. And adopts a number of management principles that can be used by top management to guide their organizations towards improved performance. The principles include:

- Customer focus: Since the organizations depend on their customers, therefore they should understand current and future customer needs, should meet customer requirements and try to exceed the expectations of customers. An organization attains customer focus when all people in the organization know both the internal and external customers and also what customer requirements must be met to ensure that both the internal and external customers are satisfied.
- Leadership: Leaders of an organization establish unity of purpose and direction of it. They should go for creation and maintenance of such an internal environment, in which people can become fully involved in achieving the organization's quality objective.
- Participation of people: People at all levels of an organization are the essence of it. Their complete participation enables their abilities to be used for the benefit of the organization.
- Process approach: The desired result can be achieved when activities and related resources are managed in an organization as process.
- System approach to management: An organization's effectiveness and efficiency in achieving its quality objectives are contributed by identifying, understanding and managing all interrelated processes as a system.
- Continual improvement: One of the permanent quality objectives of an organization should be the continual improvement of its overall performance.
- Mutually beneficial supplier relationships: Since an organization and its suppliers are interdependent, therefore a mutually beneficial relationship between them increases the ability of both to add value.

3. DMAIC – Six-Sigma Steps

The discipline of Six-Sigma views every business activity as a process, that once optimized and controlled, reduces cost. Hence, Six-Sigma itself is a process that is often briefly described by the acronym DMAIC, which stands for define, measure, analyze, improve, and control. First, the stability testing process, or process issue, needs to be defined. Second, since stability testing itself is a measuring process, its capability needs to be measured. Third, the capability of the process needs to be analyzed in order to determine if it is delivering what is required (accurate stability predictions or estimates), and if not, improve. Finally, control the stability testing process by insuring that the improvements that have been implemented are maintained through time. DMAIC is a process for continued improvement shown in figure 2. It is systematic, scientific and fact based. This closed-loop process eliminates unproductive steps, often focuses on new measurements, and applies technology for improvement.

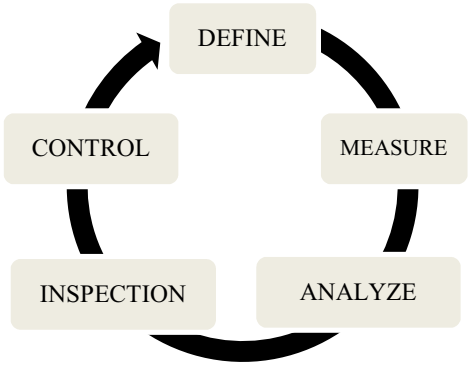

Fig. 2 Five Phases of DMAIC

DMAIC refers to a data-driven improvement cycle used for improving, optimizing and stabilizing business processes and designs. The DMAIC improvement cycle is the core process used to drive Six-Sigma projects. DMAIC is not exclusive to Six-Sigma and can be used as the framework for other improvement applications. It implements the idea of continuous process improvements. Processes are constantly monitored for possible improvement possibilities.

Table 1 Key Step of DMAIC Processes

Steps	Key Processes
Define	• Define the requirements of the customer • Define the project boundaries • Define the process by mapping the business flow
Measure	• Measure the process to satisfy customer's needs • Develop a data collection plan • Collect and compare data to determine issues and shortfalls
Analyze	• Analyze the causes of defects and sources of variation • Determine the variations in the process • Prioritize opportunities for future improvement
Inspection	• Improve the process to eliminate variations • Develop creative alternatives and implement enhanced plan
Control	• Control process variations to meet customer requirements • Develop a strategy to monitor and control the improved process • Implement the improvements of systems and structures

The main benefit of DMAIC is that it contributes to the creation of a conceptual framework for consistent performance measurement, improvement, and control. DMAIC is an abbreviation for these five phases of the DMAIC project methodology in table 1.

4. Six-Sigma and Quality Management

Six-Sigma is very popular in Korean industry. There are several reasons for this popularity. First, it is regarded as a fresh quality management strategy which can replace TQC, TQM and others. In a sense, we can view the development process of Six-Sigma as shown in figure 3. Many companies which were not quite successful in implementing the previous management strategies such as TQC and TQM are eager to introduce Six-Sigma.

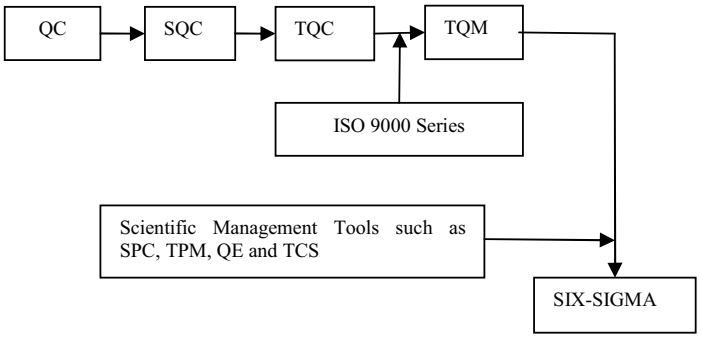

Fig.3 Development process of Six-Sigma in quality management

QC: quality control
SQC: statistical quality control
TQC: total quality control
TQM: total quality management
ISO: International Organization for Standardization
SPC: statistical process control
TPM: total productive maintenance
QE: quality engineering
TCS: total customer satisfaction

5. A Case Study

About the company

Premier Instruments & Controls (PRICOL) is engaged in the business of manufacturing Dashboard Instruments & Accessories, Oil Pumps and Idle Speed Control Valve Assembly. The company promoted by late N Damodaran and L G Varadarajulu in 1972 has commenced commercial production in 1975. Primarily an automobile ancillary unit, it diversified into electronic control instruments, precision machine tools, panel and sensor instruments for defense and industrial gauges. It plants at Coimbatore, Tamil Nadu, Gurgaon and Haryana, manufactures and assemble dashboard instruments. The company came out with a rights issue in March 1995 to augment its long-term resources and to meet additional working capital requirements. The company entered into technical collaboration with various foreign companies like N S International, US; Denso Corporation, Nippon Seiki Co. Ltd, Toyoda Gosei Co., Kojima Press Indutries, all of Japan and Deok Chang Machinery Co. of Korea to upgrade its technology. The company has marketing agents in Germany, France, Italy, Netherlands, UK, US, Finland, Turkey, Egypt, Syria, Malaysia, Belgium and South Africa. The company's new product - Disk Brake is under testing at various two-wheeler manufacturers and the commercial supplies are expected to be commencing soon. The name of the company has been changed from Premier Instruments & Controls Ltd to PRICOL Ltd.

Define Phase

In the Define phase, Six-Sigma refines the problem statement & identifies the factors which are critical to quality. This also ensures the business goal, priorities & expectations. Three major outputs from the define stage are:

- Process Map
- High Level Process Map – SIPOC (Supplier, Input, Process, Output, Customer) diagram
- Components used for Variation in Thrust clearance of F2 Speedo system spindle sub assembly.

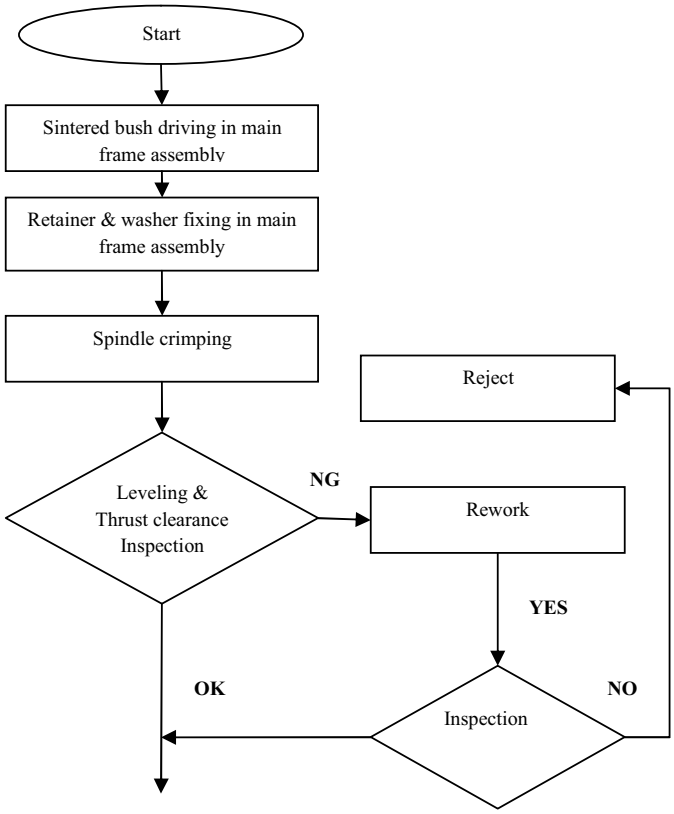

Fig. 4 Process Map

Process map virtually describes the flow of activities of a process. A process can be defined as a sequence and interactions of related process steps, activities or tasks that make up an individual process, from beginning to end. A process map is read from top to bottom or left to right. Process map for making hood latch lock is shown in figure 4.

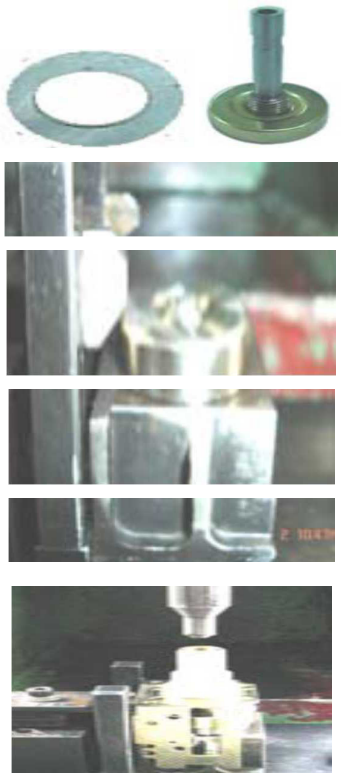

Fig .5 F2 Speedo System Spindle Sub Assemblies

F2 Speedo system spindle sub assemblies are shown in figure 5. In this figure the different parts are Retainer upper washer, Under washer, Spindle assembly and Sintered bush in main frame assembly.

Table 2 Project Analysis

Phase	Dec.13				Jan. 14				Feb. 14			
	w1	**w2**	**w3**	**w4**	**w1**	**w2**	**w3**	**w4**	**w1**	**w2**	**w3**	**w4**
Define												
Measure												
Analyze												
Improve												
Control												

Project analysis shown in the above table 2 in which the whole steps expressed from define phase to control phase with duration.

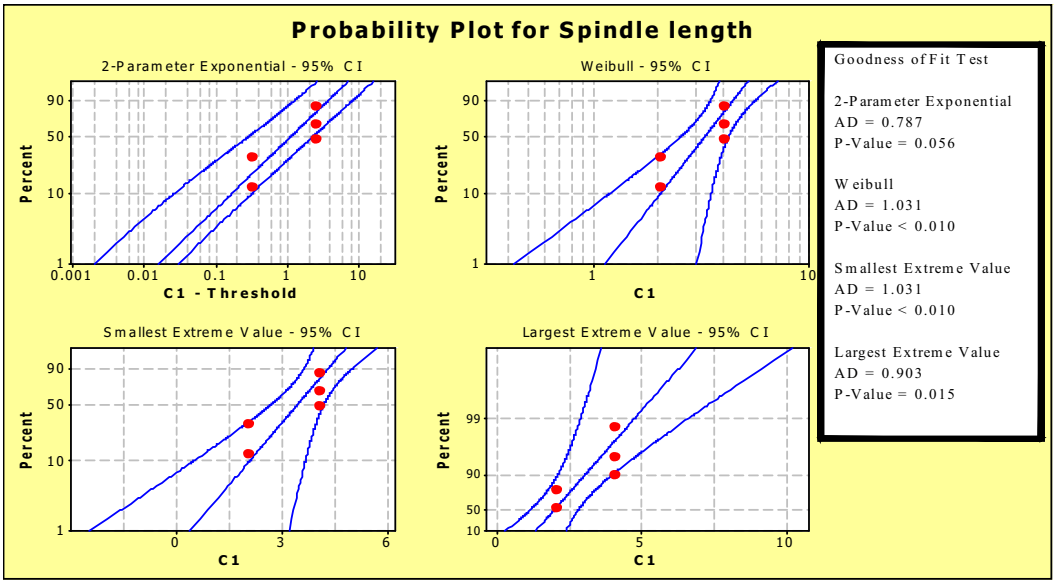

Fig. 6 Probability Distribution Chart for Completion of the Define Phase

Probability distribution chart drown in the figure 6 in which explain the variation of spindle length.

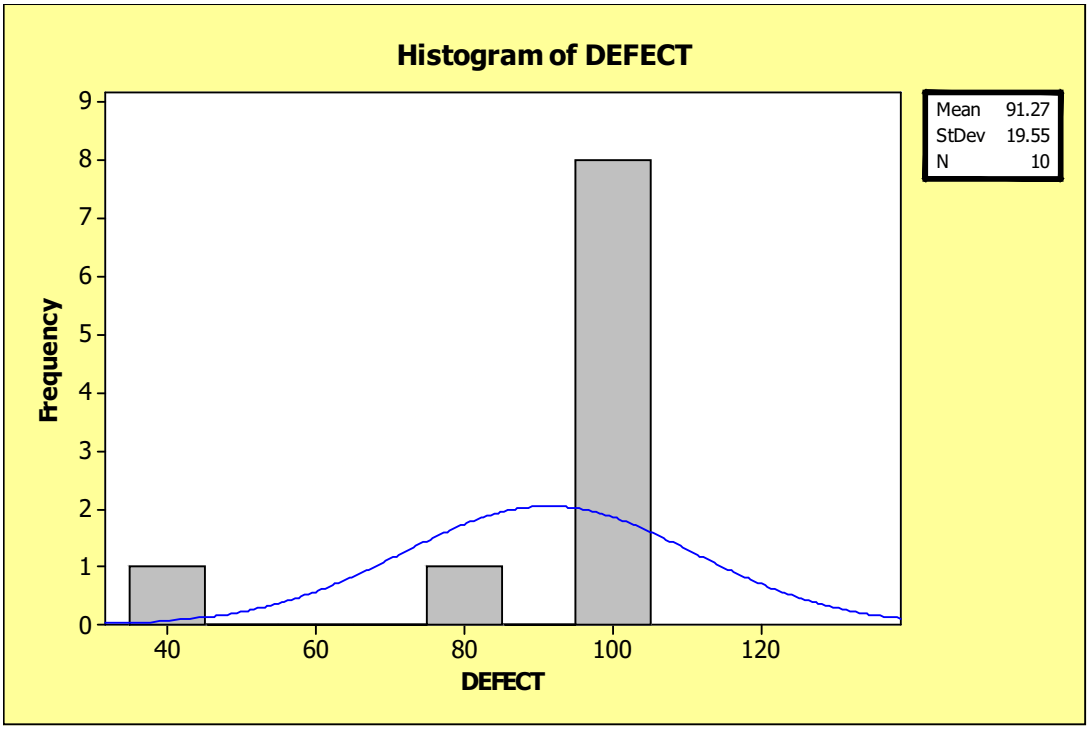

Fig. 7 Histogram Chart with Normal distribution Curve in Problem Define Phase

In the above figure 7 the variation of defects expressed in the terms of Normal Distribution curve with Histogram chart.

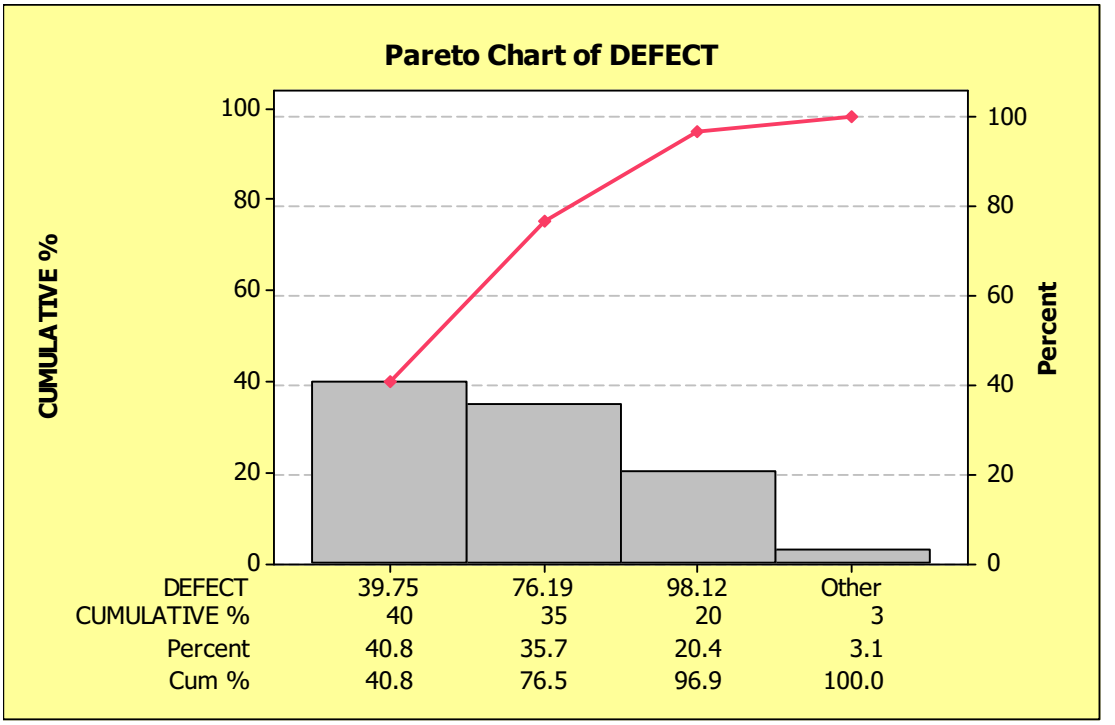

Fig. 8 Pareto Chart for Last Two Month in Problem Define Phase

Part number selected for study is 401218SA01A, other similar part numbers having the problem417374SA01A. The process stage where the Problem is detected Spindle Crimping Stage current average rework for last 2 months is 34 %. Maximum and minimum rework in last two months, maximum rework in a month - (37.99%) Dec.13 and minimum rework in a month - (31.16%) Jan. 14.

5. Conclusions

For auto sector to be globally competitive, operational excellence is the basic success mantra. They should endeavor for customer pleasure rather than satisfying them, they should now drop the slogan of satisfying customers. At the same time, overall economics also need to be kept under constant watch. For global competitiveness, many techniques, such as Quality Circles, TQM, ISO Certifications, etc. are being tried. But still, the focus remains on specific problem solving. The need of the hour is to strike global optima and not to waste time, money and energy in finding local optima. The auto sectors need advance strategy, which can have multidirectional benefits in shorter duration. In the present work, an initiative has been taken to apply Six-Sigma in auto sector manufacturing firm to reduce the level of defects In this an attempt has been made to initially apply define phase. Six-Sigma with the help of quality management improving productivity and quality at very high level and achieving customer delight for auto sector which are always susceptible by large scale industries.

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