13.1. The concepts

13.1.1. Introduction

There are many concepts concerning quality as we will see. Quality has evolved over the past 100 years starting with the inspection of the products and now developing into a global concept called Total Quality Management. The aim of this chapter is to give an idea of the different concepts, of their evolution and of the tools used to manage quality.

Let us consider a case : a Japanese manufacture calls back 3 types of television because there is a risk to be electrocuted when touching the aerial.

According to the available information, the risk of electrocution is due to a defective component manufactured by a supplier.

We have here a quality problem. What are the different types of costs ensued from such a problem ?

- Communication costs : to whom will you address the information ? To the customers of one country, of several countries ? In how many newspapers ?
- Dispatching costs from the customer to the repair service and redispersing costs.
- Repair costs :
  - Dismantling
  - Reassembling
  - Testing
  - Cost of the spare parts
- Commercial costs :
  - debasement of the image
  - the firm will lose customers
That first anecdote illustrates a traditional quality view: the product does not meet the required specifications.

A second story illustrates a new quality view. Everybody has heard about the new Swatch car. It is a two-seater car conceived by Mercedes in cooperation with Swatch, the Swiss manufacture of watches.

The idea is not to sell a car but a service to the customer. What the customer wants is not a car, he just wants to be able to go from one point to another easily, without timetable constraints, no matter if it rains, in a vehicle where he can put documents, luggage, computer, and so on.

He needs such a means of transport to go to work every day and also to go on holiday once or twice a year, with his wife and children. The idea is to sell to the customer a package including:
- the availability of a Swatch for 11 months for example;
- the availability of a Mercedes for the holidays and some weekends.

This is an example of total quality management applied to the design of the service (it is no longer a product) you will put on the market.

What do you think about that? Is it a quality-related problem according to your idea of quality?

As you see, there are different points of view regarding the concept of Quality.

13.1.2 The quality views

There are 3 quality views:

The Psychologically-related quality view deals with the way the customer perceives quality. It is particularly important in services.

The Process-based quality view focuses on the way the product is produced.

The Product-based quality view emphasizes the fact that the product meets the specifications.

The underlying basis for these 3 quality views is Garvin’s 5 quality bases: Garvin is a professor at Harvard Business School. He developed a number of contributions that greatly influenced the quality management theory.

He developed what he called the 5 quality bases.
Transcendent
It is the personal, subjective view an individual has towards an object. An Alfa Romeo can be a very good car for somebody and a bad one for another customer. Fashion, taste and status play an important part in this dimension of the quality.

Product-based
Here quality is determined by a set of measurable variables of attributes.

User-based
Quality is solely determined by the user.
Users have different wants. The product is a quality product if it fulfils the user’s needs even if it does not meet all the specifications.

Manufacture-based
In this case, the focus is internal: it applies to the design specifications. The quality is related to the manufacturing strategy that seeks to ensure that deviations from the design specifications are minimized. This strategy is characterized by a quality increase (less deviations) and by a focus on lower costs.

Value-based
This view is related to the fact that many customers assume that there is a positive correlation between quality and price.

To end this introduction to the concept of quality, it can be useful to add to these 5 quality bases the factors that affect the way customers perceive quality.

These factors are described by Garvin as follows:

Performance
Primary operating characteristics.

Features
Secondary characteristics such as a radio or warming seats, air conditioning, and so on.

Reliability
Ability to perform as expected over a period of time, measured with parameters such as MTBF (Mean Time Between Failure).

Durability
This factor is related to reliability but can include the problems of warranty, repair, downtime.

Serviceability
Use of service, availability, costs, and so on.
Aesthetics

Perceived quality
Reputation could be a translation of that notion.

Conformity
This factor used to be the central theme in quality management until recently. This is also the main theme in the application of the quality management standards such as ISO 9000. It is the degree to which a product’s design and operating outcomes meet the developed standard.

Garvin's eight factors are perhaps too numerous and some can be interrelated. The important thing is to understand that there are different quality views, that the way a customer (or a market) appraises quality can differ from the way another customer appraises it, that the concept of quality has evolved and that there are factors that affect a customer's perception of quality.

13.2. Quality management era

As we have seen, conformity used to be the central theme as regards quality management. It is thus normal that the first activity related to quality was to control and more specifically to inspect. Inspection enables you to verify if a product meets the specified criteria. We will therefore begin our course about the evolution of quality and quality systems with a chapter about Quality Control. You have here a synthesis of this evolution.

Quality management era:
Inspection
Control
Quality Assurance
Total Quality Management

It is important to notice that evolving from an era to another does not mean that the concepts used in the first era are no longer useful in the second one. That is the reason why it is interesting to tackle quality that way.

13.2.1. Inspection

13.2.1.1 Inspection of the finished products
The first concept of quality control focuses on the finished product. The customer ordered a product which has to meet an amount of specifications. Before delivering the product, the manufacturer wants to check if the specifications are met.

A lot of characteristics must be controlled.

There are different types of characteristics. With measurable characteristics, it is easy to determine whether a result is acceptable or not. It is different in the case of attributes and this creates an area where statistics may need to be applied in order to provide an effective means of evaluation.

Measurements and attributes

The classical inspection situation involves the measurement of something: height, weight, diameter, voltage, and so on.

But in many instances, such measurement is either not necessary or impossible. For example, a light bulb either works or not - we do not necessarily have to measure the number of lumen. Sometimes a "go – no go" approach can be used instead of exact measurement. The type of result is an "accept/reject" decision for each part.

Taking a sample or even testing each item enables us to record the number of defective parts versus the number of acceptable ones.

In the case of attributes, we do not longer plot the evolution of the averages of small samples but the percentage of defaults in samples (p chart instead of X and R chart).

Other example of attribute: delivery of a package within the lead time that has been promised. The attribute is delivery within 12 hours or not.

The aim of the control of the finished product is to accept or reject the product.

When craftsmen were the only producers of goods, they carried out inspections at every stage of the product manufacture. Items were handmade, produced in small quantities and the craftsman was responsible for the outcome of his work.

All this changed with the increasing production requirements and the development of technology. The increase of automation, standardization and division of work resulted in deskilling the craftsman’s job.

Specifications for the work process and job descriptions were edited, mechanics and technicians were appointed to ensure that the machinery and
equipment were maintained to remain effective. Inspection of finished items became the norm.

The defects were not accounted for until they were inspected at the end of the line. The added value given to the item with the defect is thus wasted and adds costs to the production process.

What was done to make the inspection of parts coming continuously from the production line possible? Some kind of measurement system - jigs, fixtures and gauges - was required. These were support tools that helped to manufacture products. The measurement devices were essential for a relatively quick analysis of the items produced.

Errors were frequent. Even in the best organizations, some items were defective. To ensure that this did not prevent customers from getting their product, large-scale inspections were required - every produced item was inspected and either accepted or refused. The power therefore shifted, being no longer held by front-line staff – as in the craftsmen era – but by the inspection staff in this era of scientific management.

Two examples to illustrate this:

The first one deals with the overhaul of combat vehicles in the eighties. The gearbox of those vehicles was also overhauled and an inspection was carried out after the reassembly of the box. But it frequently happened that a vehicle was refused after the final inspection because of an oil leak coming from the gearbox. This defect is very important and dangerous because oil projections on the brake discs can cause safety problems and such a vehicle without brakes is – as you may imagine – very dangerous. It is possible that another approach of the overhaul process of the gearbox or a better test after the reassembly would have prevented the oil leak appearing during the final test.

The cost of such a defect is actually very high as it necessitates the dismantling of the power plant and of the gearbox, a repair, a new test, the reassembly of the vehicle, a new drive test, and so on.

Second example: if a component must have a specific dimension, for instance a diameter of 10 cm plus/minus 0,1 mm. It is easier to have two gauges: one with a hole having an internal diameter of 10,011 and one with a hole having a diameter of 9,089. Each component must be able to pass through the largest hole but not through the narrowest.

These tests are called « GO – NO GO ». It illustrates the use of gauges and scientific management.
13.2.1.2. Inspection during the production process

To avoid waiting until the product is finished to detect defects that could have been detected during the manufacturing process or even before the beginning of the process, the inspection process evolved. Raw materials and components were inspected and control operations were introduced at the end of the different manufacturing stages.

Let us again take the example of the overhaul and repair of a light combat vehicle and let us see how the control was organized to try to understand what happened. Although the control during the overhaul process of the gearbox was sufficient, there used to be another control during the overhaul process of the vehicle, after the reassembly of the gearbox in the vehicle. We were at the beginning of the era of quality control and a department of the organization was dedicated to that mission.

To repair corroded plates, it was necessary to have new aluminium sheets. That is an example of raw material that was inspected either after delivery, or in the workshop of the vendor.

Components were also needed such aerials, seats, radios, and so on.

For each component and raw material, an inspection method had to be determined. In order to be able to establish the inspection method, to choose the measurement method and tools, to collect the drawings, the standards, the documentation about the specifications that the components must meet, the description of the manufacturing stages, it was thus necessary to have an administration and a « methods » section.

In order to measure some dimensions such as the cogs of a gear wheel, the impedance of an electrical device or characteristics such as the tensile strength, to find inclusions in an alloy, to be able to analyse an alloy, special instruments and tools are required. The «metrology» section is responsible for the acquisition, the maintenance and the periodic calibration of these tools.

Some measurements that have to be very precise must take place in a lab for instance because one needs a very sophisticated optical means or ultrasonic equipment. Other measurements can take place in the workshop but the tool must be kept in the metrology section because there is only one tool used for different purposes for instance, or for other reasons such as periodic calibration. Soon the metrology section has thus also a function of inventory control for all the gauges, jigs, fixtures and tools needed for the inspection operations.

The laboratory where the materials are tested can be a part of the metrology section. The mechanical, physical and metallurgical characteristics of the different materials are controlled here (tensile strength, analysis of an alloy, inclusions in the alloy, test concerning the roughness, hardness, and so on.).
The components delivered by suppliers must be inspected before becoming part of the inventory. When parts are delivered, the metrology section is called in order to start controlling the parts.

The parts that are rejected must be kept away from the stock available for production and sent back to the supplier. That is the mission of the « supplies acceptance » section.

Statistical data must be recorded regarding the percentage of defects in order to have an idea about the reliability of the different suppliers. This provides very useful information for the section in charge of purchases.

An important section is the section in charge of the controls in the workshop, after the different manufacturing stages.

A good analysis of the production process is the underlying basis for the choice of the moments when an inspection must be carried out during the production process. For each inspection operation, a check-list with the different points to examine must be established. Besides the different points to control, the check-list also indicates the tolerances, the inspection conditions and all the necessary information. The final control of the finished product is part of the mission of this section. It can take place in the workshop, on a testing bench or on a special track.

The management of those testing benches to test the power of engines for example or of the special tracks for drive tests is also a function that must be fully filed by the quality control department.

If the department is to organize the work of each member of the control department, to know when and where a control must take place, to schedule the interventions, the measuring, the receipt operations, it is obvious that it must have a planning section.

The information needed by this section is the production programme, the description of the production process.

Very narrow links must exist between the planning and the methods because the workload depends on the control methods.

As you can see, the Quality Control department in a big manufacture can be a very important one. In the era of quality control, the distinction between the production function and the quality control was thought necessary. The head of the quality control had to be independent of the manager in charge of the production. The personnel was dedicated to the quality control department. The best workers were selected and trained to become controllers. But there were also specific jobs
such as lab assistant for the measuring, the analysis, the calibration operations, and so on. Specialized staff was hired for these jobs.

You see on the figure below an example of organization chart for a quality control department.
13.2.1.3. An evolution from the inspection of 100 % of the products to Control by sampling

It is not always possible to inspect each finished product because it is too expensive or because the inspection process requires the destruction of the item to inspect.

If you have to inspect a lot of cartridges for example, you cannot fire all of the cartridges to make sure they are good.

A solution exists for those problems : sampling.

Sampling is the process of evaluating a portion of a batch of products in order to decide whether to accept or reject the whole batch.

Acceptance by sampling bears some risks such as greater administrative costs and less information about the total production than could be gathered by a 100 % inspection. However, sampling can provide greater assurance if it is supported by the use of statistics in order to develop sampling plans.

The problem is that if you make a sample-based decision for the batch, the risk of error is considerable.

The theory of statistics is used to define the sampling plan and calculate tables in order to minimize the risks of error.

The underlying principles concerning tables are the following ones : the 2 types of errors that are possible when deciding on a sample basis are either accepting a batch that is actually unacceptable or rejecting a batch that is good.

The first risk is called the risk of the consumer, the second one is called the risk of the supplier.

The possibility that one of these errors occurs can be reduced thanks to the selection of the sample size.

It is an obvious fact that the larger the sample, the lower the risk of error.

Acceptable probabilities of coming to an incorrect conclusion are determined:
- the probability of not accepting a batch that is actually acceptable is usually set at 5 %,
- the probability of accepting a batch that is definitely not acceptable by the consumer is usually set at 10 %.
According to these probabilities, the percentage values of defects that are considered to be acceptable or not must be defined: these values are called AQL – Acceptable Quality Level – and LTPD – Lot Tolerance Percent Defective.

These values form the points on a curve – called the operating characteristic curve – that displays the probabilities – for a certain sample size and an acceptance criterion (Ac) – to accept a lot according to the actual percentage of defective products (which is unknown) in that lot.

Thanks to trial and error and extensive calculations, it is possible to find a sample size and an acceptance criterion Ac that provide an OC (Operating Curve) with the desired probability values of acceptance:

\[ 1 - \frac{p_a}{x = AQL} = \alpha (5\%) \]
\[ \frac{p_a}{x = LTPD} = \beta (10\%) \]
Tables are available with the results of those calculations. The best-known tables are Mil STD 105 D.

In practice, the user needs to know the batch size, the AQL (Acceptable Quality Level) and the desired level of inspection to easily determine the sample size and the acceptance criterion (the number of defects in the sample will determine whether to accept or reject the batch).

In the case of our OC, if the customer uses the sampling plan corresponding to that OC, he can say that the probability of accepting the batch with an actual defect percentage of \( p_1 \) is 65%.

We will try to understand that with an example:
- batch size of 20,000 - AQL = 4% General inspection level: code letter M
- sample size for M = 315
- AQL : 4% Ac = 21
- R = 22

<table>
<thead>
<tr>
<th>Lot or batch size</th>
<th>Special inspection levels</th>
<th>General inspection levels</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>s - 1</td>
<td>s - 2</td>
</tr>
<tr>
<td>2 to 8</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>9 to 15</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>16 to 25</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>26 to 50</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>51 to 90</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>91 to 150</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>151 to 280</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>281 to 500</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>501 to 1200</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>1201 to 3200</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>3201 to 10000</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>10001 to 35000</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>35001 to 15000</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>150001 to 500000</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>500001 and over</td>
<td>D</td>
<td>E</td>
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</tbody>
</table>
The single sampling plan
Here a random sample is taken from the batch of products. If the defect rate is equal to or less than the acceptance number (Ac) for the sampling plan, then the batch is accepted. However, if the defect rate is higher than the acceptance number, the batch is rejected.

The multiple sampling plan (double)
The random sample is smaller than in the case of a single sampling plan.
The plan gives two levels for the acceptance number Ac: if the defect rate < Ac1, the batch is accepted. If the defect rate is > Ac2, the batch is rejected. If the defect rate is between Ac1 and Ac2, a new sample must be taken.

Two remarks to conclude this chapter:

1) We have so far dealt with either accepting or rejecting a batch. But there are other alternatives than sending it back. It is possible to test each item and thus separate the good items from the defective ones. Corrective action can be taken.

2) The concept of acceptable quality level is no longer compatible with the philosophy of TQM (Total Quality Management). In the era of TQM, the objective is zero defect. But it is not always possible to reach zero defect and not every company will implement TQM.

Sampling is thus always interesting to know.

13.2.2. From inspection to control system
According to me, the evolution from an inspection to a control system is characterized by the introduction of the process control.

Up to now we have seen how it was possible to verify if the products delivered by a supplier are to be accepted or rejected.

The aim of the control was: accept or reject the product.

A step toward a quality-oriented system is made when you know why a product is rejected and try to improve the process.

One of the first tools introduced to control the processes is again a statistical one: it is the Statistical Process Control (SPC).

It is a tool that enables to know whether a defect is due to common causes (chance causes) or to assignable causes. Deviations due to common causes are differences due to small changes concerning the material, temperature, humidity, and so on.

For instance, if you fire 100 times with the same gun, in the same position, on a distant target, all the impacts will not be found at the exact same place. You will have
a dispersal of the impacts. A constant cause (the gun that fires in the same circumstances) produces results that may vary in a considerable or small way.

Assignable causes are causes such as fluctuation in line voltage, tool wear, miscalibration of the equipment, material purchased from another supplier, error of the operator.

When a deviation is due to an assignable cause, the aim is to find the cause and eradicate it. When a process output is only affected by chance causes, then the process is "in state of statistical control" or "in control". However if assignable causes affect its output, the process is "out of control".

The only way to know if assignable causes are affecting outputs being the checking of that output, we will need to use some identification method when a process that was under control has gone out of control.

SPC is that method, it uses a tool called control charts to report the results of the output measurements.

A control chart is a graphical display of a quality characteristic that has been measured or computed from a sample versus the sample number or the time.

Limits can be drawn regarding the display : for example, acceptance tolerances for a dimension, a weight, and so on.

It is obvious that for the purpose of process control, the calculation of the limits will be based on the distribution of the process results.

When the variation of the results is due to common causes only, the distribution of the results is stable and the process shows stability. This means that the same percentage of the varying results continues to fall between any given pair of limits.

The probability theory is the basis for determining the Lower Control limit and the Upper Control limit in such a way that if the measures fall into the range between those limits, the process is under control. There are again formulae and tables that give the values of those limits versus the sample size for measurements. The results are plotted on 2 charts : a X bar chart and a R chart.
On the X chart, the worker plots the averages of small samples of measures and on the R chart, he plots the range between the largest and smallest measures of the sample.
Example: control of a machine filling 25 cl soft drink bottles.

For attributes, he plots the percentages of defects found in the small samples on the graphic. It becomes a p chart, also with an upper and lower limits.

Example: errors made per 100 transactions in a bank.

If the points are between the limits, the system is under control and the variations are assignable to chance causes.

The process is said to be in statistical control because it behaves like a constant cause system producing results showing stability.

If a larger difference is observed, that is to say if a measure falls out of the control lines, the production must be stopped and the cause detected in order to prevent producing outside the set production limits.

Other indications are also causes of concern and require further investigations:
- successive points near a limit;
- series of points above or below the average;
- series of points showing a trend upwards or downwards.

Process capability essentially deals with the ability of a process to consistently deliver products respecting the designed specifications.

<table>
<thead>
<tr>
<th>UCL (Upper control limit)</th>
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<tbody>
<tr>
<td>SPEC +</td>
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<tr>
<td>SPEC</td>
</tr>
<tr>
<td>CL (Centreline)</td>
</tr>
<tr>
<td>SPEC-</td>
</tr>
<tr>
<td>LCL (Lower control limit)</td>
</tr>
</tbody>
</table>

Process control means evaluating a given process, determining the causes of quality-related problems that affect its control and suppressing them. Primary control (bringing a process into a stable state) and secondary control (improving the process) are techniques that are coherent with the quality improvement philosophy.

An important difference compared with the era of quality control by inspection is that the control is no longer a responsibility of specialized personnel. It becomes the
responsibility of the worker who is working in that line. This worker must be trained to take measurements, to plot results on a graphic display, to make decisions when results show a risk of going out of control.

13.2.3. From Quality Control to Quality Assurance

From inspection to process control, the quality system for produced goods evolved from procedures to test the quality level to procedures to correct the causes of defects and thus improve the system.

The quality control has also known an evolution tending towards quality assurance regarding raw materials and goods delivered by suppliers.

Instead of waiting until the supplies are delivered, it is better to control the conformity of the supplies in the supplier's workshop as it is easier to rely on the quality system organized by the supplier.

The customer can be assured that his supplier has a system that organizes the production and controls in a reliable way.

In order to be sure that he may rely on that system, the customer will set standards that must be met by the supplier's quality system. These standards can be set on a bilateral basis but national and international standardization organizations developed standards.

13.2.3.1. The ISO 9000 series

The best-known series of documents describing standard requirements for quality systems is the ISO 9000 series.

It is not a standard to manage the quality of products, as it is management and process-oriented.

It is a series of standards designed to provide a guide for the systematic carrying-out of quality-related activities in an organization.

More and more, organizations certified that they respect the standard ensure that they are supplied by an organization which is also certified to produce in accordance with the standard. This creates an overwhelming pressure for suppliers to become certified.

The ISO 9000 series is composed of a few parts. The scope covered by the different parts is different as, for instance, ISO 9003 only deals with final inspection and testing whereas ISO 9001 is comprehensive as it covers processes from the design to the after-sales service.
You can see on the figure below the respective scopes of the different parts of ISO 9000.

ISO 9001 Model for QA in design/development, production, installation and servicing

ISO 9002 Model for QA in production and installation

ISO 9003 Model for quality assurance in final inspection and testing

ISO 9004 Quality management and quality system elements – Guidelines

The scope of the ISO 9001 part is a very broad one and the company that meets the requirements of ISO 9001 reaches the level of what is now called the Company-wide quality control or Total quality control.

The quality system elements of ISO 9000 are described below.

1. Management responsibility which is inclusive of:
   - Quality policy
   - Organization
   - Responsibility and authority
   - Verification resources and personnel
   - Management representative
   - Management review
   - Quality system
   - Contract review

2. Design control which is inclusive of:
   - General requirements
   - Design and development planning
   - Activity assignment
   - Organization and technical interfaces
   - Design input
   - Design output
   - Design verification
   - Design changes

3. Document control which is inclusive of:
   - Document approval and issue
   - Document changes/modifications

4. Purchasing which is inclusive of:
   - General requirements
   - Assessment of subcontractors
- Purchasing data
- Verification of purchased product
- Purchaser-supplied product

5. Product identification and traceability

6. Process control which is inclusive of:
   - General requirements
   - Special processes

7. Inspection and testing which is inclusive of:
   - Receiving inspection and testing
   - In process inspection and testing
   - Final inspection and testing
   - Inspection and test records
   - Inspection, measuring and test equipment
   - Inspection and test status

8. Control of non-conforming product which is inclusive of:
   - Non-conformity review and disposition
   - Corrective action

9. Handling, storage, packaging and delivery

10. Quality records

11. Internal quality audits

12. Training

13. Servicing

14. Statistical techniques

13.2.3.2. Procedure to become certified

We have earlier stated that quality assurance was depending upon an agreement between the customer and the supplier as regards the procedures for conducting quality-related activities. When customer and supplier rely on an international standard such as ISO 9000 to be the reference as regards the evaluation of their quality system, they need a third party to assess if the system is in accordance with the norm, in order to be certified.

The certification is thus generally a two-step process: the first step is an internal assessment.

Prior to the third party certification, the quality policy, procedures and detailed work-related instructions of the organization are written down and published in its
quality manual. One of the certification requirements is that the organization must ensure that its quality system complies with these procedures and work-related instructions: for instance, the actual behaviour of individuals within the organization must be reported in the quality system documentation. This reduces the likelihood of non-compliance that becomes obvious during the second party (rare) or third party assessment anyway.

This process is known as first party assessment or internal audit. Such internal audits must be carried out by staff that has effectively been trained for these quality audits. If it is necessary, an outside auditor may be appointed. The results of the audit are fed back into the quality management review process. A quality management review must be seen as being part of the continuous improvement process. If internal audits locate a non-compliance, then changes in procedures or work instructions may need to be addressed and implemented.

### 13.2.3.3. Accreditation

Not any type of organization may deliver a certification of conformity to the ISO norm. A procedure must take place in order to ensure that the standards are met by certification bodies.

In each country, an agency or a council must be created in order to give the status of certification bodies and to control if the bodies that are accredited continue to respect the standards.

EN 45012 is a norm that sets out the criteria to be met by a certification body seeking accreditation.

At the end of this chapter dealing with quality standards, it is useful to add that an important issue concerning certification and accreditation is the scope of the activities covered by the process (of certification or accreditation).

By "scope", we refer to the work stages or work places that are to be certified.

A supplier can seek certification for a product line, a department or a specific physical entity. It can occur when a company wants to become certified step for example. Moreover certification can be given for the production of goods or for the construction for instance, and not for education or training. It is therefore important to check if a supplier is certified by a body that is accredited by the authorized agency and if the certification body has operated within the accredited scope.

### 13.2.3.4. Auditing to ISO 9000

Companies that want to keep on meeting the ISO 9000 criteria have to organize quality audits. A quality audit is an independent examination that determines whether quality activities and results comply with the planned arrangements and whether these arrangements are effectively implemented and likely to achieve the objectives (ISO
The main purpose of a quality audit is to evaluate the conformity to the adopted standard. It is not an output quality audit but an audit of the processes, system, management, documentation, and so on. The result of the audit must be assessed and interpreted in order to take corrective actions. The audit should preferably be carried out by an independent person who has been trained as auditor. It is actually important to train people in auditing processes, as it is the main activity to maintain the quality management system. Interpretation skills of the standard and of what is actually carried out in the field are developed thanks to the generated experiences. These skills will ensure that the system is properly tested and that reliable data are recorded in order to support the statistical approaches. The detected inadequacies, the opportunities to improve the procedures and processes should be discussed during the management reviews.

There is a need to document the planning and progress of the audit. This leads to the development of a plan that includes the full scope of the audit schedule, the choice of the staff, the documentation and record of observations, the determination and implementation of corrective actions and the record of the audit results.

When auditing, the human relations aspect must be taken into account in order to optimize the workers' collaboration and motivation to implement the corrective actions.

Auditing must be seen as a means to improve the system and not as a means to blame the people in charge.

13.2.3.5. Other quality-related standard : ISO 14000

Managing the environmental repercussions of products and services has become one of the concerns of a quality-oriented system. The new series of standard – the ISO 14000 standard – provides a means to systematically deal with the health, safety and environmental aspects of the production.

The standard requires the creation and update of 3 manuals : the Environmental Management Manual, similar to the Quality Management Manual, the Register of Environmental Regulations and the Register of Environmental Effects that deals with the impact of the site on the environment.

A manager, who can be the same as the one in charge of the quality management, will be appointed to update the manuals and check the conformity to the standard. Certification and accreditation procedures similar to those used for quality will be developed in the coming years.

13.2.4. Quality Development by TQM (Total Quality Management)

Where as quality had a narrow perspective in the past – as it was a field for specialists – , it now has a much broader one thanks to quality assurance. Quality became a system. The quality system was the whole of the resources, processes and procedures, organized in such a way that quality had to be assured at the manufacturing place.
Quality audits were designed to provide evidence of the integrity of the production systems by an independent organization.

But it seemed necessary to go further as regards quality in order to be able to face the world-wide competition with a competitive advantage. This was the basis for the transition from the period of quality assurance to the period of Total Quality Management. Let us notice that the need for a company-wide quality control was linked to the introduction of JIT (Just In Time) as a new production philosophy. If a spare part or a component is delivered just when you need it in the production process, it is obvious that it must be of a good quality. If it is not, the process is stopped because there is no stock. It is therefore very important to do things in the right way straight away.

What is TQM?

TQM is a philosophy that seeks a continuous quality improvement of all processes, products and services of an organization. It is a company-wide commitment to become the best in one’s activity.

The successful implementation of TQM requires the commitment of the top management and the use of some experts' knowledge. These experts may be specialized in quality auditing and in the management of changes in the organization.

TQM is not a panacea for all productivity or quality problems but it can provide the framework for essential changes. Keywords related to TQM are: customer, learning organization, innovation, continuous improvement, teamwork. The problems raised by implementing TQM are considerable and need to be put early. One of those problems is the reaction of the middle management that may dislike the implications ensuing from the adopted changes for their job security and for their position towards their subordinates because TQM gives empowerment to the basic workers of the organization. It is one of the reasons that confirms the importance of the commitment of the top management.

TQM requirements:

1. Visible organizational values, principles and standards, which must be accepted by everyone
3. Clearly developed customer/supplier (internal/external) requirements.
4. Demonstrated ownership of all processes and their relative problems.
TQM requires 5 system elements. These are process, technology, structure, people and task.

Process includes all the processes in the system: design, control, production management, administration, and so on…

Technology includes any item, component or article needed to carry out the task, including the resources of the information system such as computers, the architecture of the information system, and so on…

Structure includes the organizational chart that describes the responsibility of each level and the individual responsibilities, the formal and informal communication channels.

People includes education, training, cultural changes, and so on…

Task includes quality issues, job functions.

13.2.4.1. Implementation

There are several issues to be considered before implementing TQM. Some of those require an attitude of commitment and cooperation, especially from the top management, and a willingness to experiment and tolerate errors, and to be flexible towards everyone in the organization. If these positive attitudes do not exist, then the top priority of management must be to create a cultural change in order to arouse them. Cultural change and communication about the TQM principles and practices must be the pillars supporting the implementation of TQM. The first issue is thus management commitment to achieve the cultural change and introduce a positive attitude.

Other critical issues for that implementation are discussed below:

Education

The need to adopt TQM company-wide is paramount. It is the reason why some writers call TQM company-wide quality control. If TQM is not company-wide, there will be differences in working processes from one department to another. Communication and corporate culture may therefore suffer. The top management must implement quality by developing a company-wide cultural change that includes the training to use statistical tools such as SPC (Statistical Process Control), sampling and other tools such as flow charts, systematic problem analysis, and so on…

The function of quality planning must be fulfilled.

It includes:
- an environmental analysis:
  SWOT (Strength Weaknesses Opportunities Threats) analysis
analysis of existing strategic and operational plans
- a quality mission
- a quality policy
  The development and writing of the quality policy needs to be accomplished and communicated to everyone in the organization.
- the appearance of strategic quality aims based on historical data, the evolution of the customers and competitors
- the drawing-up of action plans concerning quality
- the implementation of a quality strategy:
  - education and training, participation, cultural change, technology, processes,
  - reward structure, organization, and so on...
- the monitoring and evaluation of quality performances
  Generating data to measure quality performances is crucial. An audit is needed at this stage for the formal review of quality-related performances.

One tool available for the planning function is bench-marking. Bench-marking means comparing your performance to those of other departments (internal bench-marking) or companies (external or cross-industrial bench-marking). If their performances are assessed to be better than yours, then you can take advantage of the information you have about how these companies achieve those results in order to improve your processes, strategies, and so on...

*It is necessary to build a structure that helps the management to implement TQM.*

A Quality Council (QC) has to be set up as the steering committee for the activities improving quality. It has to get reports from Quality Planning Teams (QPT) and Quality Improvement Teams (QIT). The membership of QPT must be composed of experts in quality and planning matters and representatives from each department. QPT must be cross-functional teams. The quality policy is to be translated into realistic planning aims for each department. Members of QIT must be selected, based on problem-solving requirements for the given task, they must plan the quality improvement programme.
Each member should contribute with creative ideas and effectively use problem-solving techniques such as graphs, charts, flow charts, Pareto analysis, cause and effect diagram, and so on...

*13.2.4.2. The measurement of quality and quality cost*

Another important aspect is the ability to measure quality: it is necessary to collect data in order to be able to compare a new situation to an older one so that we know the impact of a corrective action. Estimating the cost of quality will ensure that management attention is paid to the confirmed process improvements. Quality successes should be communicated in regular meetings. The corrective actions taken must be documented and communicated to other QIT in the organization.

Flexible, multiskilled individuals, a more regular relationship with satisfied customers, a better competitiveness and a larger market share are the benefits you get from the application of TQM.
TQM also offers the ability to change the use of manpower inspecting the end of line production to line inspection during manufacturing operations.

13.2.4.3. Total Quality Management in marketing and design

It could be possible to give a course on the different functions in a company, showing how the principles of Total Quality are applicable. We will limit ourselves to a few words about two functions related to a very important thing: the customer's needs.

Quality of Design:
The conformity to the customer's needs can be enhanced by a narrow collaboration between design and marketing. The marketing is in contact with the customer. It can feel how his needs evolve and which kind of added value can be offered.

The figure below illustrates the relation between most of the departments of an organization during the design phase of a new product.
## Relationship between product design and the functional areas of an organization

<table>
<thead>
<tr>
<th>Phase of Product Development Cycle</th>
<th>Participants</th>
<th>Management Information Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Assessment</td>
<td>Marketing: Market Investigation Estimation of volume and price</td>
<td>Engineering: Interpretation of technical data and participation in technological forecasting</td>
</tr>
<tr>
<td></td>
<td>Operations: Understanding of production economics and environmental issues</td>
<td>Suppliers: Description of the financial status of the organization</td>
</tr>
<tr>
<td></td>
<td>Finance: Classification, organization and tabulation of information at all levels of product development.</td>
<td></td>
</tr>
<tr>
<td>Engineering and economic Analysis</td>
<td>Engineering: Analysis of needs Initial product and process design</td>
<td>Operations: Preliminary feasibility study for production</td>
</tr>
<tr>
<td></td>
<td>Development: Design changes Prototype construction Final product design changes Process selection</td>
<td>Suppliers: Input to the design of product and process</td>
</tr>
<tr>
<td></td>
<td>Development: Preliminary production plans</td>
<td>Finance: Preliminary financial analysis: return on investment, payback</td>
</tr>
<tr>
<td></td>
<td>Development: Assistance in prototype construction</td>
<td>Accounting: Data for cost estimation</td>
</tr>
<tr>
<td>Final planning</td>
<td>Final marketing strategy Development of a distribution system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final marketing strategy Machine selection Layout Supervision of equipment installation</td>
<td>Planning to acquire resources for full-scale production</td>
</tr>
<tr>
<td>Launch</td>
<td>Initiation of marketing Continuing product and process improvements</td>
<td>Final analysis of return Capital formation</td>
</tr>
<tr>
<td></td>
<td>Initiations of production</td>
<td>Reviewew of feasibility of final plans</td>
</tr>
<tr>
<td></td>
<td>Follow-up evaluation of profit performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collection of actual cost data</td>
<td></td>
</tr>
</tbody>
</table>

That is a new concept and a trend in quality-oriented organizations.

The marketing department and the staff in charge of the design in the other departments must collaborate efficiently.

The customer’s needs are translated into marketing requirements. The engineering department translates the marketing requirements into technical characteristics that the department in charge of the operations translates into manufacturing processes and specifications concerning the components.

It is important to notice that it is not a one-way process. Feedback must be given at every stage, for example to suggest a little change in order to use a standard component instead of a special one because it is cheaper, and so on.

To know the customer's requirements is essential for the internal customer as well as for the external one. The job descriptions conceived in order to satisfy the external customer and the internal one who follows in the process are more effective than older ones. It is more difficult to know who the external customer is. A process of market segmentation must be implemented in order to select the customers we can satisfy.

Marketing planning:

Market research is becoming a very important tool for quality management. It is a method collecting data first about what the customers want and need, then about how to monitor the organization performances in order to satisfy those customers.

The engineering, the production and the financial services are also involved. The problem is to create teamwork between all these services in order to avoid rework, waste, trials and errors. Even the services in charge of warranty claims and of the maintenance after-sales must be involved in the design.

Example: in the case of combat vehicles, the time needed to replace the engine is crucial. It affects the design of the vehicle: the engine can be put in a place that facilitates the removal for instance. QFD (Quality Function Deployment) is one of the techniques used to implement teamwork in design.

13.2.4.4. TQM in services

We have focused on the quality in product-oriented organizations. But quality is just as important in services such as health care, education, banks, hotels, and so on...

Let us illustrate that with an example of a leaflet to fulfil at the end of a stay in a hotel, where you have the opportunity to give an evaluation of the offered services:
- the reception
- the phone facilities
- the swimming pool
- the laundry
- the room
- the room service
- the cafeteria and the bar
- the breakfast

It is actually a means to measure intangibles. It is a customer survey. If you sell cars, you have an idea of their reliability if you record their repairs, but if you sell services, it is difficult to measure the outcomes because most of the time, these outcomes are intangible. There lies a first difference with products. A customer survey such as the one described for the hotel is a means to solve that problem.

Other differences are the following ones:
- the service is produced and consumed at the same place and time;
- it cannot be stored;
- a sample cannot be sent for inspection.

It is obvious that there is a difference between standardized service operations such as the delivery of tickets in a station or the sale of hamburgers in a Mac Donalds and professional services such as management consulting, teaching or training situations.

13.2.4.5. Tools for TQM

13.2.4.5.1. Waiting line theory

For the standardized service operation, an important feature is the waiting time. There is a tool to manage the waiting times: it is the waiting line theory that enables to determine the number of windows or ticket offices that must be open in order to keep the waiting time acceptable.

13.2.4.5.2. Flow chart

Another tool is the flow chart, providing a good description of the operations and their sequence. The analysis of the flow chart can lead to a reduction of redundant operations, to a change in the sequence, to do things no longer successively but at the same time.

A consequence of the fact that the service is produced and consumed at the same place is that the employees who are in contact with the customers must have managerial and marketing skills. They must be well-trained and rewarded because they play an important part.

13.2.4.5.3. Pareto diagram

Everyone knows the ABC method in inventory control. The products belonging to the A's are not numerous but they are expensive. The A category usually represents 20% of the items but 80% of the financial value of the stocks. The rule that is derived from that observation is that these items must focus our attention and that we must increase the frequency of their inventory controls.
Pareto analysis uses the same reasoning but applies it to defects. Data from control check-lists are analysed in order to indicate the relative frequencies of causes. For example, if you register the defects of a circuit board, you can classify these defects according to the main component affected by the defect.

You can then draw a histogram such as the one on the figure.


In the case illustrated in this example, you can see that an improvement of the production process for the soldering and wiring operations could lead to a 65 % reduction as regards the amount of defects.

Essentially the Pareto method is known as the 80/20 rule where 80 % of defects result from 20 % of the identified causes.

13.2.4.5.4. Ishikawa cause and effect digrams (fishbone diagram)

Solving the cause rather than the symptom of any highlighted problem is the direct objective of the cause and effect diagram. Having used tools to collect data about a process and identify the problems, we need to know their cause in order to correct them definitively.
The diagram is essentially a set of 4 M branches – M representing material, men, methods, machines – that is drawn towards a specific problem statement.

Usually more than one problem will be evaluated, constructing thus multifishbones. These provide a standardized platform from which we can develop multiperspectives about the causes of the various highlighted problems.

This method is a tool to systematically analyze all the possible causes of a problem. It is more a help or a support for a brainstorming relating to the problem.

**Fishbone Diagram for Fast-Food Restaurant (4M)**

![Diagram of fishbone diagram for fast-food restaurant](image)

13.2.4.5.5. Quality circles

The quality circle is an illustration of the development of participation in quality-oriented organizations. It is a group of individuals who work on similar tasks, who meet regularly to discuss work-related problems and help each other in order to find a solution to these identified problems.

Conditions to success include that:
- All circle members must believe in and accept the application of problem-solving techniques to their work processes.
- Circle members must have the knowledge and experience of the process and of the tasks they have to perform.
- Circle members have to want to work together effectively.

13.2.4.5.6. The house of quality

That tool is an illustration of the way the customer's needs are translated into product specifications.

The process begins with the conversion of the customer's attributes into engineering characteristics.

The house of quality is a diagram that looks like a house, as shown on the figure.
### House of Quality for “Fun to Drive” Customer Attribute

<table>
<thead>
<tr>
<th>Customer Attributes</th>
<th>Fun to drive</th>
<th>Engineering characteristics</th>
<th>Engine performance</th>
<th>Steering</th>
<th>Customer importance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Acceleration 0-60 mph</td>
<td>Passing time</td>
<td>Fuel economy</td>
<td>Turning radius</td>
</tr>
<tr>
<td>Fast response</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Good mileage</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Good handling</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 sec</td>
<td>12 sec</td>
<td>30 mpg</td>
<td>20 ft</td>
</tr>
<tr>
<td>Our car</td>
<td></td>
<td>8.5 sec</td>
<td>9 sec</td>
<td>25 mpg</td>
<td>25 ft</td>
</tr>
<tr>
<td>Competitor A</td>
<td></td>
<td>9 sec</td>
<td>10 sec</td>
<td>27 mpg</td>
<td>28 ft</td>
</tr>
<tr>
<td>Competitor B</td>
<td></td>
<td>8 sec</td>
<td>8 sec</td>
<td>30 mpg</td>
<td>20 ft</td>
</tr>
<tr>
<td>Competitor C</td>
<td></td>
<td>8 sec</td>
<td>8 sec</td>
<td>30 mpg</td>
<td>20 ft</td>
</tr>
</tbody>
</table>


mpg: miles per gallon
mph: miles per hour

The customer's attributes are placed along the left side of the house and are related to engineering characteristics on the top. Positive relationships are shown with + signs and negative ones with minus signs.
The roof of the house indicates positive and negative relationships among engineering characteristics.

Objective measurement for each engineering characteristic, comparing the company's product with those of the competitors are shown in the basement of the house. The importance of each customer's attribute is shown along the right side of the house.

Other houses are built, first translating the engineering characteristics into part characteristics, and then translating part characteristics into production requirements.

Finally, production requirements are translated into inspection details, measuring methods, and so on...

Using those steps, the customer's wants have been respected throughout the organization.

13.3 Leadership and quality

13.3.1 Introduction

We have seen that if we want to implement a total quality strategy, the first step to take is to change the culture, that the first condition to succeed is the commitment of the management.

We have also seen that the quality-oriented organization is a learning one.

The total quality system must pay attention to the customer, react rapidly and encourage initiatives and creativity. In the same way, the procedures of the ISO 9001 norm – if applicable – must be applied, the objectives must be set in a coherent way.

The conclusion of all this is that it is very difficult to run such a system that must mix the advantages of flexibility with those of bureaucracy, the advantages of centralization with those of decentralization.

There is a clear need for leadership. For all the quoted reasons, strategic quality leadership is more important and more difficult than before. The paradox of strategic quality leadership is that it means developing everyone as a leader. Management must spread a leadership culture through every organization level where team-based leadership and learning culture are emphasized.

It is therefore important to tackle leadership and the relationship between leadership and quality.

It is a difficult theme with evolving theories. For example, we can wonder if the description of the leadership process with 3 components (leader – followers –
situation) has to be revised in order to be in accordance with the statement that strategic quality leadership means developing everyone as a leader.

Are there still followers in such a vision?

We sometimes need to take a break in order to think about the answers to the following questions:

What is my leadership style?
Is it coherent with my personality?
Do I know myself well enough?
Do I pay attention to the different situations in which I must operate?

To illustrate the paradoxes of leadership and the fact that it is an old issue, here is a quotation that is 26 centuries old.

"A leader is best when people barely know that he exists, not so good when people obey and acclaim him, worst when they despise him. Fail to honour people, they fail to honour you. But a good leader who talks little, when his work is done, his aims fulfilled, they will all say "we did this ourselves"."

Lao Tseu, The Way of Life, 604 BC

This is a proof that the Chinese understood the problem.

Not only leadership but also human resources management is paramount in our TQM era. It is interesting to take a look at the figure showing the differences between the HRM needed in a quality-oriented organization and in a traditional one.

### Comparaison of quality orientation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Quality-oriented HRM</th>
<th>Traditional HRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philosophy</td>
<td>Teamwork and shared understanding and commitment</td>
<td>Individually oriented – reward for individual work</td>
</tr>
<tr>
<td>Quality Objectives</td>
<td>TQM orientation in every area and level of organization activity</td>
<td>Production-control-oriented</td>
</tr>
<tr>
<td>Employees involvement</td>
<td>High – people oriented culture</td>
<td>Low – system-oriented culture</td>
</tr>
<tr>
<td>Education and training</td>
<td>Multi-skilling orientation</td>
<td>Development of skills for a specific job</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Reward structure</td>
<td>Formally owned and administered jointly by managers and workers</td>
<td>Management owned and administered</td>
</tr>
<tr>
<td>Structural orientation</td>
<td>Decentralized</td>
<td>Centralized</td>
</tr>
</tbody>
</table>

Source: « Total Quality Management », Paul James, Prentice Hall 1996

### 13.3.2 A case in a bank office in Liège

Let us introduce this chapter about leadership with an example that illustrates the complexity of the matter.

Let us take an example in a bank. It is also a means to show that the problems of Total Quality Management are also met in services and not only in manufacturing companies.

A customer went to his bank in Liège to buy escudos. It is important to notice that he is a good customer of the bank. The clerk said that there were no escudos available and that he had to order them. It was Wednesday after Easter and the customer wanted the escudos for Friday. The clerk's answer to his request was: "It's impossible because we're shortstaffed. Can't you go yourself to the exchange office to buy escudos?" This is not acceptable. Let us admit that escudos are not frequently asked but being a European currency, it must be possible to have the needed amount within 2 days in any bank of Europe.

This bank is not a quality-oriented organization.
It is obvious that the customer's normal wants are not met. They will lose customers.

But let us suppose that the customer sends a letter to the General Manager in Brussels, complaining about the fact that it was impossible to get escudos within 2 days in their office in Liège.

What should be his reaction?

At first, we must know whether it is considered to be a normal situation or not. Let us assume that it is not accepted as a normal situation.

There are 2 possible attitudes. A first one is to blame the head of the office in Liège, to ask for a report and to inquire about the measures that will be taken against the clerk in charge.

The second one is to get informed about the bank regulations and policies relating to the availability of foreign currencies in local offices.

Actually it gives us the opportunity to study the evolution of the customer's needs in order to decide if it is necessary to revise this procedure.

Nevertheless, even if the regulation must be changed, it is necessary to deal with the other problem: the clerk's bad reaction.

In this case, the clerk is directly in contact with the customer. The service is produced when and where it is consumed and the only staff in contact with the customer is the counter clerk.

You are the head of the office of Liège, what will you do? A first attitude could be blaming the clerk. You could send a report to the headquarters, telling that the responsible has been punished. But if it is true that there was a lack of personnel and that there was nobody to go to the exchange office, who is responsible? The manager is the one responsible. If too many clerks are off, it is perhaps because holidays are badly planned. Who is responsible for the balance between workload and work capacity? But even if it is true that there was nobody to go and buy foreign currencies that day or the day after, the reaction of the counter clerk still remains a bad one. In such a situation, the clerk must answer to the customer that he will get the desired escudos for Friday and then, he must tell the head that there is a problem because there is nobody to go and buy them. The manager must find a solution, call the exchange office, send somebody belonging to another department, and so on…

This presupposes that the counterstaff has been trained to react that way, that it must be confident in the fact that the manager will accept the problem and find a solution.

With a short story, we can illustrate many aspects of leadership and of a quality-oriented service company.

A few questions:
Blame the customer or blame one's organization?
Blame the head or the subordinate?
Blame or solve the problem?
Listen to all of the persons involved. Everyone has a part of the information needed to deal with the problem: bank regulations, planning of the holidays, and so on…

Solving the problem is more complicated:
- collection of information;
- interviews with staff;
- assessment of the evolution of the customer's needs;
- training programme for the staff (and perhaps for the management).

13.3.3. Theoretical concepts

After that example, we will now discuss a few theoretical concepts regarding leadership, illustrating the different styles of leadership according to the different theories about that theme.

We can consider 2 classical ways of describing the different styles of leadership.

The first one is Blake and Mutton's managerial grid. They developed a grid with 2 dimensions: one was labelled people-oriented and the other one task-oriented. The idea was to illustrate the differences between leadership styles according to the attention paid to human aspects or to production aspects.

The grid was created by dividing each dimension into 10 equal parts, creating a grid of 100 squares. There were 5 important grid squares.

These were:
1.1 little concern for the people or production matters. It cannot be seen as leadership at all.
1.9 country club style that focuses on people-oriented issues concerning welfare and support.
5.5 center leadership style.
9.1 task-oriented style. A competent leader who does not care about people.
9.9 balanced leader that makes the integration of the task and people requirements easier.

The second one is Tannenbaum and Schmidt's autocratic-democratic continuum. It is the situation that predominates in the passage from one part of the continuum to another.

The different styles of the continuum are the following ones:
- Leader makes a decision and announces it
- Leader "sells" a decision
- Leader presents ideas and asks for questions
- Leader presents decisions that can still be modified by the group
- Leader presents the problem, gets suggestions and then makes a decision
Leader defines limits and asks the group to make a decision
- Leader lets the group make a decision

The situational theory of leadership

That theory suggests that a style is more appropriate for one situation than for another, but what are the situations and their relevant styles? The components of the situations that affect the style are:
- the environment;
- the task;
- the culture of the organization.

Tannenbaum and Schmidt's autocratic-democratic continuum is an illustration of the situational theory. It is the situation that predominates in the passage from one part of the continuum to another.

The situational theory of leadership is not supported by many specialists. It presupposes that the leader can change his style to adapt it to the situation. It is reasonable that a leader can adapt his style for a period in certain circumstances, but it is not easy for somebody who is born with an autocratic style to become really democratic when the situation and followers change.

Transactional leadership

Transformational or transactional leadership is about inducing subordinates to excel in their performances, to take risks, to innovate and to achieve results beyond expectancy.

It is closely related to the expected operation of a quality-oriented organization. Charisma is seen as a major influence on its effective implementation. Self-leadership is now developing as a leadership theory: it means that every worker or every group in the organization has the necessary skills, education, commitment, knowledge and motivation to carry out tasks on its own and to know when it has to consult and coordinate group efforts in order to achieve group aims.

Motivation

Leadership cannot be effective unless a manager understands the basis of motivation. Motivation is an internal driving force reflecting the influence of internal and external stimuli. Taylor thought that individuals were solely motivated by money. Since then, many theories have demonstrated that it was not a complete explanation of motivations. It was suggested that paying attention to people, attempting to increase the worker's decision-making autonomy and evaluating the effect of group process and group incentive schemes could provide a better approach to the concept of motivation.

The needs theories (Maslow)
Hertzberg distinguishes two levels of needs. The satisfaction of first level needs prevents dissatisfaction. It is a condition to fulfil in order to obtain results if you try to act on the higher level needs. The satisfaction of these higher level needs has an effect on the individual's satisfaction or motivation.

**The cognitive theories**

The needs theory explains that our behaviour is influenced by our needs. The cognitive theory postulates that an individual weighs up the possible outcomes of his expended efforts to achieve a particular objective and decides a priori whether to go ahead or not.

**The reinforcement theory**

This theory postulates that an individual's behaviour is influenced by the environment and especially by the reaction of the environment generated by his behaviour. The manager can thus influence the behaviour with different types of what one calls reinforcement actions such as positive reinforcement, negative reinforcement, punishment and extinction.