11 The role of quality in management information and performance measurement systems

Topic list	Syllabus reference
1 Quality overview	D6
2 Modern Japanese business practices and techniques	D6(a)
3 The terminology of quality management	D6(b)
4 The ISO 9000:2000 and 2008 series of standards	D6(d)
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7 The qualities of good information and good management information systems	D6(e)
8 Six Sigma and quality improvement	D6 (f)

Introduction

The achievement of a consistent, desired level of quality is a vital feature of putting strategy into action.

It is important to understand that consistence of *satisfactory* quality is, for most organisations, more important and appropriate than striving for the *highest* quality and sometimes failing to achieve it.

In this chapter we will examine some modern approaches to quality management. These approaches to quality tend to have common features, but make sure you understand the areas in which they differ.

Study guide

		Intellectual level
D6	**The role of quality in management information and performance measurement systems**	
(a)	Discuss and evaluate the application of Japanese business practices and management accounting techniques, including: (i) Kaizen costing (ii) Target costing (iii) Just-in-time (iv) Total quality management	3
(b)	Discriminate between quality, quality assurance, quality control and quality management	2
(c)	Assess the relationship of quality management to the performance management strategy of an organisation	3
(d)	Advise on the structure and benefits of quality management systems and quality certification	3
(e)	Justify the need and assess the characteristics of quality in management information systems	3
(f)	Discuss and apply Six Sigma as a quality improvement method using tools such as DMAIC for implementation	2

Exam guide

Quality has been a dominant theme is management thinking for the last fifty years. Consideration of quality is a fundamental part of strategy, and the word 'quality' is often mentioned in organisations' mission statements. Quality may also be an important feature of process and e-business design.

Questions on quality could either be standalone questions on specific models or quality issues, or they could be integrated with other topics such as IT or business process change.

The first section of the Chapter provides some background, explaining the history of quality management. This will help you see how modern approaches have developed. Some of the ideas here may be familiar, if only through phrases such as quality circles. However, you will not be expected to write on the history of quality management in your exam.

1 Quality overview

FAST FORWARD

Quality management has developed from an inspection-based process to a philosophy of business that emphasises customer satisfaction, the elimination of waste and the acceptance of responsibility for conformance with quality specifications at all stages of all business processes.

1.1 Traditional approaches to quality

There has been a rise in awareness of quality and the systems that support it, to the extent that it has become of **strategic significance**. Quality is now considered to be of fundamental importance to many organisations. Indeed, many firms pursue a **strategy of differentiation based on high quality**.

There was a time when quality was not measured as an output target, and when managers considered it something to be added on to a product rather than something that was integral to it. Quality control applied largely to manufacturing and meant **inspection**, or identifying when defective items are being produced at an unacceptable level.

There are many problems with this approach.

(a) The inspection process itself **does not add value**: if it could be guaranteed that no defective items were produced, there would be no need for a separate inspection function.

(b) The **production of substandard products is a waste** of raw materials, machine time, human effort and overhead cost.

(c) The inspection department takes up possibly expensive **land and warehousing space**.

(d) The production of defects is **not compatible with newer production techniques** such as just-in-time: there is no time for inspection.

(e) **Working capital is tied up** in inventories that cannot be sold.

In other words, the inspection approach builds **waste** into the process, which is not acceptable: the resources it consumes can be put to better use.

1.2 The development of quality management

Quality management is not new. Below, we give a brief guide to some of the major ideas behind the development of quality management. An important theme running through this process is the gradual expansion of the quality idea from a **technique** forming part of the management of manufacturing output to its current status as a **philosophy of business** and vital component of strategy. Partly as a result of this development, the threshold level of quality capability has gradually risen, so that high quality standards are now taken for granted.

This last point is important. Threshold values of quality have increased in most organisations over the last few decades. Therefore if an organisation wants to use 'high quality' as part of a differentiation strategy, then the levels of quality it must achieve must also increase, to maintain the differentiation from all the other organisations.

1.3 Deming

W Edwards Deming is one of the founding fathers of the quality movement. Deming's first job in this field was to use **statistical process control** to raise productivity in US factories during World War II. His ideas were adopted in Japan, once he was able to convince Japanese business leaders of their merits. Deming has asserted that over 90% of a company's problems can be corrected only by management, as management has the sole authority to change the system.

Deming's book *Out of the Crisis* listed fourteen points for managers to adopt to improve quality and competitiveness. These are summarised as follows.

(a) Improving products and services must be a constant purpose of the organisation

(b) Eliminate all waste. (This was especially important in Japan, which has few sources of raw materials).

(c) Cease depending on mass inspection to achieve quality. This ties up resources and working capital in stocks.

(d) Price should not be the only consideration in choosing a supplier. Quality and reliability are also important.

(e) Improve the systems for production and service delivery. This reduces waste and enhances quality by ensuring the production system works optimally.

(f) Train people so they are better at working, and understand how to optimise production.

(g) Lead people.

(h) 'Drive out fear'.

(i) Break down barriers between staff areas.

(j) Get rid of slogans, exhortations, targets. These can be alienating.

(k) Get rid of numerical quotas. These encourage the wrong attitude to production.

(l) Enable people to take pride in work.

(m) Encourage 'education and self improvement for everyone'.

(n) Action should be taken to accomplish quality objectives.

The abandonment of mass inspection to assess quality implies that quality must be built in from the beginning, not added on at the end.

1.4 Crosby

Philip B Crosby is chiefly known for two concepts.

(a) **Zero defects**, there should never be any defects in a product. Some consider this to be an impossible ideal, and invoke the concept of diminishing returns. Alternatively it can be seen as a slogan to employees.

(b) **Right first time** is another idea which holds that a product should not have to be corrected once it is built. It is thus a corollary of the zero defects concept.

Crosby proposes four standards that flesh out these concepts.

(a) Quality is '**conformance to requirements**'.

(b) The system for advancing quality is **prevention**, not appraisal.

(c) The **goal** should be zero defects.

(d) The importance of quality is measured by the cost of *not* having quality.

Crosby's ideas demonstrate a fundamental shift from a 'supervisory' culture of quality assurance to one where each individual takes full responsibility for his work: **quality is everyone's responsibility**.

1.5 Juran

Joseph Juran's book *Quality Control Handbook* was published in 1951. He also worked with Japanese industrialists in the years immediately after World War II, and, with Deming, is credited with increasing Japan's industrial competitiveness.

While Deming's ideas are wide ranging and expand into considerations of leadership and management style, Juran was concerned with identifying **specific improvements for enhancing quality**. Juran's ideas are different in the following ways.

(a) The best approach to enhancing quality is to 'identify specific opportunities, evaluate their viability by using conventional methods such as return on investment, plan the selected project carefully, monitor their results'.

(b) Juran believes in the law of **diminishing returns**: there is an economic level of quality beyond which it is pointless to strive, because the costs outweigh the benefits.

(c) Juran believes that most quality problems derive from management systems and processes rather than poor workmanship.

Juran defines quality as 'fitness for use', which includes two elements.

(a) **Quality of design**, which can include the customer satisfactions built into the product.

(b) **Quality of conformance**, in other words a lack of defects in the finished goods.

1.6 Feigenbaum

Armand Feigenbaum appended the word 'total' to quality, thus emphasising the relevance of quality issues to **all areas of the operations of a business**. He is also noted for assessing the economic value of quality, as the value of many quality improvement measures are not exactly self-evident. In other words he stressed the importance of identifying the **costs** of quality, and the lack of quality, to prove that, in economic and accounting terms, 'prevention is better than cure'.

This involves changing the role of the quality control function (which inspected and rejected output) to one in which quality provided an effective system for quality maintenance.

(a) An **inspection role** is carried out after the event, after the wasteful and substandard production.

(b) A **planning role** would involve the design of systems and procedures to reduce the likelihood of sub-optimal production.

1.7 Ishikawa

The quality philosophy has been implemented most famously in Japan. According to some commentators **design quality** rather than **conformance quality**, has been responsible for much of the success of Japanese firms in some industries.

Ishikawa is noted for proposing **quality circles**, which are groups of selected workers delegated with the task of analysing the production process, and coming up with ideas to improve it. Success requires a commitment from the circle's membership, and a management willingness to take a back seat.

Quality circles are mainly management stimulated. Whatever the stated reasons are for instituting quality circles, the real reason for having quality circles is to motivate employees to improve quality.

2 Modern Japanese business practices and techniques

FAST FORWARD

Changes to the **competitive environment**, **product life cycles** and **customer requirements** have had a significant impact on the modern business environment.

2.1 Changing competitive environment

2.1.1 Management accounting and organisational culture

The relevance of organisational culture to management accounting can be explained in simple terms. The business of management accounting is to provide managers with information to help them run the business. **If the management accountant is not sensitive to the culture of his organisation he will not understand how it is run and will not know what sort of information to provide.** For example, a management accountant in a public sector organisation may need to focus on the effectiveness and efficiency of cost control, while a management accountant in a commercial entity may need to focus on how it is generating value for its shareholders.

Question — **Management accounting and organisational culture**

Robert Waterman (co-author with Tom Peters of the classic text *In Search of Excellence*) published a book entitled *The Frontiers of Excellence* (1994), which argued that leading companies at the time, and those that had been successful over long periods, did not put the shareholders first. Instead they concentrated on 'putting people first', the people in question being employees and customers.

How could a management accounting system foster such a culture, or undermine it?

Answer

A system to **foster** the 'people' culture would collect and analyse data about employee performance and customer reaction, provide the basis for rewards for what is good in these terms, and supply information that indicates to people how they could do better.

The culture would be **undermined** by a system that concentrates solely on reporting in figures and language aimed at the stock market.

Undoubtedly the most **profound influences** on Western corporate cultures since the 1990s have been ideas borrowed from **Japanese management**. 'Philosophies' such as Just-in-time (**JIT**) and Total Quality

Management (**TQM**) have a direct impact on business areas that have long been the preserve of accountants – purchasing and inventory control, quality costs, waste and scrap and so on.

Similarly, the Japanese **team working** approach is a radical change from the individualistic culture of the West, and this has further implications for performance measurement and reporting.

2.1.2 Organisations and the changing environment

In Chapter 3 we looked at how the changing competitive environment can affect organisations. These changes have meant that traditional management accounting techniques had lost their effectiveness. Consequently, management accountants have begun to adopt newer techniques that suit better the dynamism and changing cost structures of modern organisations.

In this chapter we look at some of the techniques and business practices developed in Japan. Some of this material may be familiar from your earlier studies. You must build on this knowledge to be able to **discuss** and **evaluate** these techniques in the exam.

2.2 Total quality management (TQM)

One of the most significant developments in performance management has been the emphasis on quality. And a key aspect of this has been a recognition of the **costs of quality**, which we will look at in this Chapter.

FAST FORWARD

In the context of **TQM**, quality means getting it right first time and improving continuously.

Key term

Total quality management (TQM) is the process of applying a 'zero defects' philosophy to the management of all resources and relationships within an organisation as a means of developing and sustaining a culture of continuous improvement which focuses on meeting customers' expectations.

Mark Lee Inman listed 'eight requirements of quality' in an ACCA *Students' Newsletter* article, which could be seen as the **characteristics of total quality management programmes**.

(a) Organisation wide there must be acceptance that the only thing that matters is the **customer**.

(b) There should be recognition of the all-pervasive nature of the **customer-supplier relationship**, including internal customers; passing sub-standard material to another division is not satisfactory.

(c) Instead of relying on inspection to a predefined level of quality, **the cause of the defect** in the first place should be prevented.

(d) Each employee or group of employees must be **personally responsible** for defect-free production or service in their domain.

(e) There should be a move away from 'acceptable' quality levels. **Any level of defects must be unacceptable**.

(f) All departments should try obsessively to **get things right first time**; this applies to misdirected phone calls and typing errors as much as to production.

(g) **Quality certification programmes** should be introduced.

(h) The cost of poor quality should be emphasised; **good quality generates savings** (for example, through not having to re-work items with defects, or through a reduction in the level of refunds or replacement products given to customers).

Exam focus point

The examiner could ask you to discuss modern techniques such as TQM and how they could be applied in organisations, especially where they contrast with traditional management accounting techniques.

In the December 2008 exam, a part-question asked candidates to think about criteria for software to be considered **quality** software. Possible answers include building in quality and considering the costs of quality.

2.3 Just-in-time (JIT) systems

FAST FORWARD

JIT aims for zero inventory and perfect quality and operates by demand-pull. It consists of **JIT purchasing** and **JIT production** and results in lower investment requirements, space savings, greater customer satisfaction and increased flexibility.

Key terms

Just-in-time (JIT) is 'A system whose objective is to produce or to procure products or components as they are required by a customer or for use, rather than for inventory. A JIT system is a 'pull' system, which responds to demand, in contrast to a 'push' system, in which inventories act as buffers between the different elements of the system, such as purchasing, production and sales.'

Just-in-time production is 'A system which is driven by demand for finished products whereby each component on a production line is produced only when needed for the next stage'.

Just-in-time purchasing is 'A system in which material purchases are contracted so that the receipt and usage of material, to the maximum extent possible, coincide'.

Although often described as a technique, JIT is more of a **philosophy or approach to management** since it encompasses a **commitment to continuous improvement** and the **search for excellence** in the design and operation of the production management system.

In this respect, the aims of JIT are aligned with those of TQM, since both focus on eliminating waste and non-value added activities, and on producing goods which have zero defects.

Exam focus point

Part of a question in the December 2011 exam candidates to evaluate the effect that moving to Just-in-Time purchasing and production systems have on a company, and what impact they would have on the performance measures the company uses.

Quality and reliability are key elements of a successful JIT system, so it will be important for a company which uses a JIT system to introduce measures to assess how well it is performing in these areas if it does not already do so.

2.3.1 Essential elements of JIT

Exam focus point

Shane Johnson wrote an article on 'Just-in-time operations' in the April 2004 edition of *Student Accountant* magazine. The key points from the article are included in this section, but you are still advised to read the article in full.

Element	Detail
JIT purchasing	Parts and raw materials should be purchased as near as possible to the time they are needed, using small frequent deliveries against bulk contracts. Inventory levels are therefore minimised.
Close relationship with suppliers	In a JIT environment, the responsibility for the quality of goods lies with the supplier. A long-term commitment between supplier and customer should therefore be established. If an organisation has confidence that suppliers will deliver material of 100% quality, on time, so that there will be no rejects, returns and hence no consequent production delays, usage of materials can be matched with delivery of materials and inventories can be kept at near zero levels. However, flexibility and establishing good communication channels are also important aspects of the relationship with suppliers.
Uniform loading	All parts of the productive process should be operated at a speed which matches the rate at which the final product is demanded by the customer. Production runs will therefore be shorter and there will be smaller inventories of finished goods because output is being matched more closely to demand (and so storage costs will be reduced).

Element	Detail
Set-up time reduction	No value is added during set-up times; so set-ups are non-value-added activities. Consequently, time spent setting up machinery should be minimised.
Simplification	There is a constant focus on the simplification of products and processes in order to maximise the utilisation of available resources.
Machine cells	Machines or workers should be grouped by product or component instead of by the type of work performed. Products can flow from machine to machine without having to wait for the next stage of processing or returning to stores. Lead times and work in progress are thus reduced.
Quality	Production management should seek to eliminate scrap and defective units during production, and to avoid the need for reworking of units since this stops the flow of production and leads to late deliveries to customers. Product quality and production quality are important 'drivers' in a JIT system. Also, note the fundamental requirement in relation to quality is that the level of quality satisfies the customer.
Pull system (Kanban)	Products/components are only produced when needed by the next process. Nothing is produced in anticipation of need, to then remain in inventory, consuming resources.
Preventative maintenance	Production systems must be reliable and prompt, without unforeseen delays and breakdowns.
Employee involvement	Workers within each machine cell should be trained to operate each machine within that cell and to be able to perform routine preventative maintenance on the cell machines (ie to be multiskilled and flexible). Employee involvement in JIT programmes is also important at a more general level. The successful operation of JIT requires workers to possess a flexibility of both attitude and aptitude.

Case Study

The following extract from an article in the *Financial Times* illustrates how 'just-in-time' some manufacturing processes can be. The emphasis is BPP's.

'Just-in-time manufacturing is down to a fine art at *Nissan Motor Manufacturing (UK)*. **Stockholding of some components is just ten minutes** – and the holding of all parts bought in Europe is less than a day.

Nissan has moved beyond just-in-time to **synchronous supply** for some components, which means manufacturers deliver these components directly to the production line minutes before they are needed.

These manufacturers do not even receive an order to make a component until the car for which it is intended has started along the final assembly line. Seat manufacturer *Ikeda Hoover*, for example, has about 45 minutes to build seats to specification and deliver them to the assembly line a mile away. It delivers 12 sets of seats every 20 minutes and they are mounted in the right order on an overhead conveyor ready for fitting to the right car.

Nissan has **close relationships with this dozen or so suppliers** and deals exclusively with them in their component areas. It involves them and even their own suppliers in discussions about future needs and other issues. These companies have generally established their own manufacturing units close to the Nissan plant.

Other parts from further afield are collected from manufacturers by *Nissan* several times at fixed times. This is more efficient than having each supplier making individual haulage arrangements.'

2.3.2 Problems associated with JIT

JIT should not be seen as a panacea for all the endemic problems associated with Western manufacturing. It might not even be appropriate in all circumstances.

(a) It is **not always easy to predict patterns of demand.**

(b) JIT makes the organisation **far more vulnerable to disruptions in the supply chain** (as the disruption to air freight in the aftermath of the volcanic eruption of Eyjafjallajokull in Iceland demonstrated)

(c) JIT, originated by Toyota, was designed at a time when all of Toyota's manufacturing was done within a 50 km radius of its headquarters. Wide geographical spread, however, makes this difficult.

Case Studies

JIT and supply chains

Following the Eyjafjallajokull volcanic eruption in Iceland in April 2010 a number of flights across Europe were cancelled because airline companies were concerned about the potential impact of the volcanic ash on the engines of their planes.

This flight ban, in turn, threatened to force worldwide car production to grind to a halt, as manufacturers were unable to source key electronic components.

The flight disruption highlighted the car industry's dependence on complex, worldwide supply chains that need multiple modes of transport to deliver goods and components just in time, to where they are needed.

Although air freight accounts for a tiny amount of world trade by weight - about 0.5 per cent for the UK - the disruption has highlighted how it plays a vital role in supplying key, high-value components to many manufacturers. In spite of its tiny volume, it accounts for 25 per cent of UK trade by value.

Among the carmakers, BMW and Nissan said they planned to suspend some production because of disruption to supplies. Audi said it might have to cancel shifts because of missing parts.

Although all three mainly use suppliers based near their factories and use road and sea for most deliveries, they depend on air freight for a small number of high-value electronic components. Nissan UK, for example, said it might have to halt production of its Cube, Murano SUV and Rogue crossover models because it lacked supplies of a critical sensor made in Ireland.

Although some components could be transported by sea freight (instead of air freight) this is a much slower means of transport, and so would lead to a delay in the components becoming available.

Some commentators have questioned whether this disruption will make companies re-examine their arrangements for sourcing goods. Companies have become more vulnerable to disruption since moving to just-in-time production methods, where hardly any inventory of products is held.

On the other hand, it would makes little sense to carry large quantities of excess inventory given the very slim chance of further severe disruption of this kind. Carrying excess inventory is a cost in itself.

However, there is an argument that companies should set up supply chains that reduce their reliance on a single mode of transport, and could be adapted to meet different circumstances. As Emma Scott from the Chartered Institute of Purchasing & Supply in the UK commended "It's a case of taking a sensible approach and having a flexible approach to your supply chain."

Adapted from article 'Pressure grows on supply chains'
Financial Times, 21 April, 2010

2.3.3 Modern versus traditional inventory control systems

There is no reason for the newer approaches to supersede the old entirely. A restaurant, for example, might find it preferable to use the traditional economic order quantity approach for staple non-perishable food inventories, but adopt JIT for perishable and 'exotic' items. In a hospital a stock-out could, quite literally, be fatal, and JIT would be quite unsuitable.

2.3.4 Costing implications of JIT

In his article *in Student Accountant* (April 2004, *Just-in-time operations*) Shane Johnson highlighted the costing implications of JIT.

'Just-in-time manufacturing enables purchasing, production, and sales to occur in quick succession with inventory being maintained at minimum levels. The absence of inventory renders decisions regarding cost-flow assumptions (such as weighted average or first-in, first-out) or inventory costing methods (such as absorption or marginal costing) unimportant. This is because all of the manufacturing costs attributable to a period flow directly into cost of goods sold. Job costing is simplified by the rapid conversion of direct materials into finished goods that are then sold immediately.'

The article also stresses that, while minimising costs will always remain an important consideration for businesses, the focus is no longer simply on minimising costs but also on **value appreciation**. This has important implications for performance measurement and performance management. Performance information can no longer simply look at costs, but financial and non-financial information will also be required looking at supplier performance, on-time deliveries, cycle times and the number of defective items manufactured.

2.4 Life cycle costing and target costing

FAST FORWARD

Life cycle costing assists in the planning and control of a product's life cycle costs by monitoring spending and commitments to spend during a product's life cycle.

2.4.1 What are life cycle costs?

Life cycle costs are incurred for products and services **from their design stage through development to market launch, production and sales, and their eventual withdrawal from the market**.

Traditional management accounting systems in general only report costs at the physical production stage of the life cycle and do not accumulate costs over the entire life cycle. They **assess a product's or project's profitability on a periodic basis**. Life cycle costing, on the other hand, considers a product's/project's entire life.

Key term

Life cycle costing tracks and accumulates actual costs and revenues attributable to each product or project over the entire product/project life cycle

The **total profitability** of any given product/project can therefore be determined.

Traditional management accounting systems usually total **all non-production costs** and record them as a **period expense**. **Using life cycle costing** such costs are **traced to individual products over complete life cycles.**

(a) The total of these costs for each individual product can therefore be reported and compared with revenues generated in the future.

(b) The visibility of such costs is increased.

(c) **Individual product profitability can be more fully understood** by attributing *all* costs to products.

(d) As a consequence, **more accurate feedback information** is available on the organisation's success or failure in developing new products. In today's competitive environment, where the ability to produce new and updated versions of products is paramount to the survival of an organisation, this information is vital.

2.4.2 The importance of the early stages of the life cycle

It is reported that some organisations operating within an advanced manufacturing technology (**AMT**) **environment** find that approximately **80-90% of a product's life cycle cost is determined by decisions made early within the cycle** at the design stage. Life cycle costing is therefore particularly suited to such organisations and products, monitoring spending and commitments to spend during the early stages of a product's life cycle.

In order to compete effectively in today's competitive market, organisations need to **redesign continually their products** with the result that **product life cycles** have become much **shorter**. The **planning, design and development stages of a product's cycle** are therefore **critical to an organisation's cost management process**. Cost reduction at this stage of a product's life cycle, rather than during the production process, is one of the most important ways of reducing product cost.

Here are some **examples of costs that are determined at the design stage.**

(a) The number of different components
(b) Whether the components are standard or not
(c) The ease of changing over tools
(d) Type of packaging

Case Study

The following case study illustrates the benefits of increasing the amount of standardisation in the car manufacturing process.

In August 2011, General Motors Co announced plans to become leaner in the future, cutting costs so it will make stronger profits.

GM said it plans to cut costs by halving the number of frames it bases its vehicles on across the globe. In 2010, GM had 30 frames, known in the industry as 'platforms'. By 2018 it plans to cut that number to 14. It will also sell more of the cars and trucks built on those platforms across the globe, saving on manufacturing, engineering and design costs. The company also plans to cut the number of engines it develops.

The Chairman and CEO, Dan Akerson noted, "There's a lot of complexity. We need to simplify it. More of our components will be common, and more of our vehicles will be built on global architectures."

GM said just 6 percent of its cars and trucks are currently (2011) built off of global platforms. The intention is that this figure should rise to 90 percent by 2018.

Japanese companies developed **target costing** as a response to the problem of **controlling and reducing costs over the product life cycle**.

2.4.3 Target costing

FAST FORWARD

Target costing is a pro-active cost control system. The target cost is calculated by deducting the target profit from a predetermined selling price based on customers' views. Techniques such as value analysis are used to change production methods and/or reduce expected costs so that the target cost is met.

ABM
BPR

Key term

Target cost is an estimate of a product cost which is derived by subtracting a desired profit margin from a competitive market price.

Locked

One of the key drivers in target costing is that once a target cost has been established, costs – in the design and manufacture of the product - have to be reduced to provide a product that can be made for the desired (target) cost.

'Target cost management has been defined as a system that is effective in managing costs in new-product design and development stages. It has also been viewed as allowing the production cost of a proposed product to be identified so that when sold it generates the desired profit level. ... Target cost management has also been viewed as playing a useful role in enabling an enterprise to set and support the attainment of cost levels to effectively reflect its planned financial performance. ...What appears to be evident is that there are almost as **many conceptions of target costing** as there are companies deploying the approach and there are probably many **companies engaging in various aspects of target cost management without referring to the term**.

Target cost management has been posited to assist in the pursuit of product development time reduction, as well as the quality definition for a new product and cost containment generally. It has therefore been perceived as a managerial tool simultaneously to **address time, quality and cost issues**.'

(A Bhimani and H Okano, 'Targeting excellence: target cost management at Toyota in the UK', *Management Accounting,* June 1995 (with BPP's emphasis))

Case Study

Application of Target costing in the UK National Health Service (NHS)

Although target costing is often referred to in relation to products and manufacturing, it can also be applied to service industries. The following case highlights some of the issue involved in applying target costing to the NHS.

In the same way that the major part of product costs is determined at the design stage, the health service also has to design care pathways that focus on delivering care at an affordable level of cost. Therefore cost management needs to start early in the health care process just as it does in a manufacturing process.

Although the process of health care is about more than just cost control (and clearly it is important to focus on patients as well as costs) target costing can be very useful to help health services assess the costs of products or services before they are introduced.

And although the NHS is not (yet) driven by margins and financial returns in the same way that commercial organisations are, there are still questions about the extent to which primary care trusts within the NHS can afford to introduce new treatments.

In practice, some new treatments have been introduced irrespective of the question of affordability; for example based on recommendation by NICE (The National Institute for Health and Clinical Excellence).

The example of the breast cancer drug – herceptin – highlights the issue here. NICE has recommended that the drug should be made available on the NHS for women in the early stages of the disease, because it has been proved to reduce recurrence of the disease and increase life expectancy. However, herceptin is very expensive, and many primary care trusts will find it hard to afford a drug that costs around £20,000 a year per patient.

The primary care trusts might question whether NICE has considered the financial implications of their proposals, and whether it is financially viable for them to provide such an expensive drug.

However, target costing could also be used in more basic healthcare services. For example, it could be used to reduce the time patients spend in an operating theatre, or to assess whether intravenous antibiotics could not be administered orally instead. In essence, the practice of target costing would encourage a more detailed analysis of hospital practice to try to identify efficiencies in every area of the treatment process.

This can also include support areas such as procurement, encouraging managers to question the price paid for every component of the treatment, and to ask whether better deals could be struck.

Nonetheless, it is important to remember that target costing does also focus on the customer; in this case, the patient. So applying it to the NHS will not simply be about reducing costs, but about reducing costs whilst still delivering acceptable levels of patient care.

(Based on, and adapted from, '*Targeting Cost*' – an article by Simon Wombwell; October 2005, produced as part of a CIMA discussion group on Target costing and the NHS).

Question

Can you see any problems with adopting target costing as a tool in a not-for-profit organisation?

Answer

Target costing can lead to **increased pressure on the workforce** as cost targets can be demanding and require a reduction in times taken to do jobs. This can be more difficult to achieve in the not-for-profit sector where employees can be the largest cost, and they are often the means of delivering the services. Over time savings become increasingly difficult to achieve.

Target costing requires managers to change the way they think about the relationship between cost, price and profit.

(a) The **traditional approach** is to **develop a product, determine the expected standard production cost** of that product and **then set a selling price** (probably based on cost) with a resulting profit or loss. Costs are controlled through variance analysis at monthly intervals.

(b) The **target costing approach** is to develop a **product concept** and the primary specifications for performance and design and then to **determine the price customers would be willing to pay** for that concept. The **desired profit margin is deducted from the price leaving a figure that represents total cost**. This is the target cost and the product must be capable of being produced for this amount otherwise the product will not be manufactured. **During the product's life the target cost will constantly be reduced** so that the **price can fall**. **Continuous cost reduction techniques** must therefore be employed.

2.4.4 The target costing process

Step 1 **Analyse the external environment** to ascertain what customers require and what competitors are producing. Determine the **product concept**, the price customers will be willing to pay and thus the **target cost**.

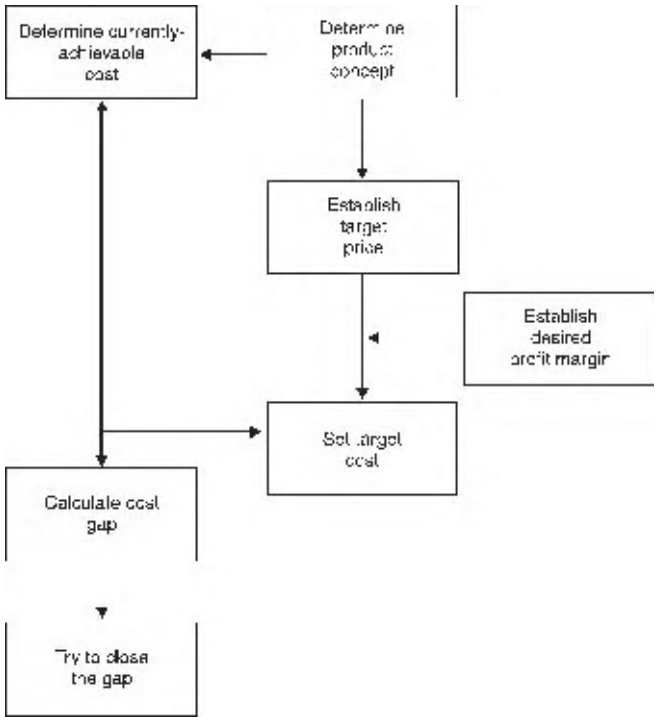
Step 2 **Split the total target cost into broad cost categories** such as development, marketing, manufacturing and so on. **Then split up the manufacturing target cost per unit across the different functional areas of the product. Design the product so that each functional product area can be made within the target cost.** If a functional product area cannot be made within the target cost, so that a **cost gap** exists between the currently achievable cost and the target cost, the targets for the other areas must be reduced, or the product redesigned or scrapped. The product should be developed in an atmosphere of **continuous improvement** using **value engineering techniques** and **close collaboration with suppliers**, to enhance the product (in terms of service, quality, durability and so on) and reduce costs.

Key term

Value engineering aims to help design products which meet customer requirements at the lowest cost while assuring the required standards of quality and reliability are maintained.

Step 3 Once it is decided that it is feasible to meet the total target cost, **detailed cost sheets** will be prepared and **processes formalised**.

The target costing process



2.4.5 Attaining the target cost

It is possible that management may decide to go ahead and manufacture a product whose target cost is well below the currently attainable cost (so that there is a **cost gap**), the currently attainable cost being determined by current technology and processes. If this is the case management will **set benchmarks for improvement** towards the target costs, by specified dates.

Options available to reduce costs

(a) **Training** staff in more efficient techniques
(b) Using **cheaper staff**
(c) Acquiring new, more **efficient technology**
(d) Cutting out **non-value-added activities**

common list of cost ↓

Even if the product can be produced within the target cost the story does not end there. **Once the product goes into production target costs will gradually be reduced.** These reductions will be incorporated into the budgeting process. This means that cost savings must be actively sought and made continuously. Value analysis will be used to reduce costs if and when targets are missed.

Key term

Value analysis involves examining the factors which affect the cost of a product or service, so as to devise ways of achieving the intended purpose most economically at the required standards of quality and reliability.

Question

Standard costing v target costing

Fill in the blank spaces ((a) to (d)) in the table below to show how standard costing and target costing differ.

Stage in product lifecycle	Standard costing approach	Target costing approach
Product concept stage	No action	(a)
Design stage	(b)	Keep costs to a minimum
Production stage	Costs are controlled using variance analysis	(c)
Remainder of life	(d)	Target cost reduced, perhaps monthly

Answer

(a) Set the selling price and required profit and determine the resulting target cost
(b) Set standard cost and a resulting standard price
(c) Constant cost reduction
(d) Standards usually revised annually

2.5 Kaizen costing

Key term

Kaizen costing focuses on obtaining small incremental cost reductions during the production stage of the product life cycle.

Kaizen costing has been used by some Japanese firms for over twenty years and is now widely used in the electronics and automobile industries, for example. 'Kaizen' translates as **continuous improvement**.

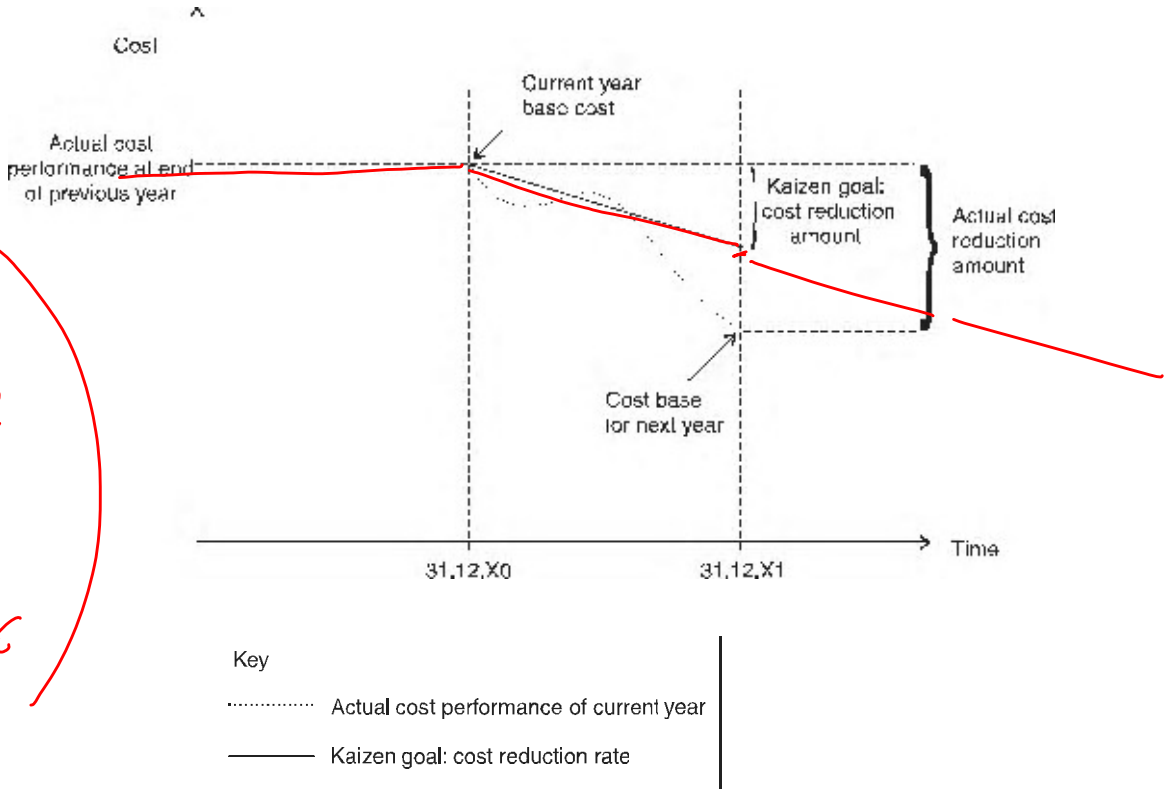
FAST FORWARD

The aim of **Kaizen costing** is to reduce current costs by using various tools such as value analysis and functional analysis.

2.5.1 The kaizen costing process

Functional analysis is applied at the design stage of a new product, and a **target cost for each function** is set. The functional target costs are added together and the total becomes the **product target cost**. Once the product has been in production for a year, the **actual cost of the first year becomes the starting point for further cost reduction**. It is this **process of continuous improvement, encouraging constant reductions by tightening the 'standards'**, that is known as kaizen costing.

The following Kaizen costing chart is based on one used at Daihatsu, the Japanese car manufacturer owned in part by Toyota, and reported in Monden and Lee's 'How a Japanese Auto Maker Reduced Costs' *(Management Accounting* (US Version), 2002).



- motivational
- cultural difference?
- relationship
- life time employment

The previous year's actual production cost serves as the cost base for the current year's production cost. A reduction rate and reduction amount are set (**Kaizen cost goals**). **Actual performance is compared to the Kaizen goals throughout the year and variances are monitored.** At the end of the current year, the current actual cost becomes the cost base for the next year. New (lower) Kaizen goals are set and the whole process starts again.

2.5.2 Kaizen costing v standard costing

Standard costing is used in conjunction with management by exception (management's attention is directed towards situations where actual results differ from expected results). The expected results are based on standards which have been derived from the capability of current organisational processes. **Standard costing therefore reflects current levels of performance and fails to provide any motivation to improve.**

The following table sets out the **principal differences between Kaizen costing and standard costing techniques**.

	Standard costing	Kaizen costing
Concepts	It is used for cost **control**. It is assumed that current manufacturing conditions remain unchanged. The cost focus is on standard costs based on static conditions. The aim is to meet cost performance standards.	It is used for cost **reduction**. It assumes **continuous improvement**. The cost focus is on actual costs assuming dynamic conditions. The aim is to achieve cost reduction targets.
Techniques	Standards are set every six or twelve months. Costs are controlled using variance analysis based on standard and actual costs. Management should investigate and respond when standards are not met.	Cost reduction targets are set and applied monthly. Costs are reduced by implementing **continuous improvement** (kaizen) to attain the target profit or to reduce the gap between target and estimated profit. Management should investigate and respond when target kaizen amounts are not attained.
Employees	They are often viewed as the **cause of problems**.	They are viewed as the **source of** and are empowered to find, the **solutions**.

(Adapted from Monden and Lee)

Exam focus point

One of the questions in the December 2011 exam picked up on the contrast between Kaizen costing and standard costing approaches. The question scenario highlighted that a company's existing performance reporting system used a standard costing approach, but that the management planned to improve financial performance through the use of Kaizen costing and just-in-time purchasing and production.

Candidates were then asked to discuss and evaluate the impact the Kaizen costing approach would have on the costing system and on employee management in the company.

In effect, the question was asking candidates to highlight the contrast between traditional costing systems which focus on cost control (against standard, fixed targets), and Kaizen costing systems which focus on cost reduction and performance improvement.

It is also important to note the impact of the change in systems has on employees and employee management.

A standard costing system doesn't provide any motivation to improve performance levels, but the whole focus of kaizen costing is on performance improvement. And crucially, instead of being seen as the cause of problems, as they are in traditional systems, employees will be seen as the source of solutions under a kaizen system, and they will be empowered to find, and then implement, those solutions. This, in turn, should help increase staff motivation.

2.5.3 How are Kaizen goals met?

(a) Reduction of non-value added activities and costs
(b) Elimination of waste
(c) Improvements in production cycle time

2.6 Continuous improvement

FAST FORWARD

The essence of **continuous improvement** is the use of an organisation's human resources to produce a constant stream of improvements in all aspects of customer value, including quality, functional design, and timely delivery, while lowering cost at the same time.

In today's highly competitive environment, performance against static historical standards is no longer appropriate and successful organisations must be **open to change** if they are to **maintain their business advantage**. Being **forward looking** and **receptive to new ideas** are **essential elements of continuous improvement**. The concept was popularised in Japan, where it is known as kaizen, and many of Japan's economic advances over the past 20 years have been attributed to it.

Key term

> **Continuous improvement** is an 'ongoing process that involves a continuous search to reduce costs, eliminate waste, and improve the quality and performance of activities that increase customer value or satisfaction'. Drury, *Management and Cost Accounting*

The implementation of continuous improvement does not necessarily call for significant investment, but it does require a great deal of **commitment and continuous effort**.

Continuous improvement is often associated with **incremental changes** in the day-to-day process of work **suggested by employees** themselves. This is not to say that continuous improvement organisations do not engage in radical change. **Quantum leaps in performance** can occur when cumulative improvements synergise, the sum of a number of small improvements causing a profound net effect greater than the sum of all the small improvements.

However, because the improvements are continuous they are, by definition, **ongoing**. The process must never stop and sustained success is more likely in organisations which regularly review their business methods and processes in the drive for improvement.

Case Study

Continuous improvement at Corus

The steel manufacturing company Corus is a subsidiary of Tata Steel, part of the giant Indian conglomerate, Tata Group. Corus' principle manufacturing site is at Scunthorpe, where is employs about 5,500 people, and produces over 4 million tonnes of steel products each year. Producing large volumes helps to drive down the costs of producing the steel, so this results in steel being a relatively inexpensive product.

Corus' business strategy is to produce quality steel to satisfy customer requirements, focusing on delivering products at the right time in order to secure profitable business. One of the key challenges it faces is meeting the increasing demands for more steel, at increasing levels of quality and to comply with more demanding delivery requirements.

Corus could meet these challenges by moving to brand new facilities. However, a new 'greenfield site' steel mill could cost more than £300 million to build. Instead, therefore, Corus needs to make process efficiencies and to achieve quality and delivery improvements within its existing manufacturing plant, and it has sought to do this through the process of continuous improvement.

One of the key issues in continuous improvement is reducing or eliminating waste, and Corus has been looking to reduce waste in its steel plate manufacturing process, and the concept of 'flow' has been vital in doing this. It has meant that products are 'pulled' through the process according to customer demand. All parts of the production process, from the supply of raw steel to the finished steel plate, are carefully planned.

Scheduling for each element of the process ensures that bottlenecks are kept to a minimum. Each process is paced to control the amount of product in each stage of the process. This ensures that processes operate smoothly without overload or delay and keep the desired output and quality.

Traditionally, the key measure of productivity at Corus was tonnage (output). So for employees to work to a smooth-paced process (rather than simply trying to maximise output) needed a significant culture change.

Continuous involvement requires team work, and at Corus' Scunthorpe plant a manager coordinates the process. 40 Continuous improvement coaches (chosen from the workforce) received training to facilitate the improvement process.

Corus has put together a 'toolbox' of techniques which the coaches use with managers, employees and operators. These help everyone understand where and how they can improve their work. A continuous improvement culture means that everyone can put forward ideas and have a say in how processes can change for the better. This is known as engagement.

An organisation needs to know where it is going in order to be able to put in place the resources it needs to achieve its plans. This is set out in its vision.

Corus' Scunthorpe plate mill has set out a 5-year vision improvement plan which will help in the process of developing a continuous improvement culture for the business. Everyone in the organisation has to understand and actively support the plan. Workshops for all employees have taken place, to explain the vision and why the change is necessary to enable Corus to remain competitive.

Helped by the continuous improvement coaches, workers have drawn maps of their processes. These show the links between the stages of manufacturing as well as what information flow is needed. The maps show: details of tonnages; numbers of products; rework cycles; inspection points; inventories; delays; and costs.

The first part of the continuous improvement process has been to draw up a 'current state value stream map'. This shows what the systems and processes are like now. The next stage considers what the 'future state map' would look like. This highlights what Corus needs to do to achieve the desired future state, for example, investing in new processes, equipment or additional staffing.

The Scunthorpe plate mill has 16 system maps. These link to each other to give an overview of the whole process. For each of the 16 systems, there are a number of rules about inventory levels and inventory rotation to ensure that the mill is properly pace and all 'downstream' processes (such as cutting, levelling and inspection) can be scheduled accordingly.

Using the value stream maps, Corus has been able to improve process flows and the working environment. It has also reduced unnecessary motion, transport and processing. By taking these small steps and involving everyone in the vision, the delivery of product has increased from 70% of plates on time to 92% on time.

Target setting

Implementing a continuous improvement process also requires everyone to think differently about the way they work. Corus recognised that people might be resistant to change and cling on to old ways of working. The key was getting all workers to see change as their responsibility.

The continuous improvement coaches support the teams and individual staff, and promote or 'champion' new ways of working. Over time, the team and individuals are empowered to take on responsibility and make decisions for themselves. To help workers accept the changes, the 5-year plan established a timeline for the programme of introducing change.

An important part of Corus' continuous improvement programme was the creation of key performance indicators (KPIs).

As we have noted above, historically performance measures at Corus were largely based on tonnes of steel rolled. However, these measures did not show whether the steel met customers' needs or whether the steel needed rework because it didn't meet customer requirements.

Consequently, Corus has now set new KPIs which focus on meeting customer deadlines, such as:

- A zero backlog of customer orders - this means customers always get their deliveries on time
- Meeting targets for rolling steel plate in its allotted week

Corus also monitors and measures how its operations compare with other producers and competitors in the steel industry, through a process of benchmarking. And Corus has also encouraged information sharing throughout the business to help drive improvement.

Costs and benefits of continuous improvement

Corus incurred significant costs in setting up a continuous improvement programme, including:

- Allocating employee time to participate in group work
- Training coaches
- Setting up a manual of tools and techniques.

However, it is now seeing the benefits of continuous improvement, including:

- Reduced waste through lean production
- Improved product quality
- Reduced re-work time
- Faster response times, giving more customers their orders on time
- Becoming more competitive by driving down costs
- Retaining/gaining customers through innovative products and services.

KPIs show that the Scunthorpe mill is now delivering almost 100% of customers' orders complete and on time.

The principles of team working have helped to create a more flexible workforce. This gives Corus the capacity to increase or change production when necessary. In addition, Corus employees are more likely to be satisfied and motivated with their jobs when they feel that they are making a contribution. They can see their expertise helps to create a more effective company. By empowering its workers, Corus gains a more committed workforce which helps to drive further improvement, and will hopefully allow Corus to out-perform its competitors .

Based on article 'Continuous improvement as a business strategy' in *The Times 100*; www.thetimes100.co.uk

2.6.1 Essential factors for continuous improvement

(a) Total **commitment from senior management**

(b) The **opportunity for all employees to contribute** to the continuous improvement process. Tactical and operational level staff, rather than senior management, usually have the information required. The most successful continuous improvement programs are the ones that have the highest staff involvement.

(c) Good, objective **information about the organisation's environment** so that its outcomes (what it does) and its processes (how it does it) can be evaluated

(d) **Employees' awareness of their role** in the achievement of the organisation's strategy

(e) **Management of the performance and contribution of employees**

(f) **Good communications** throughout the organisation

(g) Implementation of **recognised quality management systems and standards**

(h) **Measurement and evaluation of progress against key performance indicators and benchmarks**. Some organisations have found that simply displaying productivity and quality data every day or week raises production and quality because staff can tell when they are doing things right, and so find themselves in a personal continuous improvement cycle.

It is claimed that if these areas are regularly **reviewed**, change can be managed effectively and **continuous improvement becomes a natural part of the organisational processes**. It should create steady growth and development by keeping the organisation focused on its aims, priorities and performance.

2.6.2 Quality circles

A quality circle consists of a **group of employees**, often from different areas of the organisation, who meet regularly to **discuss problems of quality and quality control** in their area of work, and perhaps to suggest

ways of improving quality. It is also a way to **encourage innovation**. The aim of quality circles is to **improve employee development and morale** so as to create a **sense of ownership of the quality** of products and services.

Teamwork, in the form of quality circles and **group problem-solving activities**, is the cornerstone of continuous improvement.

delegation + recognition + reward (financial, intrinsic)

2.6.3 Benefits of continuous improvement

(a) Better performance, which produces increased profits
(b) Improvements in customer satisfaction
(c) Increases in staff morale
(d) Improvement on a continual, step-by-step basis is more prudent than changing things all at once
(e) Better communication within the organisation
(f) Improvements in relations with suppliers
(g) Better use of resources
(h) More efficient planning

Case Studies

The continuous improvement process has been implemented to a wide range of organisations in a variety of sectors, as illustrated by the following case studies. The emphasis is BPP's.

(a) Volex is a leading provider of power cords and power products. The following extract is taken from the Volex Group plc's website and is fairly typical of the way in which organisations are keen to demonstrate their commitment to continuous improvement.

'Volex is committed to a program of Continuous Improvement across all its operations. All improvement projects have a **specific customer focus** and are based on **measured progress against firm targets or industry benchmarks**. We also encourage the **active involvement of our employees**. Many sites operate Kaizen schemes with cross-functional project teams applying working-level improvement actions on many topics including environmental, health and safety programs.

At Volex, Continuous Improvement is considered a **crucial process to achieve competitive advantage for our customers and ourselves**. We accord high management priority to key product and service-level improvement projects. Programs that integrate the results using international models of performance improvement are then used to set senior management performance targets for subsequent years.

The process of improvement links closely with personal development. Volex is strongly committed to the training and development of its employees worldwide. Through our knowledge, skills and experience, we help ensure the success of our customers' projects around the world every day.'

(b) The Charter Mark is a well-established government award scheme in the UK promoting and recognising public sector excellence in customer service. **Continuous improvement** is a **key principle** of the **Charter Mark award**. The principle requires that organisations continually look for ways to improve their services and the facilities they offer. They do this by:

(i) Promoting innovation, creativity and striving for excellence.
(ii) Recognising that, no matter how good, service can always improve.
(iii) Adopting the latest technologies to change the way business is done.

(c) Chrysler's Five Star Dealer Incentive Program (which ran from 1997-2010) was designed for 'improving or creating processes to quickly find what creates customer dissatisfaction and find ways to fix these issues'. The first step for dealers was to contact their customers to get feedback on their sales or service experience. The use of this feedback was mandatory, as getting information and not using it is seen to lower trust, increase frustration and cost money. Dealers were required to put in place processes that not only resolve customer problems but also allow them to learn from them. This is a **hallmark of continuous improvement: collecting information**

at every opportunity and putting it to use. Dealers were also required to provide training for staff who deal with customers, as efforts to make change are seen to be constrained unless all staff understand not only that they can have an effect, but that they are expected to have an effect.

In theory, this programme should have been extremely powerful, but **in practice it had some problems**. Employees were under a lot of pressure to get survey ratings up. However, many of the issues which annoyed customers were not under their control. In addition, mechanics were still under a great deal of pressure to push jobs through quickly, and not waste time talking to each other, sharing lessons learned. Moreover, the desire to get customers' cars back on time may cause 'fix-it-fast' problems, although the programme's emphasis seemed to be on fixing things right the first time.

In 2010, Chrysler replaced its Five Star program with a new program called Dealer Standards. The program is administered by an external company which handles similar duties for Fiat. Dealerships are graded on a variety of categories, including customer relations and facilities, although sales volume is now a major factor.

2.7 Costs of quality and cost of quality reports

FAST FORWARD

Costs of quality can be analysed into **prevention, appraisal, internal failure** and **external failure** costs and should be detailed in a cost of quality report.

When we talk about quality-related costs you should remember that a concern for **good quality saves money**; it is **poor quality that costs money.**

Cost of quality reports highlight the total cost to an organisation of producing products or services that do not conform with quality requirements. Four categories of cost should be reported:

(a) Prevention costs
(b) Appraisal costs
(c) Internal failure
(d) External failure

Exam focus point

Costs of quality were tested in the December 2008 exam, in an eight-mark part-question. Candidates were asked to identify the four categories of quality cost and give examples of each.

Make sure you know what the four categories are, but equally be prepared to assess how they could affect an organisation's performance.

Key term

The **cost of quality** is 'The difference between the actual cost of producing, selling and supporting products or services and the equivalent costs if there were no failures during production or usage'.

The cost of quality can be analysed into the following.

- **Cost of prevention** – costs incurred prior to or during production in order to prevent substandard or defective products or services from being produced
- **Cost of appraisal** – costs incurred in order to ensure that outputs produced meet required quality standards
- **Cost of internal failure** – costs incurred as a result of outputs not meeting required quality standards, but where these deficiencies are identified before the products or services are transferred from the supplier to the purchaser
- **Cost of external failure** – costs resulting from outputs not meeting required quality standards, but where there deficiencies are only identified after the products or services have been transferred from the supplier to the purchaser.

Note that the first three 'costs' (prevention; appraisal; internal failure) are all **internal** to an organisation: for example, the inspections and analysis take place within the organisation before a product leaves the factory.

However, the fourth cost (external failure) only occurs once a product leaves the factory, and the quality problems or issues are identified by the **customer**.

Quality-related cost	Example
Prevention costs	Quality engineering Design/development of quality control/inspection equipment Maintenance of quality control/inspection equipment Administration of quality control Training in quality control
Appraisal costs	Acceptance testing Inspection of goods inwards Inspection costs of in-house processing Performance testing
Internal failure costs	Failure analysis Re-inspection costs Losses from failure of purchased items Losses due to lower selling prices for sub-quality goods Costs of reviewing product specifications after failures
External failure costs	Administration of customer complaints section Costs of customer service section Product liability costs Cost of repairing products returned from customers Cost of replacing items due to sub-standard products/marketing errors

2.8 Views on quality costs

2.8.1 View one – the traditional view

Key terms

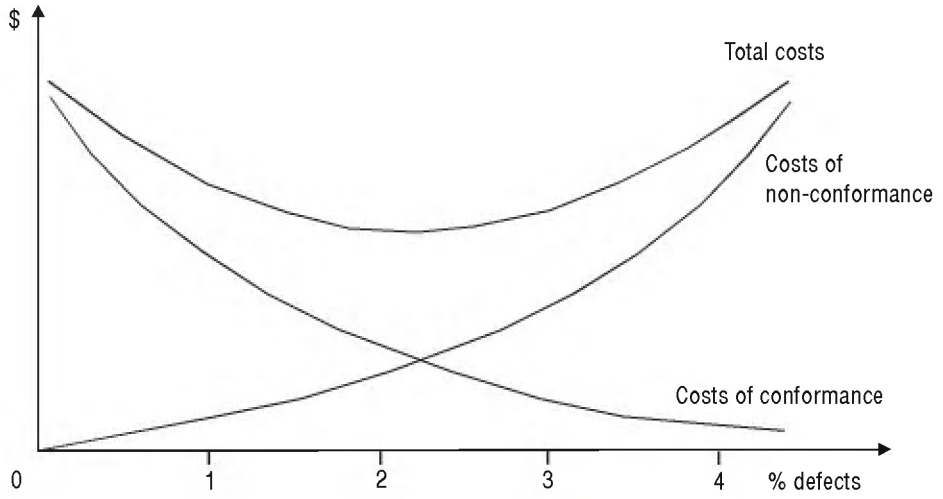
Cost of conformance is 'The cost of achieving specified quality standards'.

Cost of non-conformance is 'The cost of failure to deliver the required standard of quality'.

The **cost of conformance** is a **discretionary** cost which is incurred with the intention of **eliminating the costs of internal and external failure.**

The **cost of non-conformance**, on the other hand, can **only be reduced by increasing the cost of conformance.**

The **optimal investment in conformance costs** is when **total costs of quality reach a minimum** (which may be below 100% quality conformance). This is illustrated in the following diagram.



To achieve **0% defects, costs of conformance must be high**. For example, if every single item that comes off a production line in a factory is subjected to a detailed quality check before it leaves the factory, this should lead to a very low level of defects, but it will mean the costs of conformance are high. As a greater proportion of defects are accepted, however, the costs of conformance costs can be reduced; for example, if only a sample of the items coming off the production line are checked this will reduce the time (and cost) spent on checking.

At a level of **0% defects, costs of non-conformance** should be **nil** (because there are no defects to remedy) but the costs of non-conformance will increase as the accepted level of defects rises. There should therefore be an **acceptable level of defects** at which the **total costs of quality are at a minimum**.

2.8.2 View two – TQM philosophy

A 'traditional' approach to quality management (view one above) is that there is an **optimal level of quality effort, that minimises total quality costs**, and there is a point beyond which spending more on quality yields a benefit that is less than the additional cost incurred. Diminishing returns set in beyond the optimal quality level.

The **TQM philosophy** is different.

(a) Failure and poor quality are unacceptable. It is **inappropriate to think of an optimal level of quality** at which some failures will occur, and the **inevitability of errors is not something that an organisation should accept**. The target should be zero defects.

(b) Quality costs are difficult to measure, and failure costs in particular are often seriously under estimated. The **real costs of failure include** not just the cost of scrapped items and re-working faulty items, but also the **management time spent sorting out problems** and the **loss of confidence** between different parts of the organisation whenever faults occur.

(c) A TQM approach does not accept that the prevention costs of achieving zero defects becomes unacceptably high as the quality standard improves and goes above a certain level. In other words, **diminishing returns do not necessarily set in**. If everyone in the organisation is involved in improving quality, the cost of continuous improvement need not be high.

(d) If an organisation **accepts an optimal quality level** that it believes will minimise total quality costs, there will be **no further challenge** to management to improve quality further.

The **TQM quality cost model** is based on the view that:

(a) **Prevention costs and appraisal costs** are **subject to management influence** or control. It is **better to spend money on prevention**, before failures occur, than on inspection to detect failures after they have happened.

(b) **Internal failure costs and external failure costs** are the **consequences of the efforts spent on prevention and appraisal**. Extra effort on prevention will reduce internal failure costs and this in turn will have a knock-on effect, reducing external failure costs as well.

In other words, **higher spending on prevention will eventually lead to lower total quality costs**, because appraisal costs, internal failure costs and external failure costs will all be reduced. The emphasis should be on 'getting things right first time' and 'designing in quality' to the product or service.

2.9 Cost of quality reports

Shown below is a typical cost of quality report. **Some figures** in the report, such as the contribution forgone due to sales lost because of poor quality, may have to be **estimated,** but it is better to include an estimate rather than omit the category from the report.

The report has the following **uses.**

benchmarking

(a) By expressing each cost category as a percentage of sales revenue, **comparisons** can be made with previous periods, divisions within the group or other organisations, thereby highlighting problem areas. A comparison of the proportion of external failure costs to sales revenue with the figures for other organisations, for example, can provide some idea of the level of customer satisfaction.

(b) It can be used to make senior management aware of **how much is being spent** on quality-related costs.

(c) It can provide an indication of **how total quality costs could be reduced by a more sensible division of costs between the four categories.** For example, an increase in spending on prevention costs should reduce the costs of internal and external failure and hence reduce total spending.

COST OF QUALITY REPORT
YEAR ENDING 31 DECEMBER 20X0

	$'000	$'000	*Cost as % of annual revenue* ($10 million)
Prevention costs			
Design of quality control equipment	80		
Quality control training	80		
		160	1.6
Appraisal costs			
Inspection of goods inwards	90		
Inspection of WIP	100		
		190	1.9
Internal failure costs			
Scrap	150		
Rework	200		
		350	3.5
External failure costs			
Returns	500		
Contribution forgone on lost sales	400		
Handling customer complaints	100		
		1,000	10.0
		1,700	17.0

Although cost of quality reports provide a useful summary of the costs, effort and progress of quality, **non-financial quality measures** may be more appropriate for **lower levels of management**. Here are some examples of such measures.

(a) Number of customer complaints
(b) Number of warranty claims
(c) Number of defective units delivered to customers as a percentage of total units delivered

$ repair cost on warranty $ 1m

10% claim

1m claim

Question

Quality costs

LL designs and makes a single product, the X4, used in the telecommunications industry. The organisation has a goods received store which employs staff who carry out random checks to ensure materials are of the correct specification. In addition to the random checks, a standard allowance is made for failures due to faulty materials at the completion stage and the normal practice is to charge the cost of any remedial work required to the cost of production for the month. Once delivered to the customer, any faults discovered in the X4 during its warranty period become an expense of the customer support department.

At the end of each month, management reports are prepared for the Board of Directors. These identify the cost of running the stores and the number of issues, the cost of production and the number of units manufactured, and the cost of customer support.

Required

(a) Briefly discuss why the current accounting system fails to highlight the cost of quality.

(b) Identify four general categories (or classifications) of LL's activities where expenditure making up the explicit cost of quality will be found and provide an example of a cost found within each category.

(c) Give one example of a cost of quality not normally identified by the accounting system.

Answer

(a) **Failure of the current accounting system to highlight the cost of quality**

Traditionally, **the costs of scrapped units**, **wasted materials and reworking** have been **subsumed within the costs of production** by assigning the costs of an expected level of loss (a normal loss) to the costs of good production, while accounting for **other costs of poor quality** within **production or marketing overheads**. Such costs are therefore not only considered as **inevitable** but are not **highlighted** for management attention. Moreover, traditional accounting reports tend to **ignore the hidden but real costs of excessive inventory levels** (held to enable faulty material to be replaced without hindering production) and the facilities necessary for storing that **inventory**.

(b) **Explicit costs of quality**

There are four recognised categories of cost identifiable within an accounting system which make up the cost of quality.

(i) **Prevention costs** are the costs of any action taken to investigate, prevent or reduce the production of faulty output. Included within this category are the costs of training in quality control and the cost of the design/development and maintenance of quality control and inspection equipment.

(ii) **Appraisal costs** are the costs of assessing the actual quality achieved. Examples include the cost of the inspection of goods delivered and the cost of inspecting production during the manufacturing process.

(iii) **Internal failure costs** are the costs incurred by the organisation when production fails to meet the level of quality required. Such costs include losses due to lower selling prices for sub-quality goods, the costs of reviewing product specifications after failures and losses arising from the failure of purchased items.

(iv) **External failure costs** are the costs which arise outside the organisation (after the customer has received the product) due to failure to achieve the required level of quality. Included within this category are the costs of repairing products returned from customers, the cost of providing replacement items due to sub-standard products or marketing errors and the costs of a customer service department.

(c) **Quality costs not identified by the accounting system**

Quality costs which are not identified by the accounting system tend to be of two forms.

(i) Opportunity costs such as the loss of future sales to a customer dissatisfied with faulty goods.

(ii) Costs which tend to be subsumed within other account headings such as those costs which result from the disruption caused by stock-outs due to faulty purchases.

2.10 Quality systems documentation

TQM is a management philosophy. However, implementing TQM is not simply a matter of involving employees and encouraging a quality culture. There is also a need for systems and procedures for ensuring quality. Quality systems should be documented thoroughly.

(a) A company quality manual may summarise the quality management policy and system.

(b) A procedures manual sets out the functions, structures and responsibilities for quality in each department.

(c) Detailed work instructions and specifications for how work should be carried out show how to achieve the desired quality standards.

2.11 Adverse feedback on TQM

Although many organisations continue to implement TQM programmes, TQM is susceptible to various adverse perceptions:

(a) In practice, TQM initiatives are not introduced or implemented effectively, and the job is 'botched' by management.

(b) After obtaining short-term benefits from introducing TQM the benefits wear off over time, due to 'quality disillusionment'.

TQM programmes can also suffer from:

(a) A lack of top-management commitment.

(b) A failure to understand the full range of quality issues and quality costs.

(c) Vested interests and organisational politics.

(d) The slow speed of introducing new initiatives in an organisation, especially a large bureaucratic organisation.

(e) General cynicism about quality and fulfilling customer needs.

3 The terminology of quality management

FAST FORWARD

'Quality' does not mean 'high quality'. It is the degree to which a set of inherent characteristics fulfils requirements. **Quality control** satisfies quality requirements, while **quality assurance** gives confidence that quality requirements will be satisfied. That is, quality control is about activities such as supervision and measurement, while quality assurance is about things that make those activities effective, such as training and quality records.

The word **quality** is used in several ways in everyday speech: it is used most precisely to mean simply the **nature** of a thing or to refer to one of its specific **characteristics**. However, the word is also used, rather imprecisely, to indicate that a thing possesses a high degree of excellence or is of **good** quality, the word **good** being understood. Thus, if people speak of 'a quality product', we understand them to mean that the product is made to high standards and will give good service.

We must discard this everyday imprecision when we begin to consider quality in its more technical sense. This is because the real world of business has room for a **wide range of different products**, each providing a **different combination of price and relative quality**. People flying first class expect a greater degree of comfort and service than is provided to passengers in tourist class, and rightly so: they have paid a much higher fare. But this does not mean that tourist class passengers are not equally entitled to the proper level of service that they, in turn, have paid for. **Quality** does not mean 'the best': it means what is right and proper under the circumstances.

This concept of quality is adopted in the International Organisation for Standardisation (ISO) definition.

Key term

Quality is 'the degree to which a set of inherent characteristics fulfils requirements'. *ISO*

Exam focus point

The various ISO definitions given in this chapter are worth committing to memory. This is because questions on this part of the syllabus are likely to be quite practical and knowledge-based. A good definition is often an excellent way to start an answer to such a question (so long as it is relevant).

The ISO definition is a little open-ended, in that its full meaning depends on what the **requirements** are, but we can deal with that.

(a) In a **retail context**, we might suggest that those requirements are the same thing as **reasonable customer expectations**, bearing in mind that these will inevitably reflect the price paid, to some extent at least.

(b) Within the organisation or within a value system or network, the concept of the **internal customer** is relevant, and we may say that proper requirements reflect **fitness for purpose**, which must, in its turn, reflect the same reasonable expectations of the **strategic customer** (defined earlier in this study text). Here we might usefully introduce the concept of **design specification**, which should provide a clear specification of what is required.

(c) In a **not-for-profit** scenario, a similar concept applies, though we might speak of the reasonable expectations of the relevant **stakeholders**.

Exam focus point

While it is important to be aware of the different definitions relating to quality, it is equally important not to lose sight of *why* 'quality' is important for an organisation. For example:

'Costs' of quality will affect the organisation's profitability.

Quality (high quality) may be used as a differentiating factor by an organisation pursuing a differentiation strategy.

The quality of the goods or services that customers receive is likely to affect customer satisfaction, and in turn customer retention and revenues.

Ultimately, if the quality of an organisation's products or services regularly falls below the required standard, the organisation will not be able to survive, because customers will not want to buy products from it, or use its services.

An organisation will not be able to meet its strategic objectives consistently if doesn't have any control over the quality of the products or services it offers.

3.1 Managing quality

If an organisation is to deliver products and services of the necessary level of quality, it must actively manage all the factors that have an impact on quality. In fact, there are very few aspects of any organisation that can be regarded as having no influence on quality, so an effective **quality management system** (QMS) is likely to have complex ramifications. The International Organisation for Standardisation (ISO) definition of QMS is, perhaps, over-simplistic: 'a management system to direct and control an organisation with regard to quality'.

In their text *ISO 9001: 2000 In brief*, Tricker and Sherring-Lucas provide a more substantial definition of a quality management system:

Key term

> A **quality management system** is the organisational structure of responsibilities, activities, resources and events that together provide procedures and methods of implementation to ensure the capability of an organisation to meet quality requirements. *Tricker and Sherring-Lucas*

This definition gives a good indication of what is involved in a QMS. Much of it is present in organisations that do not claim to have a QMS as such: the difference is that the organisation that uses a QMS manages these common elements in a way that contribute to quality management. For example, any manufacturing organisation, no matter how rudimentary, will perform the activity of **procurement**. Procurement as part of a QMS will, for example, take positive steps to ensure that purchased materials conform consistently to the appropriate quality standards; non-QMS procurement may or may not do the same, but even if it does, it is unlikely that the procedures concerned will be documented and applied consistently.

The quality management system pervades the whole organisation since it is unlikely that there will be any of its aspects that do not have the potential to affect the quality of its outputs. Two very obvious features are the **quality manual** and the job of **quality manager**, but many other elements have their part to play. These include staff and management generally, customer requirements, supplier inputs, product design and development and customer service activities.

Quality management systems are discussed in more detail later in this chapter.

3.2 Quality assurance and quality control

Quality assurance (QA) and quality control (QC) are important aspects of the QMS.

Key terms

> **Quality assurance** is the 'part of quality management focussed on providing confidence that quality requirements will be fulfilled.'
>
> **Quality control** is the 'part of quality management focussed on fulfilling quality requirements'. *ISO 9000:2005*

These two definitions are worth thinking about, especially if you have fallen into the common habit of thinking that **quality assurance** is just a more up to date version of **quality control**.

Quality control is about the things the organisation has to do to be sure that the quality of its output is as it should be. It is about activities such supervision, inspection, checks and measurements and applies to all parts of the organisation's value chain.

If QC is about fulfilling quality requirements, it is clear from the definition of **quality assurance** that it is about providing confidence that all the necessary QC activities are operating as they should and that a proper level of quality is therefore being achieved. QA is therefore concerned with the things that make quality control systems and activities effective. These things include quality policies; relevant management and training; and documentation such as quality records.

Tricker and Sherring-Lucas say that the **purpose** of QA is twofold:

(a) To provide assurance to a customer that the standard of workmanship within a contractor's premises is of the desired level and that all products leaving that particular firm are at, or above, a certain fixed minimum level of specification

(b) To ensure that manufacturing and service standards are uniform between an organisation's departments or offices and that they remain constant despite changes in personnel.

Exam focus point

> You should be prepared to distinguish between the roles of quality, quality control and quality assurance in an organisation, and assess how each of these differing aspects can affect an organisation's performance.
>
> As preparation for your exam, ask yourself what role do quality, quality control and quality assurance play in an industry you are familiar with?

For example, an audit might be seen as a measure of quality control. It involves checking and reviewing work that has been done to ensure that pre-determined quality standards are being met. It involves the selection of sample items to be extracted and inspected.

Then contrast quality **control** (which is primarily about **detecting** errors) with quality **assurance** which is primarily concerned with **preventing** defective products, to be able to **guarantee the quality** of goods or services provided. How might this be achieved? For example, by having quality policies; setting quality targets; quality improvement initiatives (including new equipment or new software); or through staff training and management.

3.3 Quality certification

If an organisation's QMS is to provide a proper level of assurance to existing and potential customers, it is necessary for the organisation to achieve **quality certification**. This is an externally provided acknowledgement that the QMS is adequate in its provisions and its operation. Certification can only be provided by **accredited certification bodies**.

The fact that you are sitting this exam is an example of quality certification. As an accountant working in business or practice you will regularly provide advice to colleagues or clients. Your professional body (ACCA) needs to be sure that its members achieve the quality levels it expects, and it regulates this through the exams that you have to pass before you qualify as an ACCA.

Practical Experience Requirement

Quality and quality measurement are not only issues you need to know about for your exam. They are also important for your work as an accountant. The ACCA Practical Experience Requirements indicate that, in order to perform effectively, accountants need to 'Allocate and monitor the progress and **quality** of work in their area of responsibility'.

4 The ISO 9000:2000 and 2008 series of standards

A number of organisations produce quality standards that can be applied to a variety of organisations. The most widely used are those published by the **International Organisation for Standardisation (ISO).**

FAST FORWARD

The ISO 9000 quality standards have been adopted by many organisations world-wide. A company registering for ISO 9000 certification is required to submit its quality standards and procedures to external inspection. If it receives a certificate, it will be subjected to continuing audit. The aim of an ISO 9000 certificate is to provide an **assurance to customers** (and suppliers) of the organisation that its products are made, or its services are delivered, in a way that meets ISO's **standards** for quality.

ISO issue standards are applicable to **many types of organisation** and they are updated periodically. The ISO 9000: 2000 and 2008 series of standards consists of four primary standards: ISO 9000, ISO 9001, ISO 9004, and ISO 19011. In addition, ISO 14001 addresses environmental management.

(a) **ISO 9001:2000 and 2008** contain ISO's current quality management system requirements. This is the standard you need to use if you wish to become certified (registered).

(b) **ISO 9000:2005 and ISO 9004:2009** contain ISO's quality management system guidelines. These standards explain ISO's approach to quality management – ISO 9000:2005 presents definitions, discusses terminology and defines the eight quality management principles while ISO 9004:2009 is a set of guidelines for improving performance. These guideline standards help organisations implement quality management, but they are not intended to be used for certification purposes.

(c) **ISO 19011** covers quality auditing standards.

(d) **ISO 14001** relates to environmental management systems. It specifies a process for controlling and improving an organisation's environmental performance. Issues covered include:

(i) Use and source of raw materials
(ii) Waste
(iii) Noise
(iv) Energy use
(v) Emissions

Importantly, ISO 9000:2000 is based on a process orientation which requires organisations to define and record their core processes and sub-processes. (Note the potential links here to concepts such as the value chain and critical success factors, which identify the key processes and activities an organisation has to excel at to achieve its objectives and deliver value to its customers.)

ISO 9000:2000 also stresses four other principles (which resonate with a number of the aspects of performance management we have been discussing in this text so far):

(a) Quality management should be **customer-focused**

(b) Quality performance should be **measured**. Measures should relate both to **processes** that create products or services, and to **customer satisfaction** with those products or services.

(c) Quality management should be **improvement-driven**. Improvement must be demonstrated in both process performance and customer satisfaction.

(d) **Senior management** must demonstrate their **commitment** to maintaining and continually improving management systems.

4.1 ISO certified/registered or ISO compliant?

When a company claims that they are **ISO 9000 certified** or **registered**, they mean that **an independent registrar** has audited their processes and certified that they meet the ISO requirements. It means that a **registrar has given a written assurance** that ISO's quality management system standard has been met.

When an organisation says that they are **ISO 9000 compliant**, they mean that they have **met ISO's quality system requirements**, but have **not been formally certified** by an independent registrar. In effect, they are **self-certified**. Of course, an official certificate does tend to carry more weight in the market place.

Organisations are granted certified or **compliant** status on the basis that their **processes** rather than their products and services meet ISO 9000 requirements. The ISO 9000 standards are **process standards**, not product standards. The logic is that high quality processes ensure high quality output.

ISO 9000 has been criticised, however, for encouraging a culture of **management by manual**. The requirement to document all procedures and to conduct internal audits of the system and its procedures, is also both time consuming and expensive.

4.2 Criticisms of quality accreditation

Many writers and managers have criticised **formal quality schemes**. These criticisms tend to emphasise the following points.

(a) Documentation is **expensive** (in terms of time) to produce.
(b) Rigid policies and procedures **discourage innovation** and initiative.
(c) The schemes **encourage bureaucracy**.
(d) The formal methods may not be consistent with ways of working in small and medium-sized organisations.

5 The quality management system

We have already provided a definition of QMS. Its rather general nature is inevitable, since there is no single approved model for a QMS. However, all QMS should be designed around the eight quality management principles given in ISO 9001:2005.

- Customer focus
- Leadership
- Involvement of people (1)
- Process approach (2)
- Systems approach to management (3)
- Continual improvement
- Factual approach to decision making
- Mutually beneficial supplier relationships

Notes

(1) When we discuss job design in another chapter, you will see how the influence of Japanese management practice has led to the now commonly adopted principle that **quality is everybody's concern**. An important result of this approach is increased employee involvement in quality management through such mechanisms as **quality circles**.

(2) This means managing related activities and resources as integrated processes.

(3) This means managing groups of related processes as integrated systems

5.1 The costs of quality

FAST FORWARD

Part of the purpose of quality management is to manage both the **cost of failure** and the cost of **inspection** and **presentation** so as to minimise quality related cost overall. An effective QMS will also improve the organisation's ability to deliver satisfactory outputs; it should lead to enhanced staff commitment; and it should improve relationships with customers.

Operating a QMS inevitably incurs cost. *Juran* analyses the costs associated with quality management into four types.

(a) **Inspection** or **appraisal costs** are incurred in establishing the **extent of conformance** to quality standards and include the costs of such activities as testing, inspection and the calibration of measuring equipment.

(b) **Prevention costs** are incurred in activities intended to ensure that quality is maintained: such activities include quality training, supplier surveys, quality planning and the work of quality improvement teams.

Taken together, these two categories make up the **cost of operating a QMS**. Against them must be set the **costs of quality failure**.

(a) **Internal failure costs** are incurred when a quality failure is discovered before the product or service is delivered to the customer. Examples are the costs of scrap, rework and re-inspection.

(b) **External failure costs** are incurred when a quality failure is incurred after the product or service has been delivered to the customer. Examples are the costs of complaint processing, warranty claims and product recalls.

Part of the skill of quality management is the minimising of these costs **in total**. The more rigorous the QMS, the lower the eventual costs of failure are likely to be, but the higher the costs of prevention and appraisal. The aim must to achieve a sensible balance between the two categories.

5.2 The advantages of having a QMS

An effective QMS, as well as minimising quality-related costs will have other important advantages.

(a) An improvement in the organisation's ability to deliver outputs of consistently satisfactory quality
(b) An improved level of staff commitment based on pride in work
(c) Improved customer relationships, with fewer complaints and increased turnover

5.3 The quality manual

FAST FORWARD

An organisation's quality manual specifies its quality management system.

Key term

A **quality manual** is 'a document specifying the quality management system of an organisation'.
ISO 9000:2005

The ISO definition given above implies that there are two important aspects to the nature of the quality manual. The first is that it contains **practical details and instructions** for the operation of quality procedures and systems, so it is an everyday working document within the organisation. The second is that it is an important aspect of the design of the QMS and, as such, provides much of the **quality assurance** sought by external agencies such as customers and certification bodies. The quality manual is fundamental to quality management.

The quality manual is likely to contain a wide range of material: this can be grouped into a number of categories.

(a) **Policies** relating to quality
(b) The **organisation structure** that relates to quality management: this is likely to be identical with the overall structure of the organisation, or nearly so.
(c) Details of **quality procedures**: this category includes a wide range of documentation.

Keeping the quality manual up to date is one of the responsibilities of the **quality manager**.

5.4 Policies relating to quality

FAST FORWARD

Quality policies may include a mission statement, a corporate policy statement and process specific polices.

A **quality process** is a statement of the specified way to carry out an activity or a process

There are two types of quality process: **core business processes** and **supporting processes**.

Key term

Quality policies define 'the overall intentions and direction of an organisation related to quality as formally expressed by top management'. *ISO 9000:2005*

Statements of **quality policy** may be divided into three types.

(a) The **mission statement** is a brief statement of overall quality policy and commitment set down at the most senior level of management. It will probably refer to customer satisfaction, ISO 9000 and the importance of good quality practice.

(b) The **corporate policy statement** expands upon the mission statement. Tricker and Sherring-Lucas suggest that the eight quality principles already mentioned provide a good basis for drafting this policy. They also state that it should conform to five requirements.

    (i) It should be appropriate to the needs of the organisation and its customers
    (ii) It should involve all members of the organisation
    (iii) It should provide an outline of the organisation's goals and objectives
    (iv) It should be communicated and implemented throughout the organisation
    (v) It should be understood by everyone involved

(c) **Process-specific policies** will relate directly to the organisation's processes and quality requirements. They should be adequate to manage quality in all key processes.

5.4.1 Processes and procedures

The words **process** and **procedure** are used in very specific ways in quality management practice based on the ISO 9000:2005 series; it is important that you understand these usages and how they differ from the everyday meanings of these words.

In ordinary use, **process** and **procedure**, while, perhaps, not quite interchangeable, can be used with very similar meanings: we might, for example, speak of a company's accounting processes or its accounting procedures and mean much the same thing. This is not the case in quality management. The difference is summarised in the definitions given below.

Key terms

A **quality process** is 'a set of inter-related or interfacing activities which transform inputs into outputs'.

A **quality procedure** is the 'specified way to carry out an activity or a process'.

5.4.2 Quality processes

The definition of **quality process** will remind you of our discussion in an earlier chapter of the model of an organisation as an **open system** interacting with its environment. Here, we may consider a quality procedure to be a **subsystem** of the overall organisational system. We must consider **ten elements** in this subsystem.

(a) The first three of these elements are the **process** itself, the **inputs** into it and the **outputs** from it.

(b) The next two elements are **suppliers**, from whom inputs are obtained, and **customers,** to whom outputs are delivered. Both customers and suppliers may be internal to the organisation, since many processes are operated in co-ordinated chains.

(c) **Inputs** is used in a very narrow sense and must not be confused with the next element, the **resources** that are required to make the process work. For example, in a simple manufacturing operation, **inputs** would be parts and raw materials, while the labour and machinery required to process them would be **resources**.

(d) Similarly, **controls** constitute a separate element: they are applied to the process but are separate from both **inputs** and **resources**.

(e) There are three further elements. The **purpose** of the process is a statement of what it is intended to achieve. The **process owner** is accountable for the operation of the process as a whole. **Performance targets and measures** are established and enforced by the **controls**.

Quality processes are divided into two types: **core business processes** and **supporting processes**. The concept is similar to that of primary and support activities in the **value chain model**, but the definitions are rather different.

(a) **Core business processes** combine in a logical sequence that proceeds from a market opportunity through to the delivery of a satisfactory product or service. The process owner for the overall sequence of core business processes would normally be the CEO or equivalent.

(b) **Supporting processes** supplement the core business processes by providing the necessary infrastructure. These processes will be owned by functional directors or managers.

Both core business processes and supporting processes must be fully documented, possibly using diagrams in a hierarchy of detail.

5.4.3 Quality procedures

FAST FORWARD

ISO 9001:2000 and 2008 mandates a minimum of six specific written quality procedures. These cover two QMS processes and four MAI processes.

- Control documents
- Control records
- Internal audit
- Product failures
- Corrective action
- Preventive action

Quality procedures are the **detailed instructions** that lay down precisely **how** and **to what standards** quality processes are to be operated. They are only prepared where they are necessary and only in the detail that is needed in practice. A quality procedure may be very simple, or quite complex, possibly containing such items as lists of abbreviations, amendment records, distribution lists, statements of responsibility and examples of relevant forms as well as the detailed process instructions themselves. The detailed technical requirements and specialist procedures are normally contained in subsidiary **work instructions**.

ISO 9001:2000 and 2008 requires that, as a minimum, **written procedures** must exist to control **two QMS processes** and **four processes relating to measurement, analysis and improvement** (MAI).

5.4.4 Compulsory QMS processes

Control of documents

It is important to ensure that only the latest issue of quality related documents such as drawings and instructions is used. Such documents must also be approved before use and subject to periodic review.

Control of records

Records are important both for purposes of quality assurance and for the future development of improved procedures. Procedures must be laid down to ensure that proper records are kept and to specify details of storage, retrieval, retention period and eventual disposal.

5.4.5 Compulsory MAI processes

Internal audit

Internal quality audit is required by ISO 9001:2000 and 2008. The internal audit procedure must specify audit responsibilities, the frequency and extent of audit and the means of dealing with procedural failures.

Product failures

Defective or damaged products must not be delivered or used. Such products must be dealt with in one of three ways.

(a) **Rectification** followed by checking to ensure quality conformance
(b) '**Use under concession**' allows for a formal authorisation to make use of the product.
(c) **Prevention of use**, usually by quarantine and controlled disposal

Corrective action

A procedure is required to identify occasions of quality failure, investigate them, deal with the causes so as to prevent recurrence and verify that the new arrangements operate satisfactorily. All this must be properly recorded.

Preventive action

Appropriate efforts should be made to prevent the occurrence of quality failure. Potential instances should be identified, preventive action taken and reviewed and the whole process recorded.

5.4.6 Other necessary processes

While not specifically mandated as such, the standard implies that two other areas should be documented. These are **communication with customers** and the **evaluation and selection of suppliers**.

5.4.7 Quality objectives

The corporate policy statement and process-specific policies are likely to include **quality objectives**. These objectives should relate to the variables that determine whether or not proper quality is achieved.

Quality objectives should be '**SMART**' in the same way that strategic objectives (discussed earlier in Chapter 7) should be SMART: specific, **m**easurable, **a**ttainable, **r**elevant, and **t**ime-bounded.

5.4.8 Quality management and performance management

Earlier in the chapter we defined quality, and the definition was: 'the degree to which a set of inherent characteristics fulfils requirements.'

However, we could also add to that definition that quality also reflects the degree to which a product or service consistently **conforms to customers' expectations**.

Quality should be a key concern in all organisations. High quality goods and services can give an organisation a competitive edge over its rivals. Good quality also reduces the costs of rework, waste, complaints, and returns an organisations incurs; and – perhaps most importantly – good quality generates satisfied customers.

In this respect, quality improvements can have a major affect on other aspects of an organisation's performance. For example, revenues can be increased by better sales and being able to charge higher prices (relative to poorer quality products). At the same time, costs can be reduced through improved efficiencies and productivity.

However, the additional definition of quality also highlights the importance of the customer in any discussion of quality.

From the customer's perspective, quality problems arise when the customer's perception of a product or service fails to match their expectations of it. Therefore a key aspect of quality management is ensuring that products or services meet customers' expectations of them.

However, in order to do this, an organisation has to know:

(a) What the customers' expectations of its product or service are

(b) What the key processes and success factors are that will enable it to achieve customers' expectations

For example, let us consider some quality characteristics for an online grocery shopping service.

Quality characteristics	Examples
Product characteristics	Product range Product availability Shelf life / durability of products Products not damaged (Also, possibly more generally, the taste/flavour of the products)
Delivery service characteristics	Reliability of service (turns up when scheduled) Accuracy of delivery (what is delivered agrees to what was ordered) Products not damaged when delivered Attitude of delivery driver; and physical appearance (of driver and delivery vehicle) Coping with any errors (eg response if customer notices any differences between what was ordered and what is delivered)

Quality characteristics	Examples
Website characteristics	Ease of use Reliability of website (eg doesn't crash) Security of website

Importantly, however, once these quality characteristics have been identified, they also indicate the areas of the operation's performance which are **important to measure**; to ensure that quality levels are maintained against acceptable standards.

This is a point we will return to later in the chapter when we look at Six Sigma as a method of quality improvement. The first stage in implementing a Six Sigma programme is 'Defining customer requirements.'

6 Quality in management information systems

FAST FORWARD

Four aspects of quality are particularly important in software.

- Functionality
- Reliability
- Usability
- Build quality (flexibility, expandability, portability, ease of maintenance)

Low quality in IS development produces systems that are difficult to use, maintain and enhance.

Your syllabus requires you to have some knowledge of quality management in information systems (IS) development. The complexity and internal integration of many IS makes them particularly susceptible to undesirable effects caused by defects of design and coding in particular. If you have used a PC at all you are likely to have had experience of the frustration and delay caused by defects in even such well-established systems as *Microsoft Windows*.

6.1 Consequences of low quality in IS

Poor design and coding produce IS that are difficult to use, maintain and enhance. This has undesirable consequences.

(a) **Excessive costs** are incurred in correcting defects and adding or improving features to make the systems usable.

(b) **User confidence** is undermined.

(c) **Business efficiency** is harmed, with harmful effects on customer satisfaction and thence on profitability and even on the continuing existence of the organisation.

6.2 Features of good software

Four aspects of quality are particularly important in software.

(a) **Functionality** is the ability of the system to perform the tasks expected of it. It should do what the user wants it to do.

(b) **Reliability** means that the system keeps working and is not out of service frequently or for extended periods. Also, it does not produce unexpected or bizarre outputs.

(c) **Usability** means that the system is easy to use effectively.

(d) **Build quality** is evidenced by such features as ease of **maintenance**, **flexibility** in use, **expandability** and **portability** between platforms.

Failures of **functionality** and **reliability** give rise to the undesirable consequences already mentioned. Lack of **usability** will make operation of the system complex and costly in staff time; it will also require the

provision of **extensive training** to users. Poor **build quality** will damage prospects for further overall system development in the future, as well as complicating maintenance and upgrades.

Software quality could be very important for managers if they are using the software to produce management information. If managers are unable to review reports which give them relevant, timely and accurate information about how their business is performing, this will make their job of managing performance much harder.

7 The qualities of good information and good management information systems

FAST FORWARD

As well as ensuring that it has good quality information systems, an organisation also needs to ensure that it produces good quality management information.

Just because an organisation has good quality information systems does not guarantee that the reports or information those systems produce will be useful for management.

Earlier in this text we have highlighted some of the characteristics that good management information should demonstrate: for example, it should be timely, accurate, and relevant to its recipients.

'Good' management information is information that adds to management's understanding of performance or a particular issue, and can help them control the business.

The qualities of good information are outlined in the following table. You can use the mnemonic ACCURATE to help you remember the qualities of good information.

Quality	Example
Accurate	Figures should add up, the degree of rounding should be appropriate, there should be no typos, items should be allocated to the correct category, assumptions should be stated for uncertain information.
Complete	Information should include everything that it needs to include, for example external data if relevant, comparative information or qualitative information as well as quantitative. Sometimes managers or strategic planners will need to build on the available information to produce a forecast using assumptions or extrapolations.
Cost-beneficial	It should not cost more to obtain the information than the benefit derived from having it. Providers of information should be given efficient means of collecting and analysing it. Presentation should be such that users do not waste time working out what it means.
User-targeted	The needs of the user should be borne in mind, for instance senior managers need strategic summaries periodically, junior ones need detail.
Relevant	Information that is not needed for a decision should be omitted, no matter how 'interesting' it may be.
Authoritative	The source of the information should be a reliable one (not, for instance, 'Joe Bloggs Predictions Page' on the Internet unless Joe Bloggs is known to be a reliable source for that type of information). However, subjective information (eg expert opinions) may be required in addition to objective facts.
Timely	The information should be available when it is needed. It should also cover relevant time periods, the future as well as the past.
Easy to use	Information should be clearly presented, not excessively long, and sent using the right medium and communication channel (e-mail, telephone, hard-copy report etc).

Exam focus point

In Chapter 6 we looked at the dangers of information overload, and when assessing the quality of information (eg relevance; ease of use) it could be useful to think whether there is a danger that too much information is being provided.

Improvements to information

However, as well as being able to identify the qualities of good information, you may also need to identify the problems that an organisation is having with the information it currently produces, and to suggest potential ways that information can be improved.

The table below contains some suggestions as to how poor information can be **improved**.

Feature	Examples of possible improvements
Accurate	Use computerised systems with automatic input checks rather than manual systems. Allow sufficient time for collation and analysis of data if pinpoint accuracy is crucial. Incorporate elements of probability within projections so that the required response to different future scenarios can be assessed.
Complete	Include past data as a reference point for future projections. Include any planned developments, such as new products. Information about future demand would be more useful than information about past demand. Include external data.
Cost-beneficial	Always bear in mind whether the benefit of having the information is greater than the cost of obtaining it.
User-targeted	Information should be summarised and presented together with relevant ratios or percentages. Consider use of graphics or dashboards for summarised data for senior management.
Relevant	The purpose of the report should be defined. It may be trying to fulfil too many purposes at once. Perhaps several shorter reports would be more effective. Information should include exception reporting, where only those items that are worthy of note – and the control actions taken by more junior managers to deal with them – are reported.
Authoritative	Use reliable sources and experienced personnel. If some figures are derived from other figures the method of derivation should be explained.
Timely	Information collection and analysis by production managers needs to be speeded up considerably, probably by the introduction of better information systems (possibly even systems that can provide real-time information).
Easy-to-use	Graphical presentation, allowing trends to be quickly assimilated and relevant action decided upon. Alternative methods of presentation should be considered, such as graphs or charts, to make it easier to review the information at a glance. Numerical information is sometimes best summarised in narrative form or vice versa. A 'house style' for reports should be devised and adhered to by all. This would cover such matters as number of decimal places to use, table headings and labels, paragraph numbering and so on.

8 Six Sigma and quality improvement

FAST FORWARD

Six Sigma is a quality management system that grew out of statistical quality techniques. The overall aim is a very high and consistent standard of quality output. It tends to take the form of specific improvement projects that follow a standard five phase pattern.

- **Define** requirements
- **Measure** performance
- **Analyse** the process
- **Improve** the process
- **Control** the new process

It depends to some extent on charismatic leadership.

Six Sigma is a quality management methodology developed at *Motorola* in the late 1980s. Originally, it was set of statistics-based techniques used by managers to assess manufacturing process performance. It has evolved into a widely applicable process improvement system with links to **process re-engineering**. Both *Harmon* and *Pande and Holpp* describe Six Sigma as the latest development in an evolutionary process that began with Scientific Management and continued through lean manufacturing and TQM.

There are three classifications of **process change work** which we will introduce here briefly.

(a) **Process improvement** is a tactical level incremental technique that is appropriate for developing smaller, stable existing processes.

(b) **Process reengineering** is used at the strategic level when major environmental threats or opportunities mandate fundamental re-thinking of large scale, core processes that are critical to the operation of the value chain.

(c) **Process redesign** is an intermediate scale of operation appropriate for middle-sized processes that require extensive improvement or change.

Pande and Holpp think that Six Sigma is applicable to all three approaches and declare that 'achieving the goal of Six Sigma requires more than small, incremental improvements; it requires breakthroughs in every area of an operation'. They emphasise Six Sigma's track record of producing major return on investment and its effects on management methods.

On the other hand, Harmon describes Six Sigma as typically employed in **process improvement projects**. He goes on to say that it is very good at 'describing how to think about measuring process and activity outcomes' and 'how to use statistical techniques to analyse the outcomes and decide on corrective action'.

Pande and Holpp identify six themes in Six Sigma.

- Genuine focus on the customer
- Data– and fact-driven management
- Processes as the key to success
- Proactive management
- Boundaryless collaboration
- Perfectionism combined with tolerance of failure

Exam Focus Point

The following section is useful background which explains the theory behind Six Sigma. You will not need to know this for the exam but it helps you understand how Six Sigma was developed.

You will not need to do any calculations in the question which test Six Sigma.

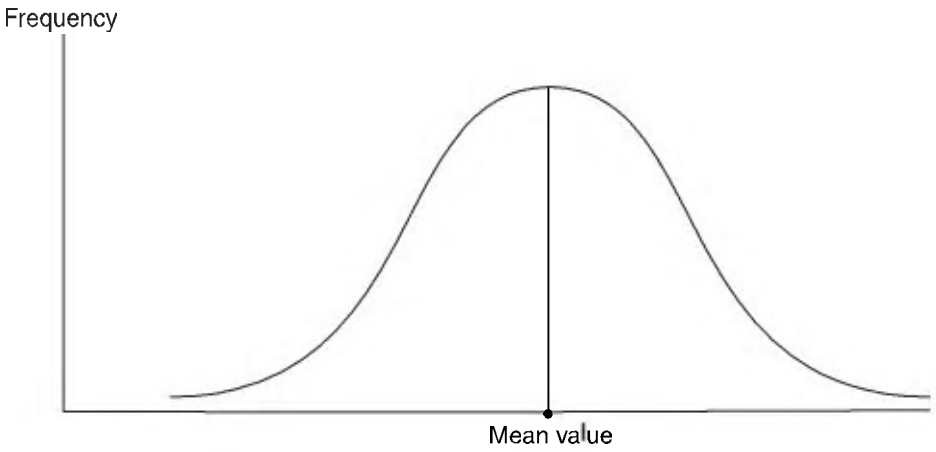
8.1 The Six Sigma concept

The essence of Six Sigma is to improve a process to the extent that there is only the tiniest probability that it will produce unsatisfactory outputs. Note that we speak of probability: there are no certainties in this sort of work and we need to look a little further at **probability** to understand what is going on.

8.1.1 The normal distribution

The kind of probability we are concerned with is based on variation of a characteristic within a population. The population might be, say, men in the UK and the characteristic might be, say height. Equally well, the population might be all the widgets a factory produces in a year and the characteristic might be their weight in grams. The important point about these two characteristics is that they **vary** from individual to individual and their variation is **normally distributed**.

Normal distribution of a population variable implies that its magnitude tends to clump around the mean, but there are also likely to be individual cases that are quite a long way from the mean. If we draw a graph to show the **frequency** with which actual measurements occur in a normally distributed variable, it will be a **bell shaped curve** such as the one below.



A good way to visualise the way the normal distribution works is to imagine **looking down vertically on a football pitch** with a large number of people standing on it. We have measured all these people's height and worked out the mean.

We persuade all the people whose height is **equal to the mean** to line up one behind the other **along the half way line**, starting from one of the touch lines; then the people who are one centimetre taller than the mean line up immediately to their right and those who are one centimetre shorter line up on their left, both starting from the same touch line. Then we repeat the process with those who are two centimetres taller and two centimetres shorter and so on, until everyone is in place.

If we then look down on the **shape of our crowd**, we will find that it is very close indeed to the curve shown above. We have drawn a graph using the touch line as the x axis and the centre line as the y axis. The people of mean height will be the most numerous and they will be at the centre of the curve. Taller and shorter people will be fewer in number and the greater the difference from the mean, the fewer people there will be. Eventually, as we move out towards the goal lines at either end, there might only be one or two people who are sufficiently tall or short to qualify.

It would probably take several thousand people to make this demonstration work. Even so, they would represent only a **sample** of the entire population of the country, so it is unlikely that we would encounter anyone who was outstandingly tall or short. But such people do exist and we cannot say for certain where the final limits of human height lie. The same is true of all normally distributed variables and so the tails of the normal curve never actually meet the x axis of our graph.

Standard deviation

However, we can say some other very precise things about our normally distributed variable. We can work out a measure of the variable called the **standard deviation**. How this is done need not concern us here, so long as we understand what it tells us. The standard deviation gives us an indication of the **dispersion**

of the variable; that is to say, whether the curve is very tall and narrow, with most of the population values very close to the mean, or very low and flat, covering a wide range of measurements. The smaller the standard deviation, the taller and narrower the curve.

The standard deviation is interesting when we come to consider **probability**. The area under a part of the curve defined by a given number of standard deviations from the mean is easily obtained from mathematical tables. So, for example, if we take the part of the curve that lies within **two standard deviations** on either side of the mean, we find that approximately **95%** of the population will lie under it.

Going back to our height example, if the mean is 170 cm and the standard deviation is 10 cm, we can say that approximately 95% of people are between 150 cm and 190 cm tall. If we include everybody within **three standard deviations**, using the tables, we can say that over 99% of the population will be between 140 cm and 200 cm tall.

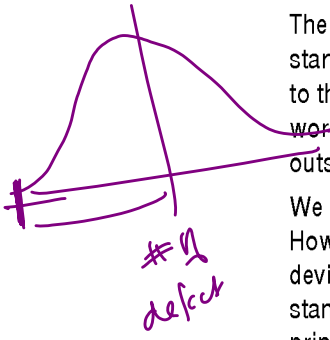
This is all very comforting and precise, but what does it have to do with **probability**, which, you may recall, was why we started on the normal distribution in the first place?

Probability

To deal with probability, we have to turn the concept on its head. We started off by describing the normal curve in terms of a **very large number of people** and we have discussed how it defines one of their variable characteristics: height in our example. We now think about what it can tell us about a **single individual**. While it cannot tell us anything absolutely precisely, it can tell us something useful with a certain degree of probability.

If we know, for example, that a person is a member of the population whose height we measured earlier, we can say **with 95% probability** that his or her height must lie in the range 170 cm to 190 cm. That is, we know that 95% of the population lie within that range, so a randomly chosen individual must therefore have a **95% chance** of being in that section of the population and, equally, of lying in that height range. Another way of using the same facts would be to say that our randomly chosen person has **only a 5% chance of lying outside** that height range.

8.1.2 Probability and process quality



The probability aspect of the normal distribution becomes very important for **process quality** when we start to think about product characteristics. We said that the essence of Six Sigma is to improve a process to the extent that there is only the **tiniest probability** that it will produce **unsatisfactory outputs**. In other words, we want to **control** things like widget weight so that it has only a tiny percentage chance of lying outside the acceptable limits.

We have spoken of 95% and 99% probability, both of which are regarded as pretty close to certainty. However, for Six Sigma we want to do better. The area under the normal curve out to three standard deviations includes well over 99% of all individual occurrences. If we extended the curve out to six standard deviations, the occurrences that were not covered would be **very, very few** indeed. This is the principle of Six Sigma: reduce the probability of defects to the minute level defined by the area **more than six standard deviations from the mean** (The Greek letter sigma in its lower case form (σ) is the usual mathematical symbol for standard deviation, hence six sigma)

In fact, the distribution used in the statistical theory that underpins Six Sigma differs slightly from the normal curve because of a phenomenon called long run process drift. Using this approach, only **3.4 items in a million** will lie outside the limit of six standard deviations either side of the mean. The goal of Six Sigma, therefore is to **reduce failures to a rate of less than 3.4 in a million**.

An important implication of this approach is that success is represented by a **band of quality** rather than a single specification. That band is defined as six standard deviations either side of the mean. Fairly obviously, if the measurements that correspond to those limits are close together, the standard deviation of the permitted measurements will be **very small** and the graph of the overall distribution will be very tall and thin.

Tolerances

It may be easiest to think about this in terms of a simple manufactured component, such as the piston in a single cylinder petrol engine. If the piston is too big, it will bind in the cylinder, or, possibly not even fit into it at all. If it is too small, it will both fail to capture the power generated from burning the fuel and it will move in an irregular fashion and cause excessive wear in the cylinder.

However, this does not mean that all pistons must be absolutely identical to the limit of measurement. Between the unacceptable extremes outlined above, there will be **a range of dimensions that are acceptable**. This range will be very narrow indeed, but it will exist. In fact, the specification for the piston diameter will probably be given with a *tolerance* such as 'plus or minus four thousandths of an inch'.

Whatever the physical dimensions of the permitted tolerance, Six Sigma requires that they must equate to plus or minus six standard deviations from the mean of the entire output of pistons if the manufacturing process is to qualify as operating at the Six Sigma level of quality.

This principle can be extended to processes other than manufacturing so long as some form of quantitative measurement is possible.

8.2 Process improvement with Six Sigma

As indicated above, Harmon suggests that Six Sigma is best applied to the **incremental improvement of fairly narrowly defined processes and sub-processes**; it is not an appropriate approach to process re-engineering or radical redesign. However, it must always be clear how the target process relates to the wider functional and strategic background.

An important feature of the system is its emphasis on the importance of basing management on **well-substantiated data** rather than opinion and intuition.

Exam focus point

In Chapter 3 we looked at business process re-engineering (BPR), and noted it involves the fundamental rethinking and radical redesign of business processes to achieve dramatic performance improvements.

By contrast, Six Sigma process improvement is best applied to the *incremental* improvement of processes and is not appropriate for radical redesign.

Make sure you appreciate this distinction in the relative suitability of the two methodologies for different scenarios.

8.2.1 Organising Six Sigma

When an organisation decides to commit to Six Sigma, it will normally appoint an overall **implementation leader** and form a **steering committee** at a senior level to provide a vision for the process and to oversee it. One of the principal responsibilities of this committee will be to nominate process areas for improvement. Each area will constitute a separate project and will have its own Six Sigma **project team** and **sponsor** or **champion**. The sponsor will be a member of the steering committee or may be the process sponsor (the process owner in ISO 9000:2000 terms). The project team will be made up of **staff experienced in the process** under review; for smaller scale projects, they will be the staff actually operating the process.

Staff involved in the **leadership of projects** may possess varying grades of qualification in Six Sigma.

(a) **Master Black Belts** are in-house consultants in Six Sigma and spend all of their time on it. They are especially skilled in the statistical techniques involved and will contribute to several projects simultaneously.

(b) **Black Belts** also spend all of their time on Six Sigma and lead specific projects.

(c) **Green Belts** also lead projects. They are managers who retain other job responsibilities alongside Six Sigma.

A Six Sigma project is likely to entail a large amount of training, both for the various leader grades and for the process operating staff that make up the project teams. **Empowerment** is a feature of the system in

that improvements are expected to flow from the bottom upwards. Team members are expected to commit to and take responsibility for the improvement work they are involved in.

Basic **project management techniques** are used in Six Sigma. Each improvement project will have a **charter** that defines its purpose, scope, assumptions and constraints in broad terms. This document will be subject to revision during the life of the project as its assumptions are challenged.

8.2.2 Six Sigma project phases

Six Sigma process improvement projects follow a **five phase** pattern known by the acronym DMAIC.

- **Define** customer requirements.
- **Measure** existing performance.
- **Analyse** the existing process.
- **Improve** the process.
- **Control** the new process.

Exam focus point

A question in the June 2012 exam asked candidates to explain how Six Sigma could help improve the quality of performance in an organisation, and then to illustrate how the DMAIC method could be applied in that organisation in order to implement Six Sigma.

Exam Focus Point

Notice that the 'D' in DMAIC relates to defining *customer* requirements, not defining the problem or issue. 'Customer' is actually the key word here. One of the key themes in Six Sigma is establishing a genuine focus on the customer, and what is important for the customer.

8.2.3 Define

The definition phase is a planning phase and includes project definition and the documentation of the existing process. Typically this will take one to two weeks, with the team meeting two or three times each week. A project charter may be provided by the project sponsor, but it may be necessary for the team to negotiate project scope and goals. The establishment of precise **customer requirements** from the process in question is an essential part of this phase. *Kano* divides customer requirements into three levels.

- **Basic** requirements are the minimum the customer will accept.
- **Satisfiers** improve the quality of the customer's experience.
- **Delighters** are totally unexpected by the customer.

Both external and internal customers may be vague in stating their requirements so careful research and logical definition are required.

A further important output from this phase is careful documentation of the process as it exists, probably using some form of **flow diagram**.

8.2.4 Measure

In the measure phase, statistical tools to assess current performance are selected using black belt expertise. Harmon, quoting *Eckes*, suggests three measurement principles.

- Only measure what the **customer** thinks is important.
- Do not measure things that the customer is satisfied with.
- Only measure things that **can be improved**.

There are three main areas for measurement.

- **Inputs** such as raw materials and product specifications
- **Process elements** such as cost, time, skills and training
- **Outputs and customer satisfaction**

Fairly clearly, outputs and customer satisfaction derive from and are determined by inputs and processes. According to Pande and Holpp, it is common to represent this relationship as an equation Y=f(X), where 'Y' represents outputs and 'X' represents inputs and processes. Y is then used in the jargon to mean goal or objective.

8.2.5 Analyse

Each element of the process may be assessed into one of three categories.

- **Value adding**
- **Necessary support** to value adding activities
- **Non-value adding**

Establishing the status of the various aspects of the process will require the use of a range of techniques including statistical analysis, and **fishbone analysis** (which you should be familiar with, from your P3 studies.)

Analysis should produce a list of problem causes and potential areas for improvement.

8.2.6 Improve

It may be particularly appropriate to **revisit the project charter** at the beginning of this phase, so as to incorporate any implications of the information obtained.

Improving the process demands a degree of **creative thought**. This can, to some extent, be guided by the wider experience of the team and its expert consultants. The problems identified in the analysis phase will indicate fruitful areas for consideration.

It is common for the people closely involved with the operation of a process to develop ideas for its improvement almost as soon as the possibility is raised. There is often value in these ideas, not least because of the great intimacy their authors have with the details of the process and its organisational setting.

Nevertheless, it is important that all proposals for improvement are subjected to a **rational review** so that their implications may be considered in as much detail as possible. **Cost** and **resource** consequences are of particular importance.

Implementation of the agreed improvements will require careful planning, probably small scale piloting and selling to stakeholders who were not involved in the project.

8.2.7 Control

Controlling processes is a **routine and continuing part of the management role**. When a process has been improved, it will probably be necessary to maintain some of the measurement processes used during the improvement effort in order to exercise control. However, the **cost of monitoring** must be considered, so it is likely that the extent of measurement will be minimised. Some processes can be monitored automatically, with control systems that generate exception reports automatically.

8.3 Example of DMAIC in context

We will now look at an example based on a restaurant ('The Foodhouse'), to illustrate how a Six Sigma project could be applied in practice.

The focus of The Foodhouse's project was on the customer satisfaction of customers who eat there. Their goal was ensuring customers are satisfied with the quality of their meal, and of the service they receive.

The project team identified a number of things about a dinner meal that *might* satisfy customers: quality of the food (taste, temperature); presentation of the food; variety of menu (number of items; daily specials); service (speed of food delivery; attention to customer's needs during the meal); ambience (room layout; cleanliness); and the price of the meal.

However, this list only showed the things that the project team thought might affect customer satisfaction. For their project to be effective, they had to determine the role that each of these possible requirements actually plays in customer satisfaction (that is, they had to **define** customer requirements).

They did this by asking all their customers to complete a short questionnaire survey after their meal.

The results of the survey showed that different types of customer have different requirements:

- For business customers, taste, temperature, speed of delivery and attentiveness during the meal were important factors.
- Elderly people indicated that taste, temperature and the availability of daily specials were most important to them.
- Customers with children indicate that taste, temperature and speed of delivery were most important to them.

The questionnaire responses gave the project team a clear idea of their customers' requirements.

They now had to identify **measures** to see how well they performed in satisfying these requirements.

One key measure The Foodhouse used to measure performance was the time it took for a customer to receive his or her meal (defined as the time between when the waiter took the order and when the meal is delivered to the table).

The total time is made up of the time it took the waiter to submit the order to the kitchen, the kitchen to cook the food and plate it up ready for service, and then for the waiter to deliver the meal.

The Foodhouse project team decided to split this process into two parts: the time it took waiters to place and deliver orders; and the time it took the kitchen to prepare and cook the food.

The team began to gather data on the time it took waiters to place and deliver orders, so that they could analysis it for trends as to what the most common causes of delay were when meals were delayed (the **analysis** phase).

The analysis indicated a number of things that took up a waiter's time and therefore interfered with the prompt placement of orders and delivery of food. These included: families with children wanting tables to be re-arranged; multiple tables all requiring waiter service at the same time; and tables wanting to make frequent drink orders.

This highlighted to the project team that an important issue affecting the speed of service was the control and placement of families. The team decided that two groups of families with children should not be put in the same area if possible; or if there was no alternative to putting families together, the number of tables served by the waiter dealing with them should be reduced, and extra tables should be allocated to another waiter. (This is the **'improve'** stage).

Overall, everyone was happy with the results obtained from the project. However, it was agreed that for one week every three months, follow-up customer feedback surveys would be distributed to all diners eating at the restaurant. The results from these surveys allow The Foodhouse's restaurant manager to monitor on-going customer satisfaction (the **'control'** stage).

Exam focus point

Importance of measurement. An important theme in the P5 syllabus is the nature of measurement, and how it might be related to quality, efficiency and reward.

However, management theorists often acknowledge that 'what gets measured, gets done.' But this also raises the caution of whether the indicators which are actually being measured are the ones which *should* be being measured in order to control critical business processes, or to promote a desired outcome.

The question scenarios in your exam may include examples of the 'wrong' measures being applied , in which case you may need to suggest alternative measures which should be used instead.

8.4 Six Sigma and new processes

Although the 'DMAIC' methodology is the methodology most commonly associated with Six Sigma, this should be used for **improving existing processes** rather than designing and **implementing new processes** or activities which are free from defects.

If an organisation is looking to design and implementing new processes or activities, then the methodology should be modified to 'DMADV'.

- **Define** customer requirements, and the objective of the process or activity
- **Measure** and identify product capabilities and process capabilities, and assess risks involved
- **Analyse** alternatives ways of designing the process or activity and evaluate them to choose the best alternative
- **Design.** Plan the design of the process or activity, optimise the design and then produce the design.
- **Verify.** Verify the actual process works as intended in the design, by carrying out trial runs. Then implement the process.

Chapter Roundup

- Quality management has developed from an inspection-based process to a philosophy of business that emphasises customer satisfaction, the elimination of waste and the acceptance of responsibility for conformance with quality specifications at all stages of all business processes.
- Changes to the **competitive environment**, **product life cycles** and **customer requirements** have had a significant impact on the modern business environment.
- In the context of **TQM**, quality means getting it right first time and improving continuously.
- **JIT** aims for zero inventory and perfect quality and operates by demand-pull. It consists of **JIT purchasing** and **JIT production** and results in lower investment requirements, space savings, greater customer satisfaction and increased flexibility.
- **Life cycle costing** assists in the planning and control of a product's life cycle costs by monitoring spending and commitments to spend during a product's life cycle.
- **Target costing** is a pro-active cost control system. The target cost is calculated by deducting the target profit from a predetermined selling price based on customers' views. Techniques such as value analysis are used to change production methods and/or reduce expected costs so that the target cost is met.
- The aim of **Kaizen costing** is to reduce current costs by using various tools such as value analysis and functional analysis.
- The essence of **continuous improvement** is the use of an organisation's human resources to produce a constant stream of improvements in all aspects of customer value, including quality, functional design, and timely delivery, while lowering cost at the same time.
- **Costs of quality** can be analysed into **prevention**, **appraisal**, **internal failure** and **external failure** costs and should be detailed in a **cost of quality report**.
- 'Quality' does not mean 'high quality'. It is the degree to which a set of inherent characteristics fulfils requirements. **Quality control** satisfies quality requirements, while **quality assurance** gives confidence that quality requirements will be satisfied. That is, quality control is about activities such as supervision and measurement, while quality assurance is about things that make those activities effective, such as training and quality records.
- The ISO 9000 quality standards have been adopted by many organisations world-wide. A company registering for ISO 9000 certification is required to submit its quality standards and procedures to external inspection. If it receives a certificate, it will be subjected to continuing audit. The aim of an ISO 9000 certificate is to provide an **assurance to customers** (and suppliers) of the organisation that its products are made, or its services are delivered, in a way that meets ISO's **standards** for quality.
- Part of the purpose of quality management is to manage both the **cost of failure** and the cost of **inspection** and **presentation** so as to minimise quality related cost overall. An effective QMS will also improve the organisation's ability to deliver satisfactory outputs; it should lead to enhanced staff commitment; and it should improve relationships with customers.
- An organisation's quality manual specifies its quality management system.
- Quality policies may include a mission statement, a corporate policy statement and process specific polices.

Chapter Roundup (cont'd)

- A **quality process** is a statement of the specified way to carry out an activity or a process
- There are two types of quality process: **core business processes** and **supporting processes**.
- ISO 9001:2000 mandates a minimum of six specific written quality procedures. These cover two QMS processes and four MAI processes.
  - Control documents
  - Control records
  - Internal audit
  - Product failures
  - Corrective action
  - Preventive action
- Four aspects of quality are particularly important in software.
  - Functionality
  - Reliability
  - Usability
  - Build quality (flexibility, expandability, portability, ease of maintenance)
- Low quality in IS development produces systems that are difficult to use, maintain and enhance.
- As well as ensuring it has good quality information systems, an organisation also needs to ensure that it produces good quality management information.
- Six Sigma is a quality management system that grew out of statistical quality techniques. The overall aim is a very high and consistent standard of quality output. It tends to take the form of specific improvement projects that follow a standard five phase pattern.
  - **Define** requirements
  - **Measure** performance
  - **Analyse** the process
  - **Improve** the process
  - **Control** the new process
- It depends to some extent on charismatic leadership

1 What is the difference between quality control and quality assurance?

2 What is the difference between a quality process and a quality procedure?

3 What does an ISO 9000 certificate mean?

4 An organisation has recently noticed it has suffered an increase in the cost of scrapped parts and materials it is incurring, and it has seen a loss of production time as a result of coping with errors.

Which of the 'costs of quality' do these issues indicate the organisation needs to address:

A Prevention costs
B Appraisal costs
C Internal failure costs
D External failure costs

5 Which of the following is NOT one of the standard five phase pattern used to improve existing processes in Six Sigma:

A Analyse the process
B Measure performance
C Create a new process
D Define customer requirements

Answers to Quick Quiz

1 Quality **control** is about fulfilling quality requirements while quality **assurance** is about providing confidence that quality requirements will be fulfilled.

2 A quality **process** transforms inputs into outputs of the quality required while the related quality **procedures** specify how that process should be performed.

3 The aim of an ISO 9000 certificate is to provide an **assurance to customers** (and suppliers) of the organisation that its products are made, or its services are delivered, in a way that meets ISO's **standards** for quality.

4 C. Internal failure costs (costs associated with errors which are dealt with inside the operation) include: the costs of scrapped parts and materials, or reworked parts and materials, and the lost production time as a result of coping with errors.

5 C. The 'C' in DMAIC stands for 'Control' the new process, not 'Create' the new process.

Now try the questions below from the Exam Question Bank

Number	Level	Marks	Time
Q19	Exam	20	36 mins
Q20	Exam	20	36 mins

Understanding life cycle costs helps determine opportunities for cost reduction, especially pre-production decisions where many of the subsequent costs are determined.

Takes selling price as given by market so, to achieve a desired profit margin, costs must be at or below target cost.

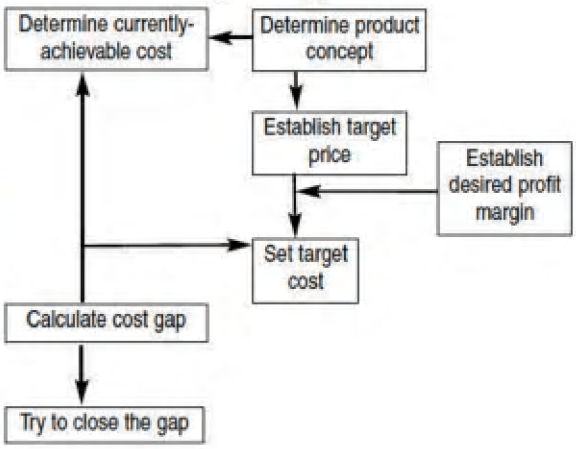
Life cycle costing

Traditional management accounting systems tend to report costs at the physical production stage of the life cycle and do not accumulate costs over the entire life cycle, assessing product profitability on a periodic basis instead.

Life cycle costing tracks and accumulates costs and revenues over the entire product life cycle, which means that a product's total profitability can be determined.

Target costing

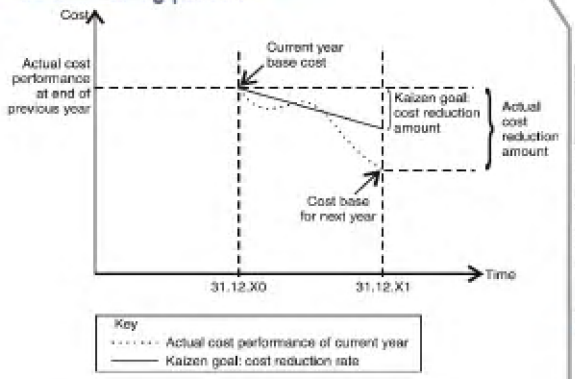
The target costing process



Kaizen costing

Focuses on obtaining small incremental cost reductions during the production stage of the product life cycle, using various tools such as value analysis and functional analysis.

Kaizen costing process



Kaizen provides opportunities for in-production cost improvements.

Kaizen is Japanese for 'improvement'.

Standard costing vs Kaizen costing

Used for ...	cost control	cost reduction
Focus is on ...	standard costs based on static conditions	actual costs assuming dynamic conditions
Standards/cost reduction targets are set ...	every 6–12 months	monthly
Costs are controlled ...	using variance analysis	by implementing continuous improvement
Employees are ...	the cause of problems	the source of solutions

Variances don't work as standards keep changing.