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QUALITY HANDBOOK FOR SMALL AND MEDIUM-SIZED EXPORTERS IN PHILIPPINES



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Foreword

Quality is a key determinant of competitiveness of business operations and entrepreneurial success. It endows businesses with a sustainable competitive advantage through excellence in products and services. Very often small entrepreneurs are not aware that not applying quality proves more costly than incurring costs of applying quality methods and techniques. From commanding favourable prices, encouraging repeat business and reducing risk and waste, to increasing market shares and profits, the benefits of quality are extensive and significant.

This guide on quality has been prepared for micro, small and medium-sized enterprises (MSMEs) in Philippines under the ARISE Plus Project. The programme, financed by the European Union, is being implemented by the International Trade Centre in partnership with the Department of Trade and Industry (DTI) of the Government of Philippines.

The project aims to he project is to foster inclusive economic growth and poverty reduction in The Philippines through improved national trade performance and competitiveness.

We hope this guide will inspire more and more Filipino MSMEs to adopt and implement a quality-based excellence approach to their entrepreneurial endeavours and contribute to their success.

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Unit 1: Introduction to quality

1. Introduction

Quality is an essential performance objective of an enterprise as it can provide it with a sustainable competitive advantage for its products and services. Quality of goods or quality of service is most often how customers judge an enterprise. Thus, any enterprise must be committed to continuous improvement in order to stay ahead of the competition. Yet, this continuous improvement and quest for excellence is no longer confined to a single enterprise but to every organization along a supply chain.

Enterprises are no longer in a 'sellers' market' where their production capacity and not the capacity of their markets was the limiting factor for their success. Today, market capacity has become smaller than production capacity and the arrival of company-wide and worldwide networks of information systems has reduced the cycle times for business transactions. The customer is no longer an object, but a subject. Enterprises are in a buyer's market where the customer

is king. An enterprise exists because of its customers!

Globalization and the increasing participation of emerging economies in world trade have resulted in virtually any customer being able to source worldwide, and high quality is often the most important factor used to differentiate between competing suppliers and supply chains.

2. What is quality?

Definitions

Some definitions of quality are:

- "fitness for use" (Juran);
- "conformance with specified requirements" (Crosby);
- "meeting and exceeding customer requirements" (Deming);
- "the degree to which a set of inherent characteristics of an object fulfils requirements" (ISO 9000).

Customer defines quality

The supplier and the customer can have different views on what quality is and this may lead to misunderstandings. It is the

customer who defines whether a product is fit for use or not. If the characteristics of a product or service do not match those required by the customer, it will not be a quality product for the customer. Quality is therefore “the conformance with customers’ requirements or fitness for purpose”.

Quality is relative

A product may be of good quality for someone, but of poor quality for someone else. For instance, one person may be comfortable with high-heeled shoes while another may prefer flat shoes.

Quality is dynamic

Customers’ requirements change over time with increasing purchasing power and more innovative products. A customer who was satisfied with a black-and-white television set in the past now goes for a colour television set with a flat screen.

Quality includes post purchase aspects

Products with a long life such as cars, refrigerators, television, require after-sales service. Such products should be readily

available for use, not break down often and should work for a reasonable period before breaking down again). Therefore, after- sales service should be reliable, prompt and performed with integrity by competent personnel.

Quality has grades

Grade is defined in ISO 9000 as the “category or rank given to different quality requirements for products, processes or systems having the same functional use”. Some examples are the class of airline ticket and category of hotel in a hotel guide.

Quality is what brings the customer back

3. The characteristics and dimensions of quality

The customer’s needs and expectations are expressed in terms of parameters or characteristics of a product. These characteristics vary from product to product. Table 1 below gives examples of characteristics of different products :

Table 1: Examples of product characteristics

Product	Characteristics
Fresh fruits and vegetables	<ul style="list-style-type: none"> • 'Free from damage caused by pest' • 'Free from abnormal external moisture' • 'Free from foreign smell and/or taste' • 'Uniformity of size', etc.
Processed food	<ul style="list-style-type: none"> • 'Flavour' • 'Aroma' • Texture 'mouth feel' • 'Nutritional Value' • Microbial Safety' (food safety characteristic)
Coffee beans	<ul style="list-style-type: none"> • Free from extraneous matter, live pest and mould'. • 'Fully conforms to sample' • 'Uniform quality throughout the entire shipment' • 'Be clean in the cup, i.e. 'free from obnoxious flavour'
Leather & Leather products	<ul style="list-style-type: none"> • 'Colour fastness to dry and wet rubbing' • 'Moisture content' • 'Good adhesive strength of joints' • 'Good workmanship' • 'Hexavalent Chromium within limits prescribed'

Dimensions of quality in goods

Quality has many dimensions (Figure 1), defined as follows:

- **Performance** refers to a product's main operating characteristics, i.e. it does what it is intended to do.
- **Features** are extras (tangible or intangible) that supplement

Unit 1: Introduction to quality

the main characteristics, e.g. after sales service or guarantees.

- **Reliability** is the probability that a product will continue to function well and not fail within a specified period of time.
- **Conformance** is the degree to which a product's design and operating characteristics meet established standards.
- **Durability** is the amount of use before the product deteriorates.

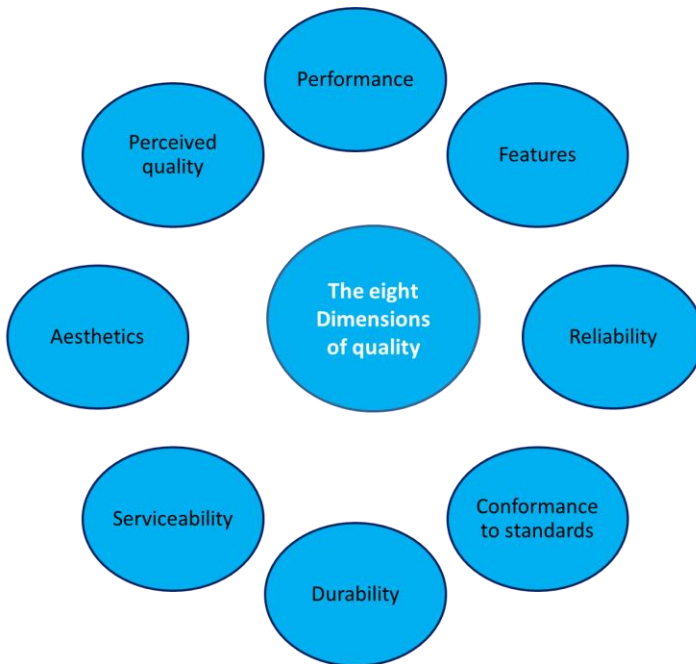


Figure 1: The eight dimensions of quality

- **Serviceability** is dependent on the service team's speed, courtesy, competence and the product's ease of repair.
- **Aesthetics** is appearance and impression.
- **Perceived quality** is linked to the reputation of the brand.

Dimensions of quality in services

The ISO 9000 definition of quality, i.e. "degree to which a set of inherent characteristics fulfils requirements", is equally applicable to a service. While it is easy to define and measure the characteristics of a hardware item, the service being an intangible item is difficult to define and measure. A generally acceptable service characteristic is RATER:

- **Responsiveness:** willingness and/or readiness of employees to help customers and to provide prompt service, timeliness of service.
- **Assurance:** knowledge and courtesy of your employees and their ability to convey trust and confidence, viz. competence, trustworthiness, inspiring confidence.
- **Tangibles:** physical appearance of the service such as facilities, tools, equipment, appearance of servicing personnel and communication materials.
- **Empathy:** provision of caring, individualized attention to the customer, giving the customer information in a language he or she understands,

understanding the customer's specific needs.

- **Reliability:** the ability to perform the promised service dependably and accurately, e.g. performing the service right the first time, giving accurate information in the billing.

The individual dimensions or characteristics of quality are not necessarily distinct. Depending on the product or service, situation, and type of contract, all of the above dimensions may be interdependent.

4. Benefits of higher quality

The benefits of high quality are indeed extensive and significant.

- **Command top price:** Higher quality than that of its competitors can result in an organization achieving top prices for its goods and / or services. Customers are often prepared to pay a price premium for the "best in class".
- **Repeat business:** Higher quality often leads to repeat business – an organization's products change from being

mere order qualifiers to becoming order winners. This often results in the development of long-term customer relationships and customer loyalty.

- **Increased market share:** Higher quality frequently results in increased productivity and the lowering of costs, which in turn can translate into increasing market share.
- **Superior branding:** Higher quality boosts the image of an organization and its brands, and enhances its reputation both at home and abroad.
- **Improved staff morale:** Higher quality enhances staff morale. People like to work for a winning company with a good reputation.
- **Reduced risks:** Higher quality reduces risks relating to, e.g. safety and health, leading to fewer complaints and recalls, and thus reducing liability and insurance costs.
- **Increased profits:** Higher quality can result in increased revenues, higher profits, and increased benefits for all stakeholders: owners / shareholders, employees and the community.

On the other hand, poor quality can have very serious consequences for a business:

- Lower productivity and increased costs.
- Warranty / guarantee costs and product liability claims.
- Loss of business, loss of market share, falling reputation, and eventually threats to survival.

5. Hurdles for quality

Many times you miss due attention to quality while carrying out your business activities due to many reasons. For example:

- **Complacency:** You are satisfied with the way you have been running your business since you are already making reasonably good profit.
- **Singular focus on low cost:** You may have a tendency to procure raw material and other supplies at the lowest price without paying due attention to the quality parameters.
- **Reactive approach:** You have more faith on the end of the line inspection for checking quality of the product rather than having a system of producing 'right first time' i.e. preventing defects proactively.

Unit 1: Introduction to quality

- **Unsuitable staff:** You may have a tendency to use low-paid employees, who may not have the required skills and are asked to meet the production targets. This means that you focus more on 'quantity' rather than 'quantity with right quality'.
- **Committing without certainty:** Many times you may agree with your customers to deliver the product in a given time without being sure that you can meet the deadline.
- **Zero or negative value processes:** Process steps being followed by you may not be correct or may not be adding value to the product. Similarly, your system for controlling quality may not be standardized and may change from person to person.
- **Failure to solve root cause of problems:** You believe in 'crisis management' or 'fire-fighting' which means that you fight the problems such as machine breakdown, rejection of product after inspection, customer complaint etc. as they arise and do the same thing again when the same problem arises. This means you do not attack the cause of the problem which results in the same problem appearing repeatedly. This is an expensive way of managing your business.
- **Misconceptions:** You may have a misconception that all quality-related problems originate on the production floor and the quality control person or inspector is responsible for this. On the contrary, Japanese industry, which is famous for its quality revolution since the early 1950s', concluded a **40-30-30 rule** explained in the box below. Dr. Juran, the famous quality guru, said that quality cannot happen by chance. If it has to happen, then one should do **quality planning, quality control and quality improvement**. This is called 'Juran Trilogy' for quality. The Japanese followed him and other quality gurus and became leaders in quality for various products, challenging western countries both in quality and pricing.

The 40-30-30 Rule

40% quality problems are caused due to poor product design or specifications of the product not being clear before starting the production.

30% quality problems are caused due to wrong or ineffective materials purchased from suppliers.

Remaining 30% quality problems are due to errors made during the manufacturing process. This may be due to lack of proper instructions to workers, machines not working well, measuring instruments not being accurate, mishandling the product, operator not performing the required controls on the process, etc.

Quality means providing products and services that do what they are supposed to do to your customers,

whether they are internal to the organisation or external. To ensure quality of your supplies, it is essential to:

- Clearly understand the requirements of your customer/market.
- Review the above and examine your ability to meet the customer requirements as well as any regulatory requirements.
- If you think it will not be possible to fulfil all that the customer has asked for, then resolve the same with the customer upfront i.e. before accepting the order and agree on what you can reasonably give.
- Deliver the product/service as promised without any deviation.

6. Conclusion

A customer will be satisfied if you deliver the product conforming to his/her needs and expectations and certainly, you also need to deliver the product within the agreed time and price.

In the marketplace, the winners will be those who can offer products or services that are better (in terms of quality), cheaper (in terms of costs)

and supplied more efficiently (delivered in time or provided with a timely after-sales service). If customers are not satisfied, they

can always buy from another supplier. In this sense, quality is the core task of a business. It is not optional. It is essential for survival.

Unit 2. The Quality Revolution

1. The Quality Gurus

Work of quality management visionaries has made a massive and immeasurable impact, resulting in a quality revolution, rather than just an evolution!

Walter Shewhart

- Is regarded as the grandfather of Total Quality Management
- Invented control charts
- Developed PDCA (Plan, Do, Check, Act) – that was later popularized.

W. Edwards Deming

- Stressed the reduction in variation as a critical factor in quality improvement
- Advocated collaboration with suppliers to improve quality and reduce costs using statistical process control (SPC)
- Contributed with "Deming's 14 Points (see section 2 of this unit).

Joseph Juran

Joseph Juran considered quality as "fitness for use", and described quality management as a trilogy consisting of:

- quality planning
- quality control
- quality improvement
- Juran also emphasized that management must be committed to continuous improvement. He estimated that about 80% of quality defects could be controlled by management!

Armand Feigenbaum

- Initiated the concept of Total Quality Control
- emphasized that the customer defines quality.
- first described the concept of quality costs (see following section)

Philip Crosby

- Coined phrases e.g. "The Quest for Zero Defects", "Quality is Free" and "Right First Time, Every Time".

Unit 2. The Quality Revolution

- Published a book *Quality is Free*¹ explaining that the costs of poor quality are substantially greater than the costs of prevention.

Crosby's four absolutes of quality management are:

- Quality is conformance to requirements, not goodness (goodness is subjective while conformance to requirements is objective and measurable).
- The system for causing quality is prevention, not appraisal (appraisal is reactive while prevention is proactive).
- The performance standard for quality is zero defects.
- The measurement of quality is the price of non-conformance.

Kaoru Ishikawa

- Came up with quality circles – where employees work in product / process improvement groups – and the cause-and-effect (or fish) diagram (Figure 2) for problem solving.

- Provided insight into quality with his interpretation: "Narrowly interpreted, quality means quality of product. Broadly interpreted, quality means quality of work, quality of service, quality of information, quality of process, quality of division, quality of people (including workers, engineers, managers and executives), quality of systems, quality of company, quality of objectives, etc..

Genechi Taguchi

- Genechi Taguchi
- Argued that the cost of quality is the cost of variation
- Emphasized the need to minimize this variation.
- Developed the Taguchi Loss Function: a formula for determining the cost of poor quality to society.
- Masaaki Imai²
- Masaki Imai popularized the "kaizen" (continuous improvement) throughout the world, the most critical element of TQM.

¹ Crosby, P.B.(1979) *Quality is Free*. McGraw-Hill, Boston

² Imai, M.(1986) *Kaizen: The Key to Japan's Competitive Success*. Random House

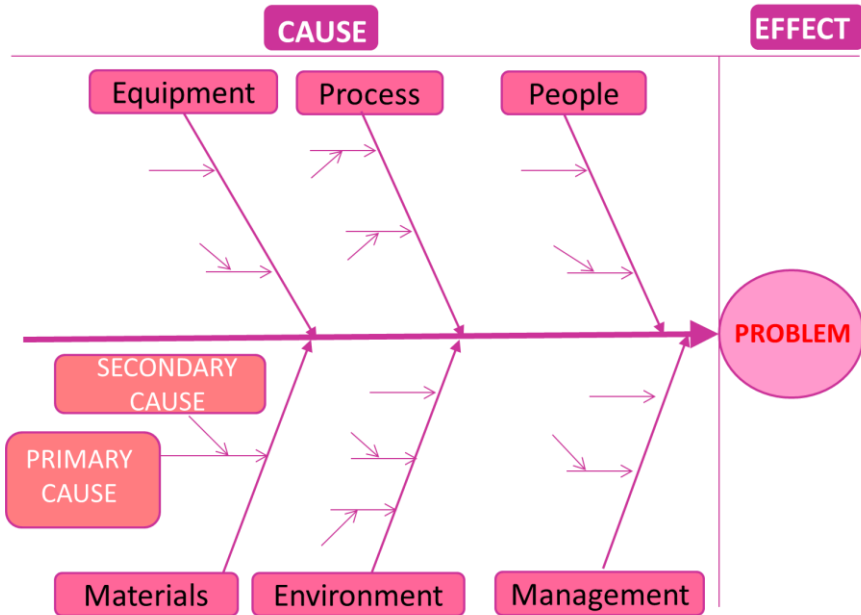


Figure 2: Cause and effect diagram

2. Applying Deming's 14 points

Quality has to be built into every level of an enterprise and become part of everything it does. Quality is essential for the success of any organisation, from answering the phone to manufacturing products and serving the end customer. Before, companies were usually

satisfied with focusing their quality efforts on the production process alone since competitive pressures were much lower. Now with globalisation and modern technology, competition has become so fierce and quality is often thought to start and end with the customer. All points

Unit 2. The Quality Revolution

leading to and from the customer must aim for high-quality service and interaction. Deming has contributed to this new thinking. His book "Out of the Crisis" summarized his famous 14-point management philosophy which was developed by Deming after a thorough study of highly

successful companies. These 14 points (Table 2) have become a reference for quality transformation and they apply to any type and size of business: service, manufacturing, small, large enterprises, and even a one-person company.

Table 2: Applying Deming's 14 points

Deming's 14 Points	Application to an organization
1. Create constancy of purpose	<ul style="list-style-type: none">• Develop a vision and commitment to quality for the long term.
2. Adopt the new philosophy	<ul style="list-style-type: none">• Change to a new system of management that recognizes the crucial importance of quality and the need for ongoing improvement.• Create cross-functional teams (Quality Circles) for problem solving and continuous improvement.• Train everyone in the new philosophy.
3. Cease dependence on mass inspection	<ul style="list-style-type: none">• Build quality into the product.• Use quality control tools to achieve this. Improve quality of inputs and processes.• Staff must be responsible for their work.
4. End the practice of awarding business on the basis of price	<ul style="list-style-type: none">• Implement supplier evaluation and accreditation systems, which incorporate quality, delivery, technology as well as price.• Collaborate with a reduced number of suppliers.
5. Improve constantly and forever the system of production and service	<ul style="list-style-type: none">• Improve quality and increase productivity (by increasing output and reducing costs): cross-functional teams are one of the main drivers for ongoing improvements.
6. Institute training on the job for all staff	<ul style="list-style-type: none">• Implement ongoing training programmes for all staff with the emphasis on quality.

Unit 2. The Quality Revolution

7. Institute leadership	<ul style="list-style-type: none">Managers must lead and provide the foundation for continuous improvement and teamwork.
8. Drive out fear	<ul style="list-style-type: none">Do not blame staff for management problems. Most problems are due to poor management and poor systems.
9. Break down organizational barriers	<ul style="list-style-type: none">Encourage the formation of cross-functional teams to break down barriers within and between organizations (supply chain management).
10. Eliminate slogans and posters etc.	<ul style="list-style-type: none">Rather provide staff with the necessary training and equipment to do the job!
11. Eliminate numerical quotas	<ul style="list-style-type: none">Eliminate quotas, work standards etc. that conflict and interfere with quality goals.
12. Give people pride in their job	<ul style="list-style-type: none">Remove barriers and recognize the contribution of staff: systems make it possible, but people make it happen.
13. Institute education & self-improvement programmes	<ul style="list-style-type: none">Emphasize the need for ongoing education and training for ALL staff.Encourage increasing professionalism by motivating staff to obtain professional qualifications.
14. Put everyone to work to achieve the above	<ul style="list-style-type: none">Create the vision, appropriate structures and goals to be a successful and respected organization.

Adapted from: Deming, W. Edwards. Quality, Productivity and Competitive Position, MIT, 1979.

3. The Evolution of Quality

From inspection to total quality management

Quality existed even in historic times. Written quality specifications and measurements can be traced back to the Egyptians and Babylonians.

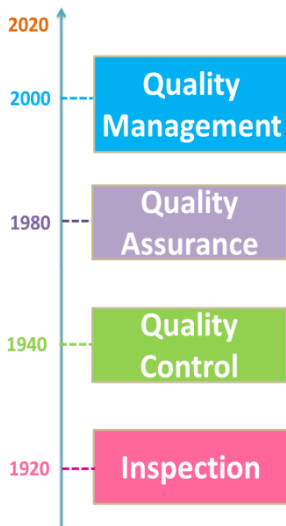


Figure 3: The evolution of quality

Figure 3 shows the evolution of quality from inspection through quality control, quality assurance to the present day concept of total quality management.

Inspection

In the early days of manufacturing, inspection was the usual method of attempting to ensure that an organization received or dispatched goods of required quality. Products were inspected after being produced to see if they were fit to be sent to the customer. This approach did not prove very useful since the product is already made and at this stage it is too late to do much with defective items except reworking / scrapping / lowering price. Such an approach led to excessive scrap and high time invested in inspections, and failed to tackle the root cause of defects or low quality.

Quality Control

The above mentioned limitations lead to the phase where product testing and documentation control became the means to ensure greater process control and increased conformity. Such a system relied on data collection, feedback to earlier stages in process and self-inspection

Quality Assurance

Both inspection and quality control were reactive rather than proactive

and prevention-based, to eliminate root causes of problems. With quality assurance came processes and systems to control what is being done from design to production and supply stages of the product. These systems were audited to ensure adequacy in use and design. Quality manuals, procedures, work instructions, quality planning and auditing form part of this approach which is prevention-based..

Total Quality Management and continuous improvement

The growth of world trade became a major impetus for the development of quality assurance systems brought together under the international umbrella of ISO 9000. The 1980s witnessed the growth of competition amongst businesses with quality as the key means to securing a sustainable competitive advantage. Pressure for continuous improvement of quality brought the Total Quality Management (TQM) concept was confined not only to manufactured goods, but to services as well (see following section).

4. Total Quality Management (TQM)

TQM is a long term goal

It involves everyone in an organization in pursuing the long-term goal of satisfying customers by continuously improving quality. There are three key elements that underpin TQM:

- Customer Satisfaction,
- Employee empowerment - Total Involvement in TQM by all staff
- Continuous Improvement.

TQM is not a quick-fix

TQM is no short-term quick fix for an ailing business organization. It has to be a strategic and involves total commitment.

TQM is everyone's responsibility

Involving everyone in an organisation in TQM requires training staff and encouraging them to work in teams.

TQM refers to both internal and external customers

Customer satisfaction refers to both external and internal

customers. Satisfying internal customers e.g. could be providing accurate and timely financial data to all departments.

TQM focuses on measurement and control

Enterprises are sets of processes. Processes are value chains serving the customer. The degree to which these value chains can satisfy their customers determines the success and survival of enterprises. The health of a process may be assessed through

- **Deliverables** : the process' contribution to the next one;
- **Cost** : the cost required to produce the deliverables;
- **Quality** : the degree of conformity to customers' requirements;
- **Education**: the knowledge level of the process performers (Gower, 1997).

5. Continuous improvement (PDCA Cycle)

Continuous Improvement (kaizen) is the nucleus and foundation of TQM. The concept of continuous improvement

developed from the Shewhart Cycle or Deming Wheel, and involves a continually evolving cycle of incremental improvements over time.

The essence of continuous improvement lies in employees' involvement. This happens when they improve their process, product or services by applying their creative faculties on their work related problems and routine jobs. Use is often made of quality circles or small cross-functional teams (also known as process improvement teams) to pinpoint areas / processes for improvement and to implement and then monitor these improvements using the PDCA cycle, (Figure 4) explained below:



Figure 4: The PDCA cycle

- **Plan**: Examine existing operations, select the process for improvement, collect information, consider

alternatives and plan improvement(s).

- **Do:** Implement the plan and collect relevant performance data.
- **Check:** Analyse the performance data, to establish if the predicted improvement was achieved.
- **Act:** If the desired level of improvement is reached, implement and monitor the improved process. If not, take necessary actions.

6. Standardization of quality

Standards define quality characteristics

Standards are a tool for quality. As mentioned earlier, quality is the conformance to certain specifications established by the company, the client or any other body. The “specifications” are established in product standards or other normative documents. A standard can be defined as a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their

purpose. Hence, there exist product standards, and systems standards.(Figure 5).

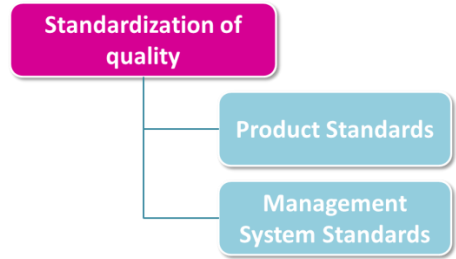


Figure 5: Two types of standards for quality

Standards support compulsory requirements for health and safety

National standards bodies have been set up in many countries to formulate these normative documents or standards. Many of these standards are specifications for products, processes or systems. To be able to access a particular market would require the compliance to the standards specified by the client and even by the regulatory authorities of the country. Standards are usually voluntary in nature, but where they can be used to protect the health, safety and environment, they can become mandatory under the

various legislations enforced by the authorities of a country.

Standards for certain building materials like steel bars and cement are mandatory in many countries as such products can affect the safety of buildings. This is also the case for children's toys since the latter should not present any danger to kids. The case of food poisoning has been very common in the recent past and in many countries standards on food hygiene or even food products have become mandatory to ensure a better protection of the health of the population.

Standards enable consistent quality

Moreover, many buyers, including retailers require their suppliers to demonstrate ability to ensure consistency of the quality level of their products or services. This demands the suppliers to implement a management system which can ensure the consistency in the level of quality. In this context, standards have been established on requirements for a quality management system, which can help an enterprise to ensure

consistency or even continuous improvement of the quality level.

ISO 9001:2015 Quality Management Systems Standard

The International Standard ISO 9001:2015 on "Quality Management Systems - Requirements" if implemented effectively by a supplier, provides the necessary confidence that the latter can consistently provide goods and services that meet the needs and expectations of the client and also comply with applicable regulations. The requirements of ISO 9001 cover a wide range of topics, including the supplier's top management commitment to quality, its customer focus, adequacy of its resources, employee competence, process management (for production, service delivery and relevant administrative and support processes), quality planning, product design, review of incoming orders, purchasing, monitoring and measurement of its processes and products, calibration of measuring equipment, processes to resolve customer complaints and a

requirement to drive continual improvement of the system. There is also a requirement for the supplier to monitor customer perceptions about the quality of the goods and services it provides.

7. Quality Management and its four component

Quality management

The term 'quality management' (QM) is defined in ISO 9000 as :

“coordinated activities to direct and control an organization with regard to quality”.

To direct and control an organization, its management should first set out its quality policy and related quality objectives and then specify activities related to quality planning, quality control, quality assurance and quality improvement.

The objective of QM is to ensure that all company-wide activities necessary for enhancing the satisfaction of customers and other stakeholders are carried out effectively and efficiently. QM focuses not only on product/service quality but also on the means for achieving it.

Components of quality management

The four components of QM are briefly explained below.

a. Quality Planning (QP) “a part of quality management focused on setting quality objectives and specifying necessary operational processes and related resources to achieve the quality objectives.” (ISO 9000)

QP is a systematic process that translates quality policy into measurable objectives and requirements and lays down a sequence of steps for realizing them within a specified time frame.

The results of QP are presented, for use by all concerned, in the form of a quality plan, a document specifying which procedures and associated resources will be applied by whom and when. Such quality plans are prepared separately for specific processes, products or contracts.

b. Quality Control (QC) is

“a part of quality management focused on fulfilling quality requirements.” (ISO 9000). It helps in evaluating the actual operating performance of the process and product and, after comparing actual performance with planned

targets, it prompts action on the deviations found, if any.

QC is a shop-floor and online activity that requires adequate resources, including skilled people, firstly to control the processes and then to carry out timely corrections when process and/or product parameters go beyond prescribed limits.

c. Quality Assurance (QA) is “a part of quality management focused on providing confidence that quality requirements will be fulfilled.” (ISO 9000)

Both customers and management have a need for an assurance of quality because they are not in a position to oversee operations themselves.

QA activities establish the extent to which quality will be, is being or has been fulfilled. The means to provide the assurance need to be built into the process, such as documenting control plans, documenting specifications, defining responsibilities, providing resources, performing quality audits, maintaining records, reporting reviews. Quality Assurance includes Quality Control, and is more comprehensive than the latter.

d. Quality Improvement (QI) is “a part of quality management focused on increasing the ability to fulfil quality requirements.” (ISO 9000)

Remaining static at whatever level you have reached is not an option if your organization is to survive. To maintain your performance and your position in the market, you will have to carry out quality improvement activities on a continual basis. Such improvement activities include refining the existing methods, modifying processes first to reduce variations and second to yield more and more by consuming less and less resources. If you want to have a breakthrough, this will often require new methods, techniques, technologies, processes.

Quality: From control to management

Figure 6 shows the evolution from quality control to quality management.

The illustration shows that quality control is the core activity within quality management. When you carry out quality control within a defined system, you have upgraded your quality control to quality assurance. If you then

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continue carrying out quality improvement activities based on the analysis of the data resulting from the measurement of processes/product as well as of data on customer feedback, you have moved towards quality management. In that sense, quality planning remains an integral part of all steps in quality management.

Put simply, the four components of quality management mean:

Quality planning – *Can we make it OK?*

Quality control – *Are we making it OK?*

Quality assurance – *Will we continue making it OK?*

Quality improvement – *Could we make it better?*

Quality control, being the core activity of quality management, should be established first by an organization. It will, inter alia, require the availability of equipment and machines of the requisite capability, skilled persons, accurate measuring instruments and basic support services. Without these, it will not be possible to exercise proper quality control and then to move towards quality assurance and quality management.

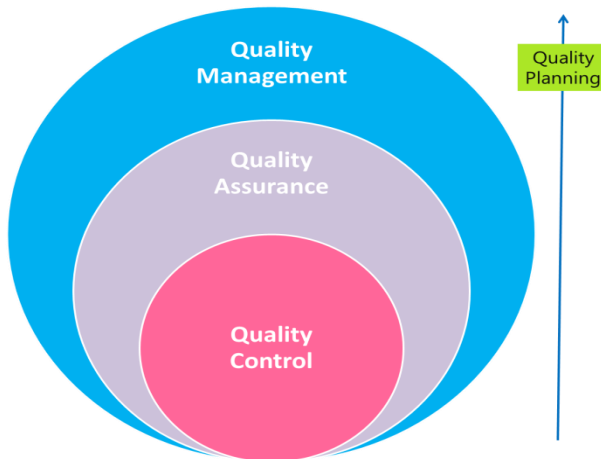


Figure 6: Evolution of quality as a concept

8. Conclusion

In this unit, we have seen the part played by the different quality gurus in the evolution of quality management. Deming's 14-point management philosophy, the Total Quality Management philosophy, the continuous improvement cycle as well as the four components of quality management. The use of standards for ensuring consistency of quality has also been indicated.

Quality management today is based not only on meeting customer expectations and regulatory requirements, but also on continuous improvement, involving everyone in the organisation. As Philip Crosby said, quality is the result of a carefully constructed cultural environment. It has to be the fabric of the organisation, not part of the fabric

Unit 3. Cost Benefits of Quality

1. Introduction

There is a general misconception that quality costs more. In fact poor quality may be already costing you more and you may not even realize it. If left unresolved this could end up costing you your business.

Quality however requires efforts and resources, which are actually investment into your business.

Consequences of poor quality

Poor quality means that a product has unintentionally reached your customer with defects, imperfection or contamination. Or there has been an error in service delivery. This will setback your business and involve extra costs related to:

Rework: Loss of time and efforts you spent firstly in making a defective product plus the additional effort and resources you put in to correct the defect.

Recall: Time and effort spent on recalling the product from the customer if you learn that a defective product has been sent to the customer.

Complaint settling: If the customer finds that the product does not conform and makes a complaint, it will require your time and effort in resolving the complaint to the satisfaction of the customer.

Quality is remembered long after the price is forgotten.

Unsatisfied customer: A dissatisfied customer may stop doing business with you.

You may not realize the implications of costs associated with the above and keep on incurring losses which ultimately affect your profitability. These losses can be considerably reduced if you detect the defects or defective product at the earliest. The best is if you can produce defect-free products, i.e. produce not only "right first time" but also "in time" which will require some effort on your part, including practicing a quality control system.

The Cost of Quality

Produce right “first time” ,
“in time” , “every time”.

As a business person you wish to have a reasonable return on your investment, i.e. you should be able to make a profit. This requires managing your business well and reducing costs wherever possible.

Further, for satisfying your customer you should meet customer requirements and deliver the right product at the right price and in time.

While you cannot avoid costs of labour, materials, facilities /machines, etc., you can certainly prevent the costs incurred on detection and removal of errors/defects during production. It is you who will pay for detection and removal of errors. As said earlier, if you can eliminate or reduce these errors/defects, you will certainly earn more profit.

Good vs bad cost of quality

Cost of quality has two components such as good amount spent (prevention and appraisal costs) and unnecessary amount spent (failure costs, both internal and external).

Prevention cost: This is the money spent by you to prevent defects. This comprises, for instance, the cost of establishing your quality control system, including the cost of preparing quality guidelines, preparing procedures/instructions and training your employees on the use of these procedures, etc.

Appraisal cost: This is the money you will spend on testing, inspection and examination of your product to assess whether it has fulfilled quality requirements. This includes, for example, the wages of your quality control personnel, the cost of testing your product, the cost of maintaining and calibrating your instruments, the fee paid to an external inspection agency if hired, etc.

Cost of internal failure: This cost will result from the failure of product at your end to meet quality requirements prior to delivery to your customer. It covers, for example, cost spent by you on reprocessing, rework, re-testing or scrapping your products, etc.

Cost of external failure: This is the cost incurred by you due to failure of your product to meet quality requirements after delivery.

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It includes many items such as repair, warranties and returns of your product or the cost of recalling your product from the market or liability costs to you if any, etc. The major part of this cost to you is if you lose your goodwill or lose a customer.

Applying quality costs less than not applying quality

The cost of correcting internal and external failures rises exponentially. For example, (Figure 7):

- If a defect arises and is detected and corrected by the worker who is responsible for that step, the cost of correction would be minimum (say **1 USD**).
- If the defect is detected and corrected at a subsequent, step this cost of correction jumps ten times (i.e. 10 USD)
- If the defect goes unnoticed and the product reaches the customer, then, you will either recall the product or resolve the customer complaint when it arises. Now the cost involved will be 100 times than that spent in correcting the defect at first step itself (i.e. **100 USD**).

If the customer becomes highly dissatisfied and stops doing business with you, then this will be the greatest loss.

The lesson learnt is that you should either prevent the defect from occurring or correct it at the earliest. This way you will reduce your losses and thus increase profit.

It is you who pays for detection and removal of errors/defects arising from bad quality.

When you eliminate or minimize these errors/defects, you will earn more profit.

Prevention and appraisal cost less than failure (detection, correction)

Quality-related costs are generally thought to account for 10 to 20% of a company's total cost.

Unfortunately, these costs are not normally known to you under traditional accounting methods. If they did, you would be paying equally serious attention to quality like to other management areas. Therefore you must measure and

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communicate quality in monetary terms so that its impact is understood.

A typical distribution of quality costs is depicted in Figure 8 that depicts the high cost of failures vs. substantially less cost of prevention.

- **Prevention: 5% of total quality-related costs;**
- **Appraisal: 30% of total quality-related costs;**
- **Failures: 65% of total quality-related costs.**

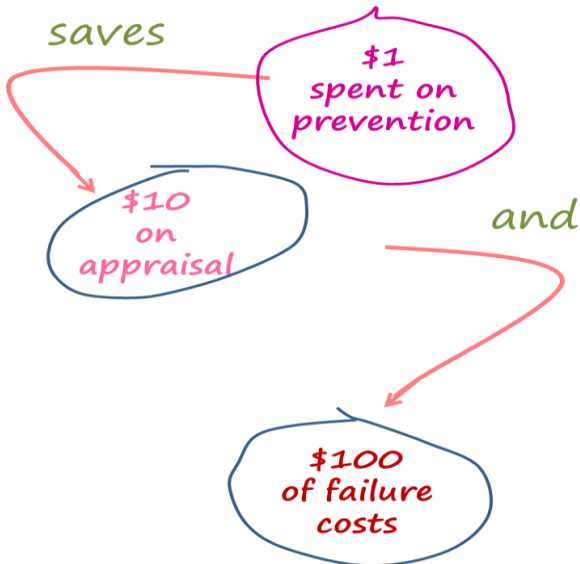


Figure 7: Quality saves money

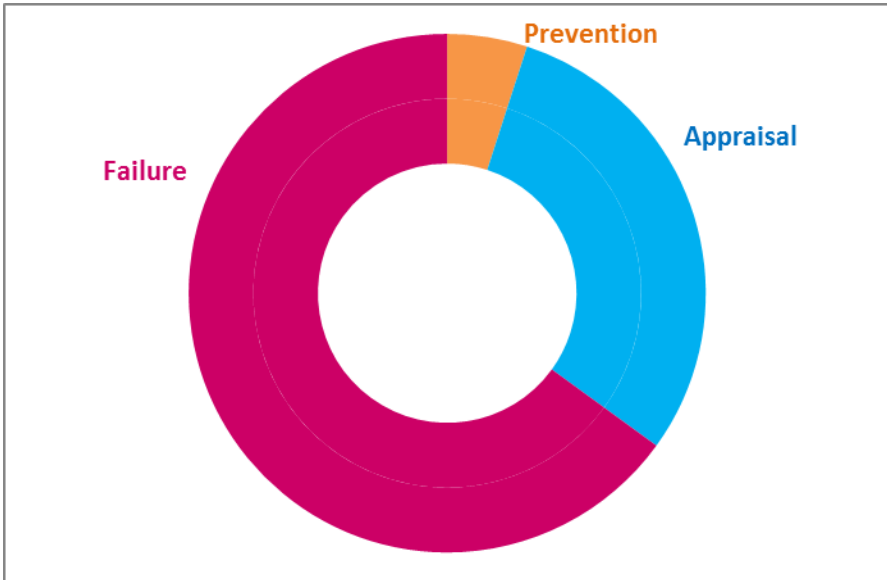


Figure 8: Distribution of total cost of quality

Smart businesses choose to spend on quality than to bear higher failure cost

An effective quality control system, will provide you ample opportunities to reduce your quality costs and thus increase your profits even without increasing your sales.

Areas, including purchasing, marketing, design, etc. are also equally significant for cost reduction through quality.

By spending a little extra on prevention, both appraisal and

failure costs can be considerably reduced, thus generating larger profits for you from the same sales turnover.

2. Costs incurred for non-value adding activities

Non-value adding activities are a waste. Eliminating waste is the key to efficiency. In the Toyota Production System, three Japanese terms, "Muda", "Muri" and "Mura" (3M) are collectively used to qualify a wide range of non-value adding activities that are the key reasons of non-optimal allocation of

resources. The 3Ms should be avoided, minimized, or eliminated.

Reducing “Muda” (Waste)

Muda is any activity that consumes resources without creating value for the customer. Waste reduction is an effective way to increase profitability. These add unnecessary cost of production. These wastes are as follows.

Muda: Waste / Unnecessary

- Transport
- Inventories
- Motion
- Waiting
- Over production
- Over Processing
- Defects
- Skills mismatch

Transport: Sometimes you may handle goods from one place to another unnecessarily. For example shifting something farther than necessary or temporarily stocking/stacking/moving material, etc. This leads to waste of time and energy. The reason for this could be the poor layout of your

production activities, lack of good housekeeping practices at your work place, etc. (discussed in Unit 4 - Japanese 5S).

Inventories: You may be piling up ‘raw materials’, ‘semi-finished products’ and ‘finished product’ inventories which are not immediately needed. Such excess inventories add to your cost of operation by blocking your money and also needing increased transportation, storage and handling on your part. Sometimes you may have to scrap excess inventories due to limited shelf life (especially food products, chemicals, rubber items, etc.), or from change of design.

Motion: Your employees may need to move around more than what is needed. For example, when materials needed are kept too far, or cannot be found at its place. The cause of this may be poor layout of your machines, materials, etc.

Waiting: Your machines or materials may lie in wait for a worker or a worker keeps waiting for material from the previous process step. Waiting does not add value. To reduce waiting time proper balancing of workload on your part is required.

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Over Processing: You may be performing process steps which are actually not needed or demanded by the customer/market. For example you may be excessively checking your product, you may be manufacturing the product with tighter tolerances than demanded by the customer, you may be over finishing the surface of the product or you may be doing excessive packaging of your product than needed, etc. This requires a review of each step of the process and streamlining or eliminating unnecessary steps if any at your end.

Over production: You may be manufacturing more than immediately required. For example, you produce extra since you have idle human power, or you had procured more than needed raw materials whose shelf life is going to end soon. This could lead to loss if the excess product cannot be sold or your customer does not repeat the order. Remediating this requires accurate forecasting of demand and proper production planning at your end.

Defects: Quality errors that cause defects invariably cost you far more than you expect. Every defective item requires rework or

replacement, it wastes resources and materials, it creates paperwork, and it can lead to lost customers. The Waste of Defects should be prevented where possible, better to prevent than to try to detect them. Prevention is better than cure.

Skills mismatch: You may be using a higher skilled worker for a simple work or deputing an unskilled worker to a job which requires a trained/skilled worker. Reason for this could be that you may not have workers with required skills or you may not be providing training to your employees before new job allocation to them.

Knowingly or unknowingly, the above non-value adding activities may be losing you 5 to 30% of your sales turnover in performing these activities. Further, these activities also have an impact on quality. In fact, the first six activities may involve additional/unwanted handling of product which may deteriorate the product quality.

Reducing “Muri” (overburden/irrationality)

Eliminating “Muri” involves eliminating overburden of equipment and people. Muri looks

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for irrationality in by identifying and eliminating things or activities that are:

Hardly feasible: Activities that are extremely difficult to do and at the moment beyond reach due to lack of organizational capability. Such activities should be identified and eliminated since it is not meaningful to pursue these.

Absurd: Activities that make no sense, or are difficult for the individual or organization to find reasons for.

Not understood: Activities that individuals perform without understanding the reason or benefit of performing.

Excessive fatigue / stress: Actions or operations that cause undue or excessive fatigue for example extreme physical effort or frequent stress to body movements, mental fatigue due to unwarranted work place stress, constant worry about defects and breakdowns, struggling to read illegible words and symbols, etc.

Reducing “Mura” (unevenness/irregularity)

Activities that create variability in a process due to some form of

imbalance denote “Mura”, for example, those that require operators to rush what they are doing, or stop one job and start another, or simply stop whilst knowing that they will need to work extremely hard to catch up.

“Mura” is revealed for example in unlevelled histograms showing erratic high usage period of resources followed by low usage period.

“Mura” can be minimized by evenly distributing production in the assembly process through level scheduling. The idea is to run production at a steady pace or smooth flow. This approach allows for timely delivery of products, services and components that make them.

“Muda”, “Muri”, and “Mura” are interlinked. You should make efforts to firstly identify which of the above activities are most common in your company and then take action to reduce or eliminate them.

3. Conclusion

This unit has provided an overview of the consequences of poor quality, the costs implications of quality, and the costs due to non-value adding activities.

There is nothing so useless as doing most efficiently that which should not be done at all.

To achieve higher quality, it may require some prevention and appraisal costs, which are in fact investment for reducing failure costs and eventually reducing total costs. Higher quality may enable the company to sell at a higher price since for the consumer the bitterness of poor quality remains long after the sweetness of low pricing is forgotten!

Quality is one of the most important strategies for competitiveness and for market access. Good management of quality costs is essential for the effectiveness of this strategy.

Unit 4. Some good quality practices and tools

1. Introduction

If better is possible, good is not enough! Indeed, what is good and accepted by consumers today will no longer be so in a near future simply because technology advances at great speed and the taste and preferences of consumers also change. On the other hand, globalisation is making competition fiercer for enterprises. It is really a buyers' market and the adage that the customer is king is more than ever valid. Therefore, to face competition, an enterprise is deemed to continuously improve its performance. In this unit, some good quality practices and tools commonly used by successful organisations are presented.

2. Kaizen

Kaizen means continuous improvement

Kaizen was created in Japan following World War II. The word Kaizen means "continuous improvement". In Japanese "kai" means "change" or "to correct" and "zen" means "good". It is a system of continuous small improvements in everything an

enterprise does. The improvement can be in quality, technology, processes, company culture, productivity, safety and leadership. Quality circles, Just-in-time delivery, Kanban and 5S are included within the Kaizen system of running an enterprise. Kaizen in Japan is a system of improvement that applies equally to both home and business life. It is also applied to social activities. Kaizen has contributed to the success of many Japanese companies.

Each employee shares suggestions

Kaizen involves every employee - from upper management to the cleaning personnel. Everyone is encouraged to come up with small improvement suggestions on a regular basis. This is not a once a month activity, but a continuous one. Certain Japanese companies, such as Toyota and Canon, receive some 60 to 70 written suggestions from each employee in one year and these are shared and implemented. These suggestions are not usually ideas for major changes, but they do contribute in making little changes on a regular basis: always improving quality,

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productivity and safety while reducing waste.

Suggestions cover all areas in the enterprise

Suggestions are not limited to any specific area such as production or marketing. They concern any area where improvements can be made. The Kaizen philosophy is well in line with the adage "If better is possible, good is not enough" because your competitor will eventually find a better way of doing things to get you out of the market.

Kaizen involves setting and improving standards

Setting standards and then continually improving those standards is an important element of Kaizen. In this context, necessary resources like training, materials and supervision are needed for employees to achieve the higher standards and maintain their ability to meet these standards on an on-going basis.

Kaizen improves job satisfaction and company performance

The benefits of Kaizen should not be underestimated. The continual

small improvements add up to major benefits. They result in improved productivity, better safety, improved quality, lower costs, faster delivery, and greater customer satisfaction and even innovation. Kaizen also results in higher employee morale and job satisfaction, and lower turnover since work is seen to be easier and more enjoyable. Employees feel they are valued as their suggestions are considered and implemented.

Kaizen delivers immediate results.

Many managers think that improvement can only be done through large capital-intensive investment. This is not always true. We can always do better with what we have. All we need is to focus on creative thinking trying to solve many small problems, which will eventually contribute in making a significant difference. Larger capital projects may still be needed, but the practice of Kaizen will even improve the processes needed for running such projects, reducing waste.

Kaizen involves change in corporate culture

For many enterprises, Kaizen would involve a significant change in the corporate culture. This is essential. It would require a change in attitude for all employees from top management down to new recruits. Employees will have to practice Kaizen, not because of management request, but because they want it and they know its importance for them and for the enterprise.

Role of management and employees is equally important

The role of management is important for Kaizen as any other initiative. Employee training and communication is critical. Together with that, management direct involvement is crucial. It would be useful for managers to spend some time on the shop floor working with employees to help and encourage them to develop suggestions. Managers should also ensure employees see their good suggestions acted on immediately. Suggestions should be implemented as far as possible on the same day. Employees should be kept informed about the outcome of their suggestions.

Problems are opportunities

Employees should see problems as opportunities to learn and should welcome them because they give them confidence and ensure promotion. Sometimes, the fear of making mistakes is a hindrance. Employees should realise that if they stumble, it is to learn in the end the secret of a more perfect walking.

3. Quality circles

A quality circle is a volunteer working group of 3 to 10 persons, belonging to the same work unit, section or division who meet regularly to solve problems encountered in their work. Quality circles are known under different names by different enterprises, e.g. Work Improvement Teams, Progress Teams, etc. However, the principle is the same for all of these: Employees are those who know more about problems in their work area and therefore can help in solving these problems and make improvements.

Quality Circles were first applied by Kaoru Ishikawa

Kaoru Ishikawa started quality circles first in Japan in 1962. The movement in Japan spread to

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more than 35 other companies in the first year. By 1980, it was claimed that there were more than one million quality circles in Japan. The use of this tool quickly spread to many East Asian countries. Today, quality circles are being implemented in many countries in the world and they are not limited to the manufacturing sector.

Quality circles use different tools to solve problems.

Tools used by quality circles include data gathering tools such as Check Sheets, graphical tools like histograms, frequency diagrams and pie charts, the Ishikawa or Fishbone diagram to identify causes of a problem, the Pareto Chart to set priorities and the PDCA approach for continuous improvement.

Quality circles define, analyse and provide solutions to problems

Because of its social focus, a quality circle will not only improve the performance of an organisation, but also motivate and enrich the work lives of fellow employees. A typical quality circle will display a good approach to:

- Analysing the context of a problem and its situation;
- Defining exactly what the problem is and the relationship between its component parts;
- Defining and measuring the impact of a given problem;
- Identifying the real causes, ensuring that solutions effectively address the problem;
- Understand the quality objectives; and
- Provide a solution to a given problem.

Types of problems addressed

Not all problems can be solved by quality circles, e.g. compensation problems can be solved by management and the trade union. Issues that are generally addressed by quality circles in enterprises include improving occupational health and safety, improving product design, and improving manufacturing process.

Typical examples of problems addressed commonly by quality circles are:

Quality problems

- Reduce percentage of defects
- Reduce internal and external customer complaints
- Improve customer service.

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Cost problems

- Reduce waste of resources (human and material)
- Reduce the deterioration of tools and machines.
-

Delivery problems:

- Reduce delivery delay
- Increase daily production
- Reduce spare parts inventory
- Ensure better delivery by sub-contractors.

Morale problems

- Reduce absenteeism
- Improve attractiveness of work place ;
- Improve skills and confidence of personnel;
- Improve participation in training sessions.

Safety problems

- Take better precaution when working on machines ;
- Reduce slippage risk on the shop floor ;
- Reduce the risk of road accidents ;
- Reduce the risk of food poisoning

Who can participate in a quality circle?

- Three to ten employees working in the same unit and

having volunteered to participate in the quality circle;

- The Head of the section should normally lead;
- Other persons (expert, representative of management or personnel section, etc.) who can contribute may also participate in one or several meetings according to the agenda set.

Who does what?

- The members of the quality circle express themselves, chose a particular problem, analyse the problem, propose a solution and do the necessary follow up ;
- The leader of the quality circle trains and chairs the work team, ensures liaison with management, other services and the experts consulted. He/she participates in meetings of leaders of quality circles
- Management assists the leader and members of the quality circle and takes into consideration and solves issues brought up by the quality circle, but outside the latter's scope of actions ;
- Management may recruit a facilitator who sees to it that

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quality circles are well operational and effective. The facilitator should solve any conflict among quality circles or with the hierarchy and assists those which are having any difficulty ;

- The functional services provide necessary information for the work of quality circles and may even participate in certain tasks and in the application of the chosen solutions ;
- A steering committee comprising the Managing Director and other Directors as well as a representative of the trade union has the responsibility to supervise the functioning of quality circles operating in an enterprise.

Functioning of a quality circle

A quality circle meets periodically: one to two hours per week or fortnight at the place of work and during the working hours. If for certain reasons they are held outside working hours, employees have to be remunerated as such. Notes of meeting are taken and three copies are produced: one for the quality circle, a second for the facilitator and a third for immediate supervisor of the Head of the Unit. The notes of meeting is

a follow up tool for those who have a copy.

Problem solving method of quality circle

The problem solving method used has four steps:

Expression phase: Problems encountered by the team are discussed.

This phase includes:

- Making an inventory of the problems encountered ;
- Classifying the problems;
- Setting priorities among the issues to be addressed.

Analysis phase: The analysis of the various factors and causes of the problem leads to the presentation of a diagnosis.

Problem resolution phase: This phase proceeds according as follows:

- Find ideas for solutions and actions options ;
- Classify and analyse these ideas, assess their relevance to the problem concerned;
- Define two or three possible solutions, develop and compare, assess the costs and consequences, advantages and disadvantages ;

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- Propose the retained solution, accompanied by an implementation plan and the budget.

Implementation and monitoring phase:

The solution is presented to management which accepts and takes all necessary measures for the implementation. The quality circle follows up and monitors the implementation and the results obtained. This allows comparing the actual outcome with what was planned. The circle may also engage, if necessary, corrective or complementary actions and possibly generalize the solution in coordination with the concerned sections or functions.

Benefits of quality circles

- Improvement of the quality of products and services
- Reduction of costs and improvement of productivity
- Improvement in work flow (industrial and administrative)
- Improvement in work environment, including human relationship
- Improvement in flow of information and internal communication
- Development of personal skills and creating opportunities for

personal development by using intelligence, initiative, imagination and personal responsibility

- Improvement of staff involvement and commitment.

A few points to consider when conducting quality circles

- Begin the activity of the quality circle with a simple project, whose success will give confidence to members
- Always speak with facts and figures to support
- Treat everyone with respect and consideration, without blaming anyone
- Work in teams to solve problems with the participation of everyone
- Seek the assistance of the management and employees of other departments of the company, if necessary

The art of management is not to pass ideas of leaders to the hands of the workers. Rather, it is the art of tapping the enterprise intelligence for the benefit of all. The most important asset of an enterprise is its employees. To be competitive, the company needs a committed staff, but not a

commitment to instructions. It needs high-performance teams. Management must share the adventure with those directly involved in the production, sale, service, who have good opinions, ideas and suggestions based on their daily work.

4. Good housekeeping practices (Japanese 5S)

The Japanese 5S is a good housekeeping tool which is described by five Japanese words,

- **Seiri**,
- **Seiton**,
- **Seiso**,
- **Seiketsu** and
- **Shitsuke**.

The use of this tool was started in 1972 by Henry Ford in the United States as the CANDO programme:

- **Cleaning up**
- **Arranging**
- **Neatness**
- **Discipline**
- **Ongoing improvement**

The technique was popularized as 'Japanese 5S' in 1980 by Hiroyuki Hirano.

You may be thinking that 'housekeeping' is simple work and that you are already doing it. Yes, it is simple, and if carried out

systematically, produces results in the long term and may save you money.

Steps of 5S

The Japanese 5S consists of the following steps (Table 3):

Each step is briefly explained below with suggested methods, examples of actions to be taken and the benefits of each step are also outlined.

1st S : SEIRI – SORT

This means distinguishing between or sorting out wanted and unwanted items at the workplace and removing unwanted items.

Suggested methods:

- You first decide what is necessary and what is unnecessary (unnecessary items may be found on the floor, in shelves, within lockers, in the storehouse, on the stairs, roofs, notice boards, etc.).
- You should put a red tag on unnecessary items and keep them in a separate area.
- You may discard or throw away items that have not been used in the past year.

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Table 3: The five steps of Japanese 5S

Sort (<i>Seiri</i>)	<ul style="list-style-type: none">• Distinguish between necessary and unnecessary items.• Remove the latter.
Set in order (<i>Seiton</i>)	<ul style="list-style-type: none">• Enforce the dictum 'a place for everything and everything in its place'.
Shine (<i>Seiso</i>)	<ul style="list-style-type: none">• Clean up the workplace and look for ways to keep it clean
Standardize (<i>Seiketsu</i>)	<ul style="list-style-type: none">• Maintain and monitor adherence to the first three Ss.
Sustain (<i>Shitsuke</i>)	<ul style="list-style-type: none">• Follow the rule to keep the workplace 5S-right.• Hold the gain.

Things used once in 6 to 12 months may be stored at a distance from the workstation, and things used more than once a month should be available at a central point in the workplace.

- It will be good to keep things used hourly/everyday/once a week near the workstation; some items may be worn by or kept in the pocket of, your workers at the workstation.

Benefits of SEIRI:

- Useful floor space is saved; the time searching for tools, materials and papers is

reduced; workflow is improved; the inventory cost of unnecessary items is cut.

2nd S : SEITON – SET IN ORDER

While Seiri helps in determining which items are needed, Seiton enables one to decide how they are to be kept. You arrange items in such a manner that they are easy to use, labelling them so that they are easy to find and put back. In effect, Seiton demands that there be a place for everything necessary and that everything should be in its place. Seiton puts an end to 'homeless' items.

Suggested methods:

- You first identify the right places for everything and put all materials and equipment at the places allocated to them with proper labels and signs. For example, you could draw outlines on tool boards, making it easy to see where each tool belongs.
- You could use floor paint marking to define working areas, paths, entrances, exits, safety equipment, cart or trolley locations, and colour coding for pipelines for steam, water, gas, drainage.
- You should display clearly written warnings, messages, and instructions at proper places at the right heights. You can also use alerts or indicators to prevent out-of-stock positions.

Benefits of SEITON:

- It becomes easy to keep and take out things; you make fewer mistakes; searching time is reduced; the work environment is safer.

3rd S : SEISO – SHINE

This means removing dirt, stains, filth, soot and dust from the work area. It includes cleaning and caring for equipment and facilities and inspecting them for abnormalities.

Suggested methods:

Decide on cleaning points, order of cleaning, type of cleaning, cleaning aids required; display cleaning schedule; during cleaning look out for defective conditions (loose bolts, vibrations, excessive noise, high temperatures, fallen tools) and correct them.

Benefits of SEISO:

The workplace becomes free of dirt and stains which is the starting point for quality; equipment life is prolonged; the number of breakdowns falls and accidents are prevented.

4th S : SEIKETSU – STANDARDIZE

Seiri, Seiton and Seiso are easy to do once but they are very difficult to maintain because they call for a systematization of practices. This means ensuring that whatever level of cleanliness and orderliness has been achieved, it should be maintained. This requires the

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development of a work structure that will support the new practices and turn them into habits.

Suggested methods:

Everyone in your company should use the same names for items, the same sizes, shapes and colours for signals, floor markings, etc. To achieve this, you could write guidelines for the first 3Ss and carry out periodic evaluations with the aid of checklists.

Benefits of SEIKETSU:

Activities are simplified;
consistency in work practices increases; mistakes are avoided.

5th S : SHITSUKE – SUSTAIN

Sustain also means 'discipline'. It denotes your commitment to maintaining orderliness and to practice the first 3S as a way of life. It requires your employees to show a positive interest in, and overcome their resistance to, change. For this, you should create awareness and publicize the first 3S.

Use 5S news releases, posters, slogans, etc. Your management should support Shitsuke by providing resources and leadership

and you should reward and recognize the best performers.

Benefits of SHITSUKE:

Promotes the habit of complying with workplace rules and procedures, creates a healthy atmosphere and a good workplace.

Before starting quality control activities, it is crucial first to set your housekeeping in order. Systematic housekeeping is the foundation for quality control.

5. The seven basic quality tools

Ishikawa believed that 95% of a company's problems could be solved by using these seven tools and that, with the exception of Control Charts; these tools could easily be taught to any member of the organization. Their ease-of-use combined with their graphical nature makes statistical analysis easier for you to understand and apply them. These seven tools are:

1. **Process Flow Chart**
2. **Check Sheet**
3. **Histograms**
4. **Pareto Analysis**
5. **Cause and Effect Diagram**
6. **Scatter Diagram**
7. **Control Charts**

95% of a company's problems can be solved by using seven basic quality control tools.

Process Flow Chart

A flowchart is a visual and sometimes detailed representation of the sequence of operations that make up a process and the relationship between them. It is often the first tool to be employed in continuous improvement as it enables one to understand the process and to identify where problems occur. Flowcharts make use commonly of three symbols in their construction: a rectangle represents an operation or procedure, a diamond represents a decision point in the process and arrows show the direction of flow.

An example of a flowchart for making tea is given in Figure 9:
Example of a flowchart for making tea.



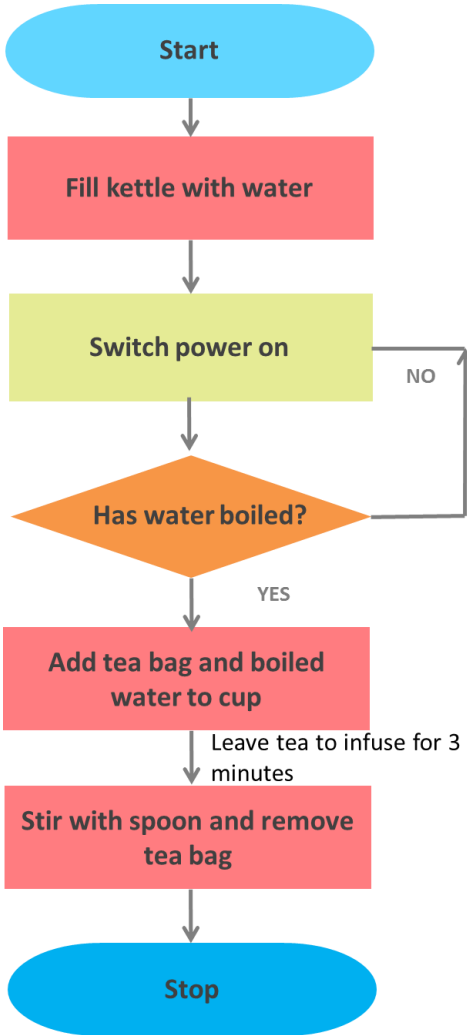


Figure 9: Example of a flowchart for making tea

Check sheet

Check Sheet or Tally Chart is a simple device on which data is collected by putting a 'mark' against pre decided items of measurement. The purpose for which the data are collected should always be clear to you. For example check sheet can be used to track events by factors like timeliness (in time, one day late, two days late, etc.), reasons of failure (defects like damage of fruit caused by pest, presence of external moisture, size not uniform etc.), number of customer complaints each day etc. An example of check sheet for recording telephone interruptions is shown in **Error! Reference source not found.**

Histograms

A histogram is the most commonly used graph for showing frequency distributions. It illustrates what proportion of cases fall into each of several categories i.e. how often each different value in a set of data occurs.

The bars must be adjacent. Figure 10 below is an example of a histogram that illustrates the number of visitors to a restaurant, by their ages.

Unit 3. Cost Benefits of Quality

Table 4: Check sheet for telephone interruptions in a week

Telephone Interruptions

Reason	Day					Total
	Mon	Tues	Wed	Thurs	Fri	
Wrong number	+++			+++	+++	20
Info request						10
Boss	+++		+++			19
Total	12	6	10	8	13	49

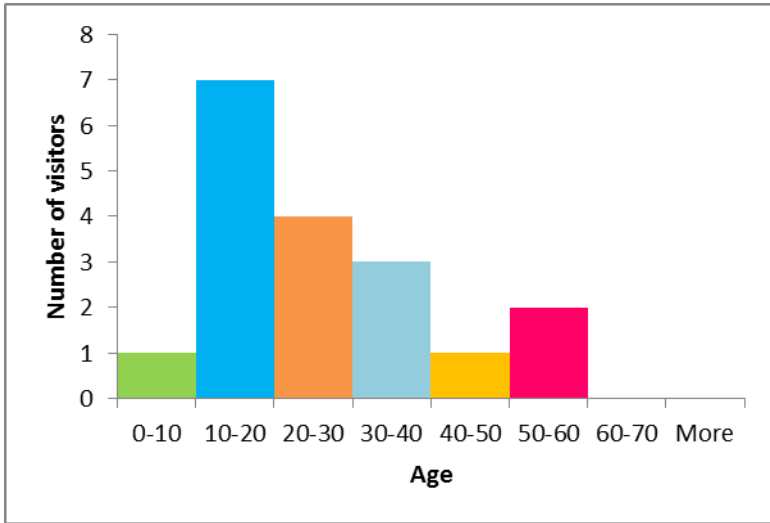


Figure 10: Histogram showing the no. of visitors by age groups

Pareto Analysis

Juran applied the phenomenon of **vital few and trivial many** to tackle quality problems and named it the **Pareto Principle**, after Vilfredo Pareto, an Italian economist.

In a study of the Italian economy, Pareto had found that 80% of the wealth was held by 20% of the people. One of the names of this tool is also '80-20 Rule', indicating that 80% of the problems stem from 20% of causes.

The 80-20 Rule

Pareto analysis is also called the '80-20 Rule', indicating that 80% of the problems stem from 20% of the causes. It helps to identify the most important areas to tackle to solve problems.

Table 5: Types of customer complaints in a restaurant, by percentage

Type of complaint	Number of complain	Cumulative total	Cumulative %
Service delay	211	211	55%
Wrong item served	89	300	78%
Wrong billing	45	345	90%
Discourteous/unfriendly staff	30	375	97%
Food related issues (temperature, spicy, oily, taste off, unhygienic	6	381	99%
Unclean cutlery/table	4	385	100%
Total	385		

A Pareto diagram is a bar graph and a line chart which show the more significant factors. The bar graph lists the problems affecting a process in descending order. The line chart accumulates the

Figure 11. The analysis shows that 78% of total customer complaints are related 'to service delays' and 'wrong items served'. Based on this finding, the restaurant can use cause and effect diagram to figure out the root cause of these two

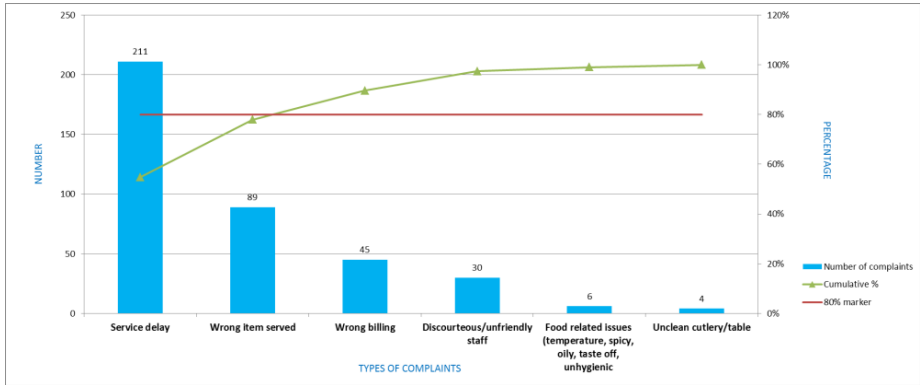
percentage of the total number of occurrences for each problem area.

For example, the customer complaint data of a restaurant is shown in Table 5.

The Pareto diagram from this data is in

major problems and solve 78% of the problems (see next tool).

Figure 11: Pareto diagram for customer complaints



Cause and effect diagram

This diagram represents the relationship between a problem and its potential causes. It is also known as fishbone or Ishikawa diagram (Figure 12). It deals only with factors, not quantities.

For preparing a fishbone diagram, all the causes relating to a problem are collated through brainstorming amongst concerned persons. The problem is written on the

horizontal arrow. All the listed causes through brainstorming are classified by themes (Human, Material, Machine, Methods etc.). Each theme represents a diagonal attached to the spine of the diagram. Individual causes are listed along the diagonal. For example, the figure below shows a cause and effect diagram of factors effecting power failure

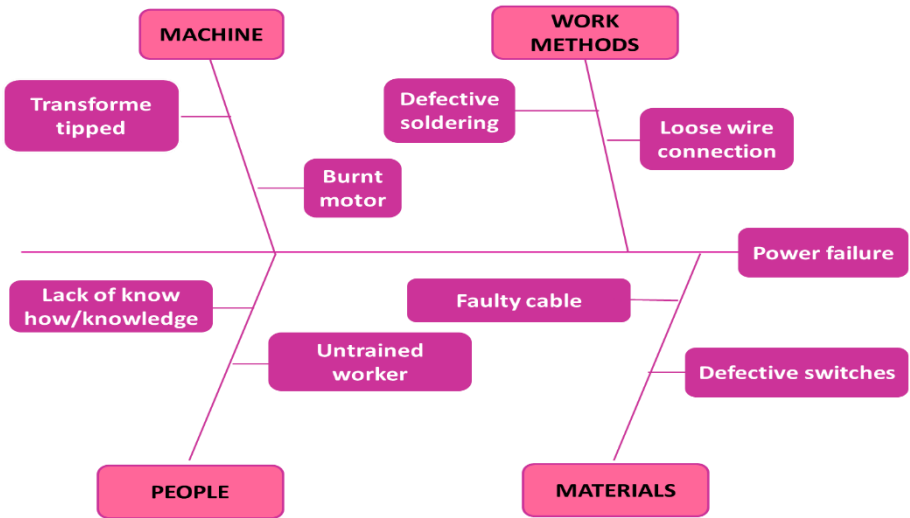


Figure 12: Cause and effect diagram for power failure

Scatter Diagram

A scatter diagram is used for studying the possible relationship between one variable and another. This can be used to test the possible cause and effect relationship. It does not prove that one variable causes the other, but it does make it clear whether a relationship exists and the nature of strength of the relationship.

Usually the horizontal axis in the scatter diagram is the one over

which you have control. Each data point as observed is plotted and then look at the pattern. More closely, the dots group along an axis, the stronger the correlation. More scattered they are, the weaker the correlation.

Figure 13 shows an example of a scatter diagram showing positive relationship. In this diagram, the x-axis is the external moisture content in fresh fruit and the y-axis, the number of spoiled fruits after a certain period.

Unit 3. Cost Benefits of Quality

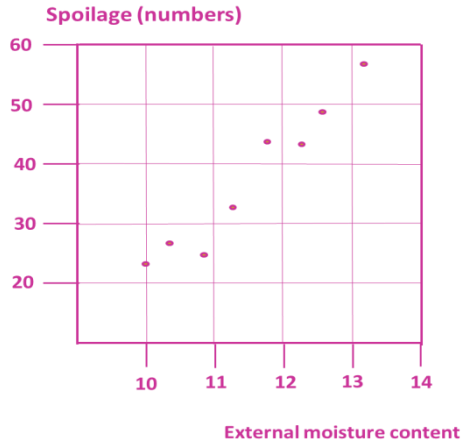


Figure 13: Scatter diagram for correlation between moisture and spoilage in fresh fruits

Control Charts

Control charts are pictures of variations found in a process.

The data of measurement or observations are plotted on graphs against time (Figure 14).

These charts comprise of two lines called an UCL (upper control limit) and a LCL (lower control limit).

These are not the same as specification tolerances. If the results of measurements exceed /

fall below these limits (e.g. "Out of control point" in Figure 14, then the cause needs to be investigated and action taken on it immediately. For reducing variations found in the process, fundamental changes would be needed in methods, machines or materials or other factors.

Control charts help to monitor and control quality by acting as a set of process "traffic lights" and are valuable in all types of activities.

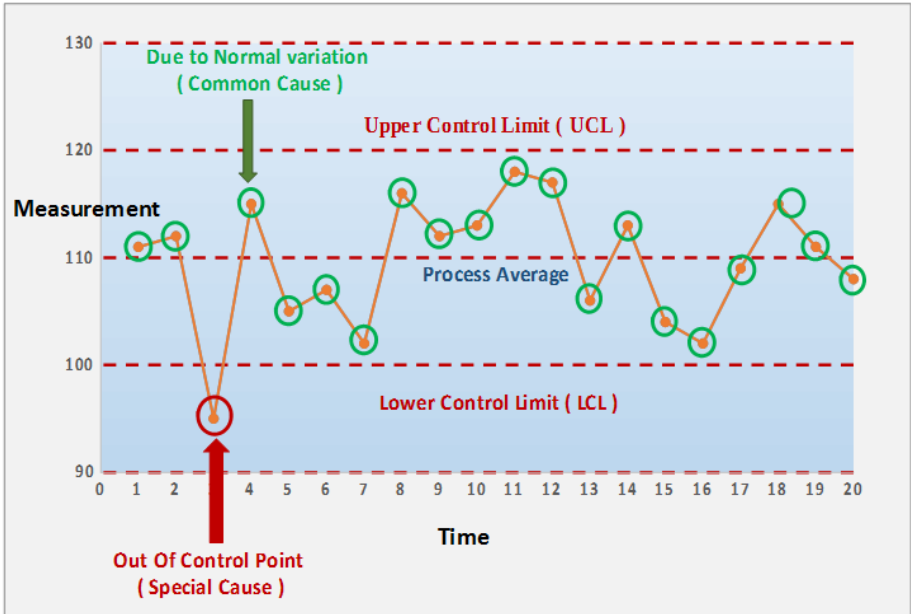


Figure 14: Example of a control chart

Benchmarking

Benchmarking is looking for best practices that will bring about superior performance by learning from others. This is the essence of continuous improvement – making small incremental improvements over time on the never-ending journey towards excellence. Xerox Corporation developed competitive benchmarking in order to retain and improve its market share in a very competitive market.

Definition: Benchmarking is a systematic procedure that compares an organization’s processes or products against those of competitors as well as industry leaders in order to identify gaps and areas for improvement.

It involves the identification, adaptation and implementation of processes and procedures (or practices) in all aspects of business that are used by world leading organizations in order to improve overall performance and to maintain the drive for continuous

improvement. Benchmarking involves asking “How are we doing compared to other organizations?”

The steps followed during a benchmarking process are given in Figure 15.



Figure 15: Steps in benchmarking

6. Business process re-engineering

Sometimes small continuous improvement (kaizen) is not enough - these small incremental improvements can reach their limit and then a major change is required to enhance performance e.g. new capital equipment to improve both quality and output. Business Process Re-engineering (BPR) is a breakthrough strategy.

Definition: Business Process Re-engineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed.

Steps: BPR comprises five major steps which managers should follow:

- Refocus organisation values on customer needs;
- Redesign core processes, often using information technology to enable improvements;
- Reorganize a business into cross-functional teams with end-to-end responsibility for a process;
- Rethink basic organizational and people issues;

- Improve business processes across the organisation.

BPR is used to improve performance substantially on key processes that has an impact on customers. BPR can reduce costs and cycle time by eliminating unproductive activities.

Reorganisation by teams decreases the need for management layers, accelerates information flows, and eliminates the errors and rework caused by multiple handoffs. BPR improves quality by reducing the fragmentation of work and establishing clear ownership of processes. Workers gain responsibility for their output and can measure their performance based on prompt feedback.

7. Just In Time (JIT)

What is JIT?

Inventory can be considered as waste since it incurs storage costs and there may be deterioration of quality. The Just-in-Time inventory system aims at having the right material, at the right time, at the right place, and in the exact amount.

JIT minimizes inventories

JIT is a 'pull' system of production in which actual customer orders provide a signal for when a product should be manufactured. Demand-pull enables a firm to produce only what is required, in the correct quantity and at the correct time. This means that stock levels of raw materials, components, work in progress and finished goods can be kept to a minimum. This requires a carefully planned scheduling and flow of resources through the production process. Supply Chain Management (SCM) and Customer Relationship Manager (CRM) software can now be used to improve communication on workflow with suppliers and customers.

Supplies are delivered right to the production line only when they are needed. For example, a car manufacturing plant might receive exactly the right number and type of tyres for one day's production, and the supplier would be expected to deliver them to the correct loading bay on the production line within a very narrow time slot.

Advantages of JIT

JIT has several advantages:

- Reduce stock holding means a reduction in storage space which saves rent and insurance costs;
- Reduce working capital is tied up in stock;
- Reduce likelihood of stock perishing, becoming obsolete or out of date;
- Avoid the build-up of unsold finished product that can occur with sudden changes in demand;
- Reduce time spent on checking and re-working the product of others as the emphasis is on getting the work right first time

8. Conclusion

In this unit, we have looked at some of the good quality practices and tools that are used by enterprises to improve their performance both in terms of

quality and productivity. These tools included Kaizen, quality circles, Japanese 5S, the basic seven quality tools, benchmarking, business process re-engineering and the Just in Time system.

It is to be pointed out that the tools described in this unit will only be useful and effective if

there is adequate management commitment to provide necessary support to the implementation of the related activities. The attitude of the employees is also important and management has to create the necessary environment to motivate them and inspire them to contribute their full potential to continuous improvement.

We should not forget that employees are the most important asset of any organisation and successful companies are those that know how to nurture interdependent and interpersonal relationships.

Unit 5: Standards, Sanitary and Phytosanitary requirements and Technical Regulations

1. Introduction

An enterprise has to understand that his/her product (including service) will have to meet the requirements of his/her target market for its acceptance on that market. The requirements may be those of the clients, the consumers and those of the government of the country.

Many suppliers develop their own specifications or standards for their products based on an existing standard or on the market requirements. Some suppliers may even exceed these requirements to differentiate their offer from others' and win a competitive advantage.

On the other side, buyers may require that the products supplied to them comply with certain national, regional or international standards. Some buyers have developed their own specifications or standards which are imposed on their suppliers.

Products that can have an impact on health, safety, security and on

the environment are usually controlled by the government regulatory bodies. The government usually intervenes on the market through technical regulations and sanitary/phytosanitary (SPS) measures to ensure the health of the population, protection of plants, animals and environment, safety, security, consumer protection and fair trade. Therefore, any supplier of such products will have to ensure compliance with the relevant technical regulations and SPS measures over and above any additional requirements of its customer.

2. Standards

What is a standard?

A standard is a document that pins down the characteristics of a product or a service. These characteristics may cover design, weight, size, performance, environmental requirements, interoperability, materials, production process or service delivery or even the protocols that

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allow computers or mobile phones to connect to each other. The standard may include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method.

Public and private standards

Standards can be categorized as public standards and private standards. Public standards are developed and published by recognized organizations, usually standardization organizations. This takes place at the international, regional and national levels. Figure 16 cites examples of public and private standards at the various levels.

When public standards are developed, the needs and wishes of many stakeholders are taken into consideration, i.e. they are developed with consensus principles in mind. This implies that the standards will make the same demands on all suppliers and all consumers, and that externalities such as health, safety and environmental considerations have been considered.

Among the typical international standards are those published by the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU), the Codex Alimentarius Commission (CAC), the World Organisation for Animal Health (OIE), the International Plant Protection Convention (IPPC) and others. Probably the best known regional standards are the harmonized standards (EN) of the European Union, but there are other standards such as the State Standards (GOST) of the States of the former Soviet Union and the African standards (ARSO).

National standards

National standards are published by more than 150 countries worldwide, and are far too numerous to list here. Among the typical national standards are those of the American National Standards Institute (ANSI), the Australian Standards (AS), British Standards (BS), the standards of the German Institute for Standardization (DIN), Indian Standards (IS), and South African National Standards (SANS) (Figure

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16). It is difficult to quantify the number of public standards in the world, but Perinorm, a bibliographic database, for example, has a list of more than 700,000 standards, which covers only the most important public

standards. Hence, public standards are everywhere in today's world, defining much of the way people, products and processes interact with each other and with their environment.

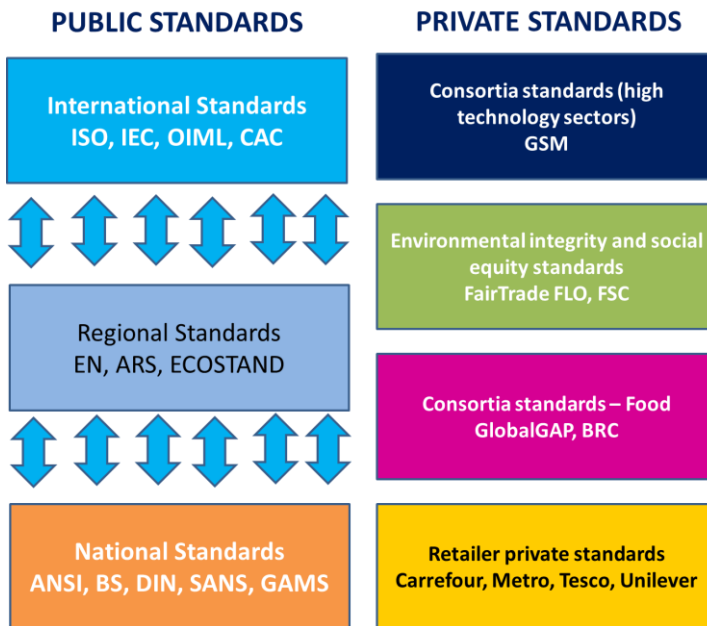


Figure 16: Diversity of standards

Development of public standards

Standards are developed by technical committees established by

national standards bodies, regional and international standardization organizations, representing all the stakeholders. The way in which standards are developed is guided

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by ISO/IEC Directives and by the requirements of Annex 3 of the WTO Agreement on Technical Barriers to Trade (TBT). National technical committees are useful vehicles for ensuring that the interests of the suppliers are considered, but it means that such suppliers have to become members of the committees and actively participate in their proceedings. The same applies to regional and international technical committees.

Standards are available for purchase from national standards bodies, or direct from the international organizations mentioned above. International standards, i.e. those from United Nations' Codex Alimentarius Commission, or of OIML and similar intergovernmental organizations, are obtainable free from the respective websites.

What are private standards?

Many standards are developed outside the auspices of national, regional, and international standards bodies. The reasons for the development of these standards are many and varied. Organizations such as major retail chains apply detailed requirements to the products they wish to trade in. The oil industry

operates worldwide on similar technical requirements and the vehicle manufacturers of the United States developed common standards for the supply of certain parts (i.e. SAE standards, SAE being the Society of Automotive Engineers). Suppliers band together to gain market advantages in supplying products with similar technology. For instance, the music CD was a joint Philips-Sony standard, and the GSM standards (Global System for Mobile Communications) for mobile phones are agreed to by a few manufacturers. These standards are generally known as private standards. Some private standards eventually end up as public standards if their growing market relevance warrants it, or the marketing advantage is no longer an issue for the originators.

Private standards are developed by specific non-government groupings, i.e. sectoral organizations including non-governmental organizations, consortia, certification bodies or major retailers. Private standards are generally geared to meet the needs of those who develop and publish them and are not intended for mandatory application by the government. Private standards

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usually require certification of suppliers. However, the decision by a supplier to obtain certification is always a business decision, depending on whether it will be profitable to do so.

Main types of private standards

Private standards can be loosely divided into four groups:

Consortia standards in the food and horticulture domains

Examples are the European Retailer Group's good agricultural practice (GLOBALG.A.P.) and the British Retail Consortium (BRC) standards. They are important because the European Union is one of the largest importers of food in the world. These standards have been developed by consortia of European and British retailers that wish to ensure that their suppliers meet all the regulatory food safety requirements, as well as the additional requirements set by the retail organizations themselves, including social accountability. For these standards, sophisticated certification systems have been established and if you wish to export food and horticultural products to EU, certification may help you to gain market share or increase

profitability. Certification, however, is not cheap, nor is it mandatory. Deciding to seek certification is purely a business decision based on the market targeted by the exporter.

Retailers' private standards

Sometimes called niche standards, retailers' private standards have a huge impact on suppliers to the large multinational retail chains such as Carrefour, Metro, Tesco, Unilever and Wal-Mart. These companies have developed their own standards for agricultural produce and processed food for competitive or brand protection purposes; they may expand their standards into other areas in the future.

Standards related to environmental integrity and social equity

In the more developed markets, many consumers are concerned about issues such as child labour, environmental protection, fair trade, and genetically modified foods. Buyers may insist that products destined for such markets have been produced in a manner that does not violate their social or environmental concerns. Relevant recommendations come from organizations like Social Accountability International, with its SA 8000 standard, for good social

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conduct in industry, the Forest Stewardship Council (FSC) for standards in the wood and paper industries, and the Fairtrade Labelling Organizations International (FLO). Demonstrating compliance through certification to such private standards may therefore be important to gain a competitive edge.

Consortia standards in high-technology sectors

A fourth group of private standards are important in specific, usually high-technology, sectors; the GSM standards for the mobile-phone industry are an example of such standards. The compliance and certification demands of these sectoral private standards are as varied as the standards and the sectors themselves; hence, a proper study of the requirements of the sector is indicated before any decisions are made.

Buyers like retail chains specify the attributes that they want in the goods they purchase. They argue that by doing so they are more able to meet their customers' requirements. However, international trade problems arise, especially where purchasers like the big retail chains in developed

countries wield enormous market power in comparison with small-scale suppliers in developing countries. These problems are exacerbated when different purchasing organizations apply different private standards on the same suppliers, or if there is a significant cost to the suppliers in demonstrating that they are meeting the purchasers' standards.

In part because of concerns raised by developing countries that multiple private standards raise the costs of compliance, private-sector retail organizations have moved to consolidate the standards of individual companies into industry-wide standards in order to avoid unnecessary adverse impacts on international trade.

Information on private standards

ITC has developed a tool called the Standards Map which provides users with information enabling them to analyse and compare information on voluntary sustainability standards operating in over 200 countries, and certifying products and services in more than 80 economic sectors. The Standards Map (www.standardsmap.org) is a

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partnership-based effort to enhance transparency in voluntary sustainability standards and to increase opportunities for sustainable production and trade.

3. Technical regulations

Introduction

Technical regulations are not standards, but these two are sometimes confused with each other because they seem alike. Technical regulations can be stand-alone documents, but they could also be based on standards or may reference them. Whereas standards are considered voluntary in principle, i.e. suppliers and buyers can choose to implement them or not, technical regulations are mandatory in nature, i.e. everybody has to comply with them by law.

What is a technical regulation?

A technical regulation is a document or legislation that lays down *product characteristics* or their related processes and production methods. A technical regulation may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method. In all cases, a

technical regulation would include the *administrative measures* required to implement it. For example, it can identify the regulatory authority, list the conformity assessment requirements, and provide for market surveillance responsibilities and the implementation of sanctions in case of non-compliance.

Who makes technical regulations?

Technical regulations are formulated and implemented by a variety of government ministries or regulatory agencies or both, depending on the practices and legal system of the country. Technical regulations are given a range of different names. In the European Union, they are called Directives, Regulations, Decisions. In some countries, they are called Compulsory or Mandatory Standards, sometimes even Compulsory Specifications or just simply Regulations.

Technical regulations often deal with product safety (e.g. safety of toys, building materials, etc.), consumer protection, and protection of environment.

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What are sanitary and phytosanitary measures?

Sanitary and phytosanitary (SPS) measures are requirements imposed on goods by governments to control certain kinds of risks to human, animal or plant life and health. Most SPS measures are concerned with the maintenance of food safety, and the protection of animal and plant health against pests and diseases. More specifically, sanitary measures deal with the protection of the life or health of humans or animals while phytosanitary measures deal with the protection of the life or health of plants.

The measures include all relevant laws, decrees, regulations, requirements and procedures. These may stipulate end product criteria; processes and production methods; testing, inspection, certification and approval procedures; quarantine treatments and requirements for the transport of animals or plants, and for the materials necessary for their survival during transport. They may also impose obligations concerning statistical methods, sampling procedures and methods of risk assessment. Finally, they may prescribe packaging and labelling

requirements directly related to food safety.

Information Sources on Technical Requirements -

To obtain information on the standards, technical regulations and conformity assessment procedures applicable to products in target markets you have the following options to obtain such information.

Your **trading partner** is the best contact point for you to give information about any technical regulatory requirement applicable to your product.

You can also search information from internet. This will require some prior knowledge to reach to the relevant site.

National Enquiry Point

Your country's National Enquiry Points (NEPs) can give you information as given below. (The WTO Agreements on TBT and SPS require that each member country should establish NEPs which are able to answer all reasonable enquiries from other member countries and interested parties, including business organizations, and provide relevant documents on technical regulations, SPS measures and

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conformity assessment procedures adopted or proposed to be adopted by the member country).

*For Philippines,
TBT National Enquiry Point is:
Bureau of Philippine Standards (BPS)
3F Trade and Industry Building 361
Sen. Gil Puyat Avenue Makati City
Philippines*

*Contact person:
Engr. James E. Empeño Director
Bureau of Philippine Standards
Department of Trade and Industry
email: bps@dti.gov.ph
Tel: +(632) 751 4 700/ + (632) 79
131 28
website: www.bps.dti.gov.ph*

and

*SPS National Enquiry Point is :
Department of Agriculture
Office of the Director
Policy Research Service
Quezon City, Elliptical Road, Diliman
email: spsphilipinas@da.gov.ph
Tel: +(632) 926 7439*

4. Conclusion

When exporting products your product has to comply with mandatory requirements of the export market government before it

is allowed to access that market. Moreover, your product must also meet the specific requirements set by your buyers.

While framing specification limits for your product or service, i.e. your own standard, you should keep in view:

- the needs of the user, customer, retailer or any other stakeholder in your supply chain;
- the requirements provided for in national and/or international standards as applicable to your export product;
- the requirements relating to product safety and health hazards provided for in the statutory and regulatory requirements of the exporting/importing country and regional bodies like the European Union, if applicable to your export products;
- the requirements relating to Sanitary and Phytosanitary (SPS) measures (if applicable to your export products) which aim to protect life and health of humans, animals and plants.

There is no way to operate competitively without using the best standards, whether a company's goal is to capture the market in its

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hometown or in other countries around the world. Good companies use the best standards. Great

companies not only use them, but also develop them!

UNIT 6: Quality management systems (QMS)

1. Introduction

A management system is simply the way an organization manages its processes, people and other resources so that its products or services meet organizational objectives and stakeholder (customers, suppliers, shareholders, employees and society) requirements.

A management system is usually a combination of policies, processes, procedures, training, forms and records that enable your business to operate effectively to meet its objectives.

The Plan-Do-Check-Act (PDCA) cycle is the operating principle of all ISO management system standards. By following this cycle, you can manage and continually improve your organization's effectiveness no matter what level of business:

Plan – set objectives and develop plans (analyse your organization's situation, establish overall objectives, set interim targets and develop plans to achieve them).

Do – implement your plans.

Check – measure/monitor your actual results against the planned objectives.

Act – Take actions to correct and improve your plans to get better results.

This unit deals with main management system standards, including those relating to quality management, the environmental management, food safety and social accountability.

2. ISO Quality management system standards

The ISO 9000 family of standards (Table 6) represents an international consensus on good quality management practices. It consists of standards and guidelines related to quality management systems (QMS). The ISO 9000 family comprises the following four main standards

UNIT 6: Quality management systems (QMS)

Table 6: The ISO 9000 family of standards

Standard	Content
ISO 9000:2015	Specifies the terms and definitions that apply to all quality management system standards developed by ISO.
ISO 9001:2015	Requirements of a quality management system to enable an organization to continually satisfy its customers and regulatory requirements. It is the only standard in the ISO 9001 family against which organizations can be certified
ISO 9004:2009	Provides guidelines to organizations to support achieving sustained success with a quality management approach.
ISO 19011:2011	Provides guidance on auditing management systems, including the principles of auditing, managing an audit programme and conducting management system audit, as well as guidance on the evaluation of competence of individuals involved in the audit process, including the person managing the audit programme, auditors and audit teams.

ISO 9001 gives a framework for good management practice. Its objectives are to:

- provide confidence in the organization's ability to consistently provide customers with conforming goods and services
- enhance customer satisfaction
- address risks and opportunities associated with the context and objectives of the organization
- The adoption of a QMS is a strategic decision for an organization – can improve overall performance and provide sound basis for sustainable development initiatives

UNIT 6: Quality management systems (QMS)

The basis of ISO 9001 are:

- 7 management principles
- Process approach
- PDCA cycle
- Risk-based thinking

ISO 9001 is applicable to all types and sizes of businesses and organizations and all sectors of industry, including manufacturing and service. It is not a product standard but a management system standard to demonstrate an organization's ability consistently to provide products or services that meet customer and regulatory requirements. ISO 9001 specifies 'what' is required to be done by an organization but does not indicate 'how' it should be done, thus giving you great flexibility in running your business.

Furthermore, ISO 9001 does not set any particular level of quality. You and your customers do that. The standard will only help you to achieve the level you want. For example, if you set an objective that 99% of the time you will meet your delivery commitments, the system will help you to achieve that.

The ISO 9000 family of standards has become a symbol of quality in both the manufacturing and services industries. It engenders greater customer loyalty as implementation ensures that customer needs and expectations are continually met, giving customers less or no reasons to complain.

More and more small and medium-sized firms are choosing to adopt the ISO 9000 family of standards – often because their customers expect them to have it. Adherence to the ISO standards can also be publicized to gain market access abroad, because many foreign buyers place a premium on these standards.

A total of 1,519,952 certificates were issued worldwide in 2015. The total number of valid ISO 9001 certificates in 2021 was 1,077,884.³

Some sector-specific QMS standards

ISO 9001 is a generic standard and can be used by any sector of industry, including the hardware, processed materials, services and

³ The ISO Survey 2021 results

UNIT 6: Quality management systems (QMS)

software sectors. However, specific industry sectors, such as the automotive, telecommunications, aerospace, medical devices, oil and gas, and information technology sectors, felt the need for specific QMS requirements in addition to those included in ISO 9001. This led to the development of sector-specific QMS standards, both by ISO and by industry groups, as indicated below.

ISO/TS 16949:2009 – Quality management systems – Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations

ISO 13485:2016 – Medical devices -- Quality management systems -- Requirements for regulatory purposes

ISO 15378:2011 Primary packaging materials for medicinal products – Particular requirements for the application of ISO 9001:2008, with reference to Good Manufacturing Practice (GMP)

ISO/TS 29001:2010 – Petroleum, petrochemical and natural gas industries – Sector-specific quality management systems – Requirements for product and service supply organizations

In addition to the sector-specific standards which can be used for certification as well, ISO has developed the following guideline standards and international workshop agreements (IWAs). The latter are ISO documents produced through workshop meeting(s) and not through the technical committee process.

ISO/IEC 90003:2014 – Software engineering -- Guidelines for the application of ISO 9001:2008 to computer software

ISO 16106:2006 – Packaging – Transport packages for dangerous goods – Dangerous goods packagings, intermediate bulk containers (IBCs) and large packagings – Guidelines for the application of ISO 9001

ISO 22006:2009 – Quality Management Systems – Guidelines for the application of ISO 9001:2008 to crop production

IWA 1:2005 – Quality management systems – Guidelines for process improvements in health service organizations

IWA 2:2007 – Quality management systems – Guidelines for the application of ISO 9001:2000 in education

IWA 4:2009 – Quality management systems – Guidelines for the application of ISO 9001:2008 in local government

The above guideline standards and IWAs do not add to, change or otherwise modify the requirements of ISO 9001 and are not intended for use in contracts for conformity assessment or for certification. However, they help the organizations concerned in developing ISO 9001 QMS for the above products and services and then to obtain certification against ISO 9001.

The seven management principles of ISO 9001

ISO 9001 is built around the following seven management principles (Figure 17). These are:

Customer focus: The customer is king and your business exists because of the customers. You need to understand current and future customer needs. You should meet customer requirements and strive to exceed customer expectations.

Leadership: An organisation can move forward only when a sense of purpose and direction has been created and shared by all employees. This can only be

achieved through effective leadership. Leaders establish the unity of purpose and the direction of the organization. Leaders should create and maintain an environment where people can become fully involved in achieving the organization's objectives.

Engagement of people: The greatest asset of any organisation is its people. Competent, empowered and engaged people at all levels throughout the organization are essential to enhance its capability to create and deliver value.

Process approach: Consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system. Figure 18.

Evidence-based decision-making: Decisions based on the analysis and evaluation of data and information are more likely to produce desired results

Relationship management: For sustained success, an organization has to manage effectively its relationships with interested parties, such as its suppliers.

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The Process approach requires the definition and management of processes, and their interactions, in order to achieve the intended results in accordance with the

quality policy and strategic direction of the organization. (Figure 18)



Figure 17: The 7 quality management principles

Processes and the system as a whole can be managed using the PDCA cycle taking into consideration risks associated to take advantage of opportunities and prevent undesirable results. This approach enables:

- Understanding and consistency in meeting requirements
- The consideration of processes in terms of added value

- Achievement of effective process performance
- Improvement of processes based on evaluation of data and information

Risk-based thinking brings benefits to:

- improve customer confidence and satisfaction
- assure consistency of quality of goods and services

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- establish a proactive culture of prevention and improvement.

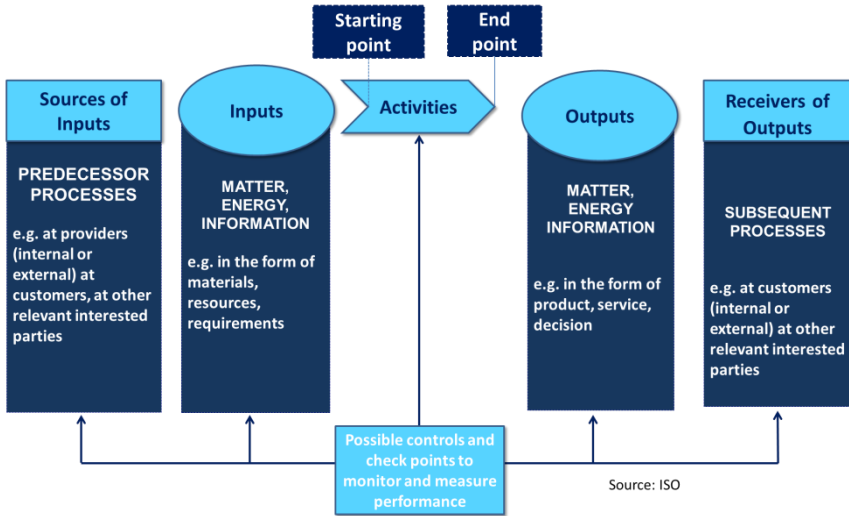


Figure 18: Schematic of the process approach

The requirements of ISO 9001

The planning aspect

The organisation is required to determine:

- the external and internal issues that are relevant to its purpose and strategic direction;
- the needs and expectations of interested stakeholders;
- the scope of its quality management system (QMS) considering the above and its products and services;
- the processes needed for the QMS, with their inputs

required, outputs expected, sequence and interaction, resources needed and their availability; assign responsibilities and authorities for the processes; address risks and opportunities; evaluate and make necessary improvements to achieve intended results.

Top management of the organisation has to demonstrate leadership and commitment with respect to the accountability and effectiveness of the QMS, including

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customer focus. Top management has to:

- establish and communicate the quality policy and quality objectives;
- ensure the integration of QMS requirements into the business processes;
- assign responsibilities and authorities to achieve the quality objectives;
- promote the use of the process approach and risk-based thinking;
- promote the importance of effective quality management and improvement;
- review the system at regular intervals to ensure that it is working properly and it meets its purpose.
- Improve the system where necessary, making sure that appropriate resources are provided.

Management has also to ensure that appropriate communication processes are in place within the organisation and that the effectiveness of the quality management system is well communicated.

There are three types of resources which are needed to implement the system: people, infrastructure

and work environment. You have to ensure the people in your organisation have the right competencies and skills. You have to determine and provide the appropriate infrastructure, which includes the facilities and equipment needed to perform effectively. You have to look at the work environment, i.e. the conditions under which work is performed and ensure that this is appropriate for meeting customers' and regulatory requirements.

The doing aspect

Now that management has provided the commitment, the sense of direction for the organisation and the necessary resources to do the job, ISO 9001 gives you also a set of requirements for managing the work you do. You have to plan the product or service realisation from the point where the customer makes a request right through delivery and beyond if necessary. This will involve different processes like sales, design and development, purchasing, production/operational/service activities and delivery. You have to ensure that for each process people know their role and are

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competent to do the tasks in line with the organisation's policies, procedures and objectives.

The check and act aspect

Your work does not stop once you have delivered to the customer. You should find out whether your customer is satisfied. There are also other measurements of the system's performance that you should take and analyse, and identify the areas for improvement.

ISO 9001 requires:

- The monitoring of customer perception. This can be done in many different ways relevant to your business, e.g. customer satisfaction surveys, customer data on delivered product quality, market share analysis, compliments, warranty claims, etc.;
- Internal audits to be conducted at planned intervals to ensure that your system is effectively implemented and maintained and things are going according to plan;
- Monitoring and measurement of products and processes. Individual processes drive the system and it is important that

they operate effectively and efficiently. Products should also be measured and monitored to ensure that they meet the customer's requirements;

- Control of non-conforming products to ensure that if something goes wrong, procedures are in place to have control on the problem and to deal with it appropriately.

Implementing the standard effectively will produce data indicating how effective your system is. These data can indicate areas for improvement of the system.

Continual improvement of the effectiveness of the quality management system is one of the key objectives of ISO 9001 and it has to be achieved through the quality policy, quality objectives, audit results, analysis of data, nonconformity and corrective action and preventive actions and management reviews

Benefits of ISO 9001

If you implement and keep practicing the system well it will provide you with a number of benefits such as:

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- Quality will be seen as everyone's responsibility instead of being the sole responsibility of the quality control inspector or manager.
- QMS will provide you with a means of documenting the company's experience in a structured manner (quality manual, procedures, instructions, etc.).
- You will generate savings, as the costs of reprocessing, rework, repeat inspections, replacing products, penalties due to delayed deliveries, customer returns, customer complaints and warranty claims will gradually fall.
- You will be able to secure your customers' loyalty as their needs and expectations will be continually met, leading to more business opportunities for you.
- You can use ISO 9001 for publicity to win more sales.
- You get preferential treatment from potential customers who themselves have implemented ISO 9001.
- Export marketing will be easier for you, as many foreign buyers place a premium on ISO 9001 systems.
- You will have a level playing field with large companies when bidding for new contracts.
- Obtaining certification will reduce the frequency of audits of your system by different customers.
- The biggest benefit to be gained from maintaining a QMS (which is an investment in preventing failures) is the huge savings you can make by considerably reducing the cost of failures.

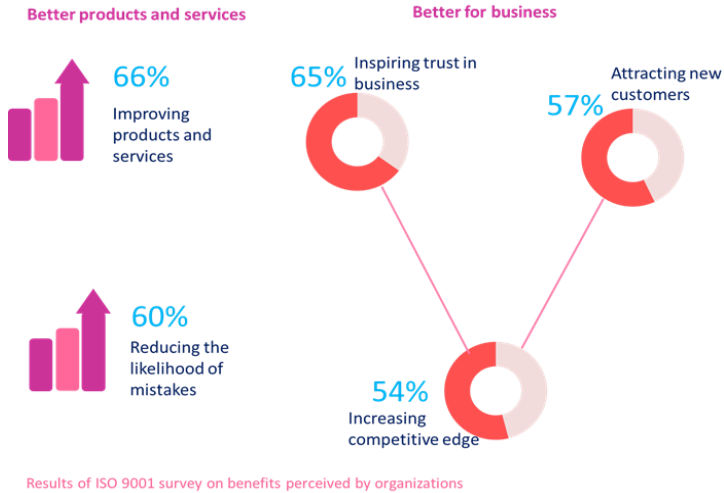


Figure 19: Results of ISO 9001 survey on benefits perceived by organizations
(Source: ISO)

3. Environmental management system

Organizations around the world as well as their stakeholders are becoming increasingly aware of the need for environmental protection. To enable organizations to manage environmental issues proactively, ISO has developed the ISO 14000 family of environmental management standards. Its two main standards are:

‘ISO 14001:2015 Environmental management systems - Requirements with guidance for use’ and

ISO 14004:2016 Environmental management systems -- General guidelines on implementation’.

ISO technical committee TC-207, which is responsible for developing the ISO 14000 family, has since 1996 been developing standards in other areas as well, such as environmental labelling, life cycle assessment, greenhouse gas management and related subjects

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such as water footprint and carbon footprint of products.

ISO 14001:2015

ISO 14001 is the world's most recognized framework for environmental management systems (EMS). The overall aim of an EMS based upon ISO 14001 is to support environmental protection and the prevention of pollution in a balance with socio-economic needs.

ISO 14001 can be implemented by any type (public, private, manufacturing, service) and size (small, medium-sized or large) of organization. An EMS based upon ISO 14001 provides a framework to help you identify those aspects of your business activities that have significant impacts on the environment, to set objectives and targets. It enables to implement operational control measures to ensure compliance with your environmental policy.

ISO 14001 does not establish a minimum level of environmental performance. Rather, it requires you to achieve the objectives for environmental performance that your management has set in your environmental policy. It also

requires you to demonstrate a commitment to complying with the applicable environmental legislation and to the continual improvement of your environmental performance.

It will be possible for you to integrate your ISO 14001 EMS with your ISO 9001 QMS as they are compatible with each other.

The impact of the environmental performance of an organization goes beyond its customers and suppliers to a broader range of stakeholders - ordinary citizens, regulators, employees, insurance companies and shareholders. Everyone has an interest in the quality of the environment around them. Thus, demonstrating compliance with an environmental management system based on ISO 14001:2004 is a sound business decision.

Certification to ISO 14001 has been constantly increasing. By the end of December 2015, around 320,000 certificates had been issued to organizations in about 160 countries.

Applicability to the services sector

Although the implementation of ISO 14001 seems to be more

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popular in the manufacturing sector, it is equally applicable to the services industry. Public utility organizations like power-generating and power supply units, water supply agencies, waste collection and disposal agencies, domestic fuel and gas supply agencies, petrol stations dispensing petrol, diesel oil and gas to the public, and transport companies belong to the services sector. The implementation of ISO 14001 EMS will enable such entities to control their environmental aspects and minimize their environmental impact. For example, transport services could use less petrol, have more efficient and better-tuned engines, and follow more efficient routes.

In addition to these public utility organizations, other services providers have made effective use of ISO 14001 EMS. Examples are hotels, construction agencies and general office services. A hotel can make substantial savings in power, fuel and water consumption by implementing ISO 14001. General office activities generate large quantities of waste such as computer monitors, printers, cartridges, telephones, cameras and other electronic devices

(popularly called e-waste) which need to be safely disposed of. The implementation of ISO 14001 in offices can assist the organizations concerned in the handling, recycling and disposal of e-waste.

ISO 14001 and compliance with environment-related legal requirements

The overall aim of ISO 14001 is to support environmental protection and the prevention of pollution. To achieve this broad objective you will need to develop and implement an environmental policy. This policy should provide for the following, among others:

- A commitment to continual improvement and the prevention of pollution.
- A commitment to comply with legal and other requirements related to the environmental aspects of your activities, products and services.
- To demonstrate compliance with environmental legal requirements the following system elements of ISO 14001 will need to be implemented.
- As a first step, identify the legal environmental requirements applicable to

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your business activities and ensure that while setting up your EMS that these are taken into consideration.

- Take the legal requirements into account while setting up your environmental objectives and targets.
- To achieve the above objectives and targets, set up environmental management programmes covering roles, responsibilities, resources, procedures and the time frame needed to achieve them.
- Your employees should be aware of the importance of conformity with your environmental policy (including the commitment to comply with legal requirements).
- Your employees should also be aware of the consequences of departures from specified requirements (including legal requirements).
- All operations that are associated with compliance with legal requirements should be planned and operational control procedures for the same should be followed by all concerned.

- Periodically evaluate compliance with applicable legal requirements.
- Identify any instances of non-compliance with legal requirements (or foreseeable non-compliance) and take prompt action to identify, implement and verify preventive and corrective action taken.
- Maintain records of compliance with legal requirements.
- While conducting periodic internal audits, assess issues related to legal compliance.
- Use information on changes to, or new, legal requirements when making modifications to your EMS.

Benefits of implementing an ISO 14001 EMS

There are several costs associated with implementing and maintaining an EMS, like training and sensitisation of personnel, assessing the current status of waste and pollutant generation in your company, revamping certain pollution abatement equipment or installing new ones and periodic testing of effluent. However, there are many tangible and intangible benefits which will offset these

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costs. These important benefits include the following:

- Enhanced public image leading to improved business opportunities, for both domestic and export trade.
- Many customers, including governmental procurement agencies, use ISO 14001 EMS as one of the criteria for evaluating their potential suppliers. The implementation of ISO 14001 EMS will give you an edge over other suppliers.
- Improved compliance with legislative and regulatory requirements will reduce penalties and remediation costs.
- EMS will help reduce incidents of release of uncontrolled pollutants and oil or chemical spills, for example, and thus cut expenses associated with their recovery.
- Cost savings can be obtained from recycling and reusing materials.

One of the objectives of EMS is the reduction of waste and its possible reuse and recycling, which will result in lower disposal costs.

- Employees will have a safer work environment, thereby improving productivity,

lowering the number of sick days and reducing insurable risks.

Here are some examples of the benefits which have been gained from an effective EMS.

In Singapore, SGS-Thomson has saved US\$ 200,000 by improving the energy efficiency of its cooling plant. Another company, Sony Display Devices, has saved about US\$ 7.5 million a year by eliminating raw material wastage. Baxter, which has obtained ISO 14001 certification, has disclosed savings and cost-avoidance of up to US\$ 3.4 million by implementing an environmental management system.

A medium-sized manufacturer of precision fittings for the automotive and refrigeration industries identified inefficiencies in its oil recovery procedures in the course of the EMS implementation. By addressing the problem, the firm realized more than US\$ 20,000 per year in savings. Another manufacturer reported a 70% reduction in waste disposal costs as its ISO 14001 EMS was put into place.

Larger companies may not find it too difficult to implement the EMS

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– they have financial strength and economies of scale. However, many SMEs are likely to have problems in adopting environmental controls because of their lack of resources.

Some governments are therefore providing SMEs financial support for implementing EMS. For example, in Singapore, the government agency SPRING (Standards, Productivity and Innovation Board) has extended its Local Enterprise Technical Assistance Scheme to give financial assistance to SMEs wishing to implement EMS and gain certification to ISO 14001. In India, financial assistance is provided to SMEs for acquiring quality, environmental and food safety (HACCP) management systems.

4. Food Safety System Standards

Every person has the right to expect that the food s/he eats is safe and will not cause injury or illness. The hazards related to food safety are known as biological, chemical and physical hazards, which, if present in food, may cause injury or illness to the human being.

Two main food safety systems are HACCP and ISO 22000.

HACCP

Hazard Analysis and Critical Control Points (HACCP) is defined as “a system, which identifies, evaluates and controls hazards which are significant for food safety” (FAO). HACCP is a proactive concept. It helps to ensure that food is safe from harvest to consumption (‘from farm to fork’). Each step involved in food production, i.e. purchasing, receiving, storage, processing, packaging, warehousing, distribution up to the point of consumption is subjected to hazard analysis and necessary controls are introduced. The premise is simple: if each step of the process is carried out correctly, the end product will be safe.

HACCP was first developed in 1960 in the early days of the space programme. NASA (National Aeronautics and Space Administration) wanted assurance that food taken on board space flights would not cause food-borne diseases. As a result of this requirement, the Pillsbury Company and the United States Army Natick Research Laboratories

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developed a process that would ensure production of safe food; the process was named HACCP.

In 1993, the Codex Alimentarius Commission (CAC) published guidelines for the application of the HACCP system. Later, in 1997, CAC incorporated HACCP into an appendix of the 'Recommended

International Code of Practice General Principles of Food Hygiene (latest version: Rev.4-2003).

The HACCP system consists of seven principles (Table 7), which give an outline of how to establish, implement and maintain a HACCP plan.

Table 7: Seven principles of the HACCP system

1. Conduct a hazard analysis	<ul style="list-style-type: none">• Prepare a process flow diagram covering all steps from receipt of raw material to dispatch of finished product.• Identify likely hazards at every process step.• Describe the measures for control of hazards at each process step.
2. Determine the critical control points (CCPs)	<ul style="list-style-type: none">• Analyse each step by using the decision tree.• Identify the steps (points) where control is critical for assuring the safety of the product.
3. Establish critical limits	<ul style="list-style-type: none">• Fix critical limit for control measures relating to each identified CCP (e.g. temperature, time, speed, pH, moisture content)
4. Establish a system to monitor control of the CCP	<ul style="list-style-type: none">• Decide on monitoring procedure, which should cover the nature of monitoring (observation, testing), monitoring frequency and responsibility for monitoring and recording monitoring results.
5. Establish corrective action to be taken when monitoring results indicate that a particular CCP is not under control.	<ul style="list-style-type: none">• Develop procedures for dealing with the deviation from critical limits when it occurs and how to bring the CCP back into control, including disposition of the affected product produced during deviation.
6. Establish procedures for verification to confirm	<ul style="list-style-type: none">• Develop procedures for verification to confirm that the HACCP plan is working (e.g. periodic audit,

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that the HACCP system is working effectively.	random sampling and analysis, review of the HACCP system and its records)
7. Establish documentation on all procedures and records appropriate to the HACCP principles and their application.	<ul style="list-style-type: none"> • Prepare and follow procedures and work instructions for each control measure, including those needed for maintaining hygiene conditions; keep records.

HACCP is not a stand-alone system. Good hygiene practices and other prerequisites for food processing as well as strong management commitment are also necessary. HACCP is not a substitute for these.

If your company produces a variety of food products, you should develop a separate HACCP plan for each product, abiding by the seven principles outlined above.

During the 1990s, HACCP was adopted by many countries (Australia, Denmark, Germany, India, Ireland, Netherlands, United States and others) in national standards specifying requirements for a food safety management system. It was also included in the regulations of the European Community dealing with 'Hygiene of foodstuffs'. The International Organization for Standardization (ISO) developed in 2005 the international standard, 'ISO

22000:2005 Food Safety Management Systems – Requirements for any organization in the food chain', which incorporates HACCP principles.

It is important for SMEs in the food processing business to use HACCP for two reasons. First, it brings internal benefits such as reduced risk of manufacturing and selling unsafe products, which will in turn generate greater consumer confidence in these products. Second, food regulatory authorities in many countries are adopting or are likely to adopt HACCP in their food regulations. By implementing HACCP, an exporter of food products will have greater chances for market access in these countries. For example, Canada has made HACCP mandatory in its fish processing industry. United States has made it mandatory for seafood processing, meat and poultry processing plants, and producers of fruit and vegetable juices to

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have HACCP in place. European Union rules on food hygiene also state that all food businesses (i.e. dealing with food of animal origin, food of non-animal origin and food containing both processed ingredients of animal origin and ingredients of plant origin), after primary production, must put in place, implement and maintain a procedure based on the HACCP principles.

ISO 22000 and its difference from HACCP

The primary objective of both the Codex HACCP principles and the ISO 22000 food safety management system (FSMS) is to ensure that the food produced by an organization is safe for human consumption. All the HACCP system elements are included in ISO 22000 and several more management system requirements have been added. The format of ISO 22000 is in line with the format of ISO 9001 ('Quality management system – Requirements'), thus making it compatible with other management systems.

The development of ISO 22000 was based on the assumption that the most effective food systems are designed, operated and continually

improved within the framework of an organization's structured management system. ISO 22000 thus carries some management system requirements that are not explicitly stated in Codex HACCP. These include a food safety policy and related objectives, planning and documenting the food safety system, effective external and internal communication arrangements, the assignment of specific responsibilities to the food safety team leader, internal audits, management reviews, continual improvement and updating of FSMS. Briefly, the ISO 22000 requirements are a combination of the following four key elements:

- Interactive communications
- System management
- Prerequisite programmes
- HACCP principles.

ISO 22000 makes extensive reference to the Codex hygiene recommendations for the development of prerequisite programmes for different sectors of the food industry. ISO 22000 in its Annex B provides a comparison of the various requirements of FSMS with those of Codex HACCP.

ISO 22000 is designed to allow all types of organizations within the food chain to implement a food

safety management system. These include crop producers, feed producers, primary producers, food manufacturers, transport and storage operators, retailers, food service operators and caterers together with related organizations such as producers of the equipment, packaging materials, cleaning agents, additives and ingredients needed during food processing.

As CODEX HACCP is a guidance document, certification to it is not possible. To fill this gap many countries such as Australia, Denmark, Germany, India, Ireland and the United States have developed national standards on the basis of the Codex HACCP. The Netherlands also did so, and the standard is popularly referred to as the Dutch HACCP. Certification against these standards is possible. ISO 22000 has made it easier for organizations worldwide to implement the Codex HACCP system for food safety in a harmonized way, i.e. it does not vary with the country or food product or service concerned. ISO 22000 can be used for certification, and this may be acceptable as an alternative to certification against different national standards.

Acceptance of ISO 22000 certification by retail chains

Food marketers, particularly retailers, are becoming increasingly interested in third-party auditing (certification) and are seeking to replace their own second-party audits of suppliers with the less costly solutions available through certification. By December 2015, around 32 000 certificates for ISO 22000 in more than 140 countries had been issued, according to a 2015 survey conducted by ISO. Your export customers may thus be the first to ask you whether or not you have a certified FSMS in place, as certification will assure them that you have met their national statutory and regulatory requirements.

FSSC 22000

FSSC 22000, a certification scheme for food safety systems, is based on ISO 22000:2005 and the Publicly Available Specification (PAS) for prerequisite programmes on food safety for food manufacturing (British Standard PAS 220:2008). FSSC stands for Food Safety System Certification and the scheme was developed by the Foundation for Food Safety Certification.

The scheme is applicable to manufacturers that process or manufacture animal products, perishable vegetable products, products with a long shelf life and other food ingredients like additives, vitamins and bio-cultures. It has been given full recognition by the Global Food Safety Initiative (GFSI). According to the Foundation for Food Safety Certification, the scheme is supported by the Confederation of the Food and Drink Industries of the European Union (CIAA).

5. Social accountability management system

SA 8000

The rising concerns of customers in developed countries about inhumane working conditions in developing countries led to the creation in 1997 of the SA 8000 standard on social accountability. The purpose of developing this standard was to draw up a universal code of practice for labour conditions, so that consumers in developed countries could be confident that the goods they were buying – in particular clothes, toys, cosmetics and electronic goods – had been

produced in accordance with good labour practices.

It has been estimated that 100 million children worldwide are in full-time labour (United States Department of Labor, 2010). The vast majority are in Africa, Asia and South America. Under the terms of SA 8000, companies must not support child labour. The standard also requires companies to ensure that none of their staff, or those working for their suppliers, is required to work more than 48 hours a week, or more than six days a week. Moreover, wages must be at least equal to legal or 'industry minimum' levels, and must be sufficient to leave the employee with some discretionary income.

SA 8000 is an initiative of Social Accountability International (SAI), an affiliate of the Council on Economic Priorities (a pioneer non-governmental organization dealing with corporate social responsibility). SA 8000 (its latest version was issued in 2008) is based on the international workplace norms of the International Labour Organization (ILO) Conventions, the Universal Declaration of Human Rights and the United Nations Convention on

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the Rights of the Child. The SA 8000 system has the following nine requirements:

Child labour: No workers under the age of 15 (unless the local minimum age law stipulates a higher age) should be employed. If the local law sets the minimum age at 14 years in accordance with developing-country exceptions under ILO Convention 138, the lower age will apply.

Forced labour: The company shall not engage in or support the use of forced labour (service that is extracted from any person under the menace of any penalty), nor shall personnel be required to lodge 'deposits' or identity papers upon commencing employment with the company.

Health and safety: The company shall provide a safe and healthy work environment; take steps to prevent injuries; give regular health and safety related training to workers; have a proper system for detecting threats to health and safety; provide access to toilets and potable water, etc.

Freedom of association and right to collective bargaining: The company should respect the worker's right to form and join trade unions and bargain

collectively; where the law prohibits these freedoms, the company should facilitate parallel means of association and bargaining.

Discrimination: There should be no discrimination based on race, caste, origin, religion, disability, gender, sexual orientation, union or political affiliation, or age; there should be no sexual harassment.

Discipline: There should be no corporal punishment, mental or physical coercion or verbal abuse.

Working hours: The company should comply with the applicable law but, in any event, its employees should work no more than 48 hours per week with at least one day off for every seven-day period. Voluntary overtime is paid at a premium rate and should not exceed 12 hours per week on a regular basis. Overtime may be mandatory if this is part of a collective bargaining agreement.

Compensation: Wages paid for a standard work week must meet legal and industry standards and should be sufficient to meet the basic needs of workers and their families. There should be no disciplinary deductions.

Management systems: Facilities seeking to gain and maintain certification must go beyond simple compliance to integrate the standard into their management systems and practices.

Third-party certification to SA 8000, which is voluntary in nature, is being offered by certification bodies accredited and overseen by the Social Accountability Accreditation Services (SAAS). All types of industries can obtain SA 8000 certification.

The implementation of SA 8000 provides benefits to all stakeholders including workers, trade unions, businesses, consumers, investors. Workers become more aware of their labour rights; trade unions are better able to bargain collectively; businesses can attract and retain more skilled employees. The specific benefits to businesses in export trade include: enhanced company image and brand reputation, provision of assurance to buyers in developed countries that their suppliers have socially acceptable workplace practices; increased opportunities to join the socially responsible supply chain.

WRAP

In the late 1990s, the American Apparel and Footwear Association (AAFA) funded a three-year study to examine working conditions in factories making sewn products around the world. This study led to a programme which was later called WRAP (Worldwide Responsible Accredited Production).

The objective of WRAP is to promote and certify lawful, humane and ethical manufacturing in the sectors producing apparel, footwear and other sewn products. It also covers other labour-intensive industries such as the hotel and construction sectors and those producing jewellery, furniture, food, home furnishing, cutlery, glassware, carpets and rugs, lamps and other products throughout the world.

WRAP is also the registered trademark of the international, non-profit and independent organization that administers the certification programme.

WRAP principles

The 12 WRAP principles listed below are based on generally accepted international workplace standards, local laws and

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workplace regulations. They cover human resources management, health and safety, environmental practices, and legal compliance including compliance with import, export and customs regulations and security standards.

Compliance with laws and workplace regulations: Facilities will comply with laws and regulations in all locations where they conduct business.

Prohibition of forced labour: Facilities will not use involuntary or forced labour.

Prohibition of child labour: Facilities will not hire any employee under the age of 14 or under the minimum age established by law for employment, whichever is greater, or any employee whose employment would interfere with compulsory schooling.

Prohibition of harassment or abuse: Facilities will provide a work environment free of supervisory or co-worker harassment or abuse, and free of corporal punishment in any form.

Compensation and benefits: Facilities will pay at least the minimum total compensation required by local law, including all

mandated wages, allowances and benefits.

Hours of work: Hours worked each day, and days worked each week, shall not exceed the limitations of the country's law. Facilities will provide at least one day off in every seven-day period, except as required to meet urgent business needs.

Prohibition of discrimination: Facilities will employ, pay, promote and terminate workers on the basis of their ability to do the job, rather than on the basis of personal characteristics or beliefs.

Health and safety: Facilities will provide a safe and healthy work environment. Where residential housing is provided for workers, it should be safe and healthy.

Freedom of association and collective bargaining: Facilities will recognize and respect the right of employees to exercise their lawful rights of free association and collective bargaining.

Environment: Facilities will comply with environmental rules, regulations and standards applicable to their operations, and will observe environmentally conscious practices in all locations where they operate.

Customs compliance: Facilities will comply with applicable customs laws, and in particular, will establish and maintain programmes to comply with customs laws on the illegal trans-shipment of finished products.

Security: Facilities will maintain security procedures to guard against the introduction of non-manifested cargo into outbound shipments (i.e. drugs, explosives, biohazards and other contraband).

WRAP certification

WRAP has adopted a management systems approach towards compliance. This requires senior management to adopt the WRAP principles in writing, assign the necessary staff to ensure that the required practices are implemented throughout the facility, and to put an internal audit system in place to provide an assurance of continuous compliance. Facilities must undergo a rigorous self-assessment and then be audited by an independent third-party monitoring company.

WRAP certifies facilities, not brands or businesses. Since 2006, it has provided a three-level facility certification programme. The

'Platinum' certificate is a two-year certificate awarded to a facility that has demonstrated full compliance with all WRAP principles for three consecutive years, and has successfully passed each audit with no corrective actions. The facility will be subject to an unannounced audit during its two-year certification. The 'Gold' certificate is a one-year certificate presented to a facility that has demonstrated full compliance with all WRAP principles. The 'Silver' certificate is a six-month certificate given to facilities that demonstrate substantial compliance with WRAP principles but has minor non-compliances in procedures or training that need to be addressed.

Over the years, WRAP certification has been in demand among purchasers in developed countries who want to have an assurance that facilities in developing countries are adopting ethical practices. In Bangladesh, over 140 facilities dealing with apparel and sewn products for export have obtained WRAP certification.

ISO 45001:2018 Occupational health and safety management systems

ISO 45001:2018 specifies requirements for an occupational

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health and safety (OH&S) management system, and gives guidance for its use, to enable organizations to provide safe and healthy workplaces by preventing work-related injury and ill health, as well as by proactively improving its OH&S performance.

The impact of work-related fatalities, injuries or ill health on small businesses can be severe. The effects can include reduced revenue, overtime costs, increased injury and ill health costs, and can even result in a small organization closing. Even larger organizations can experience significant negative effects.

Consequently it is important for the organization to eliminate or minimize its OH&S risks by taking appropriate preventive measures.

An organization's OH&S management system can translate its intentions to prevent incidents into a systematic and ongoing set of processes (supported by the use of appropriate methods and tools) and can reinforce the organization's commitment to proactively improving its OH&S performance.

Key areas in ISO 45001

ISO 45001 covers the following key areas:

- The organization and its context
- Needs and expectations of workers and interested parties
- Determining the scope of OH&S management system
- OH&S management system
- Leadership and commitment
- OH&S policy
- Organizational roles, responsibilities and authorities
- Consultation and participation of workers
- Planning actions to address risks and opportunities
- OH&S objectives and planning to achieve them
- Operational planning and control
- Emergency preparedness and response
- Performance evaluation
- Incident, nonconformity and corrective action
- Continual improvement.

Benefits of implementing ISO 45001

An ISO 45001 based OH&S management system will enable an organization to improve its OH&S performance by:

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- developing and implementing an OH&S policy and OH&S objectives
- establishing systematic processes which consider its "context" and which take into account its risks and opportunities, and its legal and other requirements
- determining the hazards and OH&S risks associated with its activities; seeking to eliminate them, or putting in controls to minimize their potential effects
- establishing operational controls to manage its OH&S risks and its legal and other requirements
- increasing awareness of its OH&S risks
- evaluating its OH&S performance and seeking to improve it, through taking appropriate actions
- ensuring workers take an active role in OH&S matters
- reducing the overall costs of incidents
- reducing downtime and the costs of disruption to operations
- reducing the cost of insurance premiums
- reducing absenteeism and employee turnover rates
- recognition for having achieved an international benchmark (which may in turn influence customers who are concerned about their social responsibilities)

6. Other management system standards

Additional management system standards that you might also consider, depending on your type of business are as follows.

ISO/IEC 27000 series of standards on Information security

ISO's information security management systems (ISMS) is a systematic approach to managing sensitive company information so that it remains secure. It encompasses people, processes and information technology (IT) systems. It is becoming ever more important to establish a

In combination these measures will ensure that an organization's reputation as a safe place to work will be promoted, and can have more direct benefits, such as:

- improving its ability to respond to regulatory compliance issues

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management system to prevent breaches in the security of records or data on electronic media (such as data on designs, banking transactions, stock trading).

The ISO/IEC 27000 series includes 'ISO/IEC 27001:2005 Information technology - Security techniques - Information security management systems - Requirements', which is a certifiable standard. The series provides good practical guidance on designing, implementing, auditing and certifying information security management systems to protect the confidentiality, integrity and availability of the information.

ISO/IEC 20000 international IT service management standard

This standard is published in two parts. 'ISO/IEC 20000-1:2005 Information technology - Service management - Part 1: Specification' is the formal specification and defines the requirements for an organization to deliver managed services of an acceptable quality for its customers. 'ISO/IEC 20000-2:2005 Information technology - Service management - Part 2: Code of practice' describes the best practices for service management

processes within the scope of ISO/IEC 20000-1. The code of practice is of particular use to organizations preparing to be audited against ISO/IEC 20000 or planning service improvements.

The standard is applicable to any organization which makes use of IT services. The users covered include internal IT departments providing services to other parts of their companies and organizations that outsource their IT functions.

ISO 28000 series on the security management systems of supply chains

The ISO 28000 series of international standards specifies the requirements for a security management system to ensure safety in the supply chain. The standards address potential security issues at all stages of the supply process; it thus targets threats such as terrorism, fraud and piracy.

'ISO 28001:2007 Security management systems for the supply chain - Best practices for implementing supply chain security, assessments and plans - Requirements' is a requirements and guidance standard that can be used for certification by

organizations of all sizes involved in manufacturing, service, storage or transportation by air, rail, road and sea at any stage of the production or supply process. The standard could be applied to all ships, irrespective of size, type, purpose and whether operated internationally, domestically or within internal waters. The same can be said of all other transport segments in the supply chain.

ISO 50001 Energy management systems

'ISO 50001:2011 Energy management systems - Requirements with guidance for use' was issued in 2011. Its purpose is to enable organizations of all types and sizes to establish the systems and processes necessary to improve energy performance, including energy efficiency, its use and consumption.

Implementation will lead to reductions in greenhouse gas emissions and other environmental impacts. It will also result in a fall in energy cost through the systematic management of energy. The term 'energy' in the standard covers electricity, fuels, steam, heat,

compressed air, and other like media.

The standard has a high level of compatibility with ISO 9001 and ISO 14001.

7. Other important standards

Eco-Management and Audit Scheme (EMAS)

EMAS is the European Union's eco-management and audit scheme. The latest version of its enforcing regulation (EMAS III) is entitled 'Regulation (EC) No 1221/2009 of 25 November 2009 on the voluntary participation by organisation in a Community eco-management and audit scheme (EMAS)'.

The scheme is intended for companies and other organizations who wish to evaluate, manage and continuously improve their environmental performance. The system has been in operation since 1995. It incorporates an environmental management system in line with EN/ISO 14001. Organizations with an ISO 14001-certified EMS can progress towards EMAS registration by incorporating a number of additional elements.

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EMAS III came into effect on 11 January 2010. This version improves the applicability of the scheme and strengthens EMAS's visibility and outreach. For instance, EMAS is strengthened by the introduction of environmental core indicators, against which environmental performance can be thoroughly documented.

Participation in EMAS is voluntary and extends to public or private organizations operating in the European Union and the European Economic Area (EEA) – Iceland, Liechtenstein and Norway. An increasing number of candidate countries are also implementing the scheme in preparation for their accession to EU. EMAS III makes registration to the scheme also possible for organizations and sites located outside EU and EEA.

International Safety Management (ISM) Code

The ISM Code formulated by the International Maritime Organization (IMO) provides an international standard for the safe management and operation of ships; it also covers the prevention of pollution.

The purpose of the ISM Code is to:

- ensure safety at sea;

- prevent human injury or loss of life; and
- avoid damage to the environment and to the ship.

In order to comply with the ISM Code, each ship class must have a working safety management system (SMS). The Code also imposes a mandatory planned maintenance system, according to which vessels must be maintained at specified intervals.

Each ISM-compliant ship is inspected regularly by a 'classification society' to check the effectiveness of its SMS. Once the classification society verifies that the SMS is working and effectively implemented, the ship is issued a safety management certificate. The American Bureau of Shipping is an example of a classification society.

Global Food Safety Initiative (GFSI)

The GFSI benchmarking process has been developed on the basis of internationally accepted food safety requirements, industry best practice and sound science, through a consensus-building process by key stakeholders in the food supply chain. The requirements can be found in the

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GFSI Guidance Document, which is freely available on their website.

GFSI is coordinated by the Consumer Goods Forum, the only independent global network for consumer goods retailers and manufacturers worldwide.

As of 2017 GFSI has benchmarked 13 schemes for the manufacturing sector, including the Canada GAP, BRC Global Standards, IFS, FSSC 22000. It has also benchmarked three schemes for primary production (including GLOBALG.A.P.) and one for the primary sector. A brief description of three of the GFSI-benchmarked schemes is given below.

Foundation for Food Safety Certification: FSSC 22000

The FSSC scheme was developed by the Foundation for Food Safety Certification and is supported by FoodDrinkEurope.

FSSC 22000 is a certification scheme for food safety systems based on the food safety management standard ISO 22000:2005 'Requirements for any organization in the food chain' and the publicly available specification (PAS) British Standard 'PAS 220:2008 for Prerequisite programmes on food safety for

food manufacturing'. The latter standard is equivalent to ISO/TS 22002-1:2009. The scheme is applicable to manufacturers that process or manufacture animal products, perishable vegetal products, products with a long shelf life and other food ingredients like additives, vitamins and bio-cultures.

The certification is accredited under the standard ISO/IEC 17021. Manufacturers that are already certified to ISO 22000 will only need an additional review against BS PAS 220 to meet the requirements of this certification scheme. The FSSC 22000 certification scheme has been given full recognition by the Global Food Safety Initiative.

GLOBALG.A.P.

The GLOBALG.A.P. standard comes from EUREPGAP, a standard that was developed by the major European food retailers. GLOBALG.A.P. is a private sector body that sets voluntary standards for the certification of agricultural products, including fresh produce, livestock, fresh-cut flowers, etc. around the globe.

The private standard is primarily designed to reassure consumers

that food is produced on farms that minimize the detrimental environmental impacts of their operations by reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety, as well as animal welfare. GLOBALG.A.P. has established itself as a key reference for Good Agricultural Practices (GAP) in the global marketplace. GAP translates consumer requirements into agricultural production practices in a rapidly growing list of countries.

British Retail Consortium (BRC) Global Standards

The BRC Global Standards comprise four technical standards that specify requirements to be met by an organization to enable the production, packaging, storage and distribution of safe food and consumer products. Originally developed in response to the needs of United Kingdom members of the British Retail Consortium, the BRC Global Standards have gained usage worldwide and are specified by a growing numbers of retailers and branded manufacturers in the European Union, North America and other regions.

Certification by accredited certification bodies is available for the above ISO and private standards. Further details of the schemes can be obtained direct from the website of the certification bodies concerned.

8. Conclusion

Many customers are not only concerned with quality of the product or service, but also how the product or service has been produced. They want to get assurance of:

- consistency of the level of quality,
- least environmental impact of the product throughout its life cycle,
- good treatment of the employees of the supplier, and
- other ethical practices of the supplier.

Different management system standards are implemented across the world by enterprises to provide the necessary confidence on the above. This unit has given an overview of the most common management systems required by potential markets.

Unit 7: Conformity assessment

1. Introduction

Suppliers' performance is monitored by a range of activities referred to as conformity assessment. This is a collective term covering the many elements required to demonstrate that a product or a service complies with stated technical and other requirements. In general, testing, inspection and certification are considered the core conformity

assessment services and they are used either individually or collectively as circumstances demand.

Testing, inspection and certification are supported by metrology and calibration to ensure the validity of measurements and by accreditation to ensure the technical competency of the conformity assessment service providers. (Figure 20)

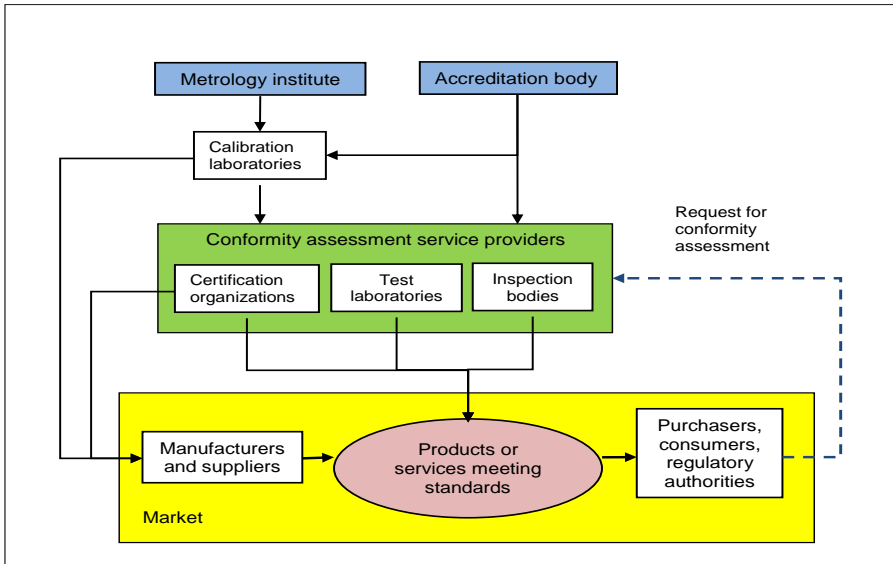


Figure 20: Conformity assessment framework

2. Conformity assessment system

Types of conformity assessment

First party: Conformity assessment services provided by the supplier himself/herself are considered first-party conformity assessment. For example, where a company of a product declares the conformity of its product based on the tests that have been done in its own testing laboratory.

Second party: Conformity assessment can also be conducted by the purchaser, i.e. the second party. This is an expensive option for the purchaser, so second-party assessment is generally encountered only among major purchasers operating their own inspection and testing infrastructures.

Third party: Much more acceptable, especially for SMEs in developing economies, is the provision of conformity assessment services by an organization that is independent of both the supplier and the purchaser. Such an organization is a third-party conformity assessment body (CAB).

A third-party CAB can be either a public or private independent

organization that has no interest in the transaction between the first and second party.

CAB should be an accredited one

The third party conformity assessment body should be able to demonstrate its technical competence through internationally accepted accreditation so that its test reports and certificates can be recognized in the export markets.

The fact that a conformity assessment service provider is a government body, e.g. the national standards body or government laboratory, does not lead to automatic acceptance of its test reports or certificates.

Mutual Recognition Agreements

Sometimes the market or regulatory authorities abroad may not accept a conformity assessment body's test reports and certificates even though it is accredited as mutual recognition agreements are required.

In developing countries, inspection, testing and certification services are frequently mainly provided only by the national

standards body and government laboratories. There are many private inspection bodies, testing laboratories and certification bodies that operate in the marketplace.

3. Inspection

Inspection involves information gathering (checking, measuring), observation (of conditions) and forming judgements on suitability for use or compliance with requirements.

Judgement is an essential element of inspection and is therefore prone to some variability of outcome. For this reason, it is crucial that inspectors be thoroughly trained for the sectors in which they are expected to work.

Inspection is used in manufacturing processes and products, in activities such as design verification, installation and commissioning of equipment, in-service monitoring, regulatory affairs, financial auditing and failure investigation. It applies to both manufacturing and services sectors.

In the regulatory sense, inspection may cover mandatory product compliance with technical

regulations prior to being made available in the market. In some societies, most notably those belonging to the former Soviet Union, there may be several thousand products that require mandatory approval before release to the market. This practice normally focuses on domestic products but may also apply to imported products in some sectors. While called inspection, such activities are often largely testing leading to a certificate of compliance.

Inspection also includes both pre- and post-market surveillance activities and regular examination of installations for safety purposes.

Pre-shipment inspection is usually performed by the manufacturer but, where the product is being exported, additional inspection may be required at the point of shipping. 'Cargo superintending' is the term often applied to this activity. It involves not only inspection of the product but also of its packaging, handling, quantity and documentation. The cargo superintending company acts as the customer's agent.

When countries have products which they have designated as being of particularly high value and

which are prone to damage during transportation or when they wish to bolster or protect an image in the market, governments themselves may impose an inspection prior to shipment. This was a key strategy of Japan for a number of products such as quality optical equipment. Australia also requires export certification for a range of perishable food products.

Finally, the customer may impose additional inspection at the point of receipt.

A number of countries impose import inspection to ensure freedom from disease. Such regimes are most rigorous for countries that are generally free of animal and plant diseases such as Australia and New Zealand but may also be imposed as an emergency measure where outbreaks of human diseases occur. Importing countries may designate private organizations as their agents to conduct pre-export inspection or approve import consignments in relation to official requirements.

While inspection may be the oldest form of conformity assessment, it has been the last to be internationally standardized. The pervasive use of inspection

throughout all industries led the European Union to introduce a common standard (EN 45004 General Criteria for the Operation of Various Types of Bodies Performing Inspection) when it created the single market. This initiative was followed by the international community when it adopted EN 45004 as ISO/IEC 17020:1998, which carries the same title and is identical with the EN. This standard is now used by accreditation bodies to accredit inspection bodies in a number of countries.

4. Testing

Testing is defined as a 'technical operation that consists of determination of one or more characteristics of an object of conformity according to a procedure'. Typical tests involve measurement of dimensions and determination of chemical composition, microbiological purity and strength or other physical characteristics of materials or structures such as freedom from defects.

The results of testing often provide sufficient information to permit a competent person to draw a conclusion as to whether or not a

Unit 7: Conformity assessment

product or service meets requirements specified by regulatory authorities, buyers or other users. In other cases, such as in-service inspection of elevators and motor vehicles, inspection alone may be sufficient. It is important to recognize that the boundaries between testing and inspection are quite blurred as there is some overlap; the same activity may be labelled as being in either field.

It is important to ensure that all the measuring equipment used either for testing or for inspection are accurate and provide reliable results on which compliance decision would be made. Such equipment have to be calibrated on a regular basis to confirm their accuracy status and their traceability to international measurement standards. In many countries, there are calibration or metrology laboratories which offer such calibration services.

Testing is most often conducted in a laboratory, either before dispatch or upon delivery to the customer. However, in many cases it may be performed in the field or on-site following delivery or installation. This is true of large or complex

machinery and welded pipelines and rail tracks.

Regulatory authorities and commercial buyers of foreign products frequently require testing at the point of import or delivery by their own designated laboratories even when adequate testing has been performed in the country of manufacture. Such policies are regarded as technical barriers to trade because they add cost through duplication and delays. If the testing carried out at the point of manufacture is performed competently and in accordance with the requirements of the customer or of the import market, then there is no technical reason for the product to be retested unless conditions during transit may cause the product to deteriorate. Mutual recognition of the competence of test laboratories and other conformity assessment bodies is therefore important to reduce such technical barriers.

While the World Trade Organisation urges Members to accept testing performed in the country of export, there is a wide range of mechanisms that are used in different jurisdictions. These

require that the testing laboratory providing the data be:

- Operated by the regulatory authority of the importing country;
- One with a good reputation established with the accepting authority;
- Recognized by the regulatory body;
- Accredited by the national body of the importing country;
- Recognized by one of the partners under a government-to-government mutual recognition agreement (MRA);
or
- Accredited by a body within the ILAC Arrangement.

In today's trading environment, accreditation is the most widely used tool for establishing and maintaining confidence in the competence of conformity assessment bodies, but it is the responsibility of the exporter to understand the rules of the importing market.

5. Third party certification

While testing and inspection are very common means of determining conformity, in some

cases, testing or inspection alone is regarded as insufficient by either the regulator or the customer. In some product sectors, certification by a third party is also required.

There are two main types of certifications are as follows.

Product certification, which is a mechanism whereby a certification organization attests that products, either a batch or the continuous production thereof, have been inspected and tested by it and that the products collectively comply with specified requirements, usually contained in a standard.

Management system certification, which an assessment of compliance of the management system (policy, processes and procedures) comply with the requirements of a specified standard for the system (e.g. ISO 9001 for quality management system, ISO 22000 for food safety management system, etc.)

6. Product certification

If a product bears a recognized mark such as a national certification mark, this would give confidence to the buyer that the product meets the specifications to which the mark corresponds. In other words, the product can be

considered as a 'quality/safe product' by the buyer.

A product bearing a third-party mark carries an assurance that:

- The product has been produced according to an applicable standard.
- The production process has been supervised and controlled.
- The product has been tested in an independent laboratory.

The mark is normally found on the product or on its packaging. The mark also carries a reference to the number of the relevant product standard against which the product is certified. If the customers find that a marked product does not meet the declared standard, they can approach the certification body that awarded the product certification for addressing their complaint.

Product certification services are offered by many certification organizations, in both public and private domains, at the national and international levels. Often developing economies, national standards bodies provide the only product certification with any market relevance. In developed

economies, private certification bodies are often more important from a market perspective. Product certification is mostly accepted only in the home market of the certification organization, but a few operate successfully at the regional or even at the international level.

Typical examples of product certification marks are the BSI Kitemark (general products – United Kingdom), the SABS mark (general products – South Africa), the GS mark (product safety – Germany), the VDE mark (electrical and electronic equipment – Germany), the UL mark (product safety – United States), the ASME mark (pressure vessels – United States), the CSA mark (general products – Canada), KEMA (electrical equipment – the Netherlands) and AGMARK (agricultural products – India). There are many more. It should be noted that the CE mark is not a product certification mark but a regulatory device of the European Union.

7. Certification of Management Systems

The required level of quality can only be built into the product through management of

processes. A properly established Quality Management System preferably in conformity with the International Standard ISO 9001 will help to demonstrate the supplier's ability to consistently provide products conforming to the buyer's requirements. This will also build the supplier's image of being a reliable one.

Other popular system certifications include:

HACCP⁴, ISO 22000 Food Safety Management System, GLOBALGAP Certification, ISO 14000 Environmental Management Systems, OHSAS 18001 Occupational Health and Safety Management Systems, SA 8000 Social Accountability, WRAP (Worldwide Responsible Accredited Production) Apparel Certification Program, Fair Trade Labelling Organization (See the previous Unit) and Organic Farming Certification.

Organic Farming is a system for assuring that the farm uses organic inputs for farming. (Organic farming is the form of agriculture

that relies on crop rotation, green manure, compost, biological pest control, and mechanical cultivation to maintain soil productivity and control pests, excluding or strictly limiting the use of synthetic fertilizers and synthetic pesticides, plant growth regulators, livestock feed additives, and genetically modified organisms).

Supplier's declaration of conformity (SDoC)

The supplier's declaration of conformity is a procedure by which the supplier (may be a manufacturer, distributor, importer, assembler, service organization, etc.) provide written assurance of conformity to the specified requirements. Under this approach, the supplier rather than the regulatory authority, takes on the responsibility for ensuring that products entering a market comply with the mandatory technical regulations. Assessment may be undertaken either by the supplier's own internal test facility or by an independent test facility. The use of such supplier's declaration of conformity for products is widely used in the USA and in Europe.

⁴ Hazard Analysis and Critical Control Point

Supplier audit

The business practices of suppliers have a direct impact on your organization. If you have a supplier that is not able to deliver the quality of products you require, and on time, that directly affects your revenue. Auditing a supplier is therefore a necessary part of your quality management system. You may decide to audit a new supplier which you are considering for your business needs, or you may decide to audit a current supplier because of an incident that occurred in the past.

Supplier audit is an effective way to ensure that supplier is following the processes and procedures that you agreed to during the selection processes. The audit identifies non-conformances in manufacturing process, shipment process, engineering change process, invoicing process and quality process at the supplier. After the audit, the supplier and manufacturer jointly identify corrective actions which must be implemented by the supplier within an agreed-upon timeframe. A follow up audit is normally scheduled to ensure that these corrective actions have been successfully implemented.

8. Accreditation of conformity assessment bodies

Accreditation is a **formal recognition of integrity, competence, and impartiality.**

From the point of view of conformity assessment, accreditation is applied to testing laboratories, inspection bodies and certification bodies. The accreditation process has been applied to laboratories since the 1940s while the accreditation of certification and inspection bodies is more recent.

Accreditation requirements for conformity assessment bodies (Table 8) are provided in the ISO/IEC 17000 series of standards.

Accreditation of a laboratory by an accreditation body which is a signatory of the mutual recognition agreement of the International Laboratory Accreditation Cooperation (ILAC MRA) normally provides the confidence in the competence of the laboratory for the scope of its accreditation.

Unit 7: Conformity assessment

Similarly, the competence a certification body accredited by an accreditation body which is a signatory of the multilateral agreement of the International

Accreditation Forum (IAF MLA) would be normally recognised for the scope of its accreditation.

Table 8: Accreditation requirements for different conformity assessment bodies

Organizations	International standards	Client requirements
Calibration laboratories	ISO/IEC 17025	Calibration of measuring instruments
Testing laboratories (general)	ISO/IEC 17025	Compliance of products with technical requirements
Inspection bodies	ISO/IEC 17020	Compliance of products and services with technical requirements
Certification bodies for:		
i. Quality management	ISO/IEC 17021	Compliance with ISO 9001
ii. Environmental management	ISO/IEC 17021	Compliance with ISO 14001
iii. Food safety	ISO/IEC 17021	Compliance with ISO 22000, HACCP
iv. Product certification	ISO/IEC 17065	Compliance with product specific requirements

9. Conclusion

Monitoring supplier's performance is an essential responsibility of an organization since the products

and services it purchases have an impact on its own performance. There are different ways of monitoring supplier's performance:

- Inspection and testing done by the organization itself or by a third party,
- third party certification,
- conducting supplier audits, or
- relying on supplier's declaration of conformity which is backed by

documentary evidence for assessments conducted.

It is important to consider the competence and recognition of any conformity assessment body which is involved in the process. In this context, accreditation would be an essential consideration.

Unit 8. Metrology

1. What is metrology?

Metrology is the science of measurement. It should not be confused with "Meteorology", the science of weather and weather forecasting. Metrology includes units of measurement and their standards, measuring instruments and their field of application, and all theoretical and practical problems relating to measurement.

**Measure several times,
but cut only once.**

Measurements are essential to nearly all aspects of human activity ranging from production control, measurement of environmental quality, health and safety assessment, conformity assessment of products to consumer protection and fair trade assurance.

2. Types of metrology

Metrology is classified in three main fields: Scientific Metrology, Industrial Metrology and Legal Metrology.

Scientific Metrology is that part of metrology which deals with

problems common to all metrological questions irrespective of the quantity measured. It covers general theoretical and practical problems concerning units of measurement, including their realization and dissemination through scientific methods, the problems of errors and uncertainties in measurement and the problems of metrological properties of measuring instruments.

There are different specialist areas of metrology, for example:

Mass metrology dealing with mass measurements;

Dimensional metrology dealing with length and angle measurements;

Temperature metrology dealing with temperature measurements;

Electrical metrology dealing with electrical measurements;

Chemical metrology dealing with measurements in chemistry.

Industrial metrology deals with measurements in production and quality control. It covers calibration procedures, calibration intervals, control of measurement

processes and management of measuring instruments in industry to ensure that they are in a state of compliance with requirements for their intended use.

To measure is to know.

If you cannot measure it,
you cannot improve it.

Legal metrology is that part of metrology which is subject to legal/regulatory control. It is defined in the *International Vocabulary of Legal Metrology* as that part of metrology relating to activities which result from statutory requirements and concern measurement, units of measurement, measuring instruments and methods of measurement and which are performed by competent bodies.

3. Legal metrology and trade

Globalisation of trade is the strongest thrust boosting the current importance of metrology and its rapid development. However, it is also the most important challenge to legal metrology as far as trade agreements based on elimination

of technical barriers to trade and mutual recognition agreements of conformity assessment is concerned. Legal metrology is by its regulatory nature, particularly sensitive to the elimination of technical barriers to trade. Government regulations are without exception real and potential technical barriers to trade, unless regionally and ultimately internationally harmonised. The harmonisation of metrological requirements as well as of conformity assessment and verification procedures is therefore becoming most urgent and an important challenge to legal metrology.

The scope of legal metrology depends on national regulations and may be different from country to country. In general, most countries have legislation to control trade measurements. A few countries also regulate measurements in the following areas:

public health and human safety (e.g. in the medical field and road safety), environmental protection and pollution monitoring, and resource monitoring and control.

Measurements enter into practically all commercial

Unit 8. Metrology

transactions from the trading of goods such as petroleum, natural gas or metal ores in bulk to the retail sale of goods to the public in the market place. In ordinary commercial transactions, legal metrology ensures that during the sale of any commodity in loose form, the actual delivery to the purchaser is not less than the quantity contracted and paid for. In the case of pre-packaged goods, the primary requirement is that the packages intended for retail sale should be marked with the correct statement of net quantity and the name of the packer in such style and form as to be readily seen by the purchaser. In addition, the packing of certain commodities may be in rationalised standard quantities to facilitate quantity and price comparison. Net content inspection of pre-packages carried out by the legal metrology authority protects consumers who cannot verify the net quantity of contents. Legal metrology therefore ensures fair trade practices and maintains a competitive marketplace. It also encourages manufacturers, distributors and retailers to follow good manufacturing and distribution practices.

Legal control on the measurements involving public health and human safety is equally important from the consumer protection viewpoint. For example, a clinical thermometer or a blood pressure instrument which is not properly verified may lead to wrong diagnosis and incorrect medication. Chemical metrology monitors food and toxic substances in the human body while the breath analyser and radar speed measurement helps to ensure our safety on the road.

The field of environmental protection and pollution monitoring is heavily regulated and is already one of the most important measurement activities of modern legal metrology. As the planet is threatened to run out of many of its precious resources (water, minerals, oil and gas, fish, etc.), prices tend to increase thereby increasing the need of more accurate measurement. Countries are increasingly regulating resource monitoring and control based on adequately accurate measurement. It is expected that in this 21st century, environmental protection and resource monitoring will become the most important areas of legal

metrology at par with trade metrology.

4. Understanding the requirements of national legal metrology legislation

A national law on metrology usually provides for the following:

- Legal units of measurement;
- Physical representation of legal units;
- Hierarchy of measurement standards – their maintenance and custody;
- Technical regulations of measuring instruments covering metrological, technical and administrative requirements;
- Metrological control on measuring instruments;
- Metrological control on pre-packaged commodities;
- Control of manufacture, import, repair and sale of measuring instruments;
- Authority responsible for legal metrology;
- Levy and collection of fees;
- Offences and penalties.

Legal units of measurement

The legal units of measurement accepted by most countries are the SI units (i.e. the International System of Units), their decimal multiples and submultiples as indicated by the use of SI prefixes and certain non-SI units specified by relevant regulations. The International System of Units is the revised and modern form of the metric system. SI has been recognised and recommended by the General Conference on Weights and Measures (CGPM) and the International Organisation of Legal Metrology (OIML) The SI system includes:

- base units ; and
- derived units including supplementary units.

The seven base units are listed in Table 9.

Table 9: The 7 SI base units

Base quantity	SI base unit	
	Name	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

Derived units are formed by combining base units according to the algebraic relations linking the corresponding quantities. For example, the unit for speed, *metre per second* (m/s) is derived from the base units *metre* and *second* while the unit for volume, *cubic metre* (m³) is derived from the base unit *metre*. Certain derived units have special names, for example, the unit for pressure *Pascal* (Pa) is the special name for *Newton per square metre* (N/m²).

There are also non-SI units which are allowed to be used for practical reasons. These are given in Table 10. The decimal multiples and sub-

multiples of SI units are formed by SI prefixes, some of which are given in Table 11. As an example of the use of prefixes,

$$1 \text{ kg} = 1\,000 \text{ g} = 1\,000\,000 \text{ mg},$$

where the prefix kilo, symbol "k", is used for the multiplying factor 1 000 and the prefix milli, symbol "m", is used for the multiplying factor 0.001.

The full stop is used as the decimal sign in many English-speaking countries (as in this document also) while the comma is often used as the decimal sign in other countries.

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Table 10: Units used with SI

Quantity	Unit		
	Name	Symbol	Definition
time	minute	min	1 min = 60 s
	hour	h	1 h = 60 min
	day	d	1 d = 24 h
plane	degree	°	1° = $(\pi/180)$ rad
angle	minute	'	1' = $(1/60)$ °
	second	"	1" = $(1/60)$ '
volume	litre	l, L *	1 L = 1 dm ³
mass	tonne **	t	1 t = 1 000 kg
<p>*The two symbols for litre are on an equal footing</p> <p>** Also called the metric ton in the English language</p>			

Table 11: Some SI prefixes for decimals

Factor	Prefix		Factor	Prefix	
	Name	Symbol		Name	Symbol
10 ⁶ = 1 000 000	mega	M	10 ⁻¹ = 0.1	deci	d
10 ³ = 1 000	kilo	k	10 ⁻² = 0.01	centi	c
10 ² = 100	hecto	h	10 ⁻³ = 0.001	milli	m

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10	deca	da	$10^{-6} =$ 0.000001	micro	μ
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Although the SI is used worldwide, there are also other systems of units used in certain countries, e.g. in the USA units like the pound (1 pound = 0.454 kg), the gallon (1 gallon = 3.785 L), the inch (1 inch = 2.54 cm) and other non-SI units are used. Non-SI units are also used for special applications like in navigation (1 nautical mile = 1 852 m) and in trade with crude oil (1 barrel = 159 L). However, the International System of Units (SI) has been adopted by most countries as it is supported by the Metre Convention.

Control of measuring equipment

Measuring instruments used for trade or covered by legal metrology legislation have to be type or pattern approved. For example, not all models of balances can be used for trade. An example is kitchen scale which falls under an accuracy class which is not allowed for trade purposes.

Those measuring instruments that are pattern approved need to be verified by the legal metrology

service at prescribed intervals of time according to the type and stamped according to the law of the country. The law provides that no trader for example can use a measuring instrument for trade (weighing balance, measure, petrol pump) if it exceeds the maximum permissible errors stipulated in the legislation.

Another aspect of the control of measuring instruments is inspection of their use in the trading premises. This is carried out by officers of the legal metrology service to check if there is no fraudulent use of such instruments and whether they have been stamped according to the provisions of the legislation.

Control of pre-packaged commodities

In recent decades, the off-take of pre-packaged commodities has received considerable impetus because of the ease and convenience with which they can be transported and marketed. Weighing and measuring in the presence of the purchaser is now tending to be gradually reduced

and is expected to be limited to a few selected items in the near future. Requirements for the sale of pre-packaged goods are part of national legislation in many countries and they usually provide for the following:

- labelling requirements;
- standardization of pack sizes;
- metrological control; and
- prevention of deceptive packaging.

Labelling requirements

Every package intended for retail sale has to bear the following main information:

- the identity of the product (common or generic name of the commodity contained in the package);
- the name and place of business of the manufacturer, packer, distributor, importer or retailer; and
- the net quantity of the product.

The information has to be conspicuously, legibly and unambiguously displayed on the "principal display panel", that is the part of the package or of its label which is likely to be shown or examined by the customer under normal conditions of sale. There is

a minimum size of letters normally prescribed for the declaration of the net quantity established in relationship to either the area of the principal display panel of the package (e.g. in the USA) or the quantity of the packaged contents (e.g. in the European Union). The way of declaring the net quantity, including the symbols for units and the number of decimal places to be used, is usually also regulated.

The International Organisation of Legal Metrology (OIML) has published an international recommendation R 79, considered as an international standard, on *Labelling requirements for pre-packaged products*. This document gives the details on the labelling requirements with respect to product identity, name and place of manufacturer/packer/distributor and the net quantity, but does not cover the declaration of ingredients, storage temperature, date limit for sale or use which are normally also regulated and controlled by other authorities in the country and which need to be taken into account by the prospective exporter.

Standardization of pack sizes

To facilitate price comparison and to prevent unfair competition, many countries have provided for prescribed standard pack sizes for certain essential commodities. It can be argued that standardization of pack sizes serves no purpose if the package has the necessary label giving information on the net quantity. This view could only be accepted if all consumers were alert and good in mental arithmetic. Most people would find it much more difficult to compare packages of net quantity 245 g sold at \$ 4.50 with 530 g packages sold at \$ 9.30 than to compare 250 g for \$ 4.60 with 500 g for \$ 8.80.

Some countries not opting for standard pack sizes have made it mandatory to declare unit price for goods in order to facilitate price comparison.

Metrological control

In order to ensure the accuracy of the net content of packages, i.e. the quantity of the commodity without the package material, the law may provide for the checking at any level of distribution including the point-of-pack, import, distribution and wholesale transactions, and sale (e.g. where

pre-packages are offered or exposed for sale or where they are distributed).

OIML has prepared a new version of the international recommendation R 87 on the quantity of product in pre-packages which lays down the metrological or accuracy requirements for pre-packaged goods labelled in predetermined constant nominal quantities of weight, volume, linear measure, area or count (Table 12) . It also specifies sampling plans and procedures for use by legal metrology officials in verifying the quantity of product in pre-packages. An examination procedure outlines procedures for determining average tare weight, the drained weight of products in liquid medium and the actual quantity of frozen goods are given in the annex of the recommendation.

It is not always possible for a package to contain exactly the nominal quantity (the quantity stated on the package). Some variations are allowed, provided that:

- the average value of the net contents in an inspection lot is

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- not less than the nominal quantity.
- the net quantity of a pre-package shall accurately reflect the nominal quantity within the reasonable limits defined as follows:
 - Not more than 2.5 % of the number of pre-packages in an inspection lot or batch may contain less than the tolerable deficiency specified in (Table 12).
 - There is no pre-package deficient by more than twice the tolerable deficiency.

Table 12: Tolerable deficiencies in actual content for pre-packages recommended by OIML R 87

Nominal Quantity of Product (Q_n) in g or mL	Tolerable Deficiency(T^a)	
	Percent of Q_n	g or mL
0 to 50	9	-
50 to 100	-	4.5
100 to 200	4.5	-
200 to 300	-	9
300 to 500	3	-
500 to 1000	-	15
1000 to 10 000	1.5	-
10 000 to 15 000	-	150
Above 15 000	1	-
aT values are to be rounded up to the next 0.1 of a g or mL for Q_{nom} less than or equal to 1000 g or 1000 mL and to the next whole g or mL for Q_{nom} higher than 1000 g or 1000 mL.		
Nominal Quantity (Q_n) in length		Percent of Q_n
Q_n of 5 m or less		No tolerable deficiency allowed
Q_n greater than 5 m		2
Nominal Quantity (Q_n) in area		Percent of Q_n
All Q_n		3

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Nominal Quantity (Q_n) in count	Percent of Q_n
Q_n of 50 items or less	No tolerable deficiency allowed
Q_n greater than 50 items	1 ^b

^b Calculate the value of T by multiplying the nominal quantity by 1 % and rounding the result up to next whole number. The value may be larger than 1 % due to the rounding but this is accepted because the products are whole items and cannot be divided

Many countries require the manufacturer or the packer to control the filling process. Verified measuring instruments have to be used and appropriate records have to be kept and presented on request to the legal metrology authorities.

Deceptive pre-package

A deceptive or misleading pre-package is a package which is so designed as to deliberately give to the consumer an exaggerated or misleading impression about the quantity of the commodity contained therein, except where bigger dimensions of the package can be justified by the manufacturer or the packer on the ground that such dimensions are necessary for:

- the protection to the commodity;

- the requirements of the machine used for filling such packages;
- unavoidable product settling during shipping and handling; or
- the need for the pre-package to perform a specific function (e.g. where packaging plays a role in the preparation or consumption of a food).

Unfilled space in cardboard packages containing materials such as soap, detergents or processed food, and jars and containers with increasingly thick walls for packing cosmetic creams are examples of deceptive packaging.

5. Calibration of measuring equipment

All measuring and test equipment which can have an impact on quality, health, safety or

environment protection should be checked for accuracy and precision. For measuring equipment not subject to legal control, they should be calibrated at regular intervals of time.

Use of calibration

Calibration is used to:

- Ensure conformity with product specifications and product quality requirements,
- Avoid the risk of scrap and rejects, and
- Meet requirements for certification, e.g. according to ISO 9001:2008.

Calibrate instruments regularly

Calibration of the measuring and test equipment must be carried out at regular intervals because their performance may change with time as a result of the influence of the environment to which it is exposed, wear and tear, overload or improper use. The accuracy of the measurement and test equipment should be checked before use and regularly calibrated or after exposure to influence factors. Recalibration is not necessary for certain simple types of measuring instruments made of

glass such as measuring cylinders, pipettes, burettes, or certain thermometers, if used within the working conditions they were designed for.

During calibration, the value of a quantity measured by the equipment is compared with the value of the same quantity provided by a measurement standard. If you have instruments of different accuracy classes for the same quantity and the same measuring range, at least the instrument with the highest accuracy – also known as ‘precision instrument’ should be calibrated by a calibration laboratory, preferably by an accredited calibration laboratory.

The calibrated precision instruments can be used for in-house calibrations of instruments of lower accuracy. Details of the calibration such as a short description of the calibration method and/or a sketch, the standard used, the results obtained, the date and the name of the operator should be documented and stored together with the operation manuals and other documents relevant for the instruments.

Calibration certificates should indicate uncertainty

Usually, the result of a calibration (or measurement) should include a calculation of the uncertainty. This is a requirement for professional calibration laboratories. Since the calculation requires a profound knowledge of the calibration process and of statistics, it might be too complicated and not absolutely necessary for calibrations requiring not too high accuracies. Instead of using methods according to the 'Guide of expression of uncertainty in measurement' (2008), other statements may suffice. For instance, if the accuracy of the standard used is 10 times higher than that of the instrument to be calibrated, a detailed calculation of the uncertainty would not be necessary for in-house purposes. However, calibration certificates must always indicate the uncertainty.

A sticker should be attached to the instrument after successful calibration showing the date of the calibration, an indication of the person who carried it out, and the date of recalibration. In case the calibration status is no longer valid or the calibration is doubtful, the

instrument should be marked as such and not used until a recalibration has been carried out.

Calibration enhances your competitiveness as it helps you to avoid the risk of producing scraps, and that of complaints by your customers.

Rules for good measurement

Good measurement practices are the basis of quality and good performance. You can apply the following good measurement practices in your enterprise:

The difference between the most and least successful companies lies in the detail in which they measure their processes.

-R. Freeman, Optical generics, UK

- **Relevance:** Measurement should be selected for relevance to product quality and cost-effectiveness. For example, a dimension of a component that has to fit into another component is more important to measure

accurately than those not fitting into another component.

- **Right measuring tools:** Tools used for specific measurements should be able to measure to the required degree of accuracy. For example, to measure the thickness of a wire, you would not use a ruler but use a more accurate instrument like a micrometer.
- **Trained staff:** Staff should be well trained and skilled in the measurements they perform. They should be able to also interpret the measurement.
- **Check the measurement system:** Have the measurement checked by an independent authority. The staff can also check with measuring items of known values and analyse the deviations to see if these are acceptable. Compare your measurements with those of suppliers or clients to check consistency.
- Get your measuring instruments calibrated at regular intervals of time.

- Follow the right measurement procedures. These procedures should be a part of your system for managing quality.

6. Conclusion

In this unit, we have seen that accurate and precise measurement is important for quality management and also for complying with the law as regards consumer protection, safety, health and protection of the environment.

If you are using a measuring instrument, you check whether it is subject to the legal metrology legislation in which case it should be verified by the legal metrology service. If you are using it for production purpose and it can affect the quality of your product or service, you should get it calibrated at regular intervals of time.

If you are selling products in pre-packages, the latter should comply with labelling and net quantity requirements stipulated in the legal metrology or weights and measures legislation.

Unit 9. Beyond conformity

1. Introduction

Meeting technical requirements of customers and regulatory bodies is however not enough. Companies are forced to differentiate their products in terms quality, price and service from others indicating better value for money.

In this century, the success of an organization will depend not only on its financial performance, the efficiency and effectiveness of its processes and the care and satisfaction of its customers, but also on the way it is conducting its business in terms ethics, impact on environment and social responsibility. It has to demonstrate a triple bottom line, i.e. people, planet and profit.

In the above context, with the aim of achieving and demonstrating higher performance than others and their social responsibility, many organizations have recourse to different practices, a few of which will be presented in this unit.

2. Some practices to demonstrate higher performance

Is Quality at 99.9% adequate?

Quality at 99.9% would mean one crash out 1000 landings of an aircraft!

Six Sigma

Zero defect for quality is a simple and direct concept. However, a process without defects requires performing tasks right and reducing variations.

Six Sigma is a data-driven structured problem-solving methodology to reduce variations in the business processes. The Six Sigma methodology, started and popularized in 1987 by Motorola in the United States, provides techniques and tools to improve the process capability and reduce the defects in any process. Six Sigma essentially has two

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elements: the 'voice of the customer' and the 'voice of the process'. It entails reducing the gap between the two voices and ensuring that they match. Six Sigma efforts target three main areas:

- Improve customer satisfaction
- Reduce cycle time
- Reduce defects

Six Sigma aims at virtually error-free business performance.

Uncontrolled variation in a business process is the enemy of quality.

Achieving the goal of Six Sigma requires more than small incremental improvements – it demands a breakthrough in every area of the business.

Sigma is a Greek letter symbolized by 'σ'. It is used to designate the

standard deviation of a process. In other words, sigma is a measurement used to determine how good or bad the performance of a process is, i.e. how many mistakes a process makes.

Traditionally, Six Sigma stands for 'six standard deviations' from process mean. Table 13 below gives process yields at various sigma levels.

DPMO (Defects per million opportunities) is the result of DPU (defects per unit) multiplied by 1 000 000 divided by opportunities for errors in a unit. For example, if a purchase order has 50 opportunities for errors and assuming that the data entry operator who prepares purchase orders makes 1 defect on average, the DPMO in this case will be 1 multiplied by 1 000 000 divided by 50 or 20,000.

Table 13: Process yield at various sigma levels:

Sigma level	Product meeting requirements: %	Defects per million opportunities (DPMO)*
1	68.26	697,672.15
2	95.45	308,770.21
3	99.73	66,810.63
4	99.9937	6,209.70

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5	99.999943	232.67
6	99.9999998	3.40

*DPMO with a 1.5 Sigma shift.

Source: David Hoyle, ISO 9000 Quality Systems Handbook, 6th ed. 2009.

Suppose that you run a business that delivers pizzas to nearby offices. You have a reputation for making good pizzas and you have many customers. According to your contract with customers, pizza will be delivered to them fresh and hot between 11.45 am and 12.15 pm. This allows them to receive their orders in time for lunch (their 'requirements'). You have also agreed that if a pizza is delivered before 11.45 am or after 12.15 pm (a defect), you will discount their next order by 50%. Because your staff gets a bonus for on-time delivery, you are all very motivated to deliver the pizza during the half-hour window.

Here is how Six Sigma, as a measure, could play a part in this simple process. If you deliver about 68% of your pizza on time, your process is only at the 1 sigma level. If you deliver it 99.73% on time, which sounds good, you are operating at only the 3 sigma level of performance. To be a 6 sigma pizza shop, you would need to

have on time pizza delivery 99.9999998% of the time. That is practically perfect. In fact, for every million pizzas you make, you would end up with only three or four late deliveries.

The first step in calculating sigma or in understanding its significance is to grasp what your customer expects. In the language of Six Sigma, customer requirements and expectations are called CTQ (critical to quality).

In the pizza example, one of the key customer requirements is timely delivery; other requirements are likely to be related to the temperature of the pizza, the accuracy of the order, tastiness and so on. In fact, one of the keys of Six Sigma is to understand better and assess how well a process performs on all CTQs, not just one or two.

Companies operating at three or four sigma typically spend between 25 and 40 per cent of their revenues fixing problems. This is known as the cost of quality, or more accurately the cost of poor

quality. Companies operating at Six Sigma typically spend less than five per cent of their revenues fixing problems. Depending on the size of a company and the volume of its production, the dollar cost of this gap can be huge. For example, the gap between three or four sigma and six sigma was costing General Electric between US\$ 8 billion and US\$ 12 billion per year.

Six Sigma uses a handful of proven methods and tools. But the tools are applied within a simple performance improvement model known as DMAIC (Define-Measure-Analyse-Improve-Control).

An important feature of Six Sigma is the creation of an infrastructure to ensure that performance improvement activities have the necessary resources. A small percentage of managers are assigned full time to the identification and execution of Six Sigma improvement projects. They are popularly called Six Sigma Black Belts, Green Belts or Champions. Effectively, Six Sigma has been the first quality initiative to bring line managers into action in addition to quality managers, quality engineers and auditors, allowing them to become Black

Belts, Green Belts or Champions. The requirements are high; for example, a Black Belt should have a college level background in mathematics, know the basic tools of quantitative analysis, and undergo 160 hours of classroom training plus one-on-one project coaching from a Master Black Belt.

National Quality Awards

National quality awards (NQA) play an important role in promoting and rewarding excellence in organizational performance. In the short history of the development of NQAs, three awards have played a key role. They are the Deming Prize (Japan, 1951), the Malcolm Baldrige National Quality Award (United States, 1987) and the EFQM (European Foundation for Quality Management) Excellence Award (Europe, 1992). Many countries have modelled their award programmes on these three awards.

Quality awards are now popular in all parts of the world. For example, there are NQAs in Australia, almost all countries of Latin America and the Caribbean, in the Middle East (Egypt and Israel), in Asia (Hong Kong SAR, India, Malaysia,

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Singapore, Sri Lanka), and in Africa (Mauritius, South Africa).

Some governments have shown strong commitment to ensuring the successful implementation of NQAs. For example, the Malcolm Baldrige National Quality Award and its associated awards were established by the Malcolm Baldrige National Quality Improvement Act of 1987 and the awards are given by the President of the United States. Another example is the National Quality Award of Argentina, which was also established by law and is supported by government funds.

Criteria

NQAs are designed to promote quality awareness, understanding of the requirements for quality excellence, and the sharing of information on successful strategies and their benefits. NQAs typically contain 7 to 10 criteria for performance excellence (with 20 to 30 sub-criteria). The 10 usual criteria elements are as follows:

- Leadership
- Strategic planning
- Customer and market focus
- Information and analysis
- Human resource focus

- Process management
- Business results
- Impact on society
- Resources
- Performance and management of suppliers/partners

For example, the European Foundation for Quality Management (Figure 21) has nine criteria elements which are divided into two categories: enablers and results. The enabler criteria are concerned with how the organization conducts itself, how it manages its staff and resources, how it plans its strategy and how it reviews and monitors key processes. The organization's results are what it achieves. These encompass the level of satisfaction among the organization's employees and customers, its impact on the wider community and key performance indicators.

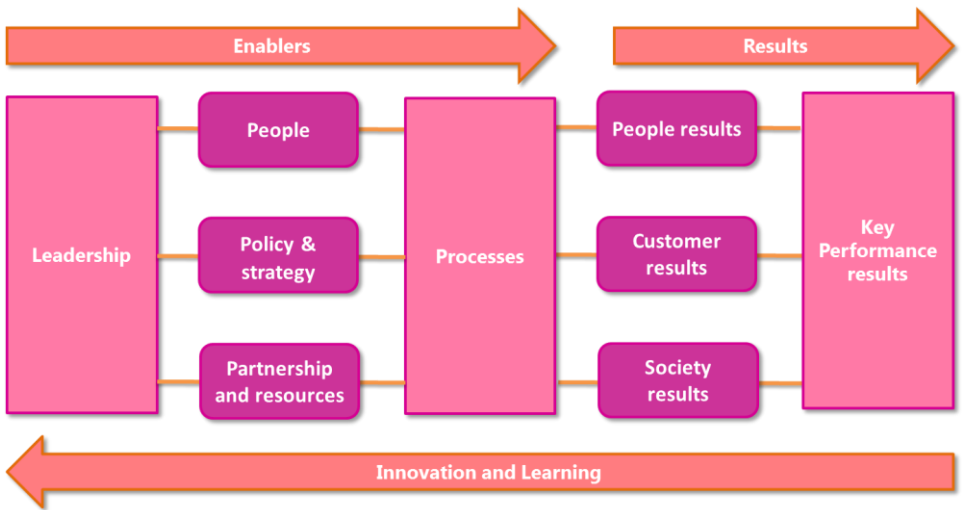
The British Quality Foundation (BQF) has also developed a software tool called 'BQF snapshot' which provides a quick and simple way of finding out how your organization measures up to the characteristics of excellence.

The general assessment process for the selection of the winners of an NQA involves preliminary scrutiny and assessment of the

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applicants' data for preliminary selection, followed by site visits and then final selection by a panel of judges. Feedback reports on the findings of the entire review process, covering among others the applicants' strengths and areas for improvement, are also given to the applicants. The names of the winners are displayed on the website of the NQA administering

organization and the awards are given to the winners in a ceremony which receives huge publicity. Separate awards are given by most countries for different sizes and sectors of industry. For example, in the case of the Malcolm Baldrige Award, the categories awarded include manufacturing, small business, health care, non-profit activities and education.



[®] The EFQM Excellence Model is a registered trademark

Figure 21: The EFQM Excellence Model

SMEs are crucial to national competitiveness and jobs. Several countries/areas have modified their award criteria for SMEs; for example, the national quality award organizations of Australia, Chile, India and Hong Kong SAR have simplified their NQA criteria for SMEs.

SMEs can also apply for an NQA. Such an award will boost the image of an SME on both domestic and international markets.

3. Ethics and corporate social responsibility

What are ethics for an enterprise?

Ethics are moral principles that guide the way an enterprise conducts its activities. The same principles that determine an individual's actions also apply to an enterprise.

Acting ethically involves distinguishing between "right" and "wrong" and then making the "right" choice. For example, companies should not use child labour, not involve in bribery, or deceive consumers and stakeholders.

While making a competitive return for its shareholders, a company has a wider responsibility to treat its employees fairly, minimise any harm to the environment and work in ways that do not damage the communities in which it operates. This is known as corporate social responsibility (CSR).

The key starting point for any business is the law of the countries in which it operates. Most leading companies also have their own statement of business principles which set out their core values and standards. A company should also follow relevant codes of practice that cover its sector. Many enterprises have created voluntary codes of practice that regulate practices in their sector. These are often drawn up in consultation with governments, employees, local communities and other stakeholders.

Why are ethics important for an enterprise?

An enterprise has a great potential to transform people's lives and to alleviate poverty through generating economic growth. It produces goods and services that customers want and it creates jobs for people. It contributes to

government revenue by paying taxes to finance schools, hospitals and other public services.

The enterprise has also to be in tune with the wishes of the societies it serves or it runs the risk of alienating its shareholders, stakeholders and customers. This would be bad for its business, reducing growth and potentially affecting profit.

The objective of CSR is to contribute to sustainable development and it is a good strategy for doing business.

Setting goals for sustainable development

Many companies set goals every year for sustainable development. These goals may include:

- working with reduced accidents;
- eliminating occupational diseases;
- increasing diversity in the workplace;
- improving employees' welfare;
- increasing the benefits of local communities;
- reducing their carbon footprint;
- increasing energy efficiency.

By working towards these goals, a company attempts to gain a competitive advantage. Through the demonstration of a more caring and sustainable approach, the company may be able to differentiate itself from rival companies and becomes a partner of choice for the government and the local communities.

Assessing corporate social responsibility of an enterprise

There are different indicators for assessing the level of CSR for an enterprise and these may include the following:

- Has the enterprise publicized a Code of Conduct/Ethics?
- Are the enterprise's conflict of interest guidelines publicly available to investors?
- Does the enterprise make it clear who the designated Ethics/Compliance Officer is?
- Does the enterprise have a whistle blowing process implemented and is it easily accessible?
- Does the enterprise publish a CSR or sustainability report?
- Is CSR one of the company's core corporate principles or business objectives?

Corporate Social Responsibility and ISO 26000

The International Standard ISO 26000 provides guidance on how businesses and organizations can operate in a socially responsible way, i.e. acting in an ethical and transparent way that contributes to the health and welfare of society. It is applicable for all types of organizations and is based on 7 principles, 7 Core subjects or requirements, with a total of 37 potential issues to be addressed by an organization. The latter has to identify which issues are relevant and significant for it to address in prioritized way, through its own consideration and through dialogue with stakeholders.

The 7 principles

The seven principles of ISO 26000 as shown in Figure 22 include:

Accountability: Companies are answerable for decisions and activities and their impacts on society, the economy and the environment.

Transparency: Openness about company's decisions and activities that impact on society and the environment.

Ethical behaviour: Companies actions are based on accepted principles of right or good conduct.

Respect for and consideration of stakeholder interests:

Company takes into account the rights, claims and interest of all stakeholders

Respect for the rule of law:

Company is in compliance with all applicable local laws and regulations.

Respect for international norms of behaviour:

Company is in compliance with international guidelines and codes of conduct.

Respect for human rights:

Company respects and foster the rights covered in the international Bill on Human Rights.



Figure 22: 7 core subjects in social responsibility

4. Conclusion

Conformity to customers and regulatory requirements is a must for market access, but not adequate for the long-term survival of the enterprise.

Competition is becoming fiercer. Long-term survival requires a zero defects approach and demonstration of a good corporate social responsibility.

Enterprises can do well by doing good! They can differentiate their brands and reputations as well as their products and services and attract top talent if they take responsibility for the protection and future of societies and environments in which they operate. A combined quality and social responsibility effort offers a holistic solution to strengthening the triple bottom line of people, planet, and profit.

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4. 'Standards Map' www.standardsmap.org, ITC