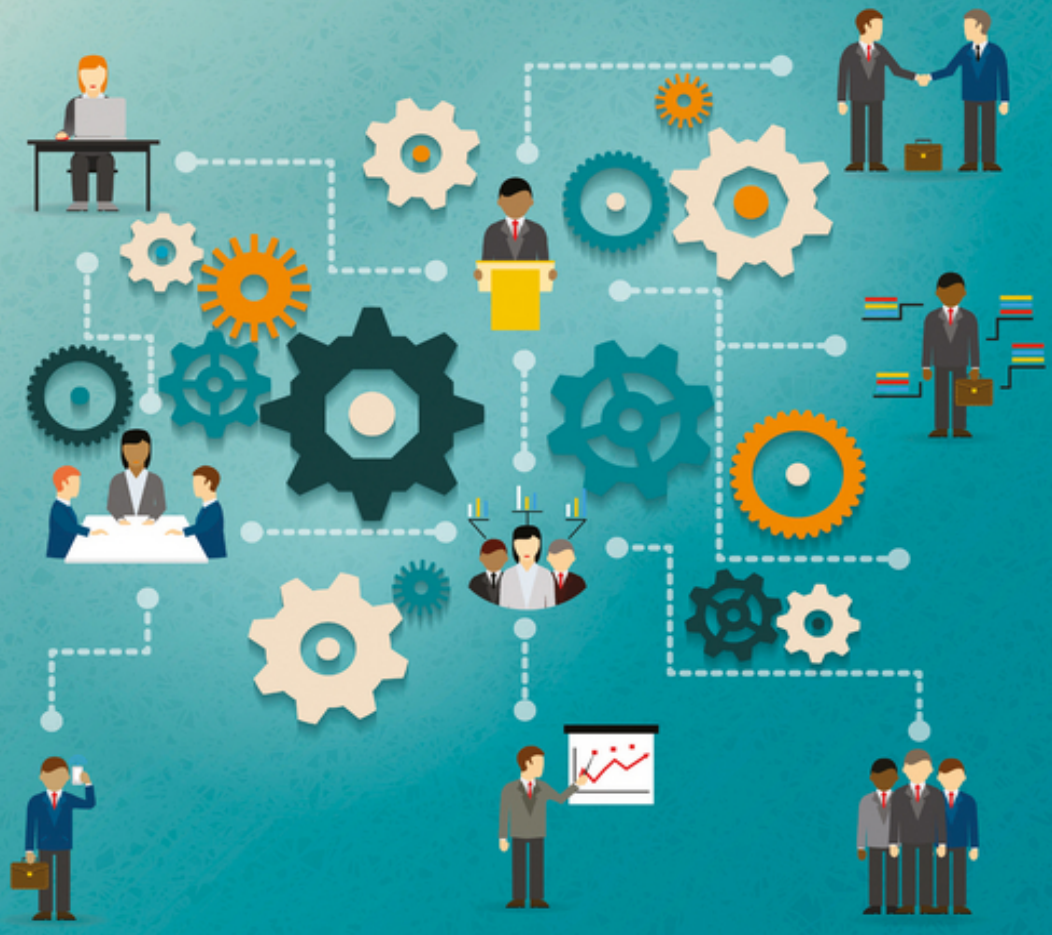
# MANAGING QUALITY

## AN ESSENTIAL GUIDE AND RESOURCE GATEWAY

6TH EDITION



EDITED BY BARRIE G.DALE, DAVID BAMFORD & TON VAN DER WIELE

WILEY

'Barrie and David are among the leading researchers and the best teachers in total quality management. Their teaching in quality management and performance improvement at Manchester Business School was very well liked by their students for many years. In this sixth edition of the book, they have chosen to cover a broad range of topics in TQM in great depth. While different companies may take different approaches to achieve their strategic goals, no company could afford not to commit itself to improving the quality of its products and services for ultimate customer satisfaction. This book introduces all important areas of TQM to students and provides a rich knowledgebase for both study and practice in quality management.'

**Professor Jian-Bo Yang, Chair of Decision and System Sciences, Alliance Manchester Business School, The University of Manchester**

'Previous editions of this excellent text have provided the basis for student reading and class reflection on current issues in quality management, but I am particularly pleased to see an excellent set of online resources to accompany the new book. The presentation material, exercise questions and video/web links provide an invaluable resource both for lecturers teaching the subject for the first time, but also for experienced teachers wishing to compare, contrast and update their material when adopting the book and planning future course delivery. I will certainly adopt and adapt the resources provided in my teaching of quality management from now on.'

**Dr Paul Forrester, Senior Teaching Fellow, Keele Management School, Keele University**

'A sustained focus on Quality Management is arguably the most important attribute of a competitive organization. An essential read for students, scholars and practitioners, the textbook provides an extensive examination of contemporary Quality Management that is timely, informed and accessible. The online resources are invaluable for educators and students alike, bringing a blended learning dimension to each chapter through multi-media videos, case studies and interactive teaching materials.'

**Dr Claire Moxham, Senior Lecturer in Operations Management, Management School, University of Liverpool**

# Managing Quality

## An Essential Guide and Resource Gateway

Sixth Edition

EDITED BY
Barrie G. Dale, David Bamford and
Ton van der Wiele

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# Acknowledgements

In our role as editors we have attempted to ensure that each topic is adequately covered in breadth and depth and is presented simply and clearly. Subject to these constraints we have tried not to interfere with our contributors' styles because we believe an author's style is an integral part of getting his or her message across to the reader.

The brief given to the contributors was to keep the level of technical detail to a minimum and to write in a focused, non-specialist language. This is much easier in some subjects than others, but we believe that this objective has been achieved, and hope the reader will find that the structure of the book is logical and the content is clear and free from confusing jargon.

Finally, we wish to thank all the contributors for making this book possible. We have learned much from them. We hope the readers will too.

# Preface

The subject of Quality Management is vast. There are many issues and interfaces to consider, and there are a considerable number of tools, techniques and systems which an organization can use to assist it in the introduction and development of the concept. The text covers the main aspects and functions of Quality Management, from identifying customer needs and requirements through to quality planning, supply and production/operations. This sixth edition of *Managing Quality* builds on the success of the previous publications. The book covers the main concepts and issues currently being debated and considered by business leaders throughout the world. It is a very comprehensive text and has developed a track record and following amongst students, academics and practitioners. Its purpose is to provide the reader with an appreciation of the concepts and principles of Quality Management. It has proved to be a wide-ranging source of reference for the many tools, techniques and systems which are associated with the concept.

In the book the term 'total quality management' (TQM) is used to describe the process of transformation by which all parts of the organization have a focus on quality with the ultimate objective of customer satisfaction and delight. Some people argue that the term TQM has fallen out of use, with directors and managers regarding it as a fallen star and a jaded concept. They moved on to what are perceived as newer concepts (e.g. Six Sigma, lean mapping, etc.). There is little doubt that in many companies and industries the issue of improvement in the quality of products and services remains urgent. Therefore in this book we are sticking to the term TQM and, when appropriate, coupling it to 'Strategic Process Improvement'.

The feedback on previous editions indicates that the book has been useful to industrialists, management consultants, academics, and undergraduate and postgraduate students from a variety of disciplines; TQM is not the special province of one group of people or one discipline. People studying for professional examinations that involve considerations of quality have also benefited from the use of the book. We hope readers will read the whole book to gain an understanding of the breadth and depth of Quality Management. However, most of the chapters do

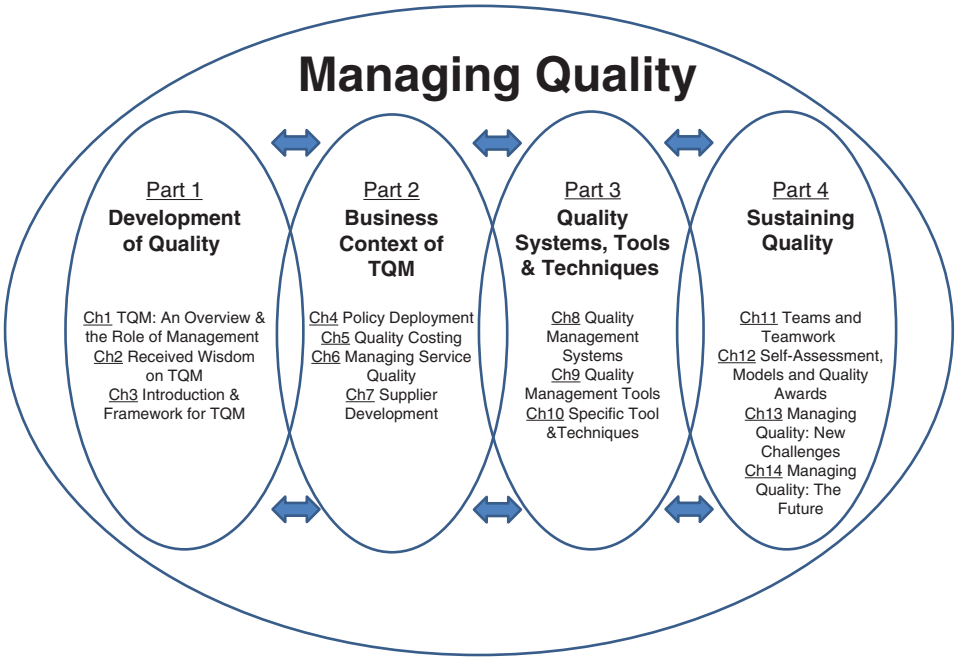


Figure 0.1 A conceptual model of management quality

stand alone and readers may choose to dip into the book in order to learn more about a particular subject.

In the spirit of continuous improvement, and a move into providing electronic support materials, a major revision of the book has been undertaken this time around. All chapters were fully reviewed and, to provide greater focus for the reader, some were extensively revised/combined, and some removed. In addition, appropriate support materials are now provided online (e.g. Instructor Resources, teaching slides, additional cases, key questions for each chapter, etc.). Please visit the book page on www.wiley.com for additional information/access.

The text is still arranged around four main areas; however, these have been refined and are presented as a conceptual model within Figure 0.1.

These interlinking parts serve to communicate the applied breadth and depth of aspects of relevant Quality Management application of tools, techniques and systems. Specifically the parts cover: Part One: Development Quality – overview and management, received wisdom, framework for TQM; Part Two: Business Context – policy deployment, quality costing, managing service quality, supplier development; Part Three: Quality systems, tools and techniques – quality systems, quality management tools, quality management techniques; Part Four: Sustaining Quality – teams, self-assessment and awards, New challenges, The future. We present the conceptual model of this.

The academic contributors have also outlined some of their recent research findings. We do hope that readers will find some new ideas and angles on subjects which have been brought to their attention. It is to be hoped that, through study of the text, readers will be encouraged to take up the challenge of strengthening their commitment and dedication to TQM and continuous improvement.

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# Part One

# The Development and Introduction of Total Quality Management (TQM)

The purpose of Part One is to introduce the reader to some of the fundamentals of TQM. It deals with how to introduce TQM into an organization and its subsequent development. Sustaining TQM is far from easy, and the chapters examine issues to which attention needs to be given. It contains the following three chapters:

Chapter 1 – TQM: An Overview and the Role of Management
Chapter 2 – The Received Wisdom on TQM
Chapter 3 – The Introduction and a Framework for TQM

Chapter 1 examines the evolution of *quality management* ('coordinated activities to direct and control an organization with regard to quality') from *inspection* ('conformity evaluation by observation and adjustment accompanied as appropriate by measurement, testing or gauging') to *quality control* ('part of quality management focused on fulfilling quality requirements') to *quality assurance* ('part of quality management focused on providing confidence that quality requirements will be fulfilled' (ISO 9001: (2015)) and finally to *Total Quality Management* (TQM). This chapter outlines the main reasons why senior management should become personally involved in TQM. It examines what they need to know about TQM and what they need to do in terms of actions. The role of middle and first-line management is also key to putting in place the principles of TQM, and the activities that they need to get involved with are discussed.

Chapter 2 deals with the received wisdom on TQM. Quality management experts such as Crosby, Deming, Feigenbaum and Juran have had a considerable influence on the development of TQM throughout the world and their views and teachings are summarized in this chapter. The Japanese have had a profound influence on the understanding and development of TQM. Therefore, no book on TQM would be complete without some discussion of the way in which Japanese companies develop and manage the concept. The views of the four

influential Japanese experts (Imai, Ishikawa, Shingo and Taguchi) are explored and summarized.

Chapter 3 deals with the introduction of TQM. It sets out by examining change and continuous improvement and deals with how the improvement process is triggered, which is usually in combination: the Chief Executive, competition, demanding customers and fresh-start situations. Following this, the chapter goes on to examine a range of approaches that can be followed in the introduction of TQM. A framework to assist with the introduction of TQM is presented. The structure of the framework consists of four main sections: organizing, using systems and techniques, measurement and feedback, and changing the culture. The framework has been used by a number of organizations in both the public and private sectors and in manufacturing and service industries to introduce the basic elements and practices of TQM and Strategic Process Improvement.

# Chapter One

# TQM: An Overview and the Role of Management

B. G. Dale, M. Papalexi, D. Bamford and A. van der Wiele

## Introduction

In today's global competitive marketplace the demands of customers are gradually increasing as they require improved quality of services and products. Also, in some markets there is an increasing supply of competitively priced products and services from low labour cost countries such as those in the Far East, the former Eastern bloc, China, Vietnam and India. TQM and Strategic Process Improvement does not appear to have reached maturity in many BRIC (Brazil, Russia, India, China) economies (Moosa and Cardak 2006). This presents an opportunity, as well as a challenge, for TQM practitioners. Continuous improvement in total business activities with a focus on the customer throughout the entire organization and an emphasis on flexibility and quality is one of the main means by which companies face up to these competitive threats. For this reason, many organizations are looking for quality management and strategic process improvement in order to survive in increasingly aggressive markets and maintain a competitive edge over their rivals (Bamford et al. 2015). As a result of the efforts made by organizations to respond to these marketplace demands the quality of products, services and processes has increased considerably during the last two decades. Oakland (2014) states that:

> Total Quality has always been a key strategic factor for business success but it is now more than ever required to compete successfully in the global markets of the twenty-first century.

Having said this, it should be pointed out that in many markets today, quality is narrowly defined as the reliability of products and services. It is not considered as a competitive weapon any more but as a given requirement; and is considered an entry-level characteristic in the marketplace.

These days, many organizations have had experiences with working on the transformation towards total quality management (TQM) and/or strategic

process improvement and this is coupled with its spread, from the manufacturing to the service sector and on to public services. In addition, new domains present themselves. For example, according to Bamford et al. (2016) achieving and maintaining a quality culture is complex across all industrial sectors but amplified in off-field sporting operations due to particular industry characteristics (Smith and Stewart 2010). For example, operating rules and regulations are often imposed on sporting venues by external parties, the outcome of a sporting tournament is uncertain, fans are both producers and consumers of the sporting experience and sporting rivals must collaborate to organize competitive events (Chadwick 2009, 2011; Stewart and Smith 1999). It is these industry characteristics that provide a backdrop of environmental uncertainty for off-field sporting operations and make quality management in this context a particularly interesting focus for further examination (Bamford et al. 2016).

But what is TQM? In simple terms, it is the mutual co-operation of everyone in an organization and associated business processes to produce value-for-money products and services which meet and, hopefully, exceed the needs and expectations of customers. TQM and strategic process improvement are ever-evolving practices of doing business in a bid to develop methods and processes that cannot be imitated by competitors. This chapter provides an overview of TQM and introduces the reader to the subject. It opens by examining the different interpretations that are placed on the term 'quality'. It then examines why quality has grown in importance during the last decades. The evolution of quality management ('Co-ordinated activities to direct and control an organization with regard to quality': ISO 9001 2015) is described through the stages of inspection, quality control, quality assurance and onwards to TQM. In presenting the details of this evolution, the drawbacks of a detection-based approach to quality are compared to the recommended approach of prevention. Having described these stages the chapter examines the key elements of TQM – commitment and leadership of the chief executive officer (CEO), planning and organization, using tools and techniques, education and training, employee involvement, teamwork, measurement and feedback, and cultural change.

The chapter concludes by presenting a summary of the points which organizations need to keep in mind when developing and advancing TQM. This is done under the broad groupings of organizing, systems and techniques, measurement and feedback, and changing the culture.

## What is Quality?

'Quality' has a variety of definitions, interpretations and uses. Today, in a variety of situations, it is perhaps an over-used word. For example, when a case is being made for extra funding and resources, to prevent a reduction in funding, or to

keep a unit in operation and in trying to emphasize excellence, just count the number of times the word 'quality' is used in the argument or presentation.

Quality as a concept is quite difficult for many people to understand, and much confusion and myth surround it.

In a linguistic sense, quality originates from the Latin word 'qualis' which means 'such as the thing really is'. There is an international definition of quality: 'the degree to which a set of inherent characteristics fulfils requirements' (ISO 9001 2015). However, in today's business world there is no single accepted definition of quality. Irrespective of the context in which it is used, it is usually meant to distinguish one organization, event, product, service, process, person, result, action, or communication from another.

Preventing confusion and ensuring that everyone in an organization is focused on the same objectives, there should be an agreed definition of quality. For example, BetzDearborn Inc. defines quality as: 'That which gives complete customer satisfaction', and Rank Xerox (UK) as 'Providing our customers, internal and external, with products and services that fully satisfy their negotiated requirements'. North West Water Ltd use the term 'business quality' and define this as:

> Understanding and then satisfying customer requirements in order to improve our business results.
>
> Continuously improving our behaviour and attitudes as well as our processes, products and services.
>
> Ensuring that a customer focus is visible in all that we do.

There are a number of ways or senses in which quality may be defined, some being broader than others but they all can be boiled down to either meeting requirements and specifications or satisfying and delighting the customer.

## Qualitative

When the word quality is used in a qualitative way, it is usually in a non-technical situation. ISO 9001(2015) says that 'the term "quality" can be used with adjectives such as poor, good or excellent'. Some examples related to this are:

- In advertising slogans to assist in building an image and persuade buyers that its production and services are the best: Esso – Quality at Work; Hayfield Textiles – Committed to Quality; Kenco – Superior Quality; Philips Whirlpool – Brings Quality to Life; Thompson Tour Operations – Thompson Quality Makes the World of Difference.
- By television and radio commentators (a quality player, a quality goal, a quality try).

- By directors and managers (quality performance, quality of communications).
- By people, in general (quality product, top quality, high quality, original quality, quality time, quality of communications, quality person, loss of quality, German quality, 100 per cent quality).

It is frequently found that in such cases of 'quality speak' the context in which the word quality is used is highly subjective and in its strictest sense is being misused. For example, there is more than one high street shop which trades under the name of 'Quality Seconds', and some even advertise under the banner of 'Top Quality Seconds'. There is even a company with the advertising slogan 'Quality Part-Worn Tyres' on the side of its vans.

## Quantitative

The traditional quantitative term which is still used in some situations is acceptable quality level (AQL). This is defined in ISO/NWIP 3951-2 (2010) as: 'the quality level that is the worst tolerable process fraction nonconforming when a continuing series of lots is submitted for acceptance sampling'. This is when quality is paradoxically defined in terms of non-conforming parts per hundred (i.e. some defined degree of imperfection).

An AQL is often imposed by a customer on its supplier in relation to a particular contract. In this type of situation the customer will inspect the incoming batch according to the appropriate sampling scheme. If more than the allowed number of defects is found in the sample the entire batch is returned to the supplier or the supplier can, at the request of the customer, sort out the conforming from non-conforming product on the customer's site. The employment of an AQL is also used by some companies under the mistaken belief that trying to eliminate all defects is too costly.

The setting of an AQL by a company can work against a 'right first time' mentality in its people as it appears to condone the production and delivery of nonconforming parts or services, suggesting that errors are acceptable to the organization. It is tantamount to planning for failure. For example, take a final product which is made up of 3,000 parts: if the standard set is a 1 per cent AQL, this would mean that the product is planned to contain 30 non-conforming parts. In reality there are likely to be many more because of the vagaries of the sampling used in the plan or scheme, whereby acceptance or rejection of the batch of product is decided.

Another example of a quantitative measure is to measure processes using sigmas (a sigma is a statistical indication of variation) and defects per million opportunities (DPMO). A sigma is essentially a measuring device that is an indication of how good a product or service is. The higher the sigma value the lower the number of defects. For example, 3 sigma equals 66,807 DPMO, while 6 sigma equals 3.4 DPMO (these values assume a normal distribution with a process shift of

1.5 sigma). The sigma level is a means of calibrating performance in relation to customer needs. Six Sigma (a quality improvement framework) has used sigmas to improve productivity and quality and reducing costs. Six Sigma is the pursuit of perfection and represents a complete way of tackling process improvement from a quantitative approach, involving many of the concepts, systems, tools and techniques described in this book. The Six Sigma concept is currently very popular as a business improvement approach. The key features include a significant training commitment in statistics and statistical tools; problem-solving methodology and framework; project management; a team-based project environment; people who can successfully carry out improvement projects (these are known as black belts and green belts, based on the martial arts hierarchy); leaders (master black belts); and project champions.

## Uniformity of the product or service characteristics around a nominal or target value

Figure 1.1 presents the inside/outside specification dilemma; only the product or service dimensions that are within the design specification or tolerance limits can be considered acceptable. The difference between what is considered to be just inside or just outside the specification is marginal. It may also be questioned whether this step change between pass and fail has any scientific basis and validity.

Designers often establish specification limits without sufficient knowledge of the process by which the product and/or service is to be produced/delivered and its capability. It is often the case that designers cannot agree amongst themselves about the tolerances/specification to be allocated, and they tend to establish a tighter tolerance than is justified to provide safeguards and protect themselves. In many situations there is inadequate communication on this matter between the design and operation functions. Fortunately, this is changing with the increasing use of simultaneous or concurrent engineering.

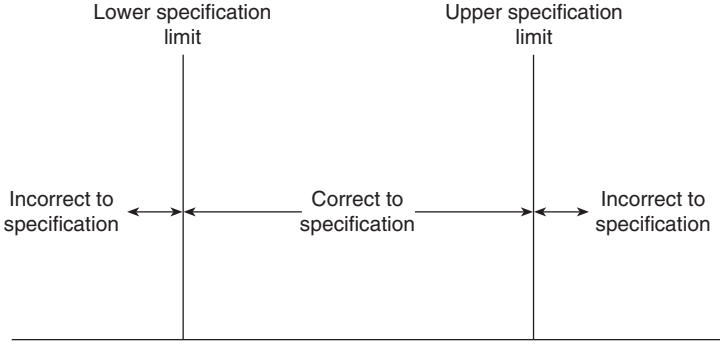


Figure 1.1 The inside/outside specification dilemma

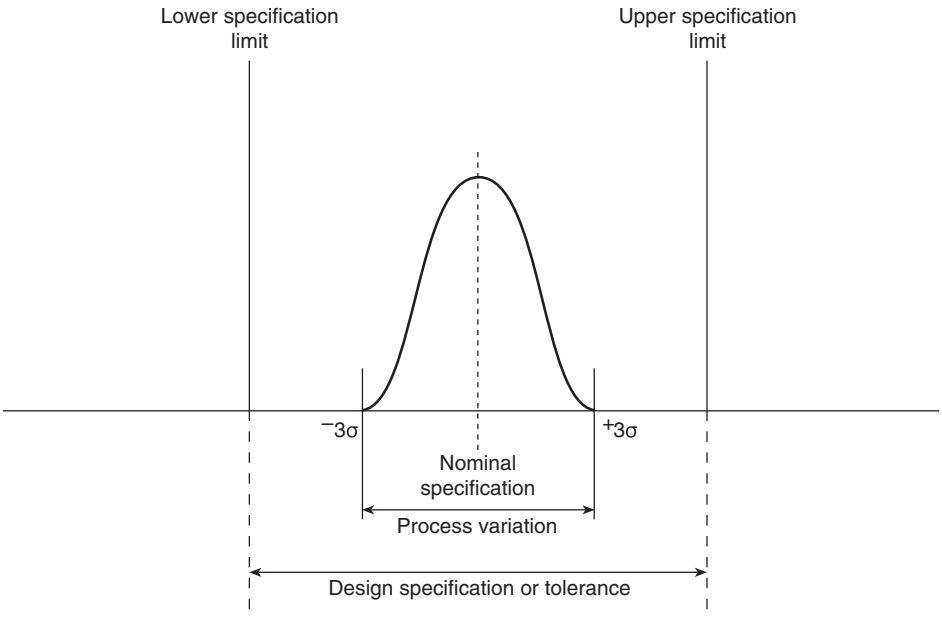


Figure 1.2 Design tolerance and process variation relationship

The main issue of working to the specification limits is that it frequently leads to tolerance stack-up; for example, in a manufacturing situation parts may not fit together correctly at the assembly stage. This is especially the case when one part that is just inside the lower specification limit is assembled to one that is just inside the upper specification. If the process is controlled such that a part is produced around the nominal or a target dimension with limited variation (see Figure 1.2), this problem does not occur and the correctness of fit and smooth operation of the final assembly and/or end product are enhanced.

The idea of reducing the variation of part characteristics and process parameters so that they are centred around a target value can be attributed to Taguchi (1986). He writes that the quality of a product is the (minimum) loss imparted by the product to the society from the time the product is shipped. Among the losses he includes time and money spent by customers; consumers' dissatisfaction; warranty costs; repair costs; wasted natural resources; loss of reputation; and, ultimately, loss of market share.

The relationship of design specification and variation of the process can be quantified by a capability index, for example, C$p$, which is a process potential capability index:

$$\mathrm{C}p = \frac{\text{Total specification width}}{\text{Process variation width}}$$

### Conformance to agreed and fully understood requirements

This definition is attributed to Crosby (1979). He believed that quality is not comparative and that there is no such thing as high quality or low quality, or quality in terms of goodness, feel, excellence and luxury. In other words, quality is an attribute (a characteristic which by comparison to a standard or reference point, is judged to be correct or incorrect) not a variable (a characteristic which is measurable). Crosby made the point that the requirements are all the actions required to produce a product and/or deliver a service that meets the customer's expectations, and that it is management's responsibility to ensure that adequate requirements are created and specified within the organization.

### Fitness for purpose/use

Juran (1988) was the first to use this definition of quality. He classifies 'fitness for purpose/use' into the categories of: quality of design, quality of conformance, abilities and field service. Focusing on fitness for use helps to prevent the over-specification of products and services. Overspecification can add greatly to costs and tends to militate against a right-first-time performance.

### Satisfying customer expectations and understanding their needs and future requirements

Satisfying customers and creating customer enthusiasm through understanding their needs and future requirements is the crux of TQM and strategic process improvement. TQM is all about customer orientation and many company missions are based entirely on satisfying customer perceptions. Customer requirements for quality are increasing and becoming stricter. There are increasing levels of intolerance of poor quality goods and services and low levels of customer service and care. In most situations customers have a choice: they are not willing to jeopardize their own business interest out of loyalty to a supplier who does not perform as they expected; they will simply go to a competitor. In the public sector the customer may not have this choice; however, they can go to litigation, write letters of complaint, cause disruption, and use elections to vote officials out of office.

Superior-performing organizations go beyond satisfying their customers: they emphasize the need to delight them by giving them more than what is required in the contract. These organizations create a total experience for their customers, which is unique in relation to the offerings of competitors (which is called 'the experience economy', see Pine and Gilmore 2011). The wisdom of this can be clearly understood considering the situation where a supplier has given more than the customer expected (for example, an extra glass of wine on an aircraft; a sales