Chapter 1

Quality Improvement in the Modern Business Environment

LEARNING OBJECTIVES

After completing this chapter you should be able to:

1. Define and discuss quality and quality improvement
2. Discuss the different dimensions of quality
3. Discuss the evolution of modern quality improvement methods
4. Discuss the role that variability and statistical methods play in controlling and improving quality
5. Describe the quality management philosophies of W. Edwards Deming, Joseph M. Juran, and Armand V. Feigenbaum
6. Discuss total quality management, the Malcolm Baldrige National Quality Award, Six-Sigma, and quality systems and standards
7. Explain the links between quality and productivity and between quality and cost
8. Discuss product liability
9. Discuss the three functions: quality planning, quality assurance, and quality control and improvement

IMPORTANT TERMS AND CONCEPTS

Acceptance sampling
Appraisal costs
Deming's 14 points
Designed experiments
Dimensions of quality
Fitness for use
Internal and External failure costs
ISO 9000:2005
Nonconforming product or service
Prevention costs
Product liability
Quality assurance
Quality characteristics
Quality control and improvement
Quality engineering
Quality of conformance
Quality of design
Quality planning
Quality systems and standards
Six-Sigma
Specifications
Statistical process control (SPC)
The Juran Trilogy
The Malcolm Baldrige National Quality Award
Total quality management (TQM)
Variability

COMMENTS

The modern definition of quality, "Quality is inversely proportional to variability" (text p. 6), implies that product quality increases as variability in important product characteristics decreases. Quality improvement can then be defined as "… the reduction of variability in processes and products" (text p. 7). Since the early 1900's, statistical methods have been used to control and improve quality. In the Introduction to Statistical Quality Control, 7th ed., by Douglas C. Montgomery, methods applicable in the key areas of process control, design of experiments, and acceptance sampling are presented.

To understand the potential for application of statistical methods, it may help to envision the system that creates a product as a "black box" (text Figure 1-3). The output of this black box is a product whose quality is defined by one or more quality characteristics that represent dimensions such as conformance to standards, performance, or reliability. Product quality can be evaluated with acceptance sampling plans. These plans are typically applied to either the output of a process or the input raw materials and components used in manufacturing. Application of process control techniques (such as control charts) or statistically designed experiments can achieve significant reduction in variability.

Black box inputs are categorized as "incoming raw materials and parts," "controllable inputs," and "uncontrollable inputs."

The quality of incoming raw materials and parts is often assessed with acceptance sampling plans. As material is received from suppliers, incoming lots are inspected then dispositioned as either acceptable or unacceptable. Once a history of high quality material is established, a customer may accept the supplier's process control data in lieu of incoming inspection results.

"Controllable" and "uncontrollable" inputs apply to incoming materials, process variables, and environmental factors. For example, it may be difficult to control the temperature in a heat-treating oven in the sense that some areas of the oven may be cooler while some areas may be warmer. Properties of incoming materials may be very difficult to control. For example, the moisture content and proportion of hardwood in trees used for papermaking have a significant impact on the quality characteristics of the finished paper. Environmental variables such as temperature and relative humidity are often hard to control precisely.

Whether or not controllable and uncontrollable inputs are significant can be determined through process characterization. Statistically designed experiments are extremely helpful in characterizing processes and optimizing the relationship between incoming materials, process variables, and product characteristics.

Although the initial tendency is to think of manufacturing processes and products, the statistical methods presented in this text can also be applied to business processes and products, such as financial transactions and services. In some organizations the opportunity to improve quality in three areas is even greater than it is in manufacturing.

Various quality philosophies and management systems are briefly described in the text; a common thread is the necessity for continuous improvement to increase productivity and reduce cost. The technical tools described in the text are essential for successful quality improvement. Quality management systems alone do not reduce variability and improve quality.