

Unit - 2

TQM Principles

2.0 INTRODUCTION—PRINCIPLES OF TQM

Following are the Principles of TQM.

- i) Performance measurement is a must at organisation, department, individual level.
- ii) Customer orientation is a must. Customer complaints, surveys, questionnaires, contact feedback, retention.
- iii) Continuous improvement is must.

Reduction in scrap, rework, inventory costs, waste of humans, potential, product, queuing, over production, unnecessary processes, excess workers movement.

- iv) Total employees' involvement is must.
Appraisal system, customer impact, competence.
Reward system, motivation, empowerment. Empower people to act and evaluate their action.
- v) Purchasing and Supplier Management is must.
 - a) Both parties should be benefited.
 - b) Both parties should seek to improve quality.
 - c) Number of suppliers should be minimised.
 - d) Suppliers should be for a long time.
 - e) Supplier should be valued by number of rejects and deliveries in time.
 - f) Vendor rating system should be developed.
 - g) Vendor development is must.
- vi) Management by facts is must.
Decision should be based on facts.

f) Statistical records.

All employees are responsible for resolving problems in their areas.

2.2.4 Quality Measurement by Customer

Appearance, aesthetic design, ruggedness, dependability and long life.

2.2.5 Customer Attitude

Quality of shipment, product installation, product operation, product functional design, service maintainability.

Serviceability—No two customers are alike. Each is unique in his/her own way. So their attitude toward your product or service will be different.

Profitability and customer satisfaction will depend on how will you customise your offerings.

2.2.6 Who is Customer?

We can know who is customer by the following methods.

- a) Flow diagram method.
- b) Activity log method.

Tools/Techniques for customer focus.

- a) Quality declaration.
- b) Internal customer concept.
- c) Purpose mission—Value statement.
- d) Quality assurance.
- e) Customer satisfaction index.
- f) Quality cost delivery service.

2.2.7 Identification of Customers

The first step is to identify the “customer”. The word “customer” is used here in the sense of only one is impacted by the product of process. Customer can be:

- a) External.
- b) Internal.
- c) Delighted.
- d) Dissatisfied.
- e) Satisfied.
- f) Indifferent.
- g) Lost.

2.2.8 Customer Satisfaction: How can I Measure it? Yoshio Kondo

- The two common aspects of quality, objective reality and subjective side of quality.
- The progress of free market economies since the end of the Cold War in 1989.
- American Customer Satisfaction Index.

Who are the customers?

- The two kinds of customers are internal customers and external customers.
- Quality is a common concern between manufacturer and customer.
- The hypothesis-testing approach is used to survey the customers on the market.

What is satisfaction?

- The absolute number and/or percentage of complaints can be the indicators of customer dissatisfaction.
- A company's ultimate goal is to reduce the number of customer complaints to zero.

Must-be quality and attractive quality

- Ishikawa recognised the importance of customer satisfaction and divided quality into two categories of backward-looking quality and forward-looking quality.
- The correlation of backward-looking quality versus forward-looking quality and human dissatisfiers versus human satisfiers.

Surplus quality

1. Quality that clearly appears excessive to both the manufacturer and customer.
2. Quality that tends to appear excessive to the manufacturer but that is strongly demanded by the customer.

Employee satisfaction: An indispensable factor

The hierarchy of human needs as the element of motivation are:

1. Physiological needs.
2. Safety needs.
3. Social needs.
4. Ego or esteem needs.
5. Self-fulfilment needs.

2.3 TYPES OF CUSTOMER**2.3.1 External Customer**

These are impacted by the product but are not member of a company (or other institution) which produces the product. External customers include

- i) Clients—They buy products (goods and services), they receive product and product information.
- ii) Regulatory agencies—They monitor products and product informations as they issue regulations.
- iii) The public—Members of the public may be impacted due to the effect of product on human safety, health or on the environment.

- iv) The community—It may be impacted by numerous practices relative to employee relations, doors, congestion, participation in community affairs, payment of community taxes.

2.3.2 Internal Customer

Within any company, each internal department supplies product to other internal departments, for example:

<i>Supplying department</i>	<i>Major products</i>	<i>Some internal customer</i>
Finance	Financial statements	Manager
Employment	Recruits	All departments
Order editing	Edited orders	Operations
Office service	Office space, supplies	All office departments
Legal	Legal advice	All departments

Within any company there are numerous situations in which departments and persons supply product to each other. The recipients are often called “customer” despite the fact that they are not customer in the dictionary sense. They are not client.

The internal customer should participate in those planning activities which relate to their operations.

2.3.3 Delighted Customer

We are managing our customer; we are watching for his problems and using our talents to help. This brings us into the rare field area of customer delight, doing something that feels special to the customer, this come back fire, not going over the top, this may be impossible to repeat, but simply doing that little bit better.

2.4 AMERICAN CUSTOMER SATISFACTION INDEX (ACSI)

An economic indicator is that which measures customer satisfaction at the national level

It is based on customer evaluations of the quality of goods and services purchased in the U.S. and being produced there. (Figure 2.2).

The index quantifies the value that customers place on products.

Companies can use data to assess customer loyalty, identify potential barriers to entry within markets, predict ROI.

It is an econometric mode, multi-equational and measures several sectors of the economy, viz. manufacturing (non-durable), manufacturing (durables), retail, transportation and communication, finance and insurance, services and public administration, and government.

Each sector has industries and each industry has specific companies.

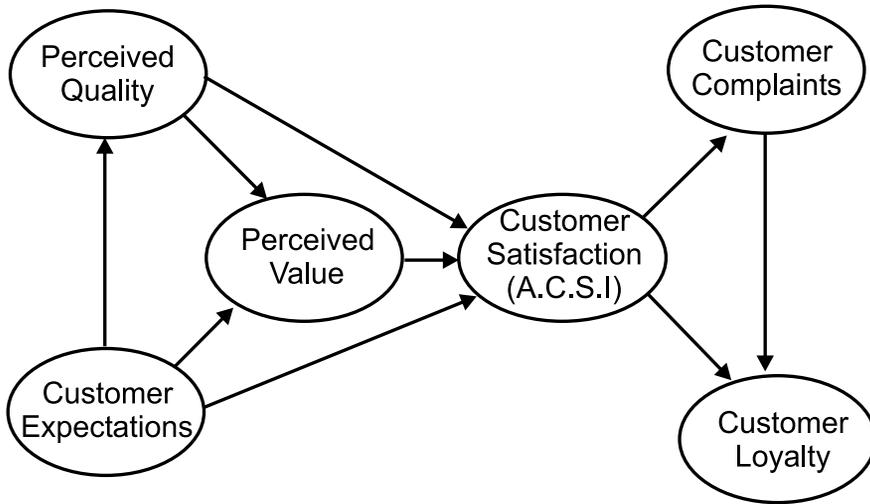


Figure 2.2: ACSI Model

2.5 CUSTOMER PERCEPTION OF QUALITY

To have customer focus, it is essential to understand the customers' perception of quality. Since the customers' needs, values and expectations are constantly changing and becoming more demanding, there is no acceptable quality level for the customers. This means there is a need for continuous improvement of quality to meet customers' expectations.

An American Society for Quality (ASQ) survey on end user perceptions of important factors that influenced purchase showed the following ranking: i) Performance, ii) Features, iii) Service, iv) Warranty, v) Price, vi) Reputation (brand image). This implies that product quality and service are more important than price.

Product performance involves fitness for use for the customer. Other considerations are availability, reliability and maintainability. Identifiable features or attributes of a product or service are psychological, time oriented, contractual, ethical and technological. Features are secondary to performance, service is an intangible characteristic contributing to customer satisfaction.

2.5.1 Performance

Performance involves "fitness for use"—a phrase that indicates that the product and service is ready for the customer's use at the time of sale. Other considerations are 1) Availability, which is the probability that a product will operate when needed, 2) Reliability, which is freedom from failure over time, and 3) Maintainability, which is the case of keeping the product operable.

2.5.2 Features

Identifiable features or attributes of a product or service are psychological, time oriented, contractual, ethical, and technological. Features are secondary

characteristics of the product or service. For example, the primary function of an automobile is transportation, whereas a car stereo system is a feature of an automobile.

2.5.3 Service

An emphasis on customer service is emerging as a method for organisations to give the customer added value. However, customer service is an intangible—it is made up of many small things, all geared to changing the customer's perception. Intangible characteristics are those traits that are not quantifiable, yet contribute greatly to customer satisfaction. Providing excellent customer service is different from and more difficult to achieve than excellent product quality. Organisations that emphasise service never stop looking for and finding ways to serve their customers better, even if their customers are not complaining.

2.5.4 Warranty

The product warranty represents an organisation's public promise of a quality product backed up by a guarantee of customer satisfaction. Ideally, it also represents a public commitment to guarantee a level of service sufficient to satisfy the customer.

A warranty forces the organisation to focus on the customer's definition of product and service quality. An organisation has to identify the characteristics of product and service quality and the importance the customer attaches to each of those characteristics.

A warranty generates feedback by providing information on the product and service quality. It also forces the organisation to develop a corrective action system.

Finally, a warranty builds marketing muscle. The warranty encourages customers to buy a service by reducing the risk of the purchase decision and it generates more sales from existing customers by enhancing loyalty.

2.5.5 Price

Customer are constantly evaluating one organisation's products and services against those of its competitors to determine who provides the greatest value. However, in our highly competitive environment, each customer's concept of value is continually changing. Ongoing efforts must be made by everyone having contact with customers to identify, verify, and update each customer's perception of value in relation to each product and service.

2.5.6 Reputation

Total customer satisfaction is based on the entire experience with the organisation, not just the product. Good experiences are repeated to six people and bad experiences are repeated to 15 people, therefore, it is more difficult to create a favorable reputation.

Customers are willing to pay a premium for a known or trusted brand name and often become customers for life. Because it costs five times as much to win a new customer as it does to keep an existing one, customer retention is an important economic strategy for any organisation.

2.6 SERVICE QUALITY

Nowadays, service industries are playing an increasingly important role in a nation's economy. Management of customer satisfaction and retention of customers is critical for the growth of service industries because of the growing importance of service as a means of strategically competing in the marketplace. Management of services is one of the most important problems managers and executives are facing today.

Because many services are intangible, the interaction between employees and the customer is critical. The one-to-one or face-to-face contact between the customer and the delivery of the service is extremely important. Customer rejection because of poor service have a substantial impact on cost and profits, economies of scale, market share and unit cost.

2.6.1 Service Quality

Strategies that have produced significant results in production are often harder to implement in a service environment. Thanks to the teachings of Deming, Juran, and others, significant strides have been made in manufacturing. The same results have been slower in service organisation or service activities in manufacturing.

Customer service is the set of activities an organisation uses to win and retain customer's satisfaction. It can be provided before, during, or after the sale of the product or exist on its own. Elements of customer service are:

i) Organisation

1. Identify each market segment.
2. Write down the requirements.
3. Communicate the requirements.
4. Organise processes.
5. Organise physical spaces.

ii) Customer Care

6. Meet the customer's expectations.
7. Get the customer's point of view.
8. Deliver what is promised.
9. Make the customer feel valued.
10. Respond to all complaints.
11. Over respond to the customer.
12. Provide a clean and comfortable customer reception area.

iii) Communication

13. Optimise the trade-off between time and personal attention.
14. Minimise the number of contact points.
15. Provide pleasant, knowledgeable, and enthusiastic employees.
16. Write documents in customer-friendly language.

iv) Front-line People

17. Hire people who like people.
18. Challenge them to develop better methods.
19. Give them the authority to solve problems.
20. Serve them as internal customers.
21. Be sure they are adequately trained.
22. Recognise and reward performance.

v) Leadership

23. Lead by example.
24. Listen to the frontline people.
25. Strive for continuous process improvement.

2.7 CUSTOMER RETENTION

- Represents the activities that produce the necessary customer satisfaction that creates customer loyalty.
- Customer retention is the nexus between customer satisfaction and the bottom line.
- Product/service dimensions act as key factors in influencing customer satisfaction.

Why customers quit ?

- 3% - Move away giving no reasons.
- 5% - Develop other supplier relationships.
- 9% - Leave for competitive reasons.
- 14% - Are dissatisfied with the product.
- 68% - Quit because of an attitude of indifference towards the customer by the owner, manager or some employees.
- 1% - Die.

2.7.1 Focus Areas of Customer Retention

- More powerful and effective than customer satisfaction.
- Customer satisfaction is measured by the hard measures of cash register receipts, market share, level of customer elevation and the number of referrals from other customers.
- Customer retention moves customer satisfaction to the top level by determining what is truly important to the customers and making sure that the focus is on that really matters to the customer.

2.7.2 Customer Retention and Profitability

What is the ultimate desired outcome of customer focus and satisfaction? Is it's achieving profit in the private sector or productivity in the public or non-profit sectors? The answer must be yes. However, an accurate cause-and-effect relationship has yet to be established between profit and customer satisfaction. (Figure 2.3).

The drivers are: employee satisfaction and employee retention. The system components are:

- Internal service quality, which establishes and reinforces a climate and organisation culture directed towards quality.
- Employee retention, which is achieved through good human resources management practices and organisation development methods such as teams, job development and empowerment. Employee retention depends on employee satisfaction, which in turn can be related to external service and customer satisfaction.

Profitability and Customer Retention

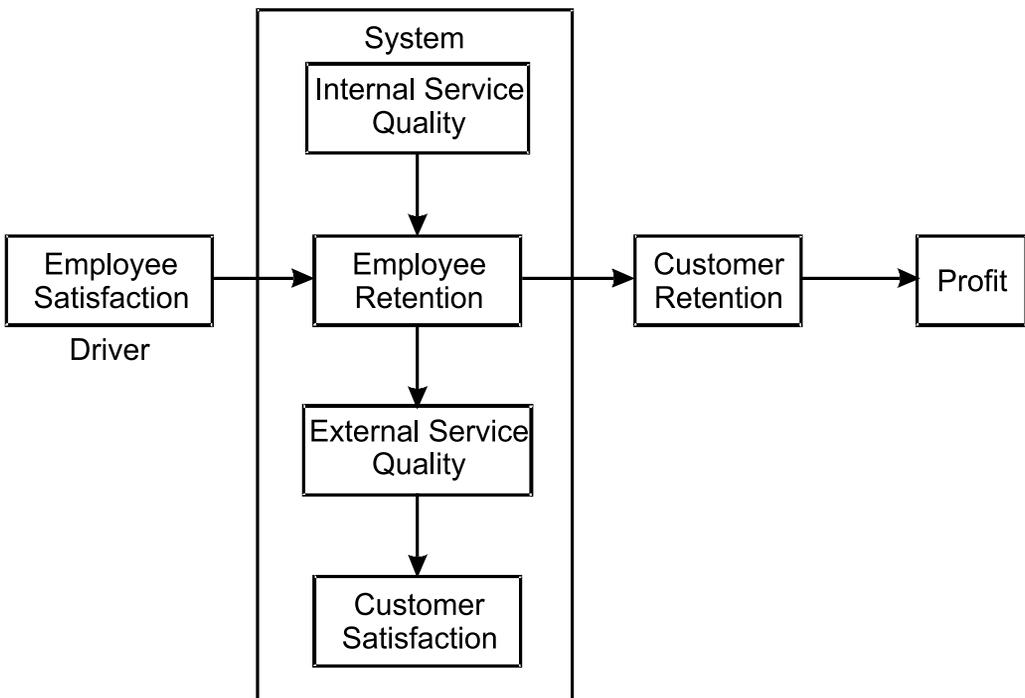


Figure 2.3: Profitability and Customer Retention

2.8 EMPLOYEE INVOLVEMENT

In TQM, quality is more an attitude of mind, based on pride in the job, in the self, in the organisation and requires a total commitment from every person at all levels and in all departments. By its very nature, the processes and operations in industry are so complex that they are beyond the control of any one individual or group of individuals. The only way to tackle problems in such a situation is through the involvement of one and all in the TQM effort.

Participative management approach helps to bring about involvement of everyone in quality improvement effort.

Among other things, studies show that employee involvement through participative management tends to:

- Increase the degree of “we” feeling or cohesiveness that participants have with their organisation.
- Provide the participants with an overall organisational point of view instead of the traditionally more narrow departmental point of view.
- Decrease the amount of conflict, hostility and cut-throat competition among the participants.
- Increase individual understanding of each other which leads to increased tolerance and patience towards others.
- Increase the individual’s free expression of his personality.
- Develop a ‘work climate’ as a result of the other tendencies, in which the subordinates find an opportunity to be more creative and to come up with ideas beneficial to the organisation.

Cole, Bacdayan and White (1993) outline the strengths and weaknesses of the participation tradition in terms of its contribution to individuals and groups. The strengths are:

- The participation yields the best results when it is based on a voluntary act and leads to self-realisation and human dignity.
- It aligns individual and organisational objectives.

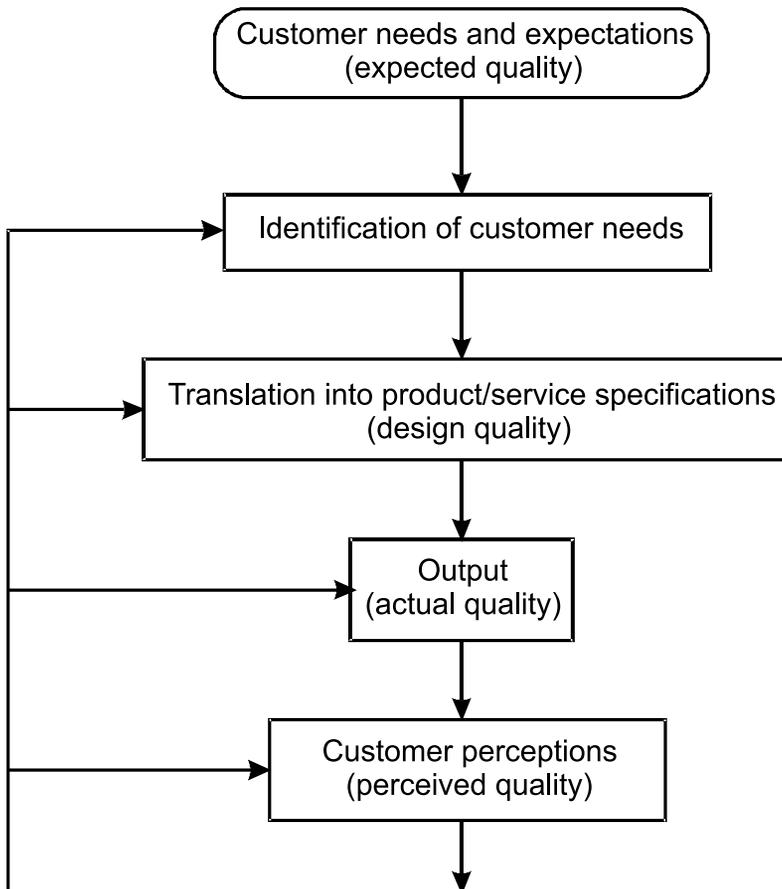


Figure 2.4: Customer-Driven Quality Cycle

2.9 MOTIVATION

Applying motivational theories to total quality

All the motivational theories mentioned below can be applied to support TQ in an organisation. Motivating factors such as achievement recognition and responsibility lead to personal satisfaction and sustained motivation for continuous improvement. Applying motivation theories to management practices in TQ environment has both advantages and drawbacks. On one hand, efforts to empower employees may appeal to individuals who have a high need for power. On the other hand, empowerment may be dangerous if not carried out properly. For example, Herzberg's two factors theory suggests that ignoring hygiene (maintenance) factors such as supervision, working conditions, salary, peer relations, status and security will produce dissatisfaction.

Hence, to implement TQ, it is necessary to address the hygiene factors before thinking of motivating factors.

2.9.1 Applying Motivation Theories to TQ

<i>Situation</i>	<i>TQ example</i>	<i>Applicable motivation theories</i>
Choice of employees	Decisions to join employee involvement groups	Expectancy
Prediction of choices	Management desires employee "buy-in" for reengineering	Equity; goal setting
Efforts exerted on a task	Group members' responses in performing a process improvement project	Reinforcement, equity
Work satisfaction	Responses to a survey on how well employees are responding to empowerment initiatives encouraged by management	Need, equity
On-the-job performance	Reduction of customer complaints in a hospital billing department, due to reduction of errors	Reinforcement, equity, goal setting
Withdrawal from	Absenteeism, turnover	Reinforcement, equity or expectancy

2.9.2 Theories of Motivation

The four major types of motivation theories and its types.

1. Need Theory.
 - a) Maslow's Hierarchy of Need.
 - b) Herzberg's Motivator Hygiene Theory.

2.10.1 Phases of Employee Involvement

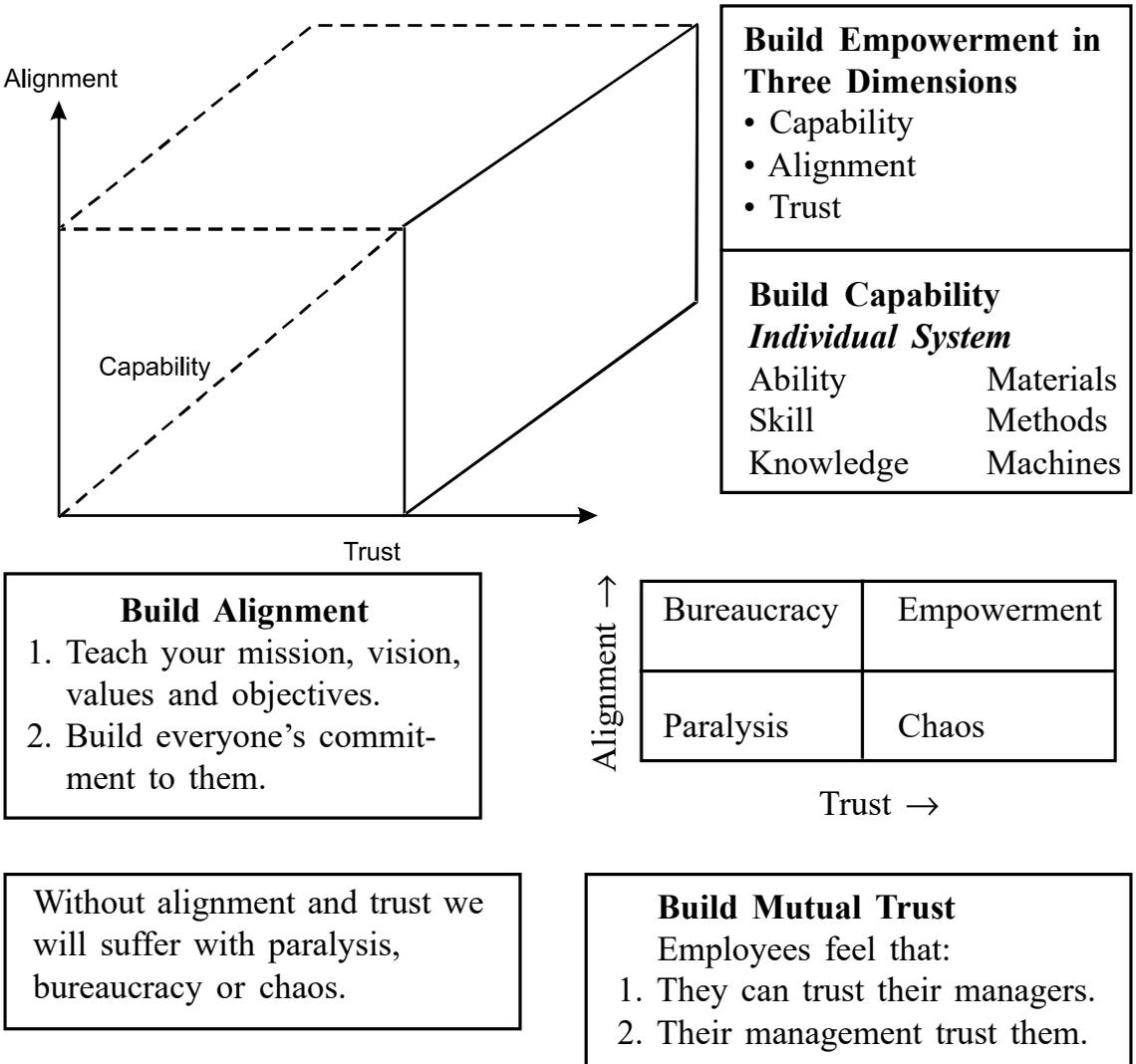
<i>Organisational Phase</i>	<i>Traditional</i>	<i>Transitional</i>	<i>High-involvement</i>
Structure	Hierarchical Precise job descriptions Functional units management	Less hierarchical Loose job descriptions Matrix	Flat No job descriptions Self-directed teams
Focus	Internal targets Preservation Costs Problem solving Find-and-fix	Competition Adaptation Quality and productivity Product service improvement Detection	Customers' needs Flexible, responsive Customer satisfaction Process improvement Prevention
Authority	Top-down command Inflexible Controlling Rank and title	Special assignment Open to challenge Sharing Committee	Consensus Seeks challenge Trusting Knowledge
Idea sources	Work measurement Suggestion systems	Staff studies Quality circles	Work teams Customers and employees
Stake	Apathetic No ownership	Complication Some ownership	Committed Full ownership

A quality revolution in an organisation should lead to numerous examples of empowerment everyday. Employee empowerment does not mean democracy. The workers still have their basic work to do—probably even more of it, if their value is better recognised.

2.10.2 Two Steps to Empowerment

- One is to arm people to be successful through coaching, guidance and training.
- The second is delegation: Letting people do by themselves. Empowerment means achieving good delegation throughout the whole organisation.
- The right managerial environment is required that can fuel the energies high.
- Just as empowered employees can create marvels, so also can empowered vendors.
- To empower people without abdicating, the quality leader must build on respect.
- Some principles for empowering people:
 - Tell people what their responsibilities are
 - Give authority that is commensurate with responsibility.
 - Set standards for excellence.
 - Render training.

- Provide knowledge and information.
- Trust them.
- Allow them to fail.
- Treat them with dignity and respect.
- A key dimension to empowerment is alignment. All employees need to know the organisation’s mission, vision, values, policies, objectives and methodologies.
- Another dimension of empowerment is capability. Employees must have the ability, skills and knowledge needed to know their jobs as well as their willingness to cooperate.



Figurr 2.5: Empowerment Matrix

2.11 TEAMWORK AND TEAM BUILDING

A team is a small number of people with complementary skills who are committed to a common purpose, set of performance goals and an approach for which they find themselves mutually accountable by teamwork.

Team members develop a rapport that allows them to perform better.
Teams provide the vehicle for improved communication.

2.11.1 Types of Teams

i) Process Improvement Team

- Consists of representation from the various processes.
- Usually a size of 6 to 10, may include external or internal supplier/customer.

It is a temporary team and is dissolved once the objective is accomplished.
Not suited when the targeted process is the entire organisation or includes many work units.

ii) Cross Functional Team

- Members will be from the various functional areas of engineering, marketing, quality, HR, accountancy.
- Including the customer and suppliers in the design review team is an effective cross functional team, usually a temporary team.

iii) Natural Work Teams

A manager heads the team and identifies various problems to be addressed.
Manager should make employees feel comfortable to work in teams.

iv) Self-directed Work Teams

- Extension of natural work teams without the supervisor.
- Epitome of empowered organisation—they not only work but also manage it.
- Team coordinated liasons with top management.
- Team meets daily to plan their activities and decisions are usually by consensus.
- Additional responsibilities may include performance evaluation, customer relations, supplier relations, etc.

2.11.2 Characteristics of Successful Teams

1. SPONSOR - From top organisation support.
2. TEAM CHARTER - Document that defines the team's mission, boundaries, authority and duties.
3. TEAM COMPOSITION - Size of the team
 - Optimal size is 10
 - Diverse members with different skills, perspectives and potential
 - Where appropriate include internal and external customers/suppliers

- | | | |
|-----|-------------------------------------|---|
| 4. | TRAINING | - Members to be trained in team dynamics, problem solving techniques and communication skills. |
| 5. | GROUND ROLES | - Team must develop its rule of operation and conduct. |
| 6. | CLEAR OBJECTIVES | - Clear objectives and goals have to be framed, with acceptance from the management. |
| 7. | ACCOUNTABILITY | - Team is accountable to perform.
- Review performance periodically to determine weakness and make improvements. |
| 8. | WELL-DEFINED
DECISION PROCEDURES | - Effective, acceptable and timely decisions. |
| 9. | RESOURCES | - Necessary time, information and funds to be allocated to the team. |
| 10. | TRUST | - Management must trust the team and the team members must trust each other. |
| 11. | EFFECTIVE PROBLEM
SOLVING | - Decisions are based on problem solving methods and not on hunches. |
| 12. | OPEN
COMMUNICATIONS | - Members should actively listen speak with clarity and directness and ask questions to clarify. |
| 13. | APPROPRIATE LEADERSHIP | |
| 14. | COHESIVENESS | - Group should act as a single unit. |

2.11.3 Developing Successful Teams

Team approaches need adequate planning. A certain period of investigation, reflection and soul searching is necessary before plunging into any team initiatives. Managers should examine their organisation's goals, objectives and culture to evaluate its readiness to develop and support team-based initiatives.

Most organisations benefit by establishing a steering committee made up of a group of interested, committed line and staff managers together with a union representative if a union exists. The steering committee establishes initial policies and procedures and chooses a person or persons to be the facilitators.

1. Clarity in team goals,
2. An improvement plan,
3. Clearly defined roles,
4. Clear communication,
5. Beneficial team behaviours,
6. Well-defined decision procedures,
7. Balanced participation,

8. Established ground rules,
9. Awareness of group process, and
10. Use of the scientific approach.

Self-Managed Teams (SMTs) represent the greatest challenge because the teams are empowered:

1. Creating a work unit responsible for an entire task,
2. Establishing specific measures of the work units' output,
3. Designing multi-skilled jobs,
4. Creating internal management and co-ordination tasks,
5. Creating boundary management tasks,
6. Establishing access to information, and
7. Establishing support systems.

2.12 RECOGNITION AND REWARD

Recognition is a process whereby management shows acknowledgement of an employee's outstanding performance. It is essential as people need to be accepted by others and recognition helps them to find themselves in a winning role.

Recognition of the efforts towards improvement is essential:

1. To show the company's appreciation for better performance.
 2. To improve morale.
 3. To reinforce behavioral patterns.
 4. To stimulate creative efforts.
 5. To create satisfied workforce.
 6. To create highly motivated workforce.
- TQM requires a cultural change and this change is brought about by the efforts of people. Furthermore, it is a continuous and long-term activity.
 - To sustain employee's interest and to propel them towards continuous improvement, it is essential to recognise the good work, in terms that are meaningful to the workers like financial, psychological or both.
 - The financial compensation can be paid in terms of increased salaries, commissions, piecework pay, employee stock plan, cash bonus and gain sharing.
 - Another way the efforts of employees can be recognised is by individual public recognition such as promotions, displaying employee's contributions on the notice board, special job assignments, etc.
 - Apart from individual recognition, efforts should be made to recognise group contributions which helps to bring a sense of belonging, leading to increased company loyalty.

2.13 PERFORMANCE APPRAISAL

Performance appraisal is an exceedingly difficult HRM activity. It is used by organisations for a number of reasons:

2.14 CONTINUOUS PROCESS IMPROVEMENT STRATEGIES

Continuous Improvement refers to both incremental improvements or large improvements. Improvements may take any one of the forms:

- Enhancing value to the customer through new and improved product or service.
- Reducing errors, defects, waste and their related issues.
- Increasing productivity and effectiveness in the use of all resources.
- Improving responsiveness and Cycle time performance for such processes as customer complaint, new product launch.

2.15 JURAN TRILOGY

2.15.1 Quality Planning

Quality does not happen by accident, rather it results directly from good planning. Quality planning begins with identifying customers, both external and internal, determining their needs and developing product features that respond to those needs. Juran wanted employees to know who uses their products, whether in the next department or in another organisation. Quality goals based on meeting the needs of customers and suppliers alike at a minimum combined cost are then established. Next, the process that can produce the product to satisfy the customers' needs and meet quality goals under operating conditions must be designed.

2.15.2 Quality Control

Juran stated that quality control involves determining what to control, establishing units of measurement to evaluate data objectively, establishing standards of performance, measuring actual performance, interpreting the differences between actual performance and the standard, and taking corrective action on the difference.

2.15.3 Quality Improvement

Quality improvement focusses on this goal seeking to achieve quality breakthroughs that move the firm to a new level of performance.

Quality trilogy has a sequence of events namely “quality planning”, “quality control” and “quality improvement” which fits all functions, levels of management and product lines.

Quality trilogy process starts with quality planning at various levels of the organisation (for example, strategic quality planning at top management level, tactical quality planning at middle management level and operational quality planning at junior management level). (Figure 2.6).

The second phase is quality control which has a goal to run the process effectively such that the plans are successfully implemented. The third phase of the trilogy process is quality improvement called as quality breakthrough sequence.

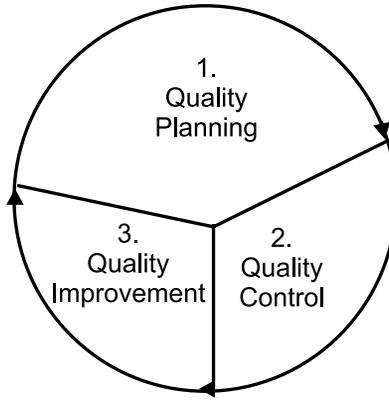


Figure 2.6: Juran's Quality Trilogy Process

2.15.4 Quality Planning

1. Identify the customer—both external and internal.
2. Determine customer needs.
3. Develop product features that respond to customer needs.
4. Establish quality goals that meet the needs of customers and suppliers alike and do so at minimum combined cost.
5. Develop a process that can produce the needed product features.
6. Prove process capability.

Quality control

1. Choose control subjects.
2. Choose units of measurement.
3. Establish measurement.
4. Establish standards of performance.
5. Measure actual performance.
6. Interpret the difference between actual performance and standard performance.
7. Take action on the difference.

Quality improvement

1. Prove the need for improvement.
2. Identify the specific projects for improvement.
3. Organise to guide the projects.
4. Organise for diagnosis for discovery of causes.
5. Find the causes.
6. Provide remedies.
7. Prove that the remedies are effective under operating conditions.
8. Provide control mechanisms to hold the gains.

2.16 DETERMINANTS OF QUALITY

Several activities or accomplishments are necessary to achieve quality. They are:

1. Quality of design.
2. Quality capability of production processes.
3. Quality of conformance.
4. Quality of customer service.
5. Organisation quality culture.

Quality of design is determined before the product is produced. After identifying who its customers are, a company must determine what its customers want from its products and services. Then products and services are designed to exhibit the attributes necessary to meet its customer's expectations.

Quality capability of production processes

Production processes must be designed and built that have the capability of producing products with the attributes wanted by customers.

Quality of conformance means producing a product to meet the specifications. Production facilities and processes are used to produce products and services that meet design and performance specifications, aimed at quality expectations of customers. When the product conforms to specifications, it is considered as a quality product regardless of the quality of the design specifications.

Quality of customer service

All contacts between customers and companies must be managed so that customers perceive that they have been treated fairly and courteously with their needs, attended to promptly and with care and concern.

Organisation quality culture

The entire organisation must become energised to doing what is necessary to design, products and services that meet customers' expectations. Mechanisms must be in place to continuously improve every aspect of the organisation towards the objective of building ever-increasing levels of customer satisfaction.

2.17 PDSA

- Deming's PDSA cycle is an effective improvement technique.

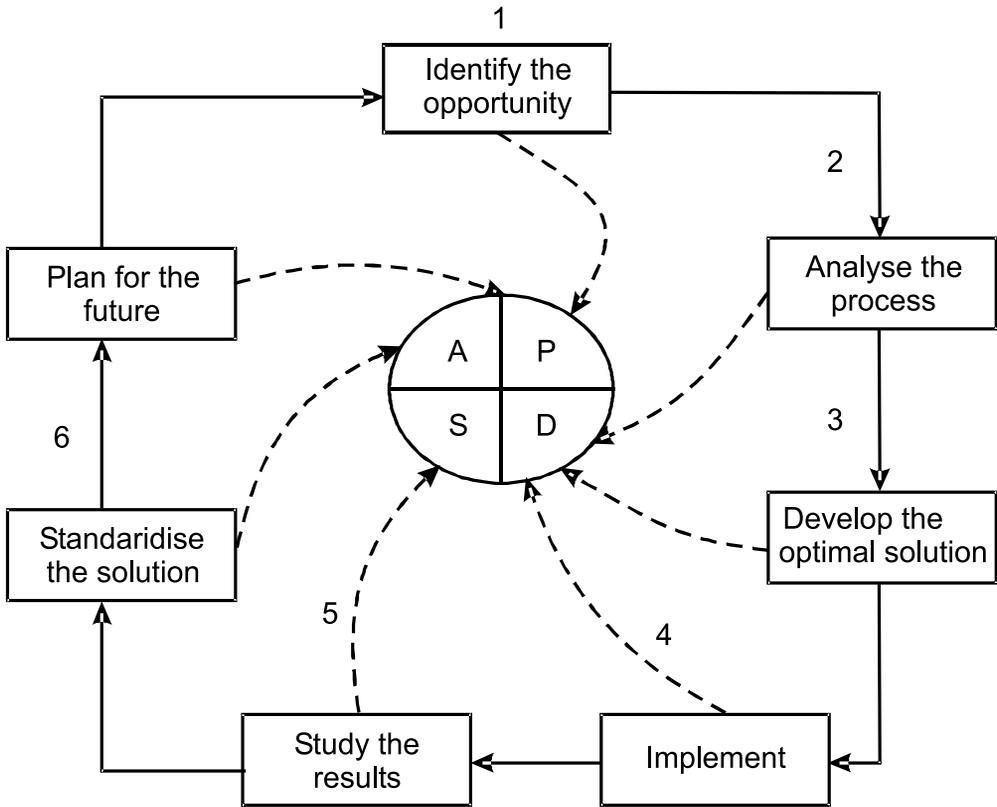


Figure 2.7: The PDSA Cycle

2.17.1 PDSA Cycle

PDSA means the following:

P	D	S	A
Plan	Do	Study	Act

- PDSA cycle was developed by Shewhart and then it was modified by Deming (which was called as PDCA cycle, C standing for “check”). (Figure 2.7).

- P (Plan) Determine what is to be done.
- D (Do) Carry out the activities as planned.
- S (Study) Study the results carefully.
- A (Act) Now as the result is known, act on the result and find what worked and what did not work as per plan.

Now as it is a cycle, using what has been learnt, try to develop a better plan and repeat the cycle.

- PDSA cycle is used for process improvement. Continuous process improvement is the main objective of PDSA cycle. The PDSA cycle has seven steps. That is, completion of all the seven steps constitutes one PDSA cycle of the process improvement model. The seven steps are as listed.

Step 1: Identify the improvement opportunity.

Step 2: Evaluate the current process.

Step 3: Analyse.

Step 4: Take action.

Step 5: Study results.

Step 6: Standardise solution.

Step 7: Plan for the future.

2.18 5-S SYSTEM

2.18.1 Introduction: 5-S System

Japanese factories are well-known for their cleanliness and orderliness. This results from their ability to instil a sense of responsibility and discipline into their workers, particularly at the plant level. The logic behind the 5-S practices is that organisation, neatness, cleanliness, standardisation and discipline at the workplace are basic requirements for producing high quality products and services, with little or no waste, and with high productivity.

There are many examples of successful implementation such as fast-food restaurants, supermarkets, hotels, libraries and leisure centres.

2.18.2 The 5-S in Detail

While contemplating each of the 5-S aspects due reference should be made to the 5-S Audit Worksheet.

Whilst the 5-S Audit Worksheet intends to cover most of the potential areas for improvement, it is not limited to the points in the table only. Depending on the need of your organisation, there may be more important points which you should add to the table at your own discretion. This principle applies to all of the five categories of the 5-S. Some photos of good and bad examples of the 5-S practices are also included as additional guidelines for the 5-S audit.

2.18.3 What is Organisation (Seiri)?

Organisation is about separating the things which are necessary for the job from those that are not and keeping the number of the necessary ones as low as possible and at a convenient location.

2.18.4 What is Neatness (Seiton)?

Neatness is a study of efficiency. It is a question of how quickly you can get the things you need and how quickly you can put them away. Just making an arbitrary decision on where things go is not going to make you any faster. There are four steps in achieving neatness.

Step 1: Analyse the status quo

Start by analysing how people get things out and put them away, and why it

takes so long. This is especially important in workplaces where a lot of different tools and materials are used, because the time spent in getting things out and putting them away is time lost. For example, if a person gets something out or puts something away 200 times a day and each time takes 30 seconds, you are taking about 100 minutes a day. If the average time could be reduced to 10 seconds, more than an hour could be saved.

If you are dealing with small-lot production and quick turnaround times, every second counts. A minute spent getting something out and putting it away could be fatal. Typical problems in retrieving things are:

1. Not knowing what things are called
2. Not sure where things are kept
3. Storage site far away
4. Storage sites scattered all around
5. Repeated trips
6. Hard to find because many things are there
7. Not labelled
8. Not there, but not clear whether it is finished or somebody is using it
9. Unclear if spare parts exist (no ledger and nowhere to ask)
10. The one brought was defective
11. Hard to get out
12. Too big to carry
13. Need to set or assemble
14. Too heavy to carry
15. No gangway of transport

Step 2: Decide where things belong

The second step is to decide where things belong. Of course, there need to be criteria for deciding this, because the absence of criteria and any pattern will make it impossible for people to remember where things are supposed to be and will mean that it takes that much longer for them to put things back or to get them out. Yet there are many possibilities, in selecting the one that is best for you and will need some study.

Step 3: Decide how things should be put away

The third step is to decide how things should be put away. This is critical to functional storage. For example, files and tools should be put away so that they are easy to find and easy to access. Storage has to be done with retrieval in mind.

In assigning storage space, designate not only the location, but even the shelf. Decide where things should be, and make sure that they are at their home. This is crucial. When the storage location is on the tool and the tool's name is on the storage location, you know you are doing it right. The following procedures should be adhered to.

1. Everything should have a name.
2. A place for everything and everything in its place.
 - No more homeless items.
 - Even if someone is just using something temporarily, it should be clear where it is.
3. Quick identification.
 - Arrows and lamps.
 - Frequent-use items to be retrieved easily.
4. Safe storage.
 - Heavy things on the bottom.
 - Heavy things on dollies.
 - Benches and ladders.
5. Height considerations.
 - Knee to shoulder height most convenient.

Step 4: Obey the put-away rules

The last step is to obey the rules. This means always putting things back where they belong. It sounds simple, and it is as if you would be doing it. It is just doing it that is difficult. Whether or not this is done will determine whether or not organisation and neatness succeeds. At the same time, inventory management is important to see that you do not run out of parts or products. In order to achieve this, the rules are:

1. Out of stock.
 - Decide on minimum stock level.
 - Indicate that more are on order.
2. Somebody is using it.
 - Have an indication of who is using it and when they will return it.
3. Lost.
 - Decide how many there should be.
 - Draw a shadow outline indicating clearly what is missing.

2.18.5 What is Cleaning (Seiso)?

‘Everyone is a Janitor’—Cleaning should be done by everyone in the organisation, from the managing director to the cleaner. This is why in Japan, they do not need street cleaners in residential areas. Every family is responsible for cleaning the pavement in front of their houses. Therefore, what they need are rubbish collectors. The Japanese believe that while they are doing cleaning, they are cleaning their minds, too.

- I will not get things dirty.
- I will not spill.
- I will not scatter things around.
- I will clean things right away.
- I will rewrite things that have got erased.
- I will tape up things that have come down.

- Position mark—Put little position marks for where things go. Place footprints where people should stand. Place marks on the floor to indicate danger zones. Place lines to indicate where things are supposed to stop. Put up lots of visual clues so that everybody will be able to see when it is happening and to anticipate what will happen next.

2.18.7 What is Discipline (Shitsuke)?

Discipline means instilling the ability of doing things the way they are supposed to be done. The emphasis here is on creating a workplace with good habits. By teaching everyone what needs to be done and having everyone practising it, bad habits are broken and good ones are formed. This process helps people form habits of making and following the rules.

The word shitsuke originally comes from the guiding stitches that are done before a garment is properly sewn. If accepted that way, discipline is an underlying tool in making life go smoother. It is recognised by the Japanese as the minimum the society needs in order to function properly.

Self-discipline is important because it reaches beyond discipline. If a person is ‘disciplined’ to do something at one time there is a chance that he may not be disciplined next time.

2.18.8 Usefulness of 5-S Practice

The 5-S can help in everything we do. The 5-S is like a mirror reflecting our attitudes and behavioural patterns. Even so, we all too often avert our eyes and prefer not to look at what we see there. Listed below are some features of non-performing workplaces.

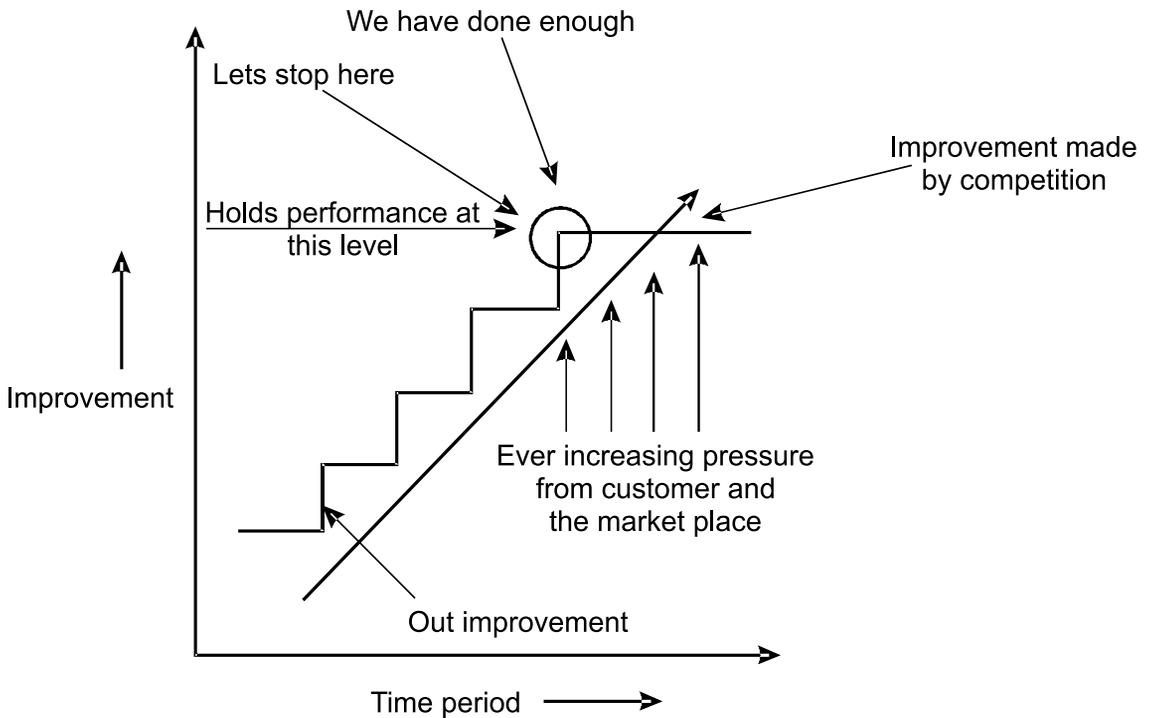
- Bad interpersonal relations.
- People look worn-out.
- High absenteeism.
- Workers do not care about their work.
- Workers do not make suggestions on how to improve the work process.
- QCC activities are stalemated.
- The workplace is beset with defectives and reworking.
- The 5-S practice is useful because it will help everyone in the organisation to live a better life.
- Improvement in your workplace environment.
- The 5-S can form a good basis for QCCs activities.
- The 5-S can provide a very good framework for improvement.
- This practice tackles the root of the problem, such as work organisation, neatness, cleaning, standardisation and self-discipline.

2.19 KAIZEN

Japanese word for small continuous improvements. Encourages suggestions by operators who continually try to incrementally improve their job or process. (Figure 2.8)

Example

- Change in colour of a tool from black to white for improved visibility.
- Maintain and improve the working standard through small gradual improvements.
- Produce a systems approach and problem solving tools as can be applied.
- Not a day should pass by without some kind of improvement being made somewhere in the company.
- Use it as a management tool within the TQM movement.

**Figure 2.8:** Kaizen Process**2.19.1 Kaizen Foundations**

- Employee Empowerment.
- Listening.
- Self-discipline.
- Efforts.
- Recognition.
- Zero Investments.

2.19.2 Kaizen Tools

- Waste Elimination.
- Standardisation.
- P-D-C-A.
- POKA-YOKE—failure proofing.

2.19.3 Kaizen Requirements

1. Operating practices—expose new improvement opportunities.
Example: JIT reveals waste, inefficiency and poor quality.
2. Total involvement.
 - Top Management—provides support and resources for all improvement activities.
 - Middle Management—implement goals, cooperation between departments, facilitate communication and guidance to work, etc.
 - Operating Management—suggestion systems, self development progress, etc.
3. Training: At Mercedes Benz Co., Ltd., any suggestion that saves 0.6 in a process is considered serious by the management.

Kaizen of Mercedes Benz—truck factory:

- Reduction of manufacturing space by 30%.
- Reduction of inventory.
- Reduction in lead time.

2.20 SUPPLIER SELECTION AND DEVELOPMENT

Early in 1980, to meet the growing demands for high quality products, most of the Japanese companies developed a zero-defect programme for their products. However, such a programme is primarily dependent upon the quality of purchased materials. The traditional methods being followed widely in many industries for determining the quality of incoming materials have been the acceptance sampling plans. Acceptance sampling implicitly conforms that there will be some non-conforming parts, and such parts would almost always be used in the manufacturing operations, resulting in lower productivity and higher manufacturing costs. Furthermore, by the time the incoming materials inspection discovers the discrepancies, several parts in the inventory have already been added resulting in longer time to correct the specific problem, often requiring modifications in the other parts or adjustments in the assembly operations. This operating mode requires more time to dispose of and to handle the discrepant materials, and more effort to analyse and correct the problems. It has been observed and verified that such a method of operation increases the operating costs, and hence decreases the profitability and leads also to longer customer delivery times.

2.21 SUPPLIER PARTNERSHIP

Introduction

One of the keys to obtaining high quality products and services is for the customer to work with suppliers in a partnering atmosphere to achieve the same quality levels attained within the organisation.

2. Trust

Trust enables the resources and knowledge of each partner to be combined to eliminate an adversarial relationship. Partners are then able to share information and accept reduced control. Mutual trust forms the basis for a strong working relationship. It should be viewed as a business paradigm shift and begins with the purchase contract that is nonadversarial. The purchasing function of the organisation must be subordinate to the overall relationship goals and objectives. Open and frequent communication avoids misdirection and disputes while strengthening the relationship.

3. Shared Vision

Each of the partnering organisations must understand the need to satisfy the final customer. To achieve this vision, there should be an open and candid exchange of needs and expectations. Shared goals and objectives ensure a common direction and must be aligned with each party's mission. Employees of both parties should think and act for their common good. Each partner must understand the other partner's business so that equitable decisions are made. These decisions must be formulated and implemented as a team. Thus, the sharing of business plans aids in mutual strategic planning.

2.21.2 Types of Sourcing

There are three types of sourcing:

1. Sole,
2. Multiple, and
3. Single.

A sole source of supply implies that the organisation is forced to use only one supplier. This situation is due to factors such as patents, technical specifications, raw material location, only one organisation producing the item, or the item being produced by another plant or division of the organisation. Partnering is a natural consequence of this type of sourcing, provided the supplier is willing to work together to satisfy the end user.

Multiple sourcing is the use of two or more suppliers for an item. Usually three suppliers are chosen, and their portion of the business is a function of their performance in terms of price, quality, and delivery. The theory of multiple sourcing is that competition will result in better quality, lower costs, and better service. However, in practice an adversarial relationship may result without the claimed advantages. Multiple sourcing also eliminates disruption of supply due to strikes and other problems.

Single sourcing is a planned decision by the organisation to select one supplier for an item when several sources are available. It results in large, long-term contracts and a partnering relationship. With a guaranteed future volume, the supplier can direct its resources to improve the processes. For the

2. The supplier shall have no product related lot rejection for a significant period of time, say, one year, or significant number or lots, say 20.
3. The supplier shall have no nonproduct related rejections for a stated period of time, say, three months, or number of lots, say, five. Nonproduct-related nonconformities such as the wrong count or a billing error are not as serious as product-related ones and are usually correctable in a short period of time.
4. The supplier shall have no negative nonproduct-related incidents for a stated period, say, six months, or number of lots, say, ten. This criterion covers incidents or problems that occur even though inspection and tests showed conformance to specifications.
5. The supplier shall have a fully-documented quality system. ISO 9000 is an excellent model to build a system even if registration is not the goal.
6. The supplier shall have successfully passed an on-site system evaluation. This evaluation could be by third party such as an ISO 9000 registrar or by a second party—the customer.
7. The supplier must conduct inspections and tests. Laboratory results are used for batch processes, and statistical process control (SPC) is used for piece part production.
8. The suppliers shall have the ability to provide timely inspection and test data. Because this documentation is necessary when the product arrives, it must be sent by computer or courier.

2.22.3 Supplier Rating

The customer rates suppliers to:

- Obtain an overall rating of supplier performance.
- Ensure complete communications with suppliers concerning their performance in the areas of quality, service, delivery, and any other measure the customer desires.
- Provide each supplier with a detailed and factual record of problems for corrective action.
- Enhance the relationship between the customer and the supplier.

A successful supplier rating system requires three key factors 1) An internal structure to implement and sustain the rating program. 2) A regular and formal review process, and 3) A standard measurement system for all the suppliers.

2.23 THE GENERAL PROBLEMS OF VENDOR QUALITY

1. The Buyer's Viewpoint

Before few decades, vendors were providing natural or semi-processed materials. The manufacturers use these materials to make the finished products. Under such conditions, the quality problems were not severe, as they are completely

dependent on the quality of the few raw materials. In this situation, vendors and buyers are almost quasi-independent and having not much interaction. Hence, totally new plans of vendor relations have to be evolved for which the key features have to be independent on a broad front; economic, managerial, and technological. Some of the activities which are being carried out to achieve the objective of procurement quality assurance are as follows:

- Thinking through and publishing the company's policy of vendor quality relations.
- Using multiple vendors for major procurement items.
- Developing methods for identifying qualified vendors, and for eliminating those who are unable to meet quality requirements.
- Communicating essential and helpful information, designs, specifications, standards, standard practices and so on.
- Communicating engineering changes promptly.
- Developing methods for detecting the deviations promptly, especially through reproduction to trial runs.
- Providing for use of vendor quality data instead of incoming inspection.
- Developing methods of giving helpful assistance to vendors of their quality problems.
- Reviewing the performance of vendors through vendor rating or other plans and following up on the chronically poor vendors.

2. *Finding Qualified Vendors*

The evaluation of vendors as a part of the procurement source selection and development process can be carried out in many ways. Here, we discuss a few points:

- **General reputation of the vendor**
 - For well-known and large companies, there is such a thing as a general reputation (good or bad).
 - For less well-known companies, the reputation is local and obscure. The reputation of a company can be assessed by conducting a survey of the user firms.
 - The companies are generally unwilling to give out such data except to a data bank which normally keeps the data anonymous (and even then with reluctance).
- **Data from a data bank**
 - A device has been very effective in the financial function. It is in the process of development for use in the quality function.
- **Vendor survey**
 - The actual decision in vendor selection is made by the company's purchasing department, which must consider all aspects of vendor relations.
 - The more accurate the quality manager prepares vendor quality information in a way which is meaningful to the purchasing department, the more likely is this information to be given weightage in vendor's selection.

2.23.1 A Framework for Vendor Quality Survey

A vendor quality survey is an evaluation of a vendor's ability to meet quality requirements. The results of the survey are used in the vendor selection decisions or, if the vendor has already been chosen, the survey alerts the purchase to areas where the vendor may require assistance in meeting the requirement. The survey can vary from a simple questionnaire sent to the vendor on:

1. Quality Policies and Practices

Policies are written or unwritten statements which define guidelines for the vendor's quality programme. As guidelines, they are the real intentions which are to be implemented to a variety of degrees. The survey has the problems of evaluating the policies and also determining the degree to which they are implemented.

2. Facilities

These not only include manufacturing facilities but inspections and tests and any other facilities required to meet quality requirements for the purchased products. Samples of products may be checked with the vendor's gauges and the buyer's gauges to compare the gauging systems. This checking may facilitate reducing the buyer's risk as well as the risks of the vendors.

3. Procedures

These include procedures for handling quality problems such as gauge control, deviations from the specifications, etc. These are often documented in the company's manual of quality procedures. The survey tries to determine whether the quality procedures prescribed are operational or not.

4. Appraisal of the Personnel

Appraisal of personnel from the viewpoint of quality is very difficult. But one can discover the technical competence and the attitude towards quality. The survey suffers from weakness that such appraisal is sometimes subjective and very often suffers from the changing conditions of the company due to turnover of the key personnel. However, a general attitude towards quality of the company through the auditing of housekeeping, maintenance, discipline and orderliness etc. can be very well discovered.

Selecting qualified vendors is a difficult task, particularly for a new product line. The selection of vendors can spell the difference between success and failure for a new product. The inplant evaluation must address the questions: "How well do the objectives of the quality programme conform to the buyers needs" and "How well do the practices of quality control programme conform to the objectives? The four areas to evaluate are quality, prices, performance, and production capabilities. Quality fits into all these areas. Table 2.1 shows a

Poor—usually haggling	2
Very poor—always haggling/never meets quote	1
C. Financial ability	
Very good—profit-making enterprise	5
Good—slightly above breakeven	4
Average—breakeven ability/no data	3
Poor—less than breakeven	2
Very poor—financial loss	1

III. PERFORMANCE	Weightage
A. Technical performance (specification)	
Very good—exceeds specification	5
Good—sometimes above specification	4
Average—runs at specification	3
Poor—sometimes below specification	2
Very poor—always below specification	1
B. Delivery history	
Very good—always	5
Good—mostly on time	4
Average—usually on time/no data	3
Poor—seldom on time	2
Very poor—always late	1
C. Technical assistance (willing to work with customers)	
Very good—high calibre/knows the process	5
Good—mostly helpful	4
Average—sometimes helpful	3
Poor—rarely helpful	2
Very poor—doesn't know the process	1

IV. PRODUCTION CAPABILITIES

A. Productivity capacity	
Very good—reserve production capabilities	5
Good—above requirements	4
Average—meets requirements	3
Poor—meets most of the requirements	2
Very poor—cannot meet requirements	1
B. Manufacturing equipment	
Very good—up-to-date methods and equipment	5
Good—mostly modern plant	4
Average—so-so on methods and equipment	3
Poor—some new equipment	2
Very poor—old fashioned	1

A vendor survey is analogous to a profit and loss statement. It tells what the status is at any given time, but it will not guarantee what it will be at any other time. The communication started during the survey must continue, for a good partnership to last for a long time.

2.23.2 Some Successful Situations Observed

Situation I

MRK company is engaged in the manufacturing of electronic appliances. The objective of this company is to identify suppliers who have the capability to ensure zero-defect supplies. The following actions are taken:

Seminar

In order to make outside vendors aware of the zero-defects objectives and the motivation in establishing them, vendor's quality awareness seminars are needed. For this seminar from the vendor side, the managers having quality responsibility are invited. Particularly, the quality control manager, chief of industrial engineering and general manager manufacturing are invited. Main points that are covered in the seminars are:

- a) Management's commitment to zero-defects.
- b) Dependence on vendor quality improvements.
- c) Motivation based upon quality.

At the end of the seminar, a guided tour of the buyer's plant is conducted. The purpose is to give an opportunity to the managers to see how their products are being manufactured. This gives a feeling of the difficulties, expenses, and the loss of production resulting from the non-conforming of parts and components supplied by the vendors.

Measurement

The objective of measurement action is to carefully examine the vendor quality conformance. The conformance measure is expressed in percentage and is defined as the number of shipments accepted by the total number of shipments received in a particular defined period. For this company, a shipment is accepted when the inspected samples are verified as conforming to requirements. If the shipment is rejected, the company writes a letter to the vendor's top management. The purpose here is to highlight the concerns to the appropriate level for attention.

Quality audit

Quality plans are invited from the vendors and joint review is carried out by both parties. Such types of review are conducted periodically to verify that they are being followed. The total quality performance instead of partial performance

characteristics are being determined. Such reviews are being fed back to the vendors and are being discussed in the annual seminar for surfacing the differences.

6. The recommendations evolving out of these steps are closely being monitored by the quality task force. Only when the outcomes of the monitoring efforts show very positive results, the contracts are awarded.

Through this process, the vendor will be in an advantageous position to obtain future business. The vendors will be recognised as a high quality source, available to other buyers.

Situation III

This company is engaged in manufacturing energy technology equipment and has developed a vendor self-inspection programme to establish the reliable supply base. The concept behind self-inspection is that the vendor is solely responsible for the quality of the product delivered. As a partner, the buyer helps the vendors in his ability to assure the outgoing quality level. The following actions are planned:

a) Re-examination of part tolerances

Parts/material design reviews have become a part of all new product quality plans. Worst case tolerance are examined and visual criteria are given close scrutiny. Action against loose tolerance are tightly enforced.

b) Vendor inspection report

This report has been designed to communicate quality information to vendors and to provide a means of requesting corrective actions. In case of parts not produced frequently, it is beneficial for vendors to have the written record of pertinent quality information in the job file as a reminder during the next set up.

c) Product/use demonstrations

Demonstrations are made by the vendors from time to time at different exhibitions and trade fairs.

d) Gauging

Functional gauges and workmanship samples are provided to vendors whenever applicable. Calibration service is also provided for all supplied gauges.

2.23.4 For Achieving Self-inspection, the Following Steps are Taken

a) Joint inspection

Both inspectors (buyer and vendor) inspect lots together using buyer's inspection

plans and history records. This step helps to clarify sampling techniques, acceptance criteria and use of special methods and gauges.

b) Verification

The vendor inspects lots using buyer's inspection plans and submits acceptable lots with the inspection records, keeping the sample separate. Buyer inspects the sample, verifies data, and clarifies any discrepancies with the vendor. It helps to discover any problem or concern missed during the joint inspection step.

c) Skip lot

The step is the same as the verification step, except the buyer verifies only every other lot or every third lot submitted. The buyer and vendor both gain confidence in the programme.

d) Self-inspection

The vendor inspects lots using buyer's inspection procedure and submits inspection results with acceptable lots. Buyer's quality assurance engineering periodically audits the vendor for compliance to procedures. The audit consists of randomly selecting a lot and inspecting it with the buyer's own sample. A facility audit is also conducted to examine material control and traceability, calibration, process control, and other similar areas.

This company has started this programme for the last 3 years. Approximately, 30% of the vendors have joined the self-inspection programme. The results have been very encouraging (the lot acceptance rate has increased from 70% to 92%). Additionally, engineering time spent in material review board activities has been reduced by 60%. Lead time has been reduced to an average of two weeks. Furthermore, there has been no requested price increase because of the programme, and no vendor has had an unfavourable audit.

Situation IV

A company's R and D institute takes up ship-to-stock (STS) programme for quality control.

This (STS) programme is a way to more efficiently and economically handle incoming material from high quality vendors. It requires buyers and vendors personnel to talk as partners rather than adversaries about quality systems and product requirements.

1. Candidacy Phase

In the candidacy phase, quality history is evaluated and found, if a vendor's system is producing quality products. Therefore, the vendor is made a potential candidate for the STS programme. This vendor and the buyer's STS

- Establishes close interface between buyer and vendor.
- Establishes mutual trust between buyer and vendor.
- Places total responsibility on the vendor leading to enhanced pride.
- Encourages other companies to do business with the vendor.
- Reduces inventory level.
- Reduces delivery time.
- Replaces incoming/source inspection activity with scheduled audits.
- Reduces need for specialised test equipment.
- Reduces rejections by placing emphasis on quality early in the process.

Situation V

A company which is engaged in manufacturing power transformers of various ranges has developed a Rejection Improvements Programme (RIP) over a period of 3 years. This programme focusses on few vendors who contribute to maximum rejections. The following are the advantages claimed:

- a) Reduction in the absolute number of rejections.
- b) Reduction in time and effort expended internally.
- c) Reduction in quality costs.

The company takes the following action plan:

1. Notification to vendors about the objectives of RIP and intentions of the company.
2. Invitation to vendors for visiting the company know the requirements and test procedures and to verify the quality assurance systems.
3. The company makes arrangements to mutually develop a supplier quality programme requirements manual. The manual contains the following pertinent information:
 - Establishment of responsibility for the overall quality assurance effort.
 - Assurance that people know how to do their jobs.
 - Control of outside purchases and verification of the facts that you get what you ordered.
 - Assurance that the proper material is used.
 - Controlling the manufacturing process of the product.
 - Assurance that measurements are accurate.
 - Verify that the product meets the buyer's requirements.
 - Resolve discrepancies.
 - Maintain records to demonstrate that work is being performed properly.

The company uses incoming inspection as the basic source for gathering vendor quality performance data. Various standard techniques of sampling and screening inspection are used to gather statistics on vendor performance.

functions. It is obvious that a quality system is an inseparable part of an organisation. Some synergistic integration will facilitate:

- Simplification and interpretation of confusions and conflicts between different parties.
- Promotion of creative techniques for specification of choices, technology upgradation, etc.
- Development of control system that can provide positive feedback mechanisms.
- Design of mutually supportive systems to deal with diversity of perspectives and evaluative measures based upon objective indicators and discouraging subjective biases.

For example, some of the specific tasks that can be taken up are as follows:

1. Vendor-vendee Relationship Through

- Mutual cooperation to improve quality.
- Buyer's assistance for technology.
- Through educative seminars to focus the issues.
- Top level management commitment.

2. Vendor Evaluation Through

- Careful examination of the vendor's quality conformance.
- Careful examination of the vendor's financial and production capability.
- Careful examination of the vendor's process capability.

3. Certification Through

- Giving a certification, if performance is at or above the expected quality level.
- For the certified vendors, omitting the incoming inspections.

4. Continuous Auditing Through

- Verification of the effectiveness of the vendor's quality systems and processes.
- Recognising good performance and separating from the poor performance.

The increasing competition in the international economic scene results in the even heavier dependence on quality as both an endogenous as well as exogenous factor. Consequently, various elements which ensure quality have an expanding role to play. The quality position of each enterprise is directly dependent on the specific performance of the suppliers. Achieving success, however, will require:

- Major reconceptualisation not only of methods of quality control, but of basic ideas about the essential tasks of technology transfer, orientation of support systems, and suggesting procedures which can facilitate problem solving.

Company specific measures: Most company measures relate to product and service quality and process performance. Product and service quality indicators focus on the outcomes of manufacturing and service processes. A common indicator of manufacturing quality is the number of non-conformities per unit or defects per unit. In service, a measure of quality analogous to defects per unit is error per opportunity. A common measure is dpmo—defects per million opportunities.

2.24.1 Key Quality Measurements in a Manufacturing Industry

1. *Customer Related Measures*

- Percentage shipping performance.
- Warehouse errors.
- Returned material cycle time.

2. *Product Quality Measures*

- Parts per million defective, electrical.
- Parts per million defective, visual/mechanical.
- Operating life test.

3. *Process Quality Measures*

- Cycle time.
- Rework at various stages.
- Final test yield.

4. *Supplier Performance Measures*

- Parts per million defective.
- Purity level.
- Functional test results.

5. *Company Operational Performance Measures*

- Cost of conformance.
- Cost of non-conformance.
- Total cost of quality.

Many companies classify defects into three categories to facilitate control:

i) Critical Defect

A critical defect is one that judgement and experience indicate will surely result in hazardous or unsafe conditions for individuals using, maintaining or depending on the product and will prevent proper performance of the product.

ii) Major Defect

A major defect is one not critical but likely to result in failure or to materially reduce the usability of the unit for its intended purpose.

iii) Minor Defect

A minor defect is one not likely to materially reduce the usability of the item for its intended purpose, nor to have any bearing on the effective use or operation of the unit.

Critical defects may lead to serious consequences or product liability suits and hence should be monitored and controlled carefully. On the other hand, minor defects can lead to customer dissatisfaction even though they do not affect fitness for use.

2.24.2 Developing Effective Performance Measurements and Indicators

While collecting the data, many companies may collect wrong data. They may make two fundamental mistakes: i) Not measuring key characteristics critical to company performance or customer satisfaction and ii) Taking irrelevant or inappropriate measurements. In the first case, the company often fails to meet customer expectations to the fullest extent and possibly loses competitive advantage. In the second, the company directs attention in areas that are not important to customers, thus wasting time and resources.

Effective performance measures and indicators are aligned with business strategy and are actionable. They provide the basis for decisions at the level at which they are applied. They are driven by factors that determine what is important to the success of the business. These include:

- The nature of the company's products and services,
- Principal customers,
- Major markets,
- Key customer quality requirements,
- Position in both market and competitive environment,
- Facilities and technologies,
- Suppliers,
- Regulatory environment, and
- Other factors, such as product innovation, industry dynamics, etc.

Measures and indicators should represent the most important factors that predict customer satisfaction and business performance.

Most companies have a set of existing indicators. To generate useful performance measures, a systematic process is required. The various steps involved in this process are:

- i) Identify all customers of the system and determine their requirements and expectations. Organisations need answers to key questions: "Who are my customers?" and "What do they expect?" Customer surveys,

focus group and user panels may be used to answer these questions. Customers' expectations change over time. Thus, regular feedback must be obtained.

- ii) Define the work process that provides the product or service. Key questions to be answered are:
 - What do I do that impacts the customer needs? and
 - What is my process?

The use of flow charts can stimulate the definition of work processes and internal customer supplier relationships.

- iii) Define the value adding activities and outputs that compose the process. This step identifies each part in the system in which value is added and an intermediate output is produced.
- iv) Develop specific performance measures or indicators. Each key activity identified in step iii) represents a critical point where value is added to the output for the next (internal) customer until the final input is produced. At these checkpoints, performance can be measured. Key questions to be answered are:
 - What factors determine how well the process is producing according to customer requirements?
 - What deviations can occur? and
 - What sources of variability can occur?

Measurements and indicators can be either attributes or variables. The attribute data are discrete. Attributes can be measured by visual inspection such as assessing whether a painted or polished surface has defects such as scratches or not.

Attribute measurements are expressed as proportions or rates, number of defects per unit or rate of errors per opportunity.

The second type of performance characteristic is called a variable. Variable data are continuous for instance, length or weight. Variable measurements are concerned with the degree of conformance to specifications. They are generally expressed as averages and standard deviations. Additional examples of both attributes and variable measurements.

2.24.3 Examples of Attributes and Variable Measurements

Attributes

- i) Percentage of accurate invoices.
- ii) Number of lost parcels.
- iii) Number of complaints.
- iv) Mistakes per week.
- v) Percentage of shipments on time.
- vi) Percentage of absenteeism.

of rules from the previous practice but it made people more of a team. As another worker stated “Before the 5-S, we just worked. Now, I try to improve my work.”

Just two years after the 5-S came to Wellex, productivity has skyrocketed by over 26%, with turnover exceeding US\$23 million. This result proves that the 5-S culture is universal and can be related to any working environment if there is a commitment to the common objective.

2. Quality Improvement Storyboard at Komatsu Company through Kaizen

The storyboard is an elaborate problem-solving process. Japanese firms originated this comprehensive approach. Since then, many firms in Japan and America have initiated variations on this process. The intent is to insure that problems are fully investigated, solved, and implemented. One sure way of attaining a high level of complete problem solving is to have a workforce trained and experienced in a comprehensive approach.

Kaizen results in constant diagnosis which, in turn, results in many problems to address. Establishing priorities, selecting candidates, and determining problem-solving approaches are decisions to be made. Counter-measures to problems are proposed that result in minimising sources of variation. When solutions are successful, permanent changes are proposed and implemented. The evaluation phase determines what problem area to take up next. The steps automatically support the firm’s commitment to continuing improvement.

The Quality Improvement Storyboard originated with the Komatsu Company, a winner of the Deming Prize during the 1970s. Mr. Nogawa, president of Komatsu, named the process Q1, for quality improvement. Florida Power and Light adapted the Q1 storyboard as the basis for their continuing improvement effort. They eventually became the first Deming Prize winner outside Japan.

TWO MARKS QUESTIONS AND ANSWERS

1. What are the requirements for customer satisfaction?

- Identifies customer needs.
- Designs the production and service systems to meet these needs.
- Measures the results as the basis for improvement.
- Integrates customers into the strategic planning activities of all managers.

2. Define Customer Retention.

- Represents the activities that produce the necessary customer satisfaction that creates customer loyalty.
- Customer retention is the nexus between customer satisfaction and the bottom line.
- Product/service dimensions act as key factors in influencing customer satisfaction.

3. What are the methods of knowing customer?

We can know who is customer by the following methods.

- a) Flow diagram method.
- b) Activity log method.

4. Name the type of customer

- a) External.
- b) Internal.
- c) Delighted.
- d) Dissatisfied.
- e) Satisfied.
- f) Indifferent.
- g) Lost.

5. What are the customer perception of quality?

- a) Performance.
- b) Service.
- c) Price.
- d) Features.
- e) Warranty.
- f) Reputation.

6. Name some theories of motivation.

Theories of Motivation:

The four major motivation theories and its types:

- 1. Need Theory.
 - a) Maslow's Hierarchy of Need.
 - b) Herzberg's Motivator Hygiene Theory.
 - c) McClelland's Need Theory.
 - d) Alderfer's ERG Theory.
- 2. Equity Theory.
- 3. Reinforcement Theory or Operand Conditioning Theory.
- 4. Expectancy Theory.
 - a) Vroom Theory.
 - b) Porter and Lawler Theory.

7. What are the characteristics of successful team?

i) Sponsor, ii) Team charter, iii) Team composition, iv) Training, v) Ground Roles, vi) Clear objectives, vii) Accountability, viii) Well-defined decision procedures, ix) Resources.

8. Name the types of team.

- a) Process Improvement Team.
- b) Natural Work Teams.
- c) Cross Functional Team.
- d) Self-directed Work Teams.