

MODEL ANSWERS.

SECTION - I

- (1) Develop: culture of listening to the VOC
 ↓
 Set: clear strategic plans: vision, vision, mission & goals with focus on customer satisfaction
 ↑
 Communicate: need for the journey to all employees & draw people together to the common goals
 ↓
 Identify: key processes & redefining them with customer-focused horizontal processes.
 ↓
 Focus on people: motivate, build teams, train
 ↓
 Cultivate: culture of customer cent. sensitivity, innovation & teamwork for CI.
 ↓
 Advantages: Total quality tools for improvement & value creation, benchmark.

- (ii) quality statements: human resources, purchasing, vendors, sales, financial.

- (iii) the company will shift to product & deliver superior quality goods & services to its customers by benchmarking the quality levels with world-class leaders, investing in latest technology, and training its workforce for developing high class skilled competent

Part - II

(Objective Type questions)

- 2 (i) (b) the effort required for locating and fixing an error in an operational program:
maintainability.

(ii) (d) $\rightarrow (a) \& (b)$

(iii) (d) All of the above

(iv) (b) DA skewness

(v) (d) Higher correlation

(vi) (c) Arnold Fiszgenbaum.

(vii) *fair*

(viii) *true*

(ix) Total quality assurance = quality of design
quality of manufacturing + ^{design} performance

(x) Value of quality is composed of (i) value inherent

and (ii) Value inherent

in commitment to
that design.

in the
inherent
design

3. Sample Total Mean Range

1	32.0	6.4	1.4
2	32.6	6.5	1.6
3	29.0	5.8	2.0
4	32.0	6.4	0.8
5	34.6	6.9	1.2
6	26.4	5.3	2.8
7	33.2	6.6	5.0
8	28.8	5.7	2.2
9	33.0	6.4	1.2
10	29.0	5.8	2.2
309.6		20.4	

$$\text{Mean of Sample} = \bar{X} = \frac{309.6}{(10 \times 5)} \Rightarrow 6.192 = 6.2 \text{ cm (approx.)}$$

$$\text{Mean of Range} = \bar{R} = \frac{20.4}{10} = 2.04$$

$$\begin{aligned} LCL &= \bar{X} - A_2 \bar{R} \quad \text{for } \bar{X} \text{ chart} \\ UCL &= \bar{X} + A_2 \bar{R} \quad \text{for } \bar{X} \text{ chart} \end{aligned}$$

$$LCL = D_2 \bar{R} \quad \text{for } R \Rightarrow LCL = 0 \times 2.04 = 0$$

$$UCL = D_4 \bar{R} \quad \text{for } R \Rightarrow UCL = 2.11 \times 2.04 = 4.31 \text{ (approx.)}$$

$$n = 5 \quad A_2 = 0.58 \quad D_2 = 0 \quad D_4 = 2.11$$

$$LCL(\bar{X}) = 6.2 - (0.58) \times 2.04 = 5.0 \text{ (approx.)}$$

$$UCL(\bar{X}) = 6.2 + (0.58) \times 2.04 = 7.4 \text{ (approx.)}$$

4.

$\Sigma np \Rightarrow$ Total no. of defectives = 66

$\Sigma n \Rightarrow$ Total number inspected = 400×15

$$\bar{p} = \frac{\Sigma np}{\Sigma n} = \frac{66}{6000} = 0.011$$

$$np = 400 \times 0.011 = 4.4$$

$$UCL = np + 3\sqrt{np(1-p)}$$

$$= 4.4 + 3\sqrt{4.4 \times 0.989} = 10.65$$

$$LCL = 4.4 - 6.25 = a (-ve) \text{ value; hence lower}$$

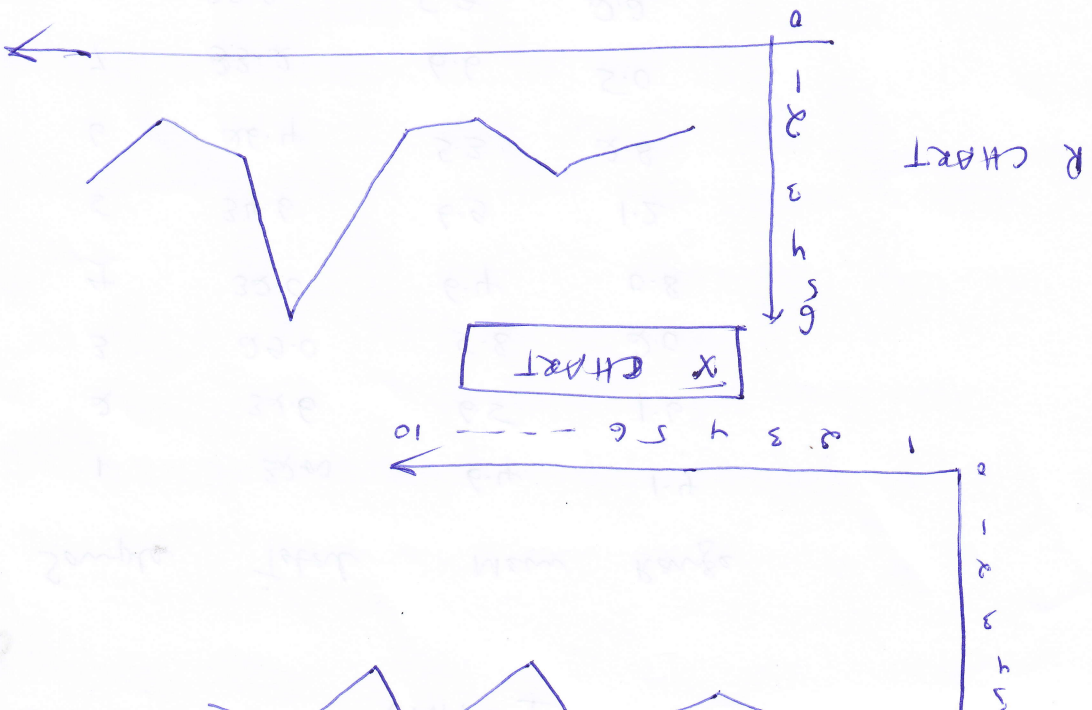
limit is 0

Let number 4.8 g falls out of control.

$\therefore$ process is not in statistical control.

for new value of fraction defective skinning
let number 4.8 g we have

$$\Sigma np = 66 - (14 + 18) = 34; \Sigma n = \text{Total number inspected} = 400 \times 13 = 5200.$$



(Q.no: 4 (Ans) contd.)

$$\bar{p} = 34/500 \Rightarrow 0.068$$

$$np = 400 \times 0.068 = 2.72$$

$$\therefore UCL = np + 3\sqrt{np(1-p)}$$

$$= 2.72 + 3\sqrt{2.72 \times 0.932}$$

$$= 7.452 \quad \therefore LCL = 2.72 - 4.732$$

$$= -ve \Rightarrow 0$$

the process is still out of control, as the

number of defectives for lot number 10 goes out of

control.

for new value of fraction defective skinning

lot number 10 we have

$$\Sigma np = 34 - 8 \Rightarrow 26; \Sigma n = \text{Total no inspected}$$

$$\Rightarrow 400 \times 12 \Rightarrow 4800$$

$$\bar{p} = 26/4800 \Rightarrow 0.0054167$$

$$np = 400 \times 0.0054167 = 2.1668$$

$$\therefore UCL = np + 3\sqrt{np(1-p)}$$

$$\Rightarrow 2.1668 + 3\sqrt{2.1668 \times 0.994167}$$

$$\Rightarrow 6.576598$$

$$LCL = np - 3\sqrt{np(1-p)}$$

$$= -2.2334$$

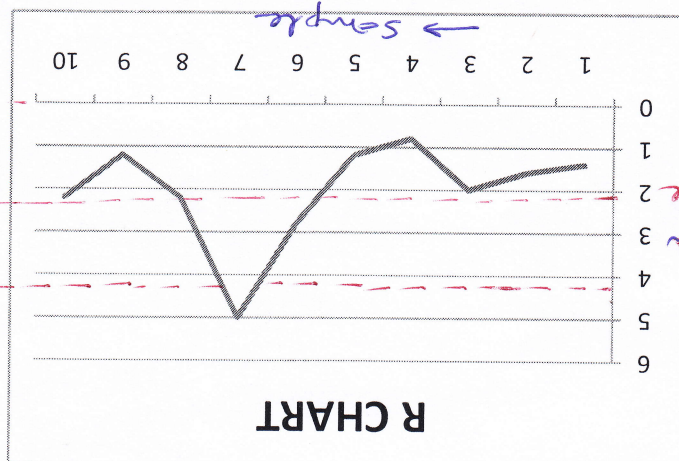
People, processes, Technology, Data, security
approach;

(1) (iv) Elements of customer services:

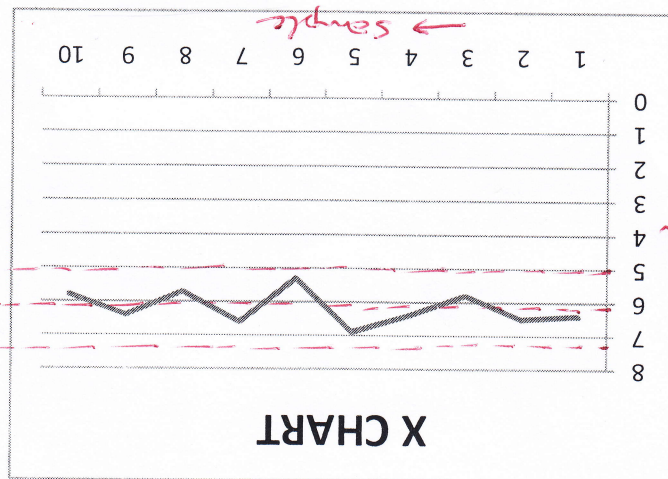
- (v) security planning
- security audit &
- security improvement

UNIT - I

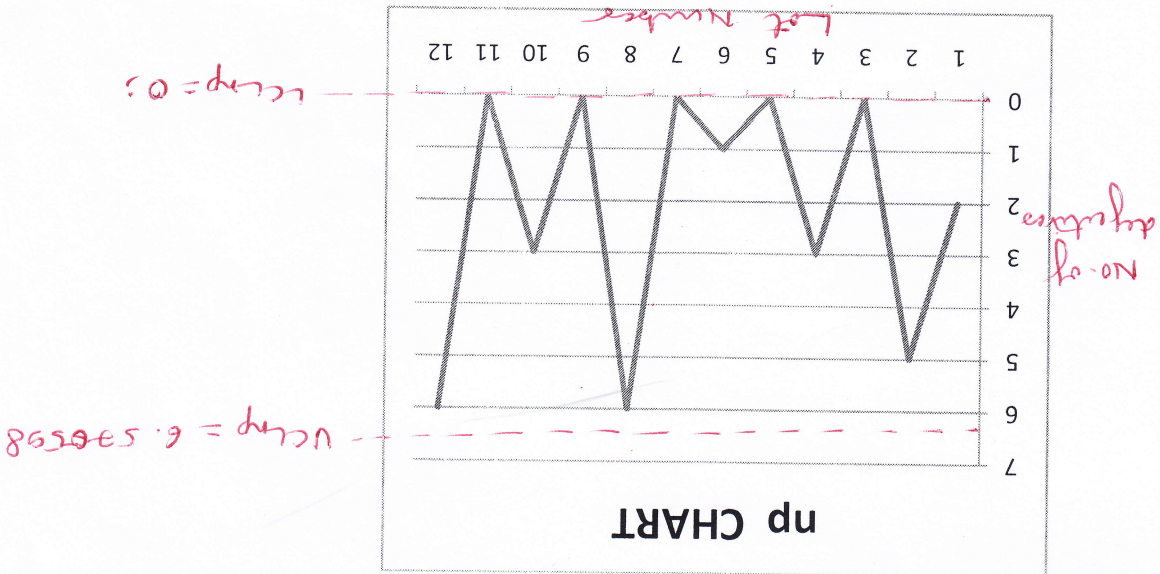
Q. No: 3.



Q. No: 03



Q. No: 04



Reasons for Sampling Inspection:

- * Testing the product is destructive: the ultimate pull strength of a rope or the sweetness of an apple can be decided only by destroying the product.
- * There is not enough time to give 100% inspection to a batch of product.

on section day newspapers are eager to get coverage. once a small percentage of the votes are in, a guess is made of the final outcome.

- * It is too expensive to test all of the batch
- * Human error is estimated to be as high as 3% when performing long-term repetitive testing.

Conditions necessary for sampling inspection:-

- * All items must be produced under similar or identical conditions.

* A random sample of the lot must be taken

- * A lot to be sampled should be a homogeneous mixture.

* The batches to be inspected should be large.

to get a bunch of good ideas to solve problems by tapping the collective intellect and creative genius of the working staff.

10.12.1. Philosophy Behind Quality Circles

Quality Circle is a philosophy of worker's direct involvement in solving problem, that affect their work, their work output and their work place. It is also a philosophy of *Human Resources Development*, of nurturing and bringing out the human potential. The results of Quality Circle could therefore, only be measured in the long-term although many organizations here and abroad have claimed significant benefits within a short period of time.

The successes of Quality Circles in Japan are striking and it is sometimes referred to as a Japanese Management Technique. The Circles can be effective here or elsewhere also, if the management commitment to the basic philosophies underlying the concept of Quality Circles is there. This philosophy and commitment takes time to permeate all levels of the organization. Of course this depends upon the already existing organizational climate and culture, and upon the social culture within which a organization has to function. In India, BHEL started its first Quality Circle at its Hyderabad unit in 1980-81. The idea caught on the entire corporation and in two years there were more than 200 circles with about 1800 members. Other companies also followed suit. Some of these are Jyothi, Shriram Refrigeration, Kirloskar, Sundaram Fasteners, Crompton Greaves, Madurai Coals, Bharat Fritz Werner, Essae Industries and Mangalore Chemicals and Fertilizers. The results of the experiment of Quality Circles in Indian Industries are encouraging. The reasons for this, it has seen in the firm commitment and continual supportive guidance by the top and senior managers to the Quality Circles Program. Quality Circle concept may be extended to Production Circle, Design Circle etc. so that the persons in the circles can discuss the problem of a particular activity and come out with a suitable solution. In the present day trend, we can see this concept is used Police Department to solve the problems of law and order, traffic control. This we can witness from the 'Sadbhavana

Meetings" conducted, to involve public in general to solve the social problems. It clearly advocates involvement of the concerned people for solving a problem will save lot of time and also get a good solution, which is amicable to all.

10.12.2. Indian Experience

It should be noted that, Quality Circles couldn't immediately be imposed on any unit and expect to yield results. Mutual trust, mutual concern for development, and cooperation, if not already exist in sufficient measure take time to build. Circles can help accelerate this building process but the introduction of this potent concept in any organization has to be gradual. Or else, with few initial failures the zeal may not be sustained in the long term.

Deming is best known for developing a system of statistical quality control, and for his advocacy that quality must be built into the product at all stages of manufacturing. His overall approach focused on improvement of systems and processes for efficient quality management. He believed it is the system and not the workers (a widely held belief by many during that period), which is responsible for the process variations and quality problems. As per Deming, quality comes from the ability to produce with a predictable degree of uniformity and dependability at a lower cost, and the product must be suitable for the market. Deming advocated that as quality improves, productivity increases with decrease in overall cost. Such a situation creates more jobs, greater market share for the products and ensures long-term survival of the company. He prescribed fourteen universal points for quality management, which are described below:

1. Create consistency of purpose with plan: This implies that companies should have a clear mission and statement of purpose. The true purpose of a business should be to serve its customers and all other stakeholders, including employees.
2. Adopt the new philosophy of quality: This refers to viewing quality as an outcome of improved systems and processes that enable to produce with a high degree of consistency and dependability at a low cost. Deming referred to improvement as a

never-ending cycle - where improvements follow one another with no letting up of efforts. He termed this approach as the new philosophy of quality.

3. Stop the practice of mass inspection: Mass inspection does not stop producing defects, and does not add value to the products; it only adds unnecessary cost and tends to dilute the responsibility of workmen for their own output. Managers should understand the causes of variations and take steps to reduce the same. Inspection, if any, should only be for the purposes of information and data building.
4. Identify problems and work continuously for improving the system: Problems will exist in a manufacturing system, and solving and improving that situation should be the key to successful quality management. Reducing the variability and thereby helping to establish a stable and predictable production system can bring about a real change in quality management practice.
5. Change the focus from quantity to quality: Ultimate value of production lies in its quality and not in quantity. Often, focus on quantity leads to production at any cost, and high cost of rework and scrap. This violates all systems of good management.
6. Stop asking for productivity improvement without identifying and providing methods to achieve them without any risk of quality: Productivity is a common buzzword, and every manager may ask for it from the workers, but to get it right managers must plan the means and provide the methods. Otherwise, it runs the risk of high cost and rework for maintaining quality.
7. Adopt the method of training on the job: Employees need proper skill and knowledge to do a job well. It is the responsibility of management to provide necessary training and skill development programmes to employees with regard to their classified jobs. Deming advocated that all employees should be further trained in statistical tools and techniques for problem solving.

organization with improved efficiency, effectiveness, profits, safety and services. "5-S" - as stands for in Japanese and its literal English translation are:

Selso	-	Cleanliness
Seiketsu	-	Clean-up Time
Selton	-	Orderliness
Seiri	-	Tidiness
Shitsuke	-	Discipline

However, in the context of general business activities, the system is popularly described as:

Sort: Sort out and sort through for cleaning the workplace by keeping what is necessary in the workplace, and relocating or discarding what is not.

Systematize: Set in order and arrange a system by which the needed items are easy to find, use and return to original location in order to streamline production system and to eliminate waste of time searching for them.

Implementation of 5-S programme would depend on the situation of a company. For example, if a company is already practicing total quality or lean manufacturing, the process must have already begun. What needed to be done is formally putting the concept and programme in the company's regular programme schedule and ways of doing the day-to-day business. Depending on the company's situation, steps to be followed for 5-S implementation are:

1. Organize the programme committee, and train the members in 5-S principles. (Programme committee typically consists of supervisors and team leaders - like plant manager or area foreman etc.)
2. Develop plans for each of the "S", i.e. how and where it should be implemented.
3. Communicate and formally announce the start of the programme.
4. Arrange training for employees concerned.
5. Schedule days and time when everybody should clean up his own workplace.
6. Schedule days and time when everybody should sort out and organize his own workplace.
7. Evaluate the results and gap areas. Communicate to concerned people about what more should be done for developing a habit of doing things as per 5-S principles.
8. Perform assessment and appraisal, take corrective actions, and ensure making it a habit of all to do things in 5-S ways.

5-S, like any other improvement programme, demands commitment of top management and participation of all employees. Members should be made to realise the need for this programme in their workplace, motivated to form the group (called committee), and trained in the methods and systems. Care should be taken to tailor

2.17.2 Kaizen

Originally a Buddhist term, Kaizen comes from the words "Renew the heart and make it good". Therefore, adaptation of Kaizen concept also requires changes in "the heart of the business", corporate culture and structure, since Kaizen enables companies to translate the corporate vision in every aspect of a company's operational practice.

KAIZEN is Japanese word KAI and ZEN. KAI means change and ZEN means better. KAIZEN means change for better. It implies continuous small improvement

☞ Consistently

☞ Every time

☞ Every step

☞ Every place and

☞ By every one in the organization, leading to development.

☞ With nil or negligible investment.

International attention is being focussed on the outstanding performance of the Japanese economy and the success of management practices being adopted in Japanese industries. In fact to remain competitive, we need change for better and hence Kaizen.

Kaizen is a Japanese way of life. Quality improvement is central to the Japanese system (along with life time employment, seniority based promotion, group participation etc). So, it is no surprise that TQM has succeeded in Japan via Kaizen inputs.

Kaizen means step-by-step, continuous improvement or approaching improvement via a regular, systematic process in little steps — as inexpensively as possible in terms of capital expenditure associated to improvement — in a long time — filling gradually the performance gap from the present status to a better performance status which is a "moving target".

Questions to be asked related to 4 M's to implement Kaizen activities effectively are:

(i) Man (operator)

- ☞ Is he qualified?
- ☞ Is he experienced?
- ☞ Is he responsible/accountable?
- ☞ Does he follow standards?
- ☞ Is he assigned to the right job?
- ☞ Is he healthy?
- ☞ Does he follow standards?
- ☞ Is his work efficiency acceptable?
- ☞ Is he problem conscious?
- ☞ Is he willing to improve?

(iii) Material

- ☞ Is the inventory level adequate?
- ☞ Are there any mistakes in grade?
- ☞ Is there any wastage in material?
- ☞ Is the handling adequate?
- ☞ Is the quality standard adequate?
- ☞ Is the layout adequate?

(iv) Method (operation)

- ☞ Is it efficient method?
- ☞ Is it a safe method?
- ☞ Is the sequence of operations adequate?
- ☞ Is the set-up proper and adequate?
- ☞ Are the temperature and humidity adequate?
- ☞ Are the lighting and ventilation adequate?
- ☞ Is the method ensures good quality?

(ii) Machine (Facilities)

- ☞ Are there enough machines/facilities?
- ☞ Does it meet process capabilities?
- ☞ Does it meet production requirements?
- ☞ Does it meet precision requirements?
- ☞ Is the layout adequate?
- ☞ Is the oiling/greasing adequate?
- ☞ Is its inspection done adequately?
- ☞ Does it make any unusual noise?

leadership by defining new roles of employees in valuing customer needs, empowering them with knowledge, skill and understanding of the process of TQM by extensive training, and facilitating performance improvement (continuous improvement) throughout the organization.

A road map for TQM implementation is illustrated in figure 2.4. The implementation starts with the culture of putting the customer first in any planning of process or activity. This culture must be cultivated amongst the senior executives and managers first - as they are the leaders for general employees, and they must act as change agents. These executives and managers should be able to motivate and inspire people for total quality and fulfilling customers' needs by transparent communication, consulting and facilitating required actions, paying attention to critical processes for the success of TQM, and by removing the barriers to total quality. This is the most difficult part towards accomplishment of total quality goals.

To achieve and sustain market leadership, organizations must empower people, institute "quality improvement programmes" (QIP), and set quality goals in all spheres of activities, preferably by benchmarking with the best in the industry practice. Planning measures for improvement and measuring the actual performance in all processes categories are important steps in the implementation of total quality. The purpose of this

The total quality perspectives as reflected in the Malcolm Baldrige National Quality Award model suggest several requirements for effective implementation of TQM. The implementation process requires:

(1) **Statement of quality policy**, (2) Strategic planning of quality objectives, key processes and implementation plan with due regard to internal capability, market environment, customer demands, and suppliers' capability, (3) An approach/ deployment plan (action plans) for implementation, (4) Measurement and monitoring plans for results and performance in each process category under MBNQA, and (5) Plans for continuous improvement and adoption of suitable strategies like benchmarking, process re-engineering, and other quality improvement methods.

The first challenge in the implementation of TQM is that the TQM system has to be implemented by managers and employees of the organization, who are obsessed with their own mind set, complacency and cultural habits. This has to be changed by the leadership by defining new roles of employees in valuing customers' needs, empowering them with knowledge, skill and understanding of the process of TQM by extensive training, and facilitating performance improvement (continuous improvement) throughout the organization.

2.9 IMPLEMENTATION OF TQM

In the organization involved into quality control has been overcome by designing "cross-functional customer-focused processes" and by implementing the concept of "internal customers" for every operation.

Company-wide Quality Control (CWQC) aims to achieve distinctive performance improvements through participation and co-operation of all members of the organization. It was first initiated in Japan alongwith Deming Application Prize in 1950s. It status that "To effectively execute quality control, participation and co-operation of all members of the enterprise activities covering market research, research and development, production planning, designing, production preparations, purchasing and sub-contracting, manufacturing, inspection, sales and after sales services, as well as finance, personnel, and education and training, are a must Quality Control thus executed is called Company Wide Quality Control (CWQC). This is very similar to total quality concept formalized by Feigenbaum. It is, thus, an early system of total quality to assure quality of products and services required by customers, and implied that products should be economically designed, produced and supplied to customers while respecting the principle of customer orientation and overall public well-being.

The definition of CWQC implies that quality activities should be:

1. Activities in an enterprise should target the customers' demands in realizing the product performance, reliability, safety, usage, economy and servicing.
2. Activities should aim for rationally and economically realizing the above objectives and use statistical and other scientific means for planning and controlling.
3. Activities to be implemented not only by production and inspection alone, but by participation and co-operation of all individual functions ranging from market research, quality planning, production planning, sales, etc. in the resolution of quality control problems faced by the enterprise.

4. Participation of everybody in the enterprise for assuring quality, including all employees and management staff, who should play their required role under the leadership of the owner.

It is obvious that this Japanese approach specifically required the total involvement of all people at all levels in the enterprise for quality control, which many Western organizations found difficult to implement in those days.

Deming Applications Prize in Japan for CWQC designed 10 checkpoints for judging the implementation effectiveness. They are: policies, the organization and its operation culture, education and training, information gathering and analysis, communication, standardization of processes, quality assurance, management control, results and future plans. These checkpoints were further divided into subcategories for deeper examination of the implementation quality. Thus, this CWQC can be considered as the forerunner of present day TQM system, where the difficulties of getting everybody in the organization involved into quality control has been overcome by designing "cross-functional customer-focused processes" and by implementing the concept of "internal customers" for every operation.

11.8. TYPES OF PLANNED AND PREVENTIVE MAINTENANCE

These types of maintenance are carried out either when the plant is running (on line) or when it is taken down as per an agreed schedule when no production is possible. These may be classified as:

11.8.1. Time Based

It means doing maintenance work at regular time intervals – herein the deterioration is linked to time rather than usage. For example, undertaking monthly, quarterly, six-monthly or yearly maintenance work as per the time calendar. Such schedules are easy to monitor. A best example of this may be quoted from maintenance schedules followed in A.P.R.T.C., where we have schedule 1, Schedule 2, Schedule 3 and so on which are based on time as daily, weekly, monthly etc.

11.8.2. Work based

In this, maintenance work is undertaken after a set number of hours of plant working or processing of certain volume of products on the machine. It is more difficult to monitor. We have to use some kind of auto-counter, servicing a vehicle every 2000 kilometers.

11.8.3. Opportunity Based

This implies doing maintenance work when the equipment is available. For example, doing maintenance work on Sunday or weekly-off days or doing maintenance work outside the normal working shifts.

11.8.4. Condition – based

When condition of the machine is such that if we do not maintain it, it may lead to costly breakdown or equipment failure.

Often, all these types of maintenance operate together, overlap or coincide.

~~The machine.~~ Roles of worker and equipment are to be compared in such a manner as to produce quality products at reduced costs. Equipment has to be operated as specified in order to maintain accuracy. Operators, maintenance and production personnel have to work together as a team to (i) Make efforts to maintain machines in the best condition. (ii) Maintain machines in such a way that they perform consistently over a long period of time (to achieve MBP).

~~11.8.5.~~ Equipment Must Change

When the introduction of TPM, equipment becomes an area of focus. We must clean it properly because when we inspect it, we uncover problems and when we solve problems, it leads to improvement in the machines. Only when we are able to eliminate the problem, we achieve satisfaction, which also imparts confidence. Once the team has succeeded in making changes in the equipment, it changes their attitude to work in general.

~~11.8.6.~~ People Must Change

The above step-by-step approach is easy to follow and invariably, it leads to recognizing the problems in the equipment and need to solve them. After we correct the trouble in the machine, it implies changes in the equipment to obtain good results. People change only when the equipment is changed – those who cannot or are unable to change the equipment, cannot change their way of thinking. Successful changes brought about in the machines impart confidence among the operators and this sows the seed in them for rethinking about themselves.