

# **Chapter 1**

## **Introduction to quality**

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By three methods we may learn wisdom: First, by reflection, which is noblest; Second, by imitation, which is easiest; and third by experience, which is the bitterest.

*Confucius (551 479 BCE) Chinese philosopher*

### **Principles or prescription**

One of the great problems in our age is to impart understanding in the minds of those who have the ability and opportunity to make decisions that affect our lives. There is no shortage of information – in fact there is too much now we can search a world of information from the comfort of our armchair. We are bombarded with information but it is not knowledge – it does not necessarily lead to understanding. With so many conflicting messages from so many people, it is difficult to determine the right thing to do. There are those whose only need is a set of principles from which they are able to determine the right things to do. There are countless others who need a set of rules derived from principles that they can apply to what they do and indeed others who need a detailed prescription derived from the rules for a particular task. In the translation from principles to prescription, inconsistencies arise. Those translating the principles into rules or requirements are often not the same as those translating the rules into a detailed prescription. Rules are often an imperfect translation of principles and yet, they are enforced without regard to or even an understanding of the principles they were intended to implement. This is no more prevalent than in local government where officials behave like robots, enforcing rules without regard to what the rules were intended to achieve.

The principles in the field of quality management have not arisen out of academia but from life in the work place. Observations from the work place have been taken into academia, analysed, synthesized and refined to emerge as

universal principles. These principles have been expressed in many ways and in their constant refreshment the language is modernized and simplified, but the essence is hardly changed.

Without a set of principles, achieving a common understanding in the field of quality management would be impossible. Since Juran, Deming and Feigenbaum wrote about quality management in the 1950s there has been considerable energy put into codifying the field of quality management and a set of principles from which we can derive useful rules, regulations and requirements has emerged. This chapter addresses these principles in a way that is intended to impart understanding not only in the minds of those who prefer principles to prescription, but also in the minds of those who prefer prescriptions. There is nothing intrinsically wrong with wanting a prescription. It saves time, it's repeatable, it's economic and it's the fastest way to get things done but it has to be right. The receivers of prescriptions need enough understanding to know whether what they are being asked to do is appropriate to the circumstances they are facing.

The concepts expressed in this book embody universal principles and have been selected and structured in a manner that is considered suitable for those wishing to get some clarity in a field of knowledge that often appears contradictory. It is not intended as a comprehensive guide to quality management – some further reading is given in the Bibliography. ISO 9000:2000 also contains concepts some of which are questionable but these will be dealt with as they arise. The aim is to give the reader a balanced view and present a logical argument that is hoped will lead to greater understanding. As the book is supposed to be about the management of quality, there is no better place to start than with an explanation of the word *quality*.

## Needs, requirements and expectations

Organizations are created to achieve a goal, mission or objective but they will only do so if they satisfy the needs, requirements and expectations of their stakeholders. Their customers, as one of the stakeholders, will be satisfied only if they provide products and services that meet their needs, requirements and expectations. Their other stakeholders (shareholders, employees, suppliers and society) will only be satisfied if the products and services provided to customers are produced and supplied in a manner that satisfies their needs, requirements and expectations – in other words, it makes a profit, does no unintentional harm, and is conceived and produced with due regard to prevailing legislation.

We all have needs, wants, requirements and expectations. Needs are essential for life, to maintain certain standards, or essential for products and services, to fulfil the purpose for which they have been acquired. According to Maslow,<sup>1</sup> man is a wanting being; there is always some need he wants to satisfy. Once this is accomplished, that particular need no longer motivates him and he turns to another, again seeking satisfaction. Everyone has basic physiological needs that



**Figure 1.1** Hierarchy of needs

are necessary to sustain life. (Food, water, clothing, and shelter). Maslow's research showed that once the physiological needs are fulfilled, the need for safety emerges. After safety come social needs followed by the need for esteem and finally the need for self-actualization or the need to realize ones full potential. Satisfaction of physiological needs is usually associated with money – not money itself but what it can buy. The hierarchy of needs is shown in Figure 1.1.

These needs are fulfilled by the individual purchasing, renting or leasing products or services. Corporate needs are not too dissimilar. The physiological needs of organizations are those necessary to sustain survival. Often profit comes first because no organization can sustain a loss for too long but functionality is paramount – the product or service must do the job for which it is intended regardless of it being obtained cheaply. Corporate safety comes next in terms of the safety of employees and the safety and security of assets followed by social needs in the form of a concern for the environment and the community as well as forming links with other organizations and developing contacts. Esteem is represented in the corporate context by organizations purchasing luxury cars, winning awards, superior offices and infrastructures and possessing those things that give it power in the market place and government. Self-actualization is represented by an organization's preoccupation with growth, becoming bigger rather than better, seeking challenges and taking risks. However, it is not the specific product or service that is needed but the benefits that possession brings that is important. This concept of benefits is the most important and key to the achievement of quality.

Requirements are what we request of others and may encompass our needs but often we don't fully realize what we need until after we have made our request. For example, now that we own a mobile telephone we discover we really need hands-free operation when using the phone while driving a vehicle. Our requirements at the moment of sale may or may not therefore express all our needs. By focusing on benefits resulting from products and services, needs can be converted into wants such that a need for food may be converted into a want for a particular brand of chocolate. Sometimes the want is not essential but the higher

up the hierarchy of needs we go, the more a want becomes essential to maintain our social standing, esteem or to realize our personal goals. Our requirements may therefore include such wants – what we would like to have but are not essential for survival.

In growing their business organizations create a demand for their products and services but far from the demand arising from a want that is essential to maintain our social standing, it is based on an image created for us by media advertising. We don't need spring vegetables in the winter but because industry has created the organization to supply them, a demand is created that becomes an expectation. Spring vegetables have been available in the winter now for so long that we expect them to be available in the shops and will go elsewhere if they are not. But they are not essential to survival, to safety, to esteem or to realize our potential and their consumption may in fact harm our health because we are no longer absorbing the right chemicals to help us survive the cold winters. We might want it, even need it but it does us harm and regrettably, there are plenty of organizations ready to supply us products that will harm us.

Expectations are *implied needs or requirements*. They have not been requested because we take them for granted – we regard them to be understood within our particular society as the accepted norm. They may be things to which we are accustomed, based on fashion, style, trends or previous experience. One therefore expects sales staff to be polite and courteous, electronic products to be safe and reliable, policemen to be honest, coffee to be hot, etc. One would like politicians to be honest but in some countries we have come to expect them to be corruptible, dishonest or at least, economical with the truth! As expectations are also born out of experience, some people might expect businessmen to be corruptible and selfish and it comes as no surprise to read about long drawn out court cases involving fraud and deceit.

**Expectations**  
It is easy to exceed customer expectations when your usual performance is well below the norm

Likewise, after frequent poor service from a train operator, our expectations are that the next time we use that train operator; we will once again be disappointed. We would therefore be delighted if, through some well focused quality initiative, the train operator exceeded our expectations on our next journey.

## The stakeholders

Organizations depend on customers because without them there is no business. However, in order to satisfy these customers, organizations also depend on a number of other parties that provide them with resources and sanction their operations. There are parties other than the customer that have an interest or stake in the organization and what it does but may not receive a product. The term quality is not defined relative to customers but to requirements and these interested parties do have requirements. ISO 9000:2000 defines an interested party as *a person or*

group having an interest in the performance or success of an organization. But, the organization may not have an interest in all of them and on reflection perhaps the word *interest* is not quite appropriate. Consider for instance, competitors, criminals and terrorists. None of these has put anything into the organization and their interest is more likely to be malevolent than benevolent so in these cases the organization fights off their interests rather than satisfies them. A better word to *interest* would be *stake* but in some cultures this translates as a bet that you place on a horse to win a race. However, it is common in the west for the term stakeholder to be used in preference to the term interested party, as it implies benevolence unlike the term interested parties which might be benevolent or malevolent.

Parties with a benevolent interest (stakeholders) are customers, owners, employees, contractors, suppliers, investors, unions, partners and society. They all expect something in return for their stake and can withdraw it should the expected benefits not be returned. When you produce products you are producing them with the intent that all these parties benefit but particularly for the benefit of customers. The other parties are not particularly interested in the products and services themselves but may be interested in their effects on their investment, their well-being and the environment.

The term interested party is also being used<sup>2</sup> to refer to anyone significantly affecting or affected by someone else's decision-making activity but the danger in this definition is that it places terrorists, criminals and competitors into the same category as those parties that the organization seeks to satisfy. Any statement that implies organizations have a duty to satisfy their interested parties would be invalid as they should only strive to satisfy those with a benevolent interest. We will therefore use the word stakeholder from here on.

## The customer

A product that possesses features that satisfy customer needs is a quality product. Likewise, one that possesses features that dissatisfy customers is not a quality product. So the final arbiter on product quality is the customer. The customer is the only one who can decide whether the quality of the products and services you supply is satisfactory and you will be conscious of this either by direct feedback or by loss of sales, reduction in

### Interested party

A person or group having an interest in the performance or success of an organization – primarily includes:

Customers, shareholders, employees, suppliers, and society but can also include competitors, criminals, and terrorists

### Stakeholder

A person or organization that has freedom to provide something to or withdraw something from an enterprise. Primarily customers, shareholders, employees, suppliers and society.

### Customer

Organization that receives a product or service – includes:

Purchaser, consumer, client, end user, retailer or beneficiary

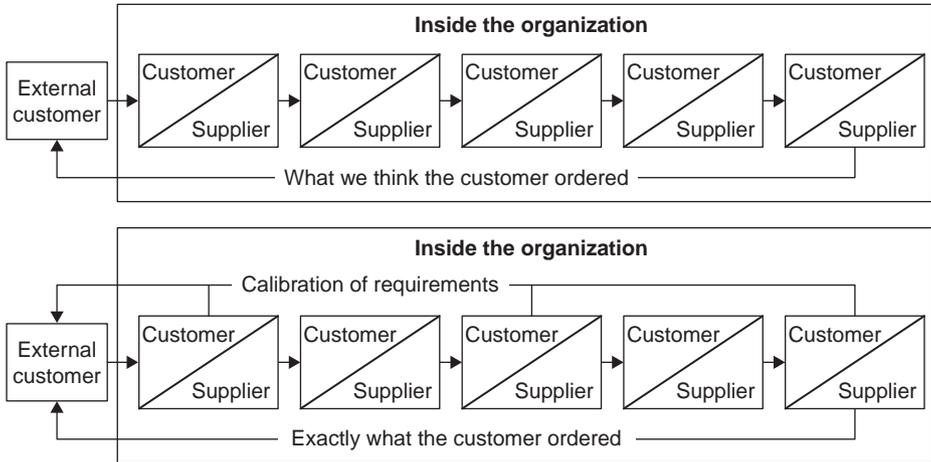
market share and, ultimately, loss of business. This brings us back to benefits. The customer acquires a product for the benefits that possession will bring. Therefore if the product fails to deliver the expected benefits it will be considered by the customer to be of poor quality. So when making judgements about quality, the requirement should be expressed in terms of benefits not a set of derived characteristics. In the foregoing it was convenient to use the term customer but the definition of *quality* does not only relate to customers. Dissatisfy your customers and they withdraw their stake and take their business elsewhere.

Clearly the customer is the only stakeholder that brings in revenue and therefore meeting their needs and expectations is paramount but not at the expense of the other stakeholders. The trick is to satisfy customers in a way that will satisfy the needs of other stakeholders. (See the section on quality management principles in chapter 2.)

## **The internal customer**

We tend to think of products and services being supplied to customers and in the wake of Total Quality Management (TQM), we are led to believe there are internal and external customers. A customer is a stakeholder; they have entered into a commitment in return for some benefits that possession of a product or experience of a service may bring. The internal receivers of products are not stakeholders (they are part of the process) therefore they are not strictly customers. Normally the customer is external to the organization supplying the product.

However, if we consider for a moment the notion of an internal customer, the operator who receives a drawing from the designer would be regarded as a customer. But the operator doesn't pay the designer for the drawing, has no contract with the designer, does not pass the output of his work to the designer, does not define the requirements for the drawing and cannot choose to ignore the drawing so is not a customer in the expected sense but a user of the drawing. If the operator provides a test piece to a laboratory and receives the test results, one might regard the operator as the laboratory's customer but once again, there is no contract and no money passing between the two parties. In fact the operator, the designer and laboratory all have the same customer – the person or organization that is paying for the organization's output and specifying the requirements the organization must satisfy. The notion of internal customers and suppliers is illustrated in Figure 1.2. In the upper diagram, requirements are passed along the supply chain and if at each stage there is some embellishment or interpretation by the time the last person in the chain receives the instructions they may well be very much different than what the customer originally required. In reality each stage has to meet the external customer requirement as it applies to the work performed at that stage not as the person performing the previous or subsequent stage wants. This is shown in the lower diagram where at each stage there is an opportunity to verify that the stage output is consistent with the external customer requirement.



**Figure 1.2** The internal customer-supplier chain

In a well-designed process, individuals do not impose their own requirements on others. The requirements are either all derived from the customer requirements or from the constraints imposed by the other stakeholders.

If instead of the label internal customers and suppliers, individuals were to regard themselves as players in a team that has a common goal, the team would achieve the same intent. In a team, every player is just as important as every other and with each player providing outputs and behaving in a manner that enables the other players to do their job right first time, the team goal would be achieved. The observation by Phil Crosby that quality is ballet not hockey<sup>3</sup> is very apt. In hockey, the participants do not treat each other as customers and suppliers but as team members each doing their best but the result on most occasions is unpredictable. In ballet, the participants also do not treat each other as customers and suppliers but as artists playing predetermined roles that are intended to achieve predictable results. Organizational processes are designed to deliver certain outputs and in order to do so individuals need to perform specific roles in the process in the same relationship that ballet dancers have to a ballet.

## The external supply chain

The transaction between the customer and the supplier is often a complex one. There may be a supply chain from original producer through to the end user. At each transaction within this supply chain, the receiving party needs to be satisfied. It is not sufficient to simply satisfy the first receiver of the product or service. All parties in the supply chain need to be satisfied before you can claim to have supplied a quality product. Admittedly, once the product leaves your premises you may lose control and therefore cannot be held accountable for any damage that may become the product, but the inherent characteristics are your responsibility.

In an increasing global market, many organizations are faced with the bulk of the cost in a product being added down or up the supply chain with less and less being added by themselves. More and more activities are being outsourced putting a greater burden on the purchasing staff to manage suppliers and commercial staff to manage customers. The integrity of the supply chain depends upon each party honouring their commitments and this depends upon each supplier having processes that have the capability to deliver quality product on time. Once products begin to flow along the supply chain any disruptions either due to poor quality or late delivery cause costs to rise further along the chain that are irrecoverable. The end customer will only pay for product that meets requirements therefore if buffer stocks have to be held and staff paid waiting time as a result of supply chain unreliability, these costs have to be born by the producers. Process capability and product and service quality along the supply chain become the most vital factors in delivering outputs that satisfy the end customer requirement.

## Society

Society is a stakeholder because it can withdraw its support for an organization. It can protest or invoke legal action. While society does not put anything into an organization directly, it does sanction its existence often through local planning authorities. Society is represented by the regulators and regardless of whether or not a customer specifies applicable regulations *you* are under an obligation to comply with those that apply. The regulator is not interested in whether you satisfy your customers, your employees or your investors or in fact whether you go bankrupt! Its primary concern is the protection of society. The regulators take their authority from the law that should have

### Regulator

A legal body authorized to enforce compliance with the laws and statutes of a national government.

been designed to protect the innocent. Regulators are certainly stakeholders because they can withdraw their approval.

## Employees

Employees may not be interested in the products and services, but are interested in the conditions in which they are required to work. Employees are stakeholders because they can withdraw their labour. Employees are also a resource and therefore have a dual role in the organization.

## Suppliers

Suppliers are interested in the success of the organization because it may in turn lead to their success. However, suppliers are also stakeholders because they can withdraw their patronage. They can choose their customers. If you treat your suppliers badly such as delaying payment of invoices for trivial mistakes, you

**Table 1.1** Criteria used by stakeholders to judge organization effectiveness or success

<i>Stakeholder</i>	<i>Success criteria</i>
Owner	Financial return
Employees	Job satisfaction, pay and conditions and quality of leadership
Customers	Quality of products and services
Community	Contribution to the community – jobs, support for other traders in the community – care for the local environment
Suppliers	Satisfactory mutual trading
Investors	Value of shares
Government	Compliance with legislation

may find they terminate the supply at the first opportunity possibly putting your organization into a difficult position relative to commitments made to customers.

## Investors

Often the most common type of stakeholder, are investors. The owners, partners and shareholders including banks are interested in protecting their stake in the business. They will withdraw their stake if the organization fails to perform. Poorly conceived products and poorly managed processes and resources will not yield the expected return and the action of investors can directly affect the supply chain; although they are not customers, they are feeding the supply chain with much needed resources. In the event that this supply of resource is terminated, the organization ceases to have the capability to serve its customers.

The success of any organization therefore depends on understanding the needs and expectations of all the stakeholders, not just its customers and on managing the organization in a manner that leads to the continued satisfaction<sup>4</sup> of all parties. Table 1.1 shows the criteria used by different stakeholders. It tends to suggest that for an organization to be successful it needs to balance (not trade-off) the needs of the stakeholders such that all are satisfied. There are those who believe that a focus on customers alone will result in the other parties being satisfied. There are those who believe that a focus on shareholder value will result in all other parties being satisfied. The problem is that the interested party is motivated by self-interest and may not be willing to compromise.

## Defining quality

In supplying products or services there are three fundamental parameters that determine their saleability. They are price, quality and delivery. Customers require products and services of a given quality to be delivered by or be available by

a given time and to be of a price that reflects value for money. These are the requirements of customers. An organization will survive only if it creates and retains satisfied customers and this will only be achieved if it offers for sale products or services that respond to customer needs and expectations as well as requirements. While price is a function of cost, profit margin and market forces, and delivery is a function of the organization's efficiency and effectiveness. Quality is determined by the extent to which a product or service successfully serves the purposes of the user during usage (not just at the point of sale). Price and delivery are both transient features, whereas the impact of quality is sustained long after the attraction or the pain of price and delivery has subsided.

The word *quality* has many meanings:

- A degree of excellence.
- Conformance with requirements.
- The totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs.
- Fitness for use.
- Fitness for purpose.
- Freedom from defects, imperfections or contamination.
- Delighting customers.

#### **Quality**

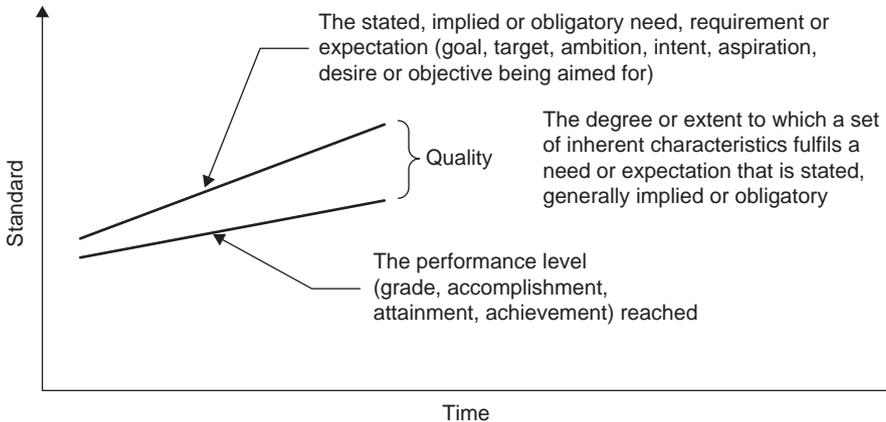
The degree to which a set of inherent characteristics fulfils a need or expectation that is stated, general implied or obligatory.

These are just a few meanings; however, the meaning used in the context of ISO 9000 was concerned with the totality of characteristics that satisfy needs but in the 2000 version this has changed. Quality in ISO 9000:2000 is defined as the degree to which a set of inherent characteristics fulfils the requirements. The former definition focused on an entity that was described as a product or service but with this new definition, the implication is

that quality is relative to what something should be and what it is. The something may be a product, service, decision, document, piece of information or any output from a process. In describing an output, we express it in terms of its characteristics. To comment on the quality of anything we need a measure of its characteristics and a basis for comparison. By combining the definition of the terms *quality* and *requirement* in ISO 9000:2000, quality can be expressed as *the degree to which a set of inherent characteristics fulfils a need or expectation that is stated, generally implied or obligatory.*

This concept of "degree" is present in the generally accepted definition of quality in the Oxford English Dictionary and is illustrated in Figure 1.3. The diagram expresses three truths.

- Needs, requirements and expectations are constantly changing.
- Performance needs to be constantly changing to keep pace with the needs.
- Quality is the difference between the standard stated, implied or required and the standard reached.



**Figure 1.3** The meaning of quality

This means that when we talk of anything using the word quality it simply implies that we are referring to the extent or degree to which a requirement is met. It also means that all the principles, methodologies, tools and techniques in the field of quality management serve one purpose, that of enabling organizations to close the gap between the standard required and the standard reached. In this context, environmental, safety, security and health problems are in fact quality problems because an expectation or a requirement has not been met. If the expectation had been met there would be no problem. Having made the comparison we can still assess whether the output is “fit for use”. In this sense the output may be non-conforming to specified requirements but remain fit for use.

The specification is often an imperfect definition of what a customer needs; because some needs can be difficult to express clearly. It therefore doesn't mean that by not conforming, the product or service is unfit for use. It is also possible that a product that conforms to requirements may be totally useless. It all depends on whose requirements are being met. For example, if a company sets its own standards and these do not meet customer needs, its claim to producing quality products is bogus. On the other hand, if the standards are well in excess of what the customer requires, the price tag may well be too high for what customers are prepared to pay – there probably isn't a market for a gold-plated mousetrap, for instance, except as an ornament perhaps!

## The characteristics of quality

### Classification of products and services

If we group products and services (entities) by type, category, class and grade we can use the subdivision to make comparisons on an equitable basis. But when we compare entities we must be careful not to claim one is of better quality than the

other unless they are of the same grade. Entities of the same type have at least one attribute in common. Entities of the same grade have been designed for the same functional use and therefore comparisons are valid. Comparisons on quality between entities of different grades, classes, categories or types are invalid because they have been designed for a different use or purpose.

Let us look at some examples to illustrate the point. Food is a type of entity. Transport is another entity. Putting aside the fact that in the food industry the terms *class* and *grade* are used to denote the condition of post-production product, comparisons between *types* is like comparing fruit and trucks, i.e. there are no common attributes. Comparisons between *categories* are like comparing fruit and vegetables. Comparisons between *classes* are like comparing apples and oranges. Comparisons between *grades* are like comparing eating apples and cooking apples.

Now let us take another example. Transport is a type of entity. There are different categories of transport such as airliners, ships, automobiles and trains; they are all modes of transport but each has many different attributes. Differences between categories of transport are therefore differences in *modes* of transport. Within each category there are differences in *class*. For manufactured products, differences between classes imply differences in *purpose*. Luxury cars, large family cars, small family cars, vans, trucks, four-wheel drive vehicles etc. fall within the same category of transport but each was designed for a different purpose. Family cars are in a different class to luxury cars; they were not designed for the same purpose. It is therefore inappropriate to compare a Cadillac with a Chevrolet or a Rolls Royce Silver Shadow with a Ford Mondeo. Entities designed for the same purpose but having different specifications are of different grades. A Ford Mondeo GTX is a different grade to a Mondeo LX. They were both designed for the same purpose but differ in their performance and features and hence comparisons on quality are invalid.

A third example would be the service industry: accommodation. There are various categories, such as rented, leased and purchased. In the rented category there are hotels, inns, guesthouses, apartments etc. It would be inappropriate to compare hotels with guesthouses or apartments with inns. They are each in a different class. Hotels are a class of accommodation within which are grades such as 5 star, 4 star, 3 star etc., indicating the facilities offered not quality levels. It would therefore be reasonable to expect a 1 star hotel to be just as clean as a 4 star hotel.

You can legitimately compare the quality of entities if comparing entities of the same grade. If a low-grade product or service meets the needs for which it was designed, it is of the requisite quality. If a high-grade product or service fails to meet the requirements for which it was designed, it is of poor quality, regardless of it still meeting the requirements for the lower grade. There is a market for such differences in products and services but should customer's expectations change then what was once acceptable for a particular grade may no longer be acceptable and regrading may have to occur.

Where manufacturing processes are prone to uncontrollable variation it is not uncommon to grade products as a method of selection. The product that is free of imperfections would be the highest grade and would therefore command the highest price. Any product with imperfections would be downgraded and sold at a correspondingly lower price. Examples of such practice arise in the fruit and vegetables trade and the ceramics, glass and textile industries. In the electronic component industry, grading is a common practice to select devices that operate between certain temperature ranges. In ideal conditions all devices would meet the higher specification but due to variations in the raw material or in the manufacturing process only a few may actually reach full performance. The remainder of the devices has a degraded performance but still offer all the functions of the top-grade component at lower temperatures. To say that these differences are not differences in *quality* would be misleading, because the products were all designed to fulfil the higher specification. As there is a market for such products it is expedient to exploit it. There is a range over which product quality can vary and still create satisfied customers. Outside the lower end of this range the product is considered to be of poor quality.

## Quality and price

Most of us are attracted to certain products and services by their price. If the price is outside our reach we don't even consider the product or service, whatever its quality, except perhaps to form an opinion about it. We also rely on price as a comparison, hoping that we can obtain the same characteristics at a lower price. In the luxury goods market, a high price is often a mark of quality but occasionally it is a confidence trick aimed at making more profit for the supplier. When certain products and services are rare, the price tends to be high and when plentiful the price is low, regardless of their quality. One can purchase the same item in different stores at different prices, some as much as 50% less, many at 10% less than the highest price. You can also receive a discount for buying in bulk, buying on customer credit card and being a trade customer rather than a retail customer. Travellers know that goods are more expensive at an airport than from a country craft shop. However, in the country craft shop, defective goods or "seconds" may well be on sale, whereas at the airport the supplier will as a rule, want to display only the best examples. Often an increase in the price of a product may indicate a better after-sales service, such as free on-site maintenance, free delivery, and free telephone support line. The discount shops may not offer such benefits.

The price label on any product or service should be for a product or service free of defects. If there are defects the label should say as much, otherwise the supplier may well be in breach of national laws and statutes. Price is therefore not an inherent feature or characteristic of the product. It is not permanent and as shown above varies without any change to the inherent characteristics of the product. Price is a feature of the service associated with the sale of the product.

Price is negotiable for the same quality of product. Some may argue that quality is expensive but in reality, the saving you make on buying low-priced goods could well be eroded by inferior service or differences in the cost of ownership.

## **Quality and design**

In examining the terms design and quality, we need to recognize that the word design has several meanings. Here we are not concerned with design as a verb or as the name we give to a process of design or the output of the design process. In this context we are concerned with the term design as an aesthetic characteristic of a product or service rather than a quality characteristic. The quality characteristic embraces the form, fit and function attributes relative to its purpose. The attributes that appeal to the senses are very subjective and cannot be measured with any accuracy, other than by observation and comparison by human senses. So when we talk of quality and design we are not referring to whether the design reflects a product that has the correct features and functions to fulfil its purpose, we are addressing the aesthetic qualities of the product. We could use the word appearance but design goes beyond appearance. It includes all the features that we perceive by touch, smell and hearing.

If the customer requires a product that is aesthetically pleasing to the eye, or is to blend into the environment or appeal to a certain group of people, one way to measure the quality of this subjective characteristic is to present the design to the people concerned and ask them to offer their opinion.

Quality of design is a different concept and is addressed below.

## **Quality and cost**

Philip Crosby published his book *Quality Is Free* in 1979 and caused a lot of raised eyebrows among executives because they always believed the removal of defects was an in-built cost in running any business. To get quality you had to pay for inspectors to detect the errors! What Crosby told us was that if we could eliminate all the errors and reach zero defects, we would not only reduce our costs but also increase the level of customer satisfaction by several orders of magnitude. In fact there is the cost of doing the right things right first time and the cost of *not* doing the right things right first time. The latter are often referred to as *quality costs* or the cost incurred because failure is possible. Using this definition, if failure of a product, a process or a service is not possible, there would be no *quality costs*. It is rather misleading to refer to the cost incurred because failure is possible as *quality costs* because we could classify the costs as avoidable costs and unavoidable costs. We have to pay for labour, materials, facilities, machines, transport etc. These costs are unavoidable but we are also paying in addition some cost to cover the prevention, detection and removal of errors. Should customers have to pay for the errors made by others? There is a basic cost if failure

is not possible and an additional cost in preventing and detecting failures and correcting errors because our prevention and detection programmes are ineffective. However, there is variation in all processes but it is only the variation that exceeds the tolerable limits that incurs a penalty. If you reduce complexity and install failure-prevention measures you will be spending less on failure detection and correction. There is an initial investment to be paid, but in the long term you can meet your customer's requirements at a cost far less than you were spending previously. Some customers are now forcing their suppliers to reduce internal costs so that they can offer the same products at lower prices. This has the negative effect of forcing suppliers out of business. While the motive is laudable the method is damaging to industry. There are inefficiencies in industry that need to be reduced but imposing requirements will not solve the problem. Co-operation between customer and supplier would be a better solution and when neither party can identify any further savings the target has been reached. Customers do not benefit by forcing suppliers out of business. So is *quality free*?

## **High quality and low quality; poor quality and good quality**

When a product or service satisfies our needs we are likely to say it is of good quality and likewise when we are dissatisfied we say the product or service is of poor quality. When the product or service exceeds our needs we will probably say it is of high quality and likewise if it falls well below our expectations we say it is of low quality.

These measures of quality are all subjective. What is good to one may be poor to another. In the under-developed countries, any product, no matter what the quality, is welcomed. When you have nothing, even the poorest of goods is better than none. A product may not need to possess defects for it to be regarded as poor quality which means it may not possess the features that we would expect, such as access for maintenance. These are design features that give a product its saleability. Products and services that conform to customer requirements are considered to be products of acceptable quality. However, we need to express our relative satisfaction with products and services and as a consequence use subjective terms such as high, low, good or poor quality. If a product that meets customer requirements is of acceptable quality, what do we call one that does not quite meet the requirements, or perhaps exceeds the requirements? An otherwise acceptable product has a blemish – is it now unacceptable? Perhaps not because it may still be far superior to other competing products in its acceptable features and characteristics.

While not measurable, these subjective terms enable customers to rate products and services according to the extent to which they satisfy their requirements. However, to the company supplying products and services, a more precise means of measuring quality is needed. To the supplier, a quality product is one that meets in full the perceived customer requirements.

## Quality characteristics

Any feature or characteristic of a product or service that is needed to satisfy customer needs or achieve fitness for use is a *quality characteristic*. When dealing with products the characteristics are almost always technical characteristics, whereas service quality characteristics have a human dimension. Some typical quality characteristics are given below.

### Product characteristics

Accessibility	Functionality	Size
Availability	Interchangeability	Susceptibility
Appearance	Maintainability	Storability
Adaptability	Odour	Strength
Cleanliness	Operability	Taste
Consumption	Portability	Testability
Durability	Producibility	Traceability
Disposability	Reliability	Toxicity
Emissivity	Reparability	Transportability
Flammability	Safety	Vulnerability
Flexibility	Security	Weight

### Service quality characteristics

Accessibility	Credibility	Integrity
Accuracy	Dependability	Promptness
Courtesy	Efficiency	Responsiveness
Comfort	Effectiveness	Reliability
Competence	Flexibility	Security

These are the characteristics that need to be specified and their achievement planned, controlled, assured, improved, managed and demonstrated. These are the characteristics that form the subject matter of the product or service requirements referred to in a contract, specification or indeed ISO 9000. When the value of these characteristics is quantified or qualified they are termed *product requirements*. We used to use the term *quality requirements* but this caused a division in thinking that resulted in people regarding quality requirements as the domain of the quality personnel and technical requirements being the domain of the technical personnel. All requirements are *quality requirements* – they express needs or expectations that are intended to be fulfilled by a process output that possesses inherent characteristics. We can therefore drop the word *quality*. If a modifying word is needed in front of the word requirements it should be a word that signifies

the subject of the requirements. Transportation system requirements would be requirements for a transportation system, Audio speaker design requirements would be requirements for the design of an audio speaker, component test requirements would be requirements for testing components, and management training requirements would be requirement for training managers. The requirements of ISO 9000 and its derivatives such as ISO/TS 16949, TL 9000, AS9100B and ISO 13485 are often referred to as *quality requirements* as distinct from other types of requirements but this is misleading. ISO 9000 is no more a quality requirement than is ISO 1000 on SI units, ISO 2365 for ammonium nitrate or ISO 246 for rolling bearings. The requirements of ISO 9001 are quality management system requirements – requirements for a quality management system.

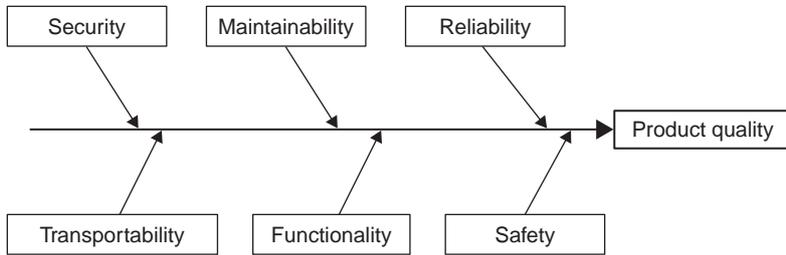
## Quality, reliability and safety

There is a school of thought that distinguishes between quality and reliability and quality and safety. Quality is thought to be a non-time-dependent characteristic and reliability a time-dependent characteristic. Quality is thought of as being limited to conformance to specification regardless of whether the specification actually meets the needs of the customer or society. This belief resulted in Quality Control specialists serving manufacturing and Reliability specialists serving product design. However, it is probably more to do with the assumed competence of the people involved than with definitions. Reliability engineering was perceived to require higher academic attainment than Quality Control but this was due to the limited application QC techniques at the time to manufacturing.

If we take a logical approach to the issue, when a product or service is unreliable, it is clearly unfit for use and therefore of poor quality. If a product is reliable but emits toxic fumes, is too heavy or not transportable when required to be, it is of poor quality. Similarly, if a product is unsafe it is of poor quality even though it may meet its specification in other ways. In such a case the specification is not a true reflection of customer needs. A nuclear plant may meet all the specified safety requirements but if society demands greater safety standards, the plant is not meeting the requirements of society, even though it meets the immediate customer requirements. You therefore need to identify the stakeholders in order to determine the characteristics that need to be satisfied. The needs of all these parties have to be satisfied in order for *quality* to be achieved. But, you can say, “This is a quality product as far as my customer is concerned”. Figure 1.4 shows some of the characteristics of product quality – others have been identified previously.

## Quality parameters

Differences in design can be denoted by grade or class but can also be the result of poor attention to customer needs. It is not enough to produce products that conform to the specifications or supply services that meet management’s



**Figure 1.4** Determinants of product quality

requirements. Quality is a composite of three *parameters*: quality of design, quality of conformance and quality of use which are summarized below:

- *Quality of design* is the extent to which the design reflects a product or service that satisfies customer needs and expectations and regulatory requirements. All the necessary characteristics should be designed into the product or service at the outset.
- *Quality of conformance* is the extent to which the product or service conforms to the design standard. The design has to be faithfully reproduced in the product or service.
- *Quality of use* is the extent by which the user is able to secure continuity of use from the product or service. Products need to have a low cost of ownership, be safe and reliable, maintainable in use and easy to use.

Products or services that do not possess the right features and characteristics either by design or by construction are products of poor quality. Those that fail to give customer satisfaction by being uneconomic to use are also products of poor quality, regardless of their conformance to specifications. Often people might claim that a product is of good quality but of poor design, or that a product is of good quality but it has a high maintenance cost. These notions result from a misunderstanding because product quality is always a composite of the quality of design, conformance and use.

## Dimensions of quality

In addition to quality parameters there are three *dimensions of quality* which extend the perception beyond the concepts outlined previously:

- *The business quality dimension*. This is the extent to which the business serves the needs of all stakeholders and is the outward facing view of the organization. The stakeholders are not only interested in the quality of particular products and services but judge organizations by their potential to create wealth, the continuity of operations, the sustainability of supply, care of the environment, and adherence to health, safety and legal regulations. Changes in business strategy, direction or policies might yield improvement in business quality.

- *The product quality dimension.* This is the extent to which the products and services provided meet the regulatory requirements and needs of specific customers. Enhancement to product features to satisfy more customers might yield improvement in product quality.
- *The organization quality dimension.* This is the extent to which the organization maximizes its efficiency and effectiveness and is the inward facing view of the organization. Efficiency is linked with productivity which itself is linked with the motivation of personnel and the capability or processes and utilization of resources. Effectiveness is linked with the utilization of knowledge focusing on the right things to do. Seeking best practice might yield improvement in organizational quality. This directly affects all aspects of quality. Viewing the organization as a system would redefine this dimension as, *The system quality dimension.*

Many organizations only concentrate on the product quality dimension, but the three are interrelated and interdependent. Deterioration in one leads to a deterioration in the others, perhaps not immediately but eventually.

As mentioned previously, it is quite possible for an organization to satisfy the customers for its products and services and fail to satisfy the other stakeholders. Some may argue that the producers of pornographic literature, nuclear power, non-essential drugs, weapons etc. harm society and so regardless of these products and services being of acceptable quality to their customers, they are not regarded by society as benefiting the quality of life. However, society has a way of dealing with these – through representation in government, laws are passed that regulate the activities of organizations thus imposing limits on producers of pornographic literature, nuclear power, non-essential drugs, weapons etc., so that any harm that may beset society is minimized. Within an organization, the working environment may be oppressive – there may be political infighting, the source of revenue may be so secure that no effort is made to reduce waste. In such situations organizations may produce products and services that satisfy their customers. We must separate the three concepts above to avoid confusion. When addressing quality, it is necessary to be specific about the object of our discussion. Is it the quality of products or services, or the quality of organization (or system) in which we work, or the business as a whole, about which we are talking? If we only intend that our remarks apply to the quality of products, we should say so.

## Summary

In this chapter we established that individuals differ in the level of information they require to do the right things right and that this has led to the development of principles, rules and instructions. With this in mind, we approached the meaning of quality from different perspectives. We established that quality is primarily about satisfying the needs of stakeholders and proceeded to

describe the stakeholders and their individual needs. We then examined various definitions of quality, identified the factors that characterise the quality of products and services and addressed several misconceptions where quality is perceived as being separate to or inclusive of price, cost, reliability etc. Finally we defined the parameters and dimensions of quality to reveal the scope of quality management and thus the basis for achieving, sustaining and improving quality that is dealt with in the next Chapter.