Production & Industrial Engineering

Quality and Reliability

Comprehensive Theory

with Solved Examples and Practice Questions

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Quality and Reliability

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CHAPTER 02

Quality Management

INTRODUCTION

Statistics

Statistics means a good amount of data to obtain reliable results. The science of statistics handles this data in order to draw certain conclusions. Statistical techniques find extensive applications in quality control, production planning and control, business charts, linear programming, etc.

Quality

Quality is a relative term and is generally explained with reference to the end use of the product. e.g. a gear used in a sugarcane juice extracting machine though not of the same material and without possessing good finish, tolerance and accuracy as that of a gear used in the head stock of a sophisticated lathe may be considered of good quality if it works satisfactory in the juice extracting machine.

Thus, a component is said to be of good quality if it works well in the equipment for which it is meant. Quality is thus defined as fitness for purpose.

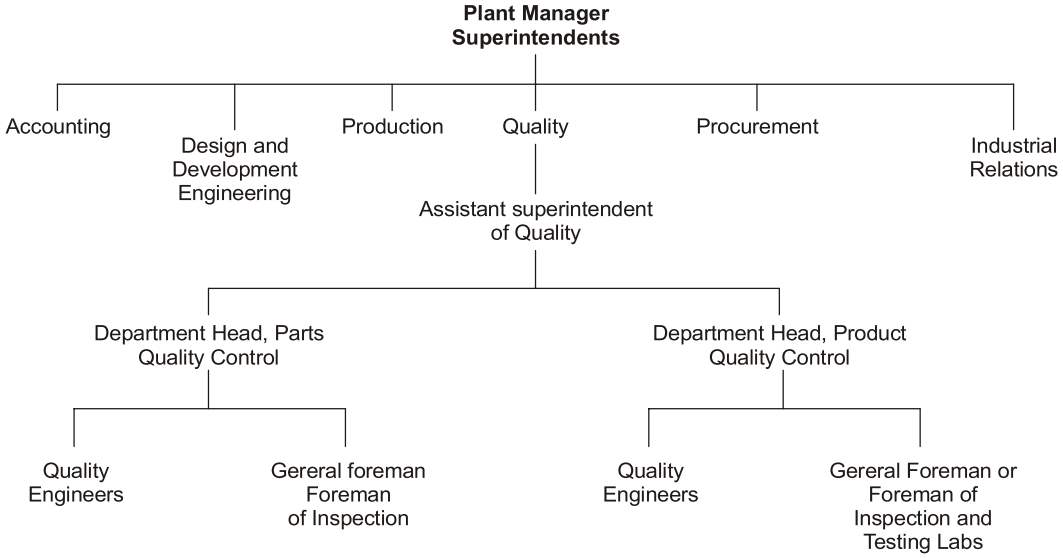

Fig. Origanization of an inspection department

Aiming at improving organizational performance through the effective use of production capability and technology, operations strategy such as total quality management (TQM), quality function deployment (QFD), six sigma, business process re-engineering (BPR), just in time (JIT), benchmarking, performance measurement and

many others are commonly used. The concept of quality has evolved from mere specifications, controls, inspections, systems, and methods for regulatory compliance to a harmonized relationship with business strategies aimed at satisfying both the internal and external customer. Today, quality and value are, first and above all, givens, and the customer expects them. Quality in the successful organization is fully integrated into all of the business processes and is an extension of everything else that has to happen along the path to success, both for the company and for the people involved.

2.1 Quality Philosophy by Different Quality Gurus

In this section we will discuss the insights regarding managing and improving quality proposed by various quality gurus, which are as follows.

1. The Deming Philosophy
2. The Juran Philosophy
3. The Crosby Philosophy
4. The Ishikawa's Philosophy

2.1.1 The Deming Philosophy

- Deming emphasized that all stakeholders and all departments in an organization should be considered as a part of one whole system. The stakeholders and departments should work together towards a common goal to optimize the performance of system.
- As per Deming, variation of any form caused due to any reason can lead to increase in the costs. It is important to understand the variation, and identify the source or cause of variation. Identify the cause of variation and make changes in the process, technology, people, material, methods or measurement systems.
- It is important to understand the psychology of people. Proper nurturing of people will help employees to enjoy work by exhibiting their innate attributes, which may have quality impact on quality performance.
- Deming also suggested that management decisions should be supported with data, facts and justifiable theories.

Deming propounded on '14 points for management' to meet customer needs and for continuous improvement which are given below in table.

Table. Deming's points on quality management

Deming Points	Description
Consistency	• Continuous improvement in all areas of business. • Ensure that the company's vision of quality is understood by all in an organization.
Learning new philosophy	• Bring new ways of thinking by learning new approaches or by encouraging innovations.
Minimize cost of inspection	• Eliminate unnecessary inspections that adds to non-value added costs. • Improve the process which leads to less number of defects.
Price should not be only criteria for purchasing	• Purchasing decisions only based on low price may actually result in costs due to inferior materials realized during production process in the form of expensive inspection, rework, and scrap. • Encourage reduction of total cost of ownership. • Emphasize on partnership with few suppliers providing good quality products or services.
Improve constantly	• Understand customer needs through market surveys and feedback to incorporate service design process. • Eliminate wastes in all the functional areas.
On-the-job training	• Institute training for employees on diagnosing, analyzing and solving quality related problems on continual basis. • Evaluate training programs or effectiveness of training using statistical methods.
Good leadership as facilitators	• Good leadership and guidance should facilitate workforce to learn by eliminating fear and by encouraging team work.
Drive out fear	• Encourage workforce to communicate their problems share new ideas without fear.

Remove functional silos	• Remove barriers between individuals and between departments. • Encourage team work to have common goal.
Eliminate exhortations	• Remove barriers between individuals and between departments. • Encourage team work to have common goal of meeting customer needs and improving process performance.
Eliminate numerical targets	• Slogans and posters may cause resentment to employees as most of the system related problems are not under their control.
	• Setting numerical goals may result in resentment and frustration in employees and may affect quality.
Instill sense of pride in workmanship	• Encourage empowerment. • Provide sense of ownership to the employees work processes.
Provide education	• Educate workforce outside of specific job skills like self-development.
Top management commitment	• Top management should be committed of continuous improvement as any cultural change begins with top management and then percolates to whole organization.

2.1.2 The Juran Philosophy

Juran took a pragmatic approach towards quality by focusing on accounting and analysis of quality costs. Juran defines quality as "fitness for use", which can be classified into four categories as shown below in figure.

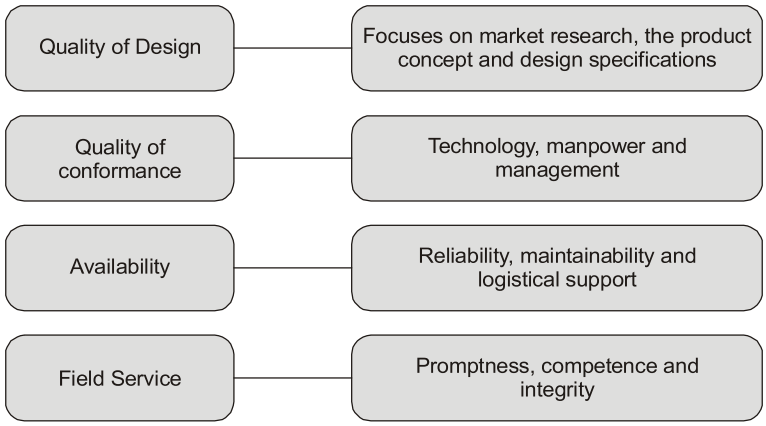

Fig. Jurans classification of quality

Juran linked quality trilogy with cost of poor quality in the form of waste. Once the operation begins for any product after quality design 20% of work has to be repeated due to quality deficiencies leading to chronic waste. To prevent the process from going out of control, quality control is implemented to bring the process back within control limits.

2.1.3 The Crossby Philosophy

Crosby's philosophy can be related with the concepts of 'do it right first time' and 'zero defects'. Crosby defines quality with Absolutes of quality management and these Absolutes are presented below.

1. Quality means conformance to the requirements, which can be achieved by stating and understanding these requirements clearly.
2. There is nothing like quality problems. The problems or causes of problems originate from different departments. Quality department should measure conformance and report results.
3. Doing the jobs right at first time will not incur any costs hence there is nothing like economics of quality. The cost of quality is the expense of nonconformance.
4. The performance standard must be zero defects. Organizations should concentrate on preventing defects rather than finding and fixing them.

2.1.4 The Ishikawa Philosophy

Professor Ishikawa pioneered quality circle which is a voluntary group of some workers or employees, also named as corrective action teams. The quality circles can belong to a specific department or they may be limited in scope to problems within that department. There can be quality circles at cross functional level. The teams meet once a week to identify a set of problems and select one to work on using standardized problems solving methodology. Ishikawa devised Pareto diagrams and cause-and-effect diagrams to emphasize on good data collection and presentation techniques. These easy to use tools assist quality circles in cost reduction, identifying the causes of defects and quality improvement.

So, the definitions of quality as given by various quality gurus can be summarized as follows:

- Quality is fitness for use (JURAN)
- Quality is conformance to requirements (CROSBY)
- The efficient production of the quality that the market expects (DEMING)
- Quality is what the customer says, it is (FEIGENBAUM)
- Quality is the loss that a product costs to the society after being shipped to the customer (TAGUCHI)
- The totality of features and characteristics of a product or services that bear on its ability to satisfy stated or implied needs of the customers (ASQC)
- A quality system is the agreed on company wide and plant wide operating work structure, documented in effective, integrated, technical and managerial procedures for guiding the co-coordinated actions of people, the machines, or the information of company in the best and most practical ways to assume customer quality satisfaction and economical costs of quality. (FEIGENBAUM)

2.2 Dimensions of Quality

2.2.1 Dimensions of Product Quality

As prescribed by Garvin, the eight dimensions of quality are:

- Performance (will the product do the intended job?)
- Reliability (how often the product fails?)
- Durability (how long the product lasts?)
- Serviceability (how easy is to repair the product?)
- Aesthetics (what does the product look like?)
- Features (what does the product do?)
- Perceived quality (what is the reputation of a company or its products?)

Garvin (1984) also provides discussion of eight critical dimensions of product quality. The summarized key points concerning these dimensions of quality is provided below.

1. **Performance (will the product do the intended job in field?)**
   This we have already discussed. It talks about evaluation of product or service performance with respect to certain specific functions and determine how well it performs from customer's perspective.
2. **Reliability (how often the product can fail within a stipulated time?)**
   It talks about probability of not failing of components of say automobiles or airbus while on service for a specified time period. Less the reliability, more the chances of repair or replacement.
3. **Durability (how long can the product last?)**
   This is the effective life of the product or longevity before it is declared as unfit for use. Repair is not possible after this phase of life.