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QUALITY CONCEPT AND ITS EVOLUTION

“Bad quality means wastage, has an effect not only on the business creating the waste but also on its customers and on society as a whole”

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Historical Back Ground and Present Status — Global Scenario and Events Around The World — What is Quality ? — Phases of Quality Revolution — Quality Control and its Evolution — Quality Control Development — Quality Assurance Concept and Definition

1.1. HISTORICAL BACK GROUND AND PRESENT STATUS

Technological developments have been at the origin of each of the major world transformations, that we can characterise as an age. Processes of cultural transformation in all previous ages were relatively slow and their impact on societies was gradual and diffused. We are now witnessing the birth of a “Knowledge age”, that is replacing the “Systems age” created by the industrial revolution (See Fig. 1.1).

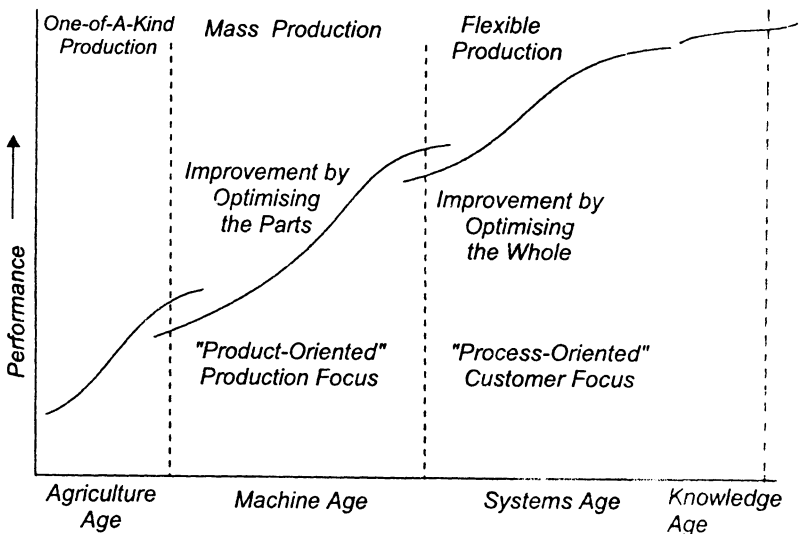


Fig. 1.1. Transformation and performance improvement.

The end of an age does not occur suddenly, rather one age fades into the next, and is characterised by people struggling with the problems of the age while using the tools, techniques and practices of the past age. The problems of the people are marked by the cultural dislocations that occur as societies attempt to adapt or find difficulty in adaptation to the new world realities. Eventually, those societies develop successfully that adapt new and more appropriate tools, techniques and paradigms emerge as leaders, and other followers. Often the rise and fall of nations is a function of their ability to adapt to the world's technological transformations.

In developing countries like India economy is based on agriculture which accounts for 60–80% of their Gross National Product and their industries are in various stages of development. The manufacturing companies are generally family owned and professional management is confined to large companies or to production units working under license from multinationals. Consequently, most producers are not aware of the benefits of the Quality Systems and their effects on profitability and long term growth.

Quality goods are available only at significantly higher prices, which most of the people cannot afford. Industry is largely underdeveloped, the population is growing very rapidly and demand for customer goods generally exceeds the supply. Under such conditions almost anything sells. Because of low level of literacy there are no customer movements. Owing to the poor quality image of domestic products not only in India but in most of the developing countries, imported goods were greatly admired among the high societies, who could afford the price. The situation of the companies in the developing countries is not yet so good because of low levels of working capital and supply of sub standard raw materials. These sub standard materials, when introduced into the manufacturing system adversely affect the quality of the end product. Developed nations like USA, Japan and Germany are working to attain 99.99997% defect free or even zero defect production, while in India, manufacturing organisations are struggling hard to reduce their rejection rates under 5%.

The performance of India in the global field of quality and quality practices is not so satisfactory. In the 41 countries whose products and services were ranked by the 'WORLD COMPETITIVE REPORT 1994, CONDUCTED BY GENEVA BASED WORLD ECONOMIC FORUM'. It occupies lowly 28th place on the price to quality, 38th rank for TQM practices, 40th rank for customer orientation. Above facts and figures show our quality standard which are not upto the mark, whereas India ranks tenth among the most industrialized

countries in the world. Our country has the third largest technocrats and scientists in the entire world and largest number in the third world countries. So to fulfil the gap, India needs a quality revolution, to come to world class level, to compete with quality which is at par with the world companies.

1.2. GLOBAL SCENARIO AND EVENTS AROUND THE WORLD

In the global scenario, a few important events have taken place almost simultaneously. The first one relates to economic unification of European nations, forming a single large cartel of customers with uniform policy towards import of goods and services these customers put together, represent about 22 percent of the world's trade and business. All those countries which are doing business with EC expect that market forces will intensify and ISO will become a prerequisite for doing the trade.

The second event which has happened back at home is the disappearance of controls and regulations signifying the end of the so called license raj. Economic liberalization and openness are being pursued now. This might have been triggered off by the fast deteriorating foreign exchange situation and resultant pressures from IMF or world bank, but the process has started and is shaping up in the form of gradual and phased removal of restrictions.

The failure of socialist model of managing economy in the Soviet Union as a third event has reinforced the belief of many countries in market-driven economy. In India the economy with little or no protection will now be governed by open competition. This has focused the attention of industry on one aspect of business which has all along been neglected *i.e.* quality. Probably quality suffered the maximum neglect in India because competition was practically non existent. The managements now have the need and even the compulsion to look at this aspect of business and industry. The Indian product has in general been considered as indifferently produced and poorly finished, shabbily packed and lacking in design, performance and reliability. The situation is fast changing with quality assuming the status of a corporate strategy, a large number of companies are focusing their trust on quality.

World class organisations have to make major changes in their business performance and customer orientation as a result of ever changing global market conditions. The present era has seen that quality has moved from a shop floor control technique to a strategy where it is the driving force of the whole business encircling the entire gamut of an organisational activity.

Quality has to be adopted as a corporate strategy. There are lot of lessons to be learned from the experience of applications of universal concepts and processes which make an organisation world class.

1.3. WHAT IS QUALITY ?

Quality is Relative. The dictionary gives its meaning as "Degree of Excellence". Its definition depends on the perception and varies from situation to situation or from individual to individual. Broadly speaking these situations or individuals can be grouped in two classes.

Abstract Class. The abstract qualities of individual or physical bodies fall under this class. These qualities can not be defined or seen. They can be felt directly or indirectly. They can be described to some extent. For example, some qualities of a person can not be known just by seeing him. The knocking tendency of a petrol sample can not be seen, it can be felt if it is used in a vehicle.

Physical Class. The qualities falling in this class can be seen with naked eyes, can be felt and can be measured under some scale. Most of the qualities of this class relate to the physical bodies. For example, the complexion, height, structure of all persons can be seen.

As said earlier Quality depends on the perception of a person in a given situation. The situation can be user oriented, supplier oriented or cost oriented. Since any item is manufactured for the use of a customer/user, it is the later who dictates the quality. This gives a basis for defining Quality in the present context, i.e. industrial context.

"Quality is the ability of the material to perform satisfactorily in an application for which it is intended by the user. During the performance, the material should not have deleterious effect on the application and should preferably have added benefits to the application. The material should not be too expensive also.

Quality : Then and Now

Old Quality is :	New Quality is :
Technical	Strategic
About products	About organisations
Led by experts	Led by management
For inspectors	For everyone
High grade	The appropriate grade
About control	About improvement
About specifications	About customer satisfaction

1.3.1. Quality Definitions

A comprehensive definition of quality has been provided in ISO-8402 : 1994 standard as follows :

"The totality of features and characteristics of a product or services that can bear on its ability to satisfy stated or implied needs". (ISO-9000)

Definitions given by other quality gurus are as under.

Quality is fitness for use. (*Juran 1974*)

Quality is conformance to requirements or specifications.

(*Crosby 1979*)

Quality is what the customer says it is. (*A. Feigenbaum*)

“Quality is never an accident but it is the result of intelligent efforts.”

“Quality is a feature by which a thing or service may be identified.”

“Quality is an effective system or of integrating quality improvement efforts of various groups of the organization so as to provide Products/Service at level which allow customer satisfaction.”

(*A.V. Feigenbaum*)

Why Industries Bother for Quality ?

In the present time, every industry bother about their product's quality, therefore they bring the necessary improvement in their product's quality change. All these brought about by industries for the following reasons :

- (i) To be profitable
- (ii) To reinforce personnel quality standard
- (iii) To maintain customer satisfaction
- (iv) To use employee's creative energies
- (v) To lower cost
- (vi) To increase customer satisfaction
- (vii) To increase productivity
- (viii) To increase competitiveness

If an industry can follow all or some of these reasons, there will necessarily be some improvement in their product's quality.

Quality is the loss that a product costs to society after being shipped other than any losses by its intrinsic functions. (*Taguchi*)

Quality of the defect free production through prevention rather than detection. (*Zero Defect*)

Quality is the totality of features and characteristics of a product in satisfying customer needs and expectations on a continuous basis. In fact to delight the customer. (*TQM*)

In a contractual environment, needs are specified, whereas in other environments, implied needs should be identified and defined.

In many instances, needs can change with time. This implies periodic revision of specifications.

Needs are usually translated into features and characteristics with specified criteria. Needs may include aspects of :

- Usability
- Availability
- Maintainability
- Environment.
- Safety
- Reliability
- Economics and

Product and service quality are influenced by many stages of interactive activities, such as design, production or service operation and maintenance.

It is unfortunate that some people consider TQM to be just a fad. They fail to visualize the evolutionary process by which considerable growth and reliance on the role of quality has taken place. Its evolution could be traced back to the areas of inspection control, assurance and management. Each of these stages reflects a change in the market conditions and customer requirements. The entire revolution of quality can be classified into four phases as given in Art. 1.4.

1.3.2. Quality Requirements

From the aforesaid definitions, it should be seen that a product should have certain abilities to perform satisfactorily in a stated application. Now we can categorise these abilities into six factors as given under :

- (i) Suitability,
- (ii) Durability,
- (iii) Dependability, reliability
- (iv) Safe workability
- (v) Affordability
- (vi) Applicability.

A product can be said to have a good quality if all the above abilities are balanced while designing and producing it.

1.3.3. Does extra quality mean extra cost

Competition is inherent in human nature. Success in the competition is a must for survival. Those who cannot compete cannot survive. Even small improvements matter greatly. Ways can always be found to keep the cost same even after improving the quality. Sometimes customers do not hesitate to pay slightly higher price if the quality is comparatively better. The old notion of higher quality means higher cost does not apply in the present day competitive world. The new notion for higher quality is "QUALITY IS FREE".

1.4. PHASES OF QUALITY REVOLUTION

1.4.1. Inspection and Quality Control

In earlier centuries before the rise of modern factory, product inspection was performed by the workman himself or by the

master of the small shop. When large factories were organised, the same concept of inspection as a part time job was retained and so inspection was performed either by the foreman of the shop department or by those workmen whom the foreman could rely upon, to do their own inspection.

As shop departments became larger with products becoming more complex, the time and skill needed for product inspection extended beyond the part-time capacity of the shop floor. To meet the expanded need, the foreman appointed some men to serve as part-time inspectors and with further expansion, as full time inspectors.

With the ushering in of “scientific management”, at the beginning of the century, the concept of self inspection has undergone extensive changes. Under the Taylor System, which propounded separation of planning from execution, the job of the foreman and the workman was reduced to one of meeting the multiple standards established by the various specialists. The effect of this system on quality was decidedly not beneficial. In many cases the work methods made no provision for meeting the criteria of operator self-control as applied to quality. For example, it was a common practice to assign the setting up of machines to specialists (set-up men) leaving to the workman only the job of feeding the machine and removing the processed job. Such workmen felt no responsibility for product quality since there was no involvement of these men in quality.

Among the multiple standards that were prescribed for the foreman to execute, quantity of production was unquestionably rated as the highest priority. Improving productivity was widely regarded as the main and even the sole purpose. This was underscored by the nature of the piece work incentive system which was based on meeting the standards for quantity of production to the virtual exclusion of all other standards. This emphasis on quantity lowered the priority attached to quality and simulated the movement to relieve workmen and foremen of product inspection and turn the job over to full time inspectors.

Now after half a century of independent inspection departments we find the system not so effective. It is under attack for a variety of reasons. In many cases the relationship between production and inspection was strained and hostile. Manufacturing was no longer responsible for quality. Quality control (as inspection was known later) started “policing”, trying to discover poor quality, and the manufacturing department tried to process as much product as possible through the QC, resulting in continuous friction on the shop floor.

Obviously this situation needed to be remedied. An immediate solution is to return the product inspection to the production men. A successful transfer reduces the friction and hostile relations that existed. Re-delegating the job of inspection to production workers is a most dramatic form of "job enrichment". It is not only an enlargement of scope and responsibility, but is also a role of managerial confidence in the worker on a matter of highest sensitivity.

Despite the advantages of returning product inspection to production department, the change-over cannot be done for many reasons. This step is a major breakthrough which requires cutting of cultural barriers. Justifiably there are reservations on the side of management. And the production men are also not ready to accept the responsibility. Even if this is possible, it is not hundred per cent practicable.

The limited capacities of the workmen in terms of their knowledge, skill, expertise and availability of time for doing inspection require the management to use some "outside" men for carrying out some checks. High degree of sophistication in product inspection such as non-destructive examination, measurement of surface finish, measurement of electrical characteristics, etc., require special skills and certain amount of training in execution. Again the production men do not have time at their disposal for all those special checks. The costly equipment that is needed for checks cannot be provided in large number to all the production men. Various supporting services for inspection such as gauges and instruments should be under the control of one agency. Hence Quality Control function as a separate entity is necessary.

1.4.2. Inspection

Thus, development of Quality Management function is presented as an evaluation from inspection to Quality Control, to quality assurance and finally to Total Quality Management. In forth coming chapters, you will come across all the above said quality system elements. However, to begin with, the initial definitions and practical representation of inspection should be grasped.

All the activities such as measuring, examining, testing, grouping one or more characteristics of a product or service and comparing these with specified requirements to affirm conformity, fall under the category of inspection, various elements of inspection process can be represented as shown in Fig. 1.2.

1.4.3. Quality Assurance

Recognising that inspection should primarily be a service function to the manufacturing, modern companies have recognised

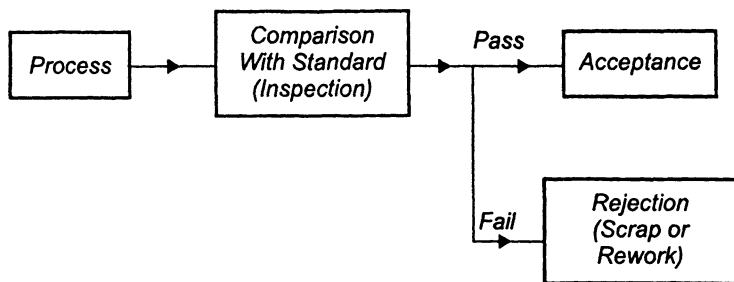


Fig. 1.2. Inspection process leads to acceptance or rejection.

their quality functions in tune with the basic philosophy that “the task performer should be responsible for Quality as well”. Every department contributes to the end product quality. Building quality into the product needs a total participation from all the departments, starting from pre-contract stage, through Design, Purchase, Production Engineering, Technology, Manufacturing, Testing and Dispatch right upto the product commissioning and subsequent services. To coordinate the activities of various departments, Quality Assurance groups are created at plant level.

The primary objective in creation of QA is to provide the necessary confidence to the customer as well as to the top management that all concerned are carrying out their activities effectively and that the product quality is achieved to the customer’s satisfaction at an economic cost.

1.4.4. Total Quality Management

TQM “means meeting the requirements of the internal/ external customer consistently by continuous improvement in the quality of work of all employees.”

To the customer, it includes, price, delivery, service and responsiveness. Internally it means elimination of gaps in communication, creating a commonality of understanding of what the customer’s needs are throughout the organisation, and ensuring that the needs of customers in the organisation are identified and their expectations are properly met.

- I. TQM is an integrated management approach in satisfying customer needs in totality on a continuing basis through involvement of each and every employee in the organisation making continuous improvement on one side and on appropriate cost effective technology along with proper problem solving methodology on the other.
- II. TQM is a management philosophy, a journey to organisational excellence through customer orientation.

- III. U.S. Deptt. of Defense in their pamphlet on "*TQM — A Guide for Implementation*" has defined TQM as both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organisation. TQM is the application of quantitative methods and human resources to improve the product and services supplied to meet the customer requirements now and in future.

1.5. QUALITY CONTROL AND ITS EVOLUTION

Quality Control function has very significant importance with a view that a single defect may result in ghastly economic loss and also commercial damage. In order to avoid such situation Quality Control function has to be pre-planned where responsibilities have to be worked out and implemented with a commitment for quality satisfaction best to the customer requirement.

Quality Control. The objective of QC function at operators level, foremen level, inspectors level or managers level is to involve with operational techniques and activities carried both at monitoring a process and at eliminating causes of unsatisfactory performance.

The development of Quality Control has taken place over the entire century with major changes in approach to QC, have occurred approximately every 20 years (See Fig. 2.1). The above said four QC concept changes can be described as under :

(a) **Operators Quality Control.** This was inherent in the manufacturing jobs upto the end of nineteenth century. Under this system, one worker or atleast a very small number of workers were responsible for the manufacture of the entire product and therefore, each worker could totally control the quality of his/their personal work.

(b) **Foremen Quality Control.** This kind of Quality Control is due to the advent of our modern factory concept, in which many individuals performing a similar task were grouped so that they could be directed by a foreman who then assumed responsibility for the quality of their work.

(c) **Inspectors Quality Control.** Manufacturing system became more complex during the world War-I, involving large number of workers reporting to each production foreman. As a result, the first full time inspector appeared on the scene, initiating the third step known as inspection quality control. This step peaked in the large inspection organisations by 1920s and 1930s separately organised from production and big enough to be

headed by superintendents. This programme remained in vogue until the tremendous mass production requirements of World War-II necessitated the fourth step of the quality control described as follows.

(d) **Managers Quality Control.** In effect, this is an extension of the inspection phase and boiled down to making the big inspection organisation more efficient. The most significant contribution of statistical quality control is that it provides sampling inspection rather than 100% inspection. The task of quality control, however, remains restricted to production areas only.

This is the oldest and most widely known of the several process control methods. It involves the use of statistical techniques, such as control charts, to analyse a process, or to solve a quality problem. The data can be used to identify variations and to take appropriate action in order to achieve and maintain state of statistical control (pre-determined upper and lower limits) and to improve the capability of the process. Statistical Quality Control consists of three activities :

1. Data Collection,
2. Data Display,
3. Problem Analysis,
4. Corrective Action.

The application of statistics to process quality control, (SPC) can be useful for improving results in manufacturing and non-manufacturing areas such as a sales and staff activities and functions of an Industry.

Thus, Quality Control is concerned with the feedback of the comparative information in order to regulate the process. The entire process of Quality Control is centred around the basic idea that process limits are so set that the process be readjusted before the out going product reaches the limit of rejection. Its practical significance is shown in Fig. 1.3.

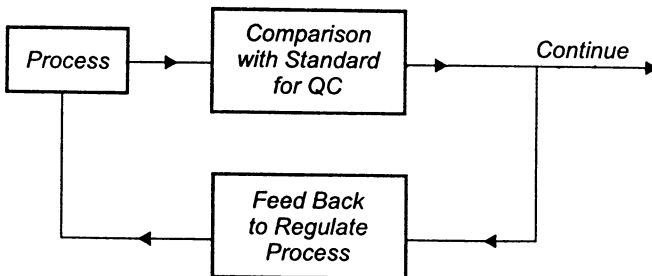


Fig. 1.3. Quality control shown as close-loop process control system.

The Total Quality Control concept has left a major impact on management and engineering practices; it has also provided the foundation, in the decade of 1980s and beyond a Total Quality Management Concept as a major new business strategy.

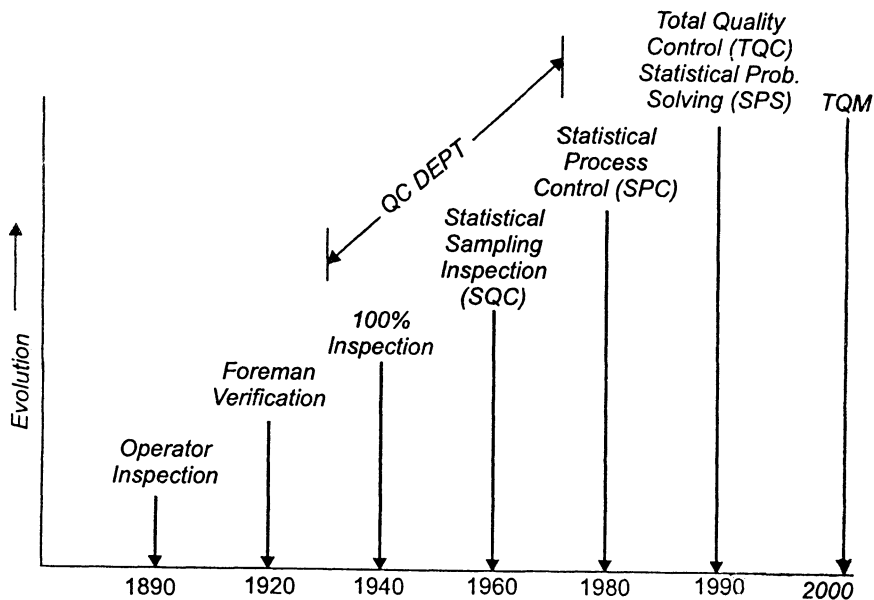


Fig. 1.4. Quality control evolution.

1.6. QUALITY CONTROL DEVELOPMENT

As described above we have observed the varying span of control function from operator to manager and it is also observed that at every stage the control of quality slipped beyond the overall span of their reach. This philosophy has always led to new measures of control and management of quality. Whatever the situation may be following are the responsibilities of the individual or department handling the quality control function.

- (i) Perform acceptance and process control inspections as required by quality control procedures. Also assure that necessary corrective actions are taken when deviations occur.
- (ii) Provide assistance to manufacturing to assure that quality is maintained during manufacturing processes.
- (iii) Attach to raw material purchase orders, the necessary material specifications and any specific requirements to assure that the purchased material is capable of meeting any special customer requirement.
- (iv) Perform and document inspection, tests and verification of purchased material as specified in procedures.

- (v) Request and maintain documentation on corrective action requests.
- (vi) Perform in-process tests and verification as specified in Quality Control Procedures.
- (vii) Perform final inspection, tests and verification as required by Quality Control Procedures.
- (viii) Maintain the calibration of all equipment and tools in accordance with the methods and procedures established and monitored as in Quality Manual.
- (ix) Ensure that all equipment and tools are calibrated when required. Make necessary arrangement to bring tools back into calibration shop before releasing for re-use.
- (x) Maintain required records indicating traceability of standards and calibrations performed.

1.7. QUALITY ASSURANCE CONCEPT AND DEFINITION

In recent years, the demand for higher quality and reliability of consumers have grown almost exponentially. The need is rather urgent and serious to re-evaluate and restructure quality.

A number of situations where involvement of finance in some quality problems of the plant becomes inevitable. Such are the problems related to increasing manpower requirements in QC, high consumption of test material, delays in receipt inspection, inconsistent purchase specifications and inadequacy of specifications from reliability and performance point of view. In all these cases some questions are aimed at pruned funding, more effective and economic approaches to achieve satisfactory quality and reliability objectives in the products. The investigations in to these problems set in motion a number of very fruitful exercises which eventually led to significant improvements and greater assurance of quality. Triggered from these seemingly simple provocations, the plants thereafter get tuned to look for avenues of more constructive quality and reliability goals.

The above exercise has been largely from manufacturing areas in plants. But in a total quality and reliability programme, studies would have to cover a wide spectrum of functions and product areas covering design of systems, structures and components through various stages of material, manufacture, construction and commission to efficient maintenance and operation of the systems as a whole. It is realised that this would be necessary to assure and build right quality and reliability into our products and assure continuing failure-free operation of the system as a whole, to customers.

Quality as an exercise does not end in manufacture; in our view manufacturing quality without regard to other areas is a myth. It is an integral part of the total quality effort and cost in the entire product cycle covering design, manufacture and usage of products.

It is certain that even a single defect, whatever may be the origin, may result in an economic loss that is ghastly in financial and commercial terms. In such a situation, the organisation, manning, training and restructuring of the responsibilities would have to be worked out and implemented in the context of proper appraisal, understanding and commitment to quality and reliability by top management.

Quality Assurance is a word to caution those designing and implementing a total quality system. Therefore utmost care has to be taken to avoid the feeling that quality control and quality assurance are a cult that has removed the inherent accountability

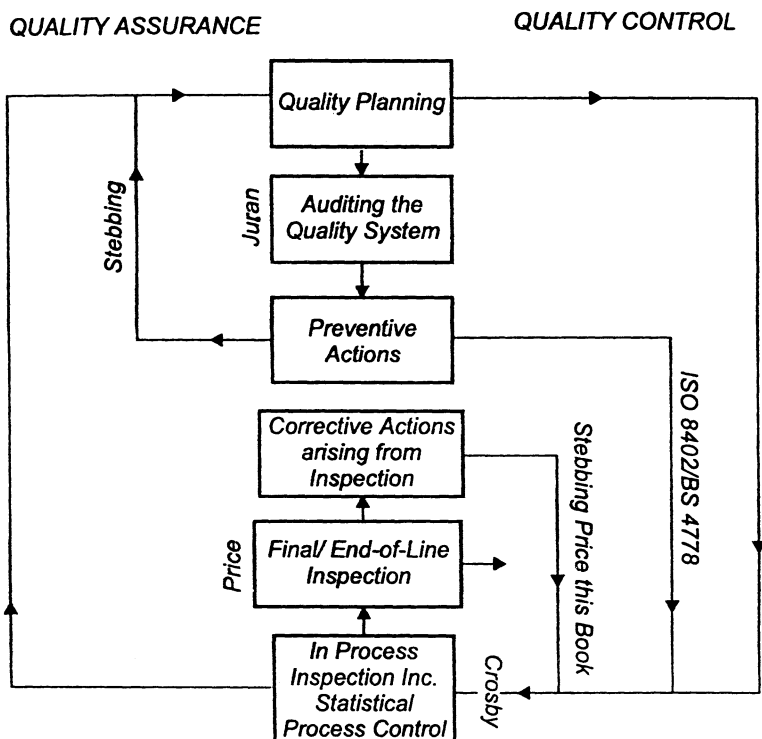


Fig. 1.5. Quality Assurance is due to stringent quality control function deployment.

for right quality and reliability from designer, production engineer, operator, the erector and the maintainer as well as the user of the product. QC and QA might instil quality awareness at all the levels of industry. Eventually their task would lead to design of systems, checks and procedures primarily to define responsibilities and apprise accountabilities of individuals in the actual fulfilment of quality objectives in their respective spheres of operations. In pursuance of such an approach, a broad spectrum of plantwise quality activities have to be developed in your own plant covering a set of criteria such as : organisation structure, QA programme, design control, procurement control, identification and control of materials, control of special processes, inspection and test control, control of measuring and test equipment, handling, storage and shipping, non-conforming material, corrective action, records and audits.

It is said that quality management problems arise not because technical or organisation aspects are not recognised by top management but because such clear recognition and consequent individual and collective contributions by personnel involved in the tasks are not brought about. Recognising this, the management must show and initiate the necessary steps for bringing about this awareness.

In the light of aforesaid description 'Quality Assurance' can be defined as "A well organised programme for all planned and systematic and sequential activities which are necessary to provide adequate confidence to the management and customer that a product or service will satisfy all those given requirements of quality to the utmost satisfaction of customer".

Review Questions

1. What do you understand by transformations ? How does these differ from 'S' curve.
2. What is the old and new concept of quality? How does the concept differ and what is the impact of this difference on organisational behaviour.
3. What are the phases of 'Quality Revolution' ? Explain
4. Define quality assurance and explain how does it differ from quality control ?