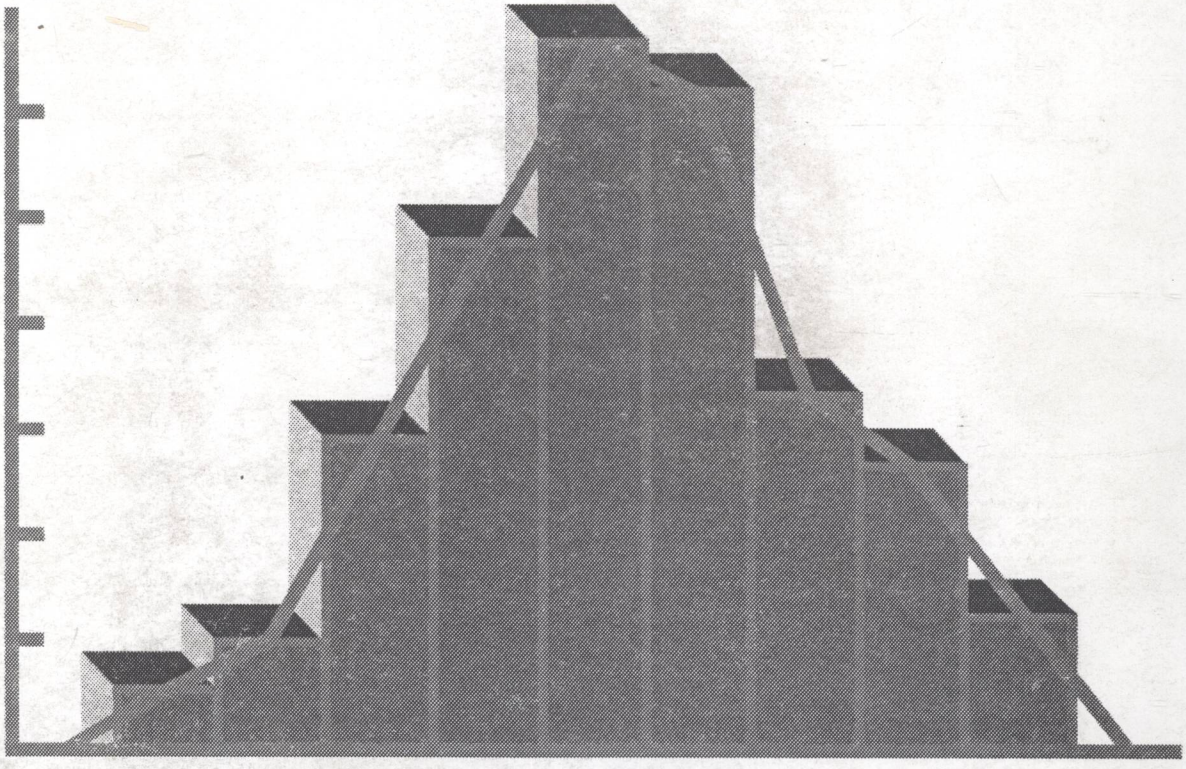
Introduction to

Quality

Management, Assurance, and Control



HUTCHINS

Introduction to Quality
Control, Assurance, and Management

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Preface

The challenges, excitement, and opportunities in quality technology and management are increasing yearly. In the 1990s, all organizations face the issues of improving product and service quality, containing costs, and enhancing innovation. Quality and competitiveness are now synonymous.

The discipline of quality has evolved and expanded rapidly from inspection to company-wide quality management. Not too many years ago, quality was inspected into a product after it was made. Then quality was controlled in the manufacturing process. Now quality is a company-wide phenomenon encompassing every person and every element of the organization.

Because quality topics and technologies have increased as quickly as the importance of the field, this book covers traditional topics in inspection, quality control, and quality assurance as well as current topics in company-wide quality management. This text covers the mechanics of quality problem solving while emphasizing the importance of quality management and quality decision making.

Throughout the book, I have tried to present important technical material in a fun, readable, simple, stimulating, and instructive manner. I have tried to enliven a very important topic and show its relevance in a number of areas, as well as to cover the fundamental technologies. I believe that if technical concepts are made relevant and interesting, they can be learned more easily and remembered longer.

Introduction to Quality: Management, Assurance, and Control is designed for a first, one quarter course in quality for students majoring in technology and

engineering. However, the coverage and level of topics may make it appropriate for students as an introduction to any quality course in any field.

My primary objective is to introduce, integrate, and explain quality management, assurance, and control principles in the clearest possible manner, and to provide students with an introductory text that will assist them in applying quality analysis to real-world problems.

The mathematical prerequisite is a basic algebra course. Computational procedures are presented and demonstrated only to the extent that they help students understand quality principles. Formulas are derived intuitively and are presented in their simplest form.

Within each chapter, difficult quality subjects begin with a discussion and are followed by an industry example and finally by a numerical example. Progressively more difficult topics are gradually introduced.

Special features of the text are:

- **Real-life examples.** The importance and application of statistical techniques are illustrated by real-life examples.
- **Key concept emphasis.** Key concepts of customer satisfaction, management of quality, defect prevention, and continuous improvement are constantly emphasized. They are incorporated into the text and are highlighted in the Spotlight special features.
- **Key word highlights.** Key words are boldfaced throughout the text, explained in context, and defined succinctly in the Key Terms section at the end of each chapter.
- **Concept summary.** Key concepts are reviewed and summarized at the end of each chapter.
- **Discussion questions.** At the end of each chapter, problems emphasize computational skills, while discussion questions stress conceptual understanding. These sections can serve as the basis for classroom discussions or for homework assignments.

I thank Steve Helba and Sharon Rudd for their unwavering support of this project.

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You, the instructor and students, are my customers. I want to hear from you. Please send your comments to me or to the publisher.

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About the Author

Greg Hutchins was an instructor at Portland Community College in Mathematics and Technology. For the past five years he has been a principal with Quality Plus Engineering in Portland, Oregon. Quality Plus Engineering is a quality engineering and management firm that provides consulting services to Fortune 500 companies and small businesses.

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Quality Management

In the global marketplace, the issue of quality is changing, continuously adapting to customer needs and expectations. Several important trends are accelerating this change.

Customer demand for quality is increasing. Quality is being enhanced through increased product performance, design, usability, reliability, and maintainability.

Defect prevention is replacing defect inspection as the means to pursue continuous quality improvement. Many organizations are eliminating incoming, in-process, and final inspection. Responsibility for quality is being placed on the person doing the work, whether assembling, fabricating, managing, servicing, or delivering.

Company-wide quality management is replacing quality assurance. Quality management is a broader concept than quality assurance or control. It not only implies controlling and assuring, but it also includes organizing, monitoring, coordinating, and even "cheerleading" quality.

WHAT IS QUALITY?

The term **quality** can be defined in various ways, depending on the perspective of the user. Quality is

- □ Conformance to applicable specifications and standards

- ☐ Fitness for use
- ☐ Satisfaction of customer wants, needs, and expectations at a competitive cost

Conformance. Every organization, whether profit, nonprofit, manufacturing, service, private, or public, has **specifications** and **standards.** Organizations develop these to measure performance and to correct deviations from expected levels of performance. For example, in a manufacturing operation, specifications detail dimensional limits or physical attributes of a quality characteristic of a part. In a service operation, standards dictate approved methods of behavior or service.

Fitness for Use. Joseph Juran, an eminent authority on quality management, coined the phrase "fitness for use" to define quality. This is a market- or customer-based definition. A product or service is fit for use if it satisfies customer needs and requirements.

An interesting point is that a product might be fit for use in terms of satisfying the customer, but not conform to the specification. A surface finish specification was developed for a consumer product. The condition of the surface finish is important because it enhances the product's appearance and hence its marketability. The specification was written to include all surfaces, both external and internal. However, if the inside product surface is blemished, but it cannot be seen by a customer and does not adversely influence the buy decision, the nonconformance is accepted. So a product with a blemish may be fit for use if the blemish does not affect performance, safety, or marketability.

Customer Satisfaction at a Competitive Price. Another definition says that product or service quality is the producer's ability to satisfy customer needs while still being able to realize a profit. This definition has both a customer and a manufacturer orientation. While the customer is the reason for the organization's existence, the product manufacturer and service provider must still make a profit.

This definition focuses on satisfying the customer at a competitive price. Many customers will not purchase a product or service unless it is reasonably priced.

HISTORY OF QUALITY

Early Quality

Quality techniques were first used in ancient times. Four thousand years ago, the Egyptians measured the rocks used in their pyramids. Then the Greeks and Romans measured buildings and aqueducts to ensure they conformed to requirements. Later, craft guilds in Renaissance Europe specified, measured, controlled, and assured the quality of paintings, cloth, tapestries, sculpture, and architecture. To assure uniformity, guild students went through exhaustive apprenticeship programs overseen by accomplished masters.

Modern Quality

The quality function in modern organizations has evolved through the following stages: inspection, quality control, quality assurance, and company-wide quality management.

Inspection. Modern quality started in the 1920s. The first quality groups were **inspection** departments. During production, inspectors measured products against specifications. Inspection departments were not independent; they usually reported to the manufacturing department whose efforts they were inspecting. This presented a conflict of interest. If the inspection department rejected a batch of nonconforming products and the manufacturing department wanted to push this batch of products out the door regardless of quality, the manufacturing department always got its way. This sent a "production at any cost" message to the organization instead of a "quality is job #1" message. Product quality could only improve slowly in this environment.

Quality Control. In the 1940s, inspection groups evolved into **quality control (QC)** departments. The start of World War II required that military products be defect-free. Product quality was crucial to winning the war and could only be ensured if the inspection department could control production processes. Quality, defined as conformance to specification, was controlled during production instead of being inspected into products. Responsibility for quality was transferred to an independent QC department, which was now considered the "guardian" of quality. Also, the QC department was now separated from manufacturing to give it autonomy and independence.

Quality Assurance. Quality control evolved into **quality assurance (QA).** The QA department focuses on assuring process and product quality through executing operational audits, supplying training, performing technical analysis, and advising operational areas on quality improvement. QA consults with the departments where the responsibility for quality actually rests.

QC is still alive in some organizations where QA has not evolved. It is considered to be a functional area, which is responsible for inspecting products, calibrating instruments, testing products, and inspecting incoming material.

Company-Wide Quality Management. As the issue of quality becomes more prominent, QA is evolving into a **company-wide quality management (CWQM)** function. CWQM is also called total quality management (TQM) or total quality control (TQC). The quality organization is the prime facilitator and consultant in this effort. Corporate quality groups are small with more authority but less direct responsibility for quality. For example, the quality organization has authority to stop defective material from leaving the manufacturing door, while the responsibility for the control of quality is pushed to the manufacturing department operator.

The chief executive officer (CEO) often starts and guides the CWQM program. As the quality message permeates the organization, more people become

involved, and slowly a quality ethic and culture develop. The focus of the program is company-wide, customer-oriented, and competitively driven.

Quality no longer resides in one department. It is a company-wide issue essential to the organization's survival. To produce a quality product or deliver a quality service requires the attention and commitment of everyone in the organization. It is the responsibility of the person doing the work, whether it is the receptionist greeting people, the manager supervising employees, the operator fabricating material, or the person delivering flowers. Every element in the organization, from the executive committee that establishes policy to the receptionist at the front desk, contributes to or detracts from the quality effort. The executive committee defines a realistic policy; line management establishes doable objectives; engineers design attractive, reliable, and functional products; receptionists are courteous and prompt; and operators produce defect-free products.

Customer orientation is essential in CWQM programs because the customers' needs change and the organizations must adapt to changing needs. Adapting means designing aesthetic products, producing defect-free products, and delivering products on time, at a profit. Most importantly, an organization must design, produce, and deliver what the customer wants, not what the organization thinks the customer wants.

COMPANY-WIDE QUALITY MANAGEMENT

In a global economy, product manufacturing and service delivery know no boundaries. Corporate management might reside in Germany. An automobile might be designed in Italy. Parts might be made anywhere in the world. The automobile might be assembled in Mexico. It might be marketed and serviced in the United States.

The auto, from conception to manufacturing to delivery, has to embody quality. The **International Standards Organization (ISO)** developed standards (9000–9004) so that there could be a common language and understanding of important terms and concepts in quality.

The American standard "Quality Management and Quality System Elements—Guidelines" (ANSI/ASQC Q94-1987), issued by the **American National Standards Institute (ANSI),** evolved from the ISO standards. This standard specifies the principal elements of a CWQM system. ANSI standards are technically equivalent to ISO standards.

This book is primarily concerned with the producer of products rather than the deliverer of services. However, in almost every example, a product manufacturer is also a service deliverer. When a meal is ordered in a restaurant, the service component of the meal is as important as the product component, which is the meal itself. The waitress delivers food. The atmosphere is conducive to conversation, and the restaurant has special activities for entertaining children.

If the quality of complex goods and services is to be controlled and assured, a CWQM program is developed. The goal of the program is to measure, detect, reduce, eliminate, and prevent quality deficiencies. Deficiencies can be defective products, discourteous service, late deliveries, or nonserviceable automobiles.