Project Quality Management

What is Quality?

The concept and vocabulary of quality are elusive. Different people interpret quality differently. Few can define quality in measurable terms that can be proved operationalize. When asked what differentiates their product or service;

The banker will answer" service"

The healthcare worker will answer "quality health care"

The hotel employee will answer "customer satisfaction"

The manufacturer will simply answer "quality product"

Five Approaches of Defining Quality

Harvard professor David Garvin, in his book *Managing Quality* summarized five principal approaches to define quality.

- Transcendent
- Product based
- User based
- Manufacturing based
- Value based

TRANSCENDENTAL VIEW

- Those who hold the transcendental view would say “I can’t define it, but I know it when I see it”
- Advertisers are fond of promoting products in these terms.“ Where shopping is a pleasure” (supermarket), “We love to fly and it shows" (airline).
- Television and print media are awash with such indefinable claims and therein lies the problem:
- Quality is difficult to define or to operationalize. It thus becomes elusive when using the approach as basis for competitive advantage. Moreover, the functions of design, production and service may find it difficult to use the definition as a basis for quality management.

PRODUCT BASED

- Quality is viewed as a quantifiable or measurable characteristic or attribute. For example durability or reliability can be measured and the engineer can design to that benchmark.
- Quality is determined objectively.
- Although this approach has many benefits, it has limitation as well. Where quality is based on individual taste or preference, the benchmark for measurement may be misleading.

USER BASED

It is based on idea that quality is an individual matter and products that best satisfy their preferences are those with the highest quality. This is rational approach but leads to two problems;

- Consumer preference vary widely and it is difficult to aggregate these preferences into products with wide appeal. This leads to the choice between a niche strategy or a market aggregation approach which tries to identify those product attributes that meet the needs of the largest number of consumers.

- Another problem concerns the answer to the question “Are quality and customer satisfaction the same?” the answer is probably not. One may admit that a Lincoln continental has many quality attribute, but satisfaction may be better achieved with an Escort.

MANUFACTURING BASED

- Manufacturing-based definitions are concerned primarily with engineering and manufacturing practices and use the universal definition of “conformance to requirements”. Requirements or specifications are established by design and any deviation implies a reduction in quality. The concept applies to services as well as product. Excellence in quality is not necessarily in the eye of the beholder but rather in the standards set by the organization.
- This approach has the serious weakness. The consumer’s perception of quality is equated with conformance and hence is internally focused.

Value Based

- It is defined in term of costs and prices as well as number of other attributes. Thus, the consumer's purchased decision is based on quality at an acceptable price. This approach is reflected in the popular *Consumer Reports* magazine which ranks products and services based on two criteria: Quality and Value.
- The highest quality is not usually the best value. That designation is assigned to the "best- buy" product or service.

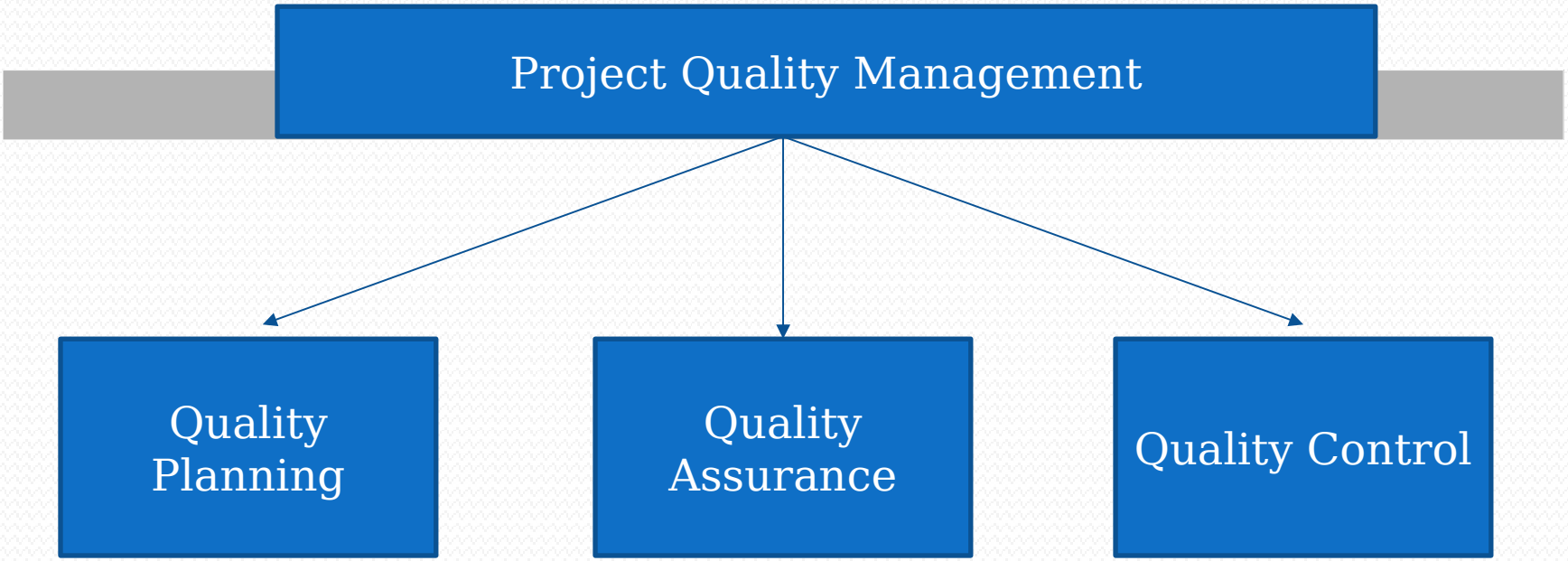
Definition of Quality

- Quality is conformance to the requirements (Phillip B. Crosby)
- Quality is the degree to which a set of inherent (existing) characteristics fulfils requirements (ISO)
- High Quality Products – meets or exceeds customer requirements
- Low Quality Products – not meeting stated requirements

Project Quality Management

- **Project quality management** ensures that the project will satisfy the needs for which it was undertaken
- It includes creating and formulating policies & procedures in order to ensure project meets its defined needs.
- PQM includes all the activities of the overall management function that determine the quality policy, objectives, and responsibilities and implement them within the quality system.

Means of Implementation of PQM

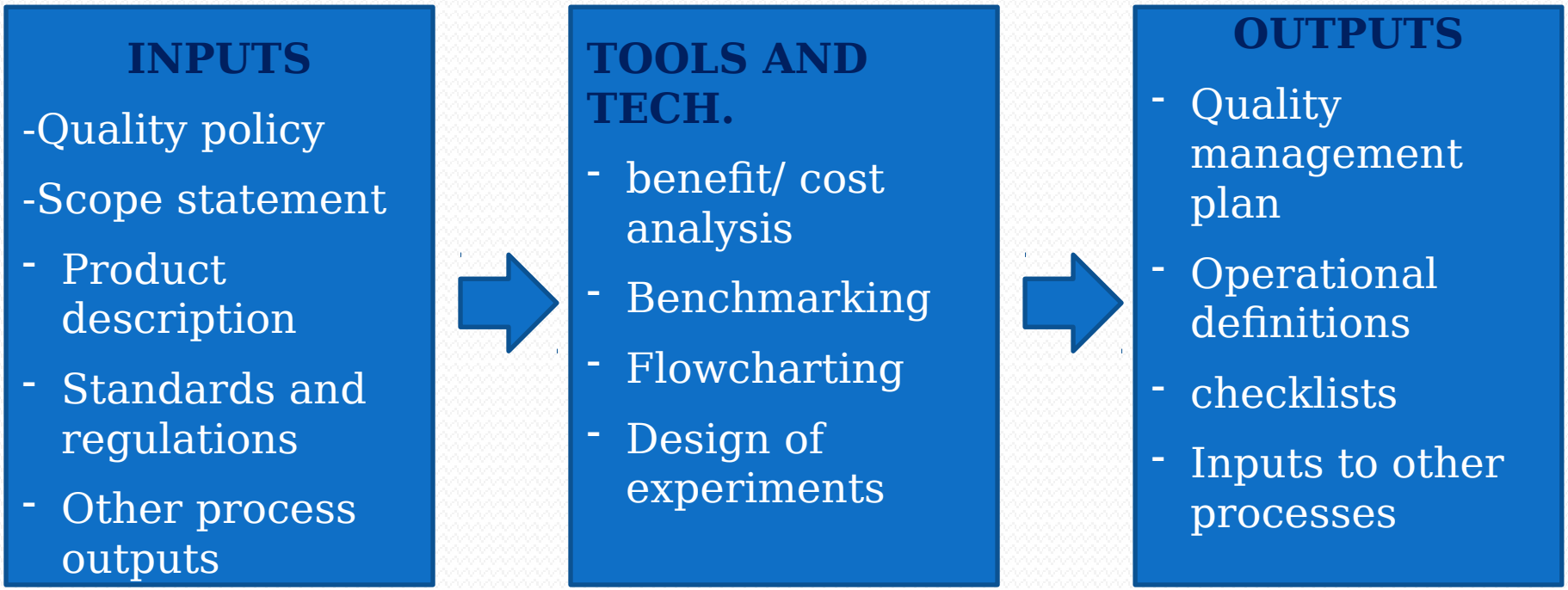


Quality planning

- Quality Planning involves identifying with quality standards
- It is a key facilitating process during the Project planning Process
- In modern quality management quality is planned in and not inspected in
- Prior to the development of ISO 9000 series, quality planning concepts were widely discussed as part of quality assurance.

Quality Planning

Identifying which quality standards are relevant to the project and how to satisfy them



Quality Planning Inputs

Quality policy

- the over all intentions and direction of an organization with regard to quality, as formally expressed by the top management
- In the case of a joint venture, a quality policy for the individual project should be developed
- The management team is responsible for dissipating the quality policy to all project stakeholders through appropriate information distribution channels

Quality Planning Inputs

Scope Statement

- The scope statement is a key input to quality planning because it documents major project deliverables as well as project objectives which serve to define important stakeholder requirements

Product description

- Although the elements of the product description may be embodied in the scope statement, the product description often contains details of technical issues and other concerns that may affect quality planning

Quality Planning Inputs

Standards and Regulations

- The project management team any application-area-specific standards or regulations that may affect the project

Other Process Outputs

- In addition to the scope statement and product description, processes in other knowledge areas may produce outputs that should be considered as part of the quality planning
- **Example**: procurement planning outputs may identify contractor quality requirements that should be reflected in the overall Quality Management Plan

Tools and Techniques for Quality Planning

- **Benefit / cost analysis**
- The planning process must consider benefit/cost tradeoffs
- The Primary Benefit: Is less work, higher productivity, lower costs, and increased stakeholder satisfaction
- The Primary Cost: Is the expanses associated with PQM activities

Note: it is elementary that the benefit should outweigh the cost

Tools and Techniques for Quality Planning

Benchmarking

- Benchmarking involves comparing actual or planned project practices to those of other projects to generate ideas to:

1- Generate ideas for improvement

2- provide a standard for measurement of performance

Note: other projects compared may be within the same organization or out side and may be within the same application area or in another

Tools and Techniques for Quality Planning

Flow charting

- The flowcharting techniques in quality management generally include
  - cause and effect diagram
  - System or process flow charts

- Flowcharting can help in anticipating probable quality problems and thus helps to develop approaches for dealing with them

Tools and Techniques for Quality Planning

Design of Experiments

- This is an analytical technique which aims to define variables that have most influence on the overall outcome
- This technique is commonly applicable to the product of the project issues.
- However this technique can also be used in project management issues such as cost and schedule tradeoffs to allow for optima solutions.

Outputs from Quality Planning

Quality Management Plan

- The quality management plan should describe how a project management team will implement its quality policy
- Also called Quality System, (in ISO terminology), the plan should define :

- The organizational structure
- Roles and responsibilities
- Resources needed for implementation of quality management

Outputs from Quality Planning

Quality Management Plan (continued)

- The Quality Plan should address:
  - Quality Control of the project
  - Quality Assurance
  - Quality Improvement of the project

Note: the project quality plan can be highly detailed or broadly framed based on the needs of the project

Outputs from Quality Planning

Operational Definitions

- An operational definition describes what something is and how it is measured by the quality control process. For example:
- the project management team must indicate the start and end of every activity in a detailed schedule
- Weather the whole activity or certain deliverables are to be measured

Operational definitions are also called *Metrics* in some areas of application

Outputs from Quality Planning

Checklists

- A checklist is a structured tool used to verify that a set of required steps or requirements have been performed.
- Many organizations have standard checklists to ensure consistency of frequently performed activities

Inputs To Other Processes

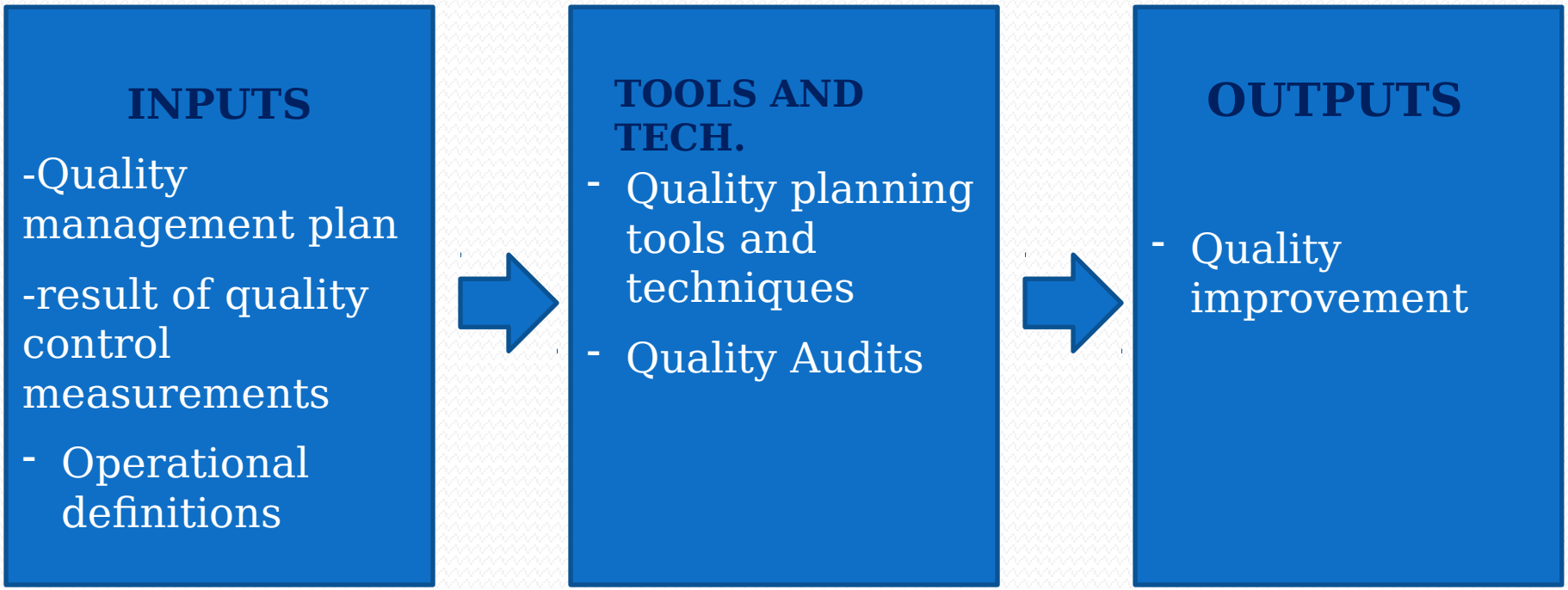
- The quality planning process may identify need for further activity in another area

Quality Assurance

- Quality assurance encompasses all the planned and systematic activity implemented in a quality system to provide confidence that the project will satisfy the relevant quality standards
- Quality assurance is provided by a Quality Assurance dept.
- Quality assurance can be INERNAL (from the project management team to the performing organization)
- Quality assurance can be EXTERNAL (provided to the customer and other parties actively involved in the work of the project

Quality Assurance

periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards



Inputs To Quality Assurance

- Quality management plan as previously described
- Results of quality control measurements which are records of quality control testing and measurement in a format of comparison or analysis
- Operational definitions as previously described in the output of the Quality Planning

Tools and Techniques For Quality Assurance

- Quality Planning tools and techniques , which can be used for quality assurance as well
- Quality Audits which are a structured review of other quality management activities:
  - they may be timely or carried out randomly
  - They may be carried out by properly trained Internal-auditors or by third parties such as quality systems registration agencies

Outputs From Quality Assurance

Quality Improvement

- Quality improvement includes taking action to increase the effectiveness and efficiency of the project to be provide added benefits to the stakeholders of that project .
- In many cases the implementation of quality improvements will require preparation of change requests or taking corrective actions and will be handled according to procedure for overall change control

Quality Control

- Quality control involves monitoring specific project results to determine if they comply with relevant standards and identifying ways to eliminate causes of unsatisfactory results.
- Project results mentioned include both PRODUCT results such as deliverables and MANAGEMENT results such as cost and schedule performance
- Quality control is often performed by a quality control department
- The project management team should have a working knowledge of statistical quality control especially sampling and probability to help evaluate and control outputs.

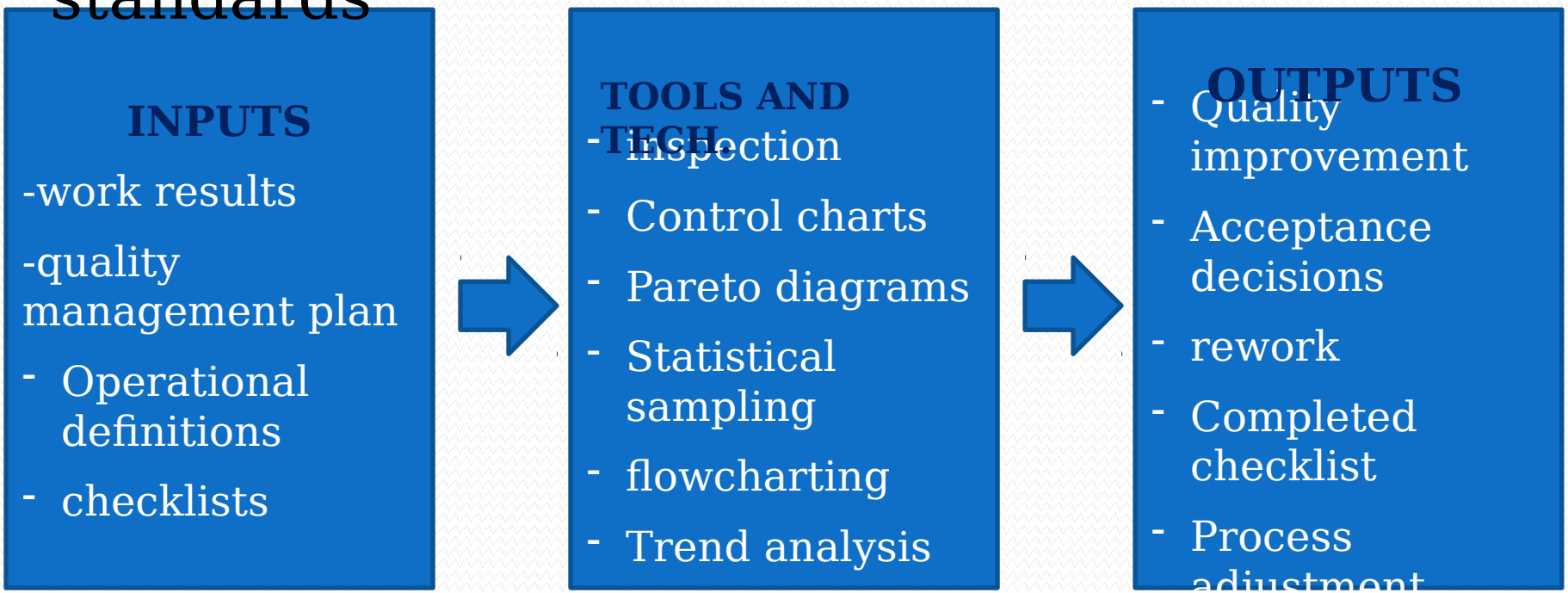
Quality Control

- **The project management should be aware of the following among other subjects:**

- ***prevention*** (keeping errors out of the process)
- ***Inspection*** (keeping errors out of the customers hand
- ***Attribute sampling*** (for conformity of results)
- ***Variable sampling*** (where the results are rated on a continuous scale that measures the degree of conformity or non conformity
- ***Special cause*** (unusual events)
- ***Random causes*** (normal process variations)
- ***Tolerances*** (where results should fall with in a defined tolerance range
- ***Control limits*** (the process is in control if it falls within these defined limits)

Quality Control

Monitoring specific project results to ensure that they comply with the relevant quality standards



Inputs To Quality Control

- **Work results** : including both product results and process results
- **The quality management plan**
- **Operational definitions**
- **Checklists**

Tools and Techniques for Quality Control

Inspection

- Inspection includes activities such as measuring, examining and testing undertaken to determine whether results conform to requirements
- Inspection can be carried out on the level of a single activity or a final product
- Inspections can be called reviews, product reviews, audits, and walk-throughs

Tools and Techniques for Quality Control

- **Control Charts**
- These charts are graphical representations that display the result of a process over time and are used to determine if the process is “in control”
- When in control the process should ***not*** be adjusted , however it may be ***changed*** in order to provide improvements
- Control charts may be used ot monitor any type of output variable
- Control charts are most often used to monitor repetitive activity in production but can also be used to monitor cost and schedule variances

Tools and Techniques for Quality Control

Pareto Diagram

- A Pareto diagram is a histogram ordered by frequency of occurrence which shows how many results were generated by what category or identified cause
- The project management team should take action to fix the problems that are causing the greatest number of defects first
- Typically the Pareto diagram reflects that a relatively small number of causes are responsible for the majority of the problems or defects

Tools and Techniques for Quality Control

Statistical Sampling

- Statistical sampling involves choosing a part of a population of interest for inspection
- Appropriate sampling can effectively reduce the cost of quality control
- There is a vast body of knowledge related to statistical sampling and therefore the management must be aware of the various sampling techniques

Tools and Techniques for Quality Control

Flowcharting

- Flowcharting is used in quality control to help analyze how a problem occurs

Tools and Techniques for Quality Control

Trend Analysis

- The trend analysis involves the use of mathematical techniques to forecast future outcomes based on historical results it is often used to monitor:

  - Technical performance – *how many defects have been identified and how many remain uncorrected*

  - Cost and schedule performance – *how many activities in a certain period were completed with significant variances*

Outputs for Quality Control

- Quality improvement (previously described)

- Acceptance decisions, where the inspected items will either be accepted or rejected and those rejected may be reworked
- Rework, which is an action taken to bring defects or nonconforming items into compliance with requirements and specifications. Rework is a frequent cause of project over-runs and the project management team must make an effort to minimize it .

Outputs for Quality Control

- Completed Checklists, which become a part of a project record when they are used
- Process Adjustments, which involves immediate corrective or preventive action as a result of quality control measurements. In some cases the adjustment may need to be handled according to procedures for overall change control.

Tools & Techniques for Quality Control

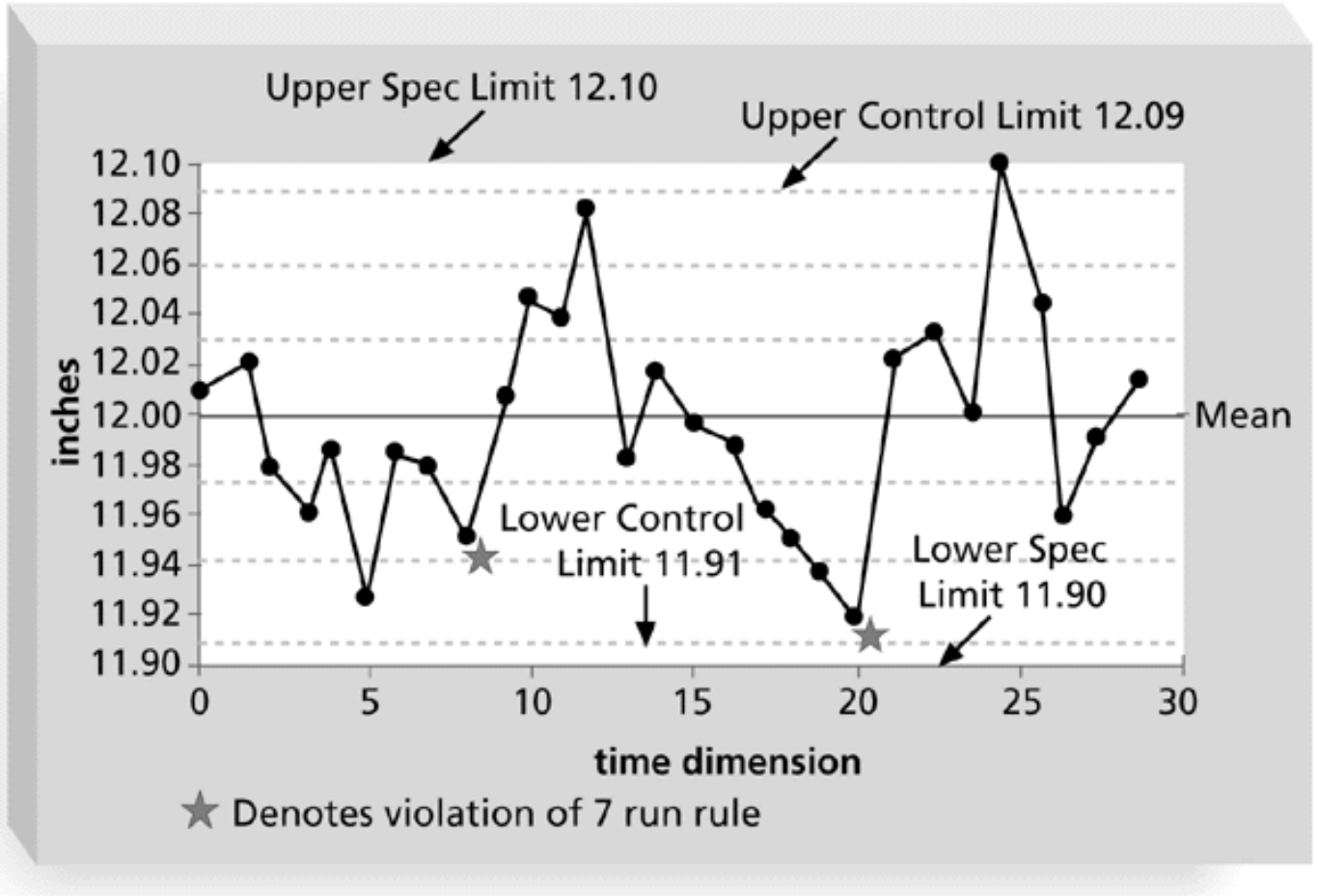
Run Chart

- A run chart displays the history and pattern of variation of a process over time
- It is a line chart that shows data points plotted in the order in which they occur
- Can be used to perform trend analysis to forecast future outcomes based on historical patterns e.g., of defects

Quality Control Charts

- A **control chart** is a graphic display of data that illustrates the results of a process over time
- The main use of control charts is to prevent defects, rather than to detect or reject them
- Quality control charts allow you to determine whether a process is in control or out of control
  - When a process is in control, any variations in the results of the process are created by random events; processes that are in control do not need to be adjusted
  - When a process is out of control, variations in the results of the process are caused by nonrandom events; you need to identify the causes of those nonrandom events and adjust the process to correct or eliminate them

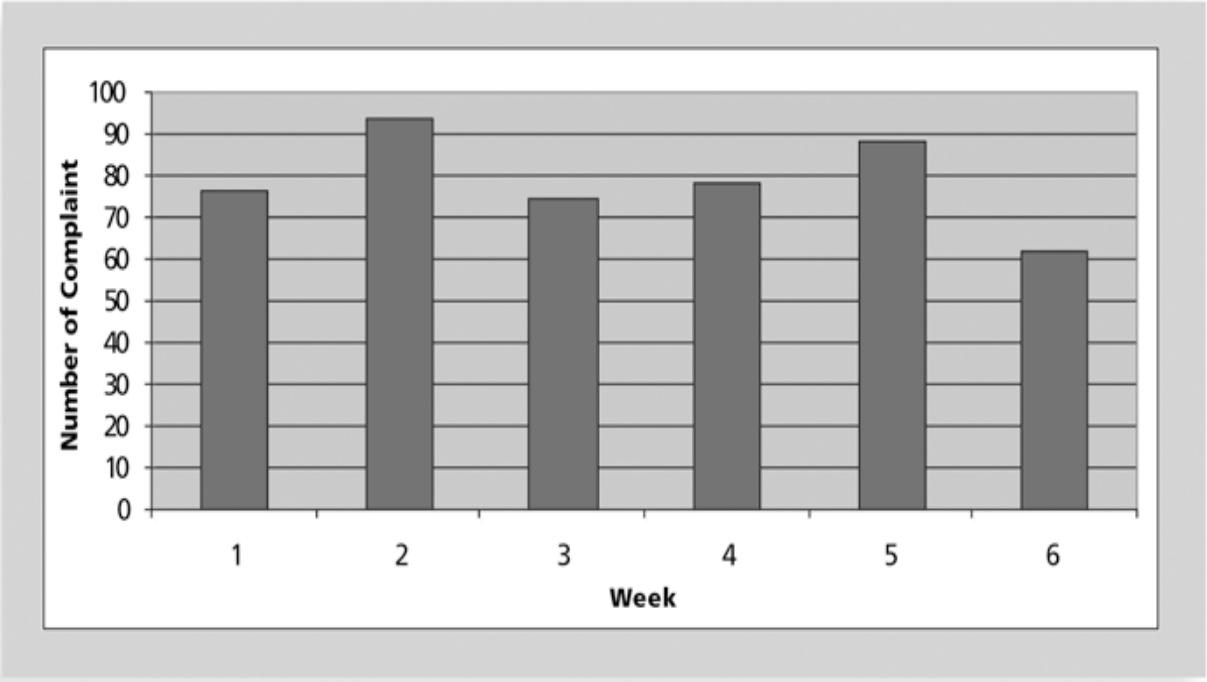
Sample Quality Control Chart



The rule violations indicate that a calibration device may need adjustment

Histograms

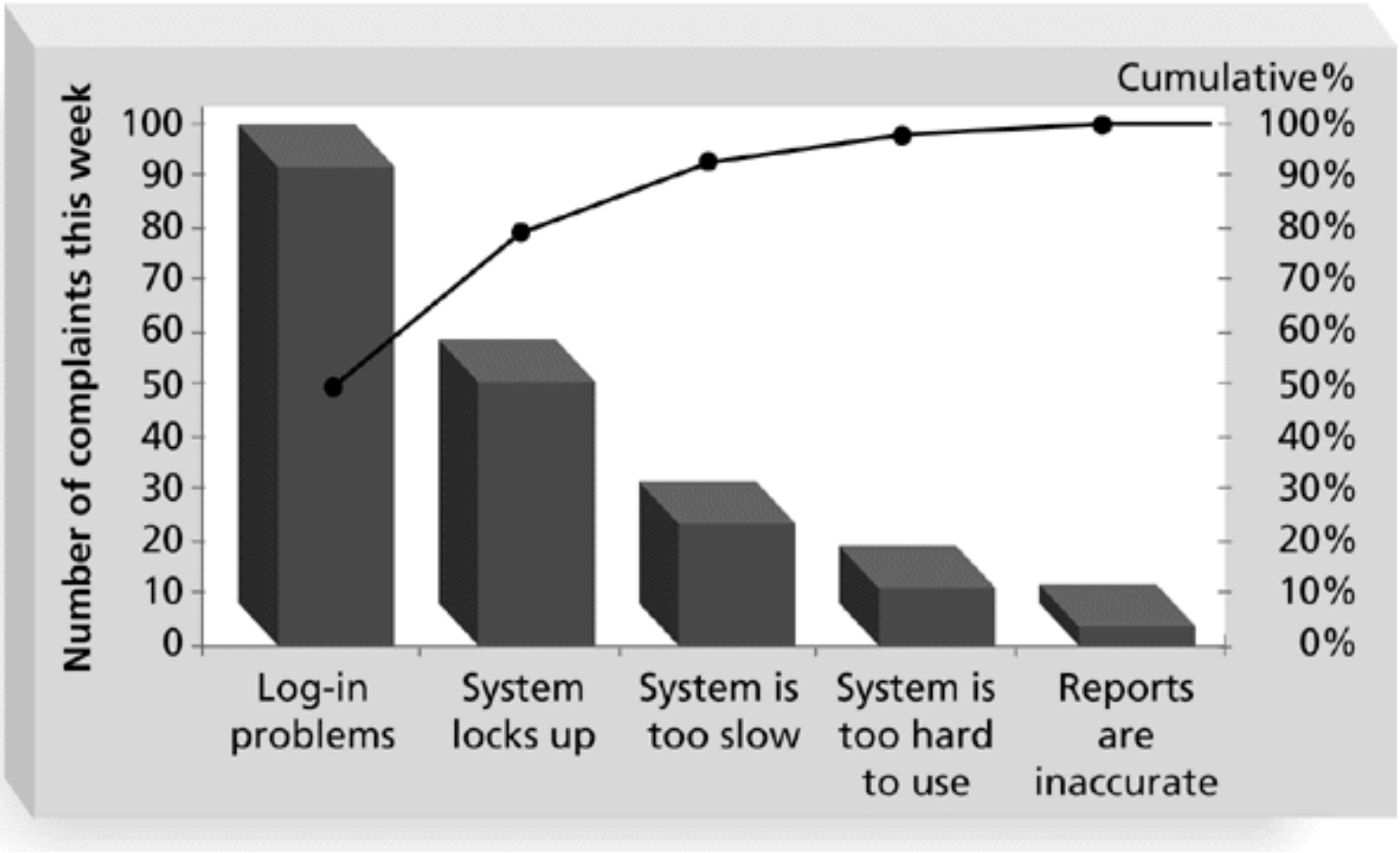
- A **histogram** is a bar graph of a distribution of variables
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency



Pareto Charts

- A **Pareto chart** is a histogram that can help you identify and prioritize problem areas
  - The variables are ordered by frequency of occurrence to help identify the key contributors that account for most quality problems (hopefully following the 80-20 rule)
- **Pareto analysis** is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes
- In the following chart, Log-in Problems account for about 55% of the complaints and together with System lock-ups accounts for about 80%
  - Fixing these two problems can greatly reduce the volume of compalints
  - Small problems should be investigated before addressing them in case the user is in error

Sample Pareto Diagram



STATISTICAL SAMPLING AND TESTING

Acceptance Sampling

- Accept/reject entire lot based on sample results
- Created by Dodge and Romig during WWII
- Not consistent with TQM of zero defects
- Does not estimate the quality of the lot

What is Acceptance Sampling?

Lot acceptance sampling

- A SQC technique where a random sample is taken from a lot and upon the results of appraising the sample, the lot will either be rejected or accepted.
- A procedure for sentencing incoming batches or lots of items without doing 100% inspection

What is Acceptance Sampling?

Purposes

- Determine the quality level of an incoming shipment at the end of the production
- Judge whether the quality level is within the level that has been predetermined

But acceptance sampling gives you no idea about the process that is producing those items.

- Another area of quality control and improvement
- Closely connected with inspection and testing of products
- Inspection can occur at many points in a process

Acceptance Sampling : *the inspecting and classification of a sample selected at random from a large batch or a lot and ultimate decision about the disposition of the lot.*

Sampling Plans

Plans that specify lot size, sample size, number of samples and acceptance/ rejection criteria

- Single sampling
- Double sampling
- Multiple sampling and sequential sampling

Why use acceptance sampling

- Can do either 100% inspection or inspect a sample of dew items taken from a lot
- Complete inspection

  Inspecting each items produced to see if each item meets the level desired

  Used when defective items would be very detrimental in some way

Sampling involves risk –

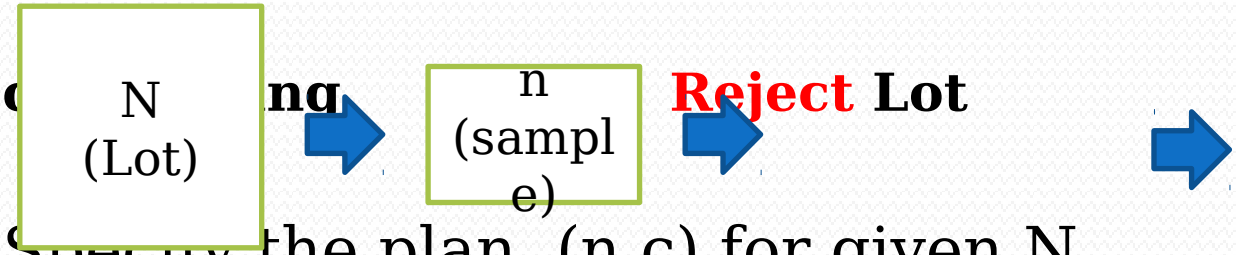
- good product may be rejected
- bad product may be accepted

Why not 100% inspection

Problems with 100% inspection

- Generally very expensive
- Can not use when product must be destroyed to test it
- Handling by inspectors can induce defects
- Inspection may be very tedious so defective items may slip through even 100% inspection

A Lot-by Lot Sampling Plan



- Specify the plan (n,c) for given N
- For a lot size N, determine
  - the sample size n and
  - The acceptance number c
- Reject lot if number of defect> c
- Specify course of action if lot is rejected

Sampling Terms

- Acceptable Quality Level (AQL) – the percentage of the defects at which consumers are willing to accept lot as "good"
- Lot Tolerance Percentage Defectives (LTPD or RQL) – the upper limit on the percentage of the defects that a consumer is willing to accept
- **Consumer's Risk**: the probability that a lot contain defective exceeding the LTPD will be accepted
- **Producer's Risk**: the probability that a lot

Three approaches for sentencing a lot

- Single Sampling
  - For low cost or low impact material on the subsequent process
  - From trusted supplier
- Rectified Sampling
  - Inspect every item in the lot, then remove the defective units by reworking or returning to the supplier
  - For critical process defective items may result high failure cost
  - From new supplier
- Double or multiple sampling
  - When 100% inspection is too costly
  - Trusted supplier with potential risk

Single Sampling Plan

Advantages

- Less expensive because of less inspection
  - works with single sample
  - Protects both consumers and producers
- Rejection on entire lot motivates quality improvements for suppliers

Disadvantages

- Risk of accepting a lot of poor quality
- Risk of rejecting a lot of acceptable quality
- Requires planning and documentation
- Requires extensive study on consumer requirements

Lot Formation

- Lots should be such that…

  produced on the same machines, by same operators, from common raw materials at approximately the same time period
- Larger lots are better than smaller lots

  these are more representative of the overall quality
- Lots should be comfortable to the material handling systems and personnel.
- Random Selection

Testing

- Many IT professionals think of testing as a stage that comes near the end of IT product development
- Testing should be done during almost every phase of the IT product development life cycle

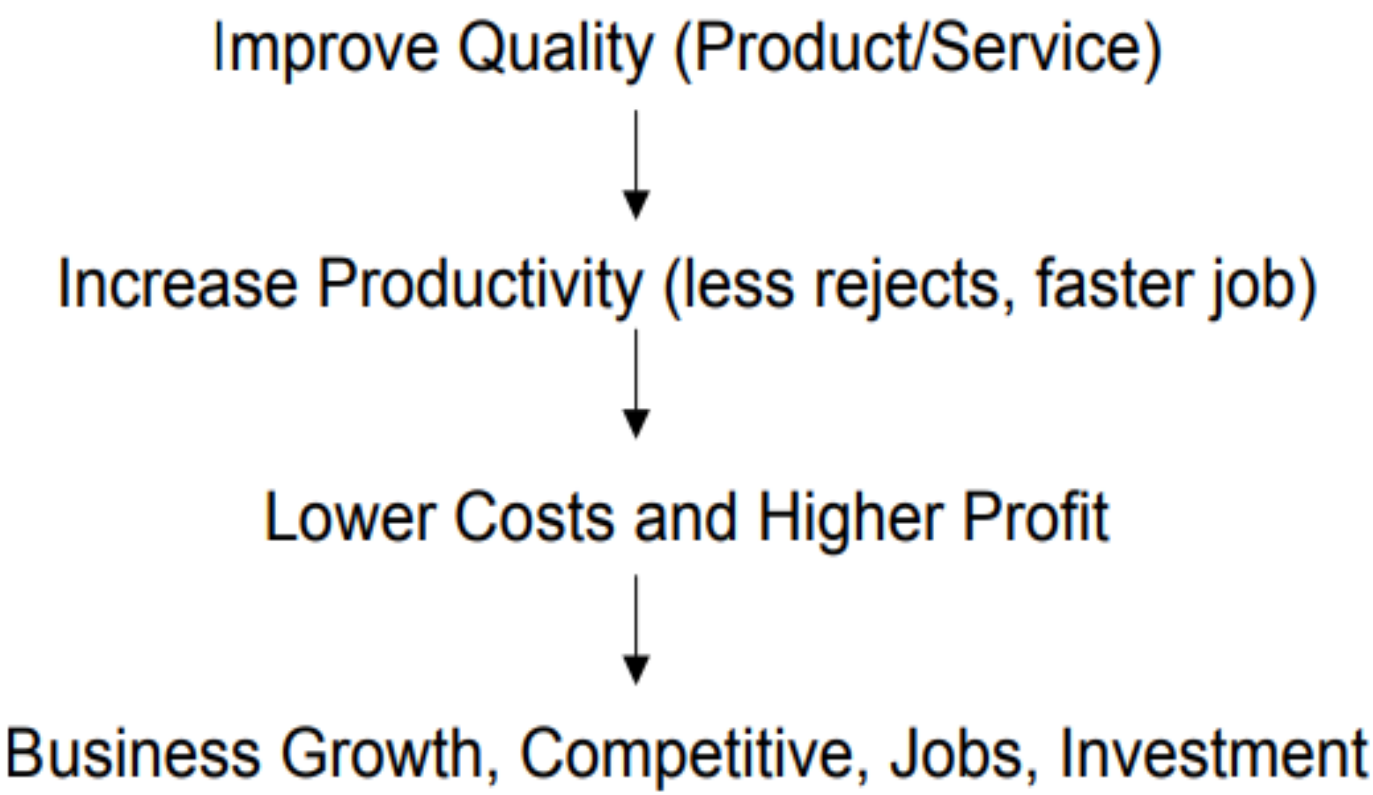
TOTAL QUALITY MANAGEMNET (TQM)

Definition of TQM

"A management philosophy embracing all activities through which the needs and expectations of the CUSTOMER and COMMUNITY, and the objectives of the organization are satisfied in the most efficient and cost effective manner by maximising the potential of ALL employees in a continuing drive for improvement."

- Requires cultural change – prevention not detection, pro-active versus fire-fighting, life-cycle costs not price, etc.
- Many companies will not start this transformation unless faced with disaster/problems or forced by customers

Effect of TQM (Quality Improvement)



TQM Six Basic Concepts

1. Leadership
2. Customer Satisfaction
3. Employee Involvement
4. Continuous Process Improvement
5. Supplier Partnership
6. Performance Measures

Criteria 1 : Leadership

- Top management must realize importance of quality
- Quality is responsibility of everybody, but ultimate responsibility is CEO
- Involvement and commitment to Quality Improvement
- Quality excellence becomes part of business strategy
- Lead in the implementation process

Characteristics of Successful Leaders

1. Give attention to external and internal customers
2. Empower, not control subordinates. Provide resources, training, and work environment to help them do their jobs
3. Emphasize improvement rather than maintenance
4. Emphasize prevention
5. Encourage collaboration rather than competition
6. Train and coach, not direct and supervise
7. Learn from problems – opportunity for improvement
8. Continually try to improve communications
9. Continually demonstrate commitment to quality
10. Choose suppliers on the basis of quality, not price
11. Establish organisational systems that supports quality efforts

Implementation Process

- Must begin from top management
- Cannot be delegated (lack of involvement cited as principle reason for failure)
- Top/senior management must be educated on TQM philosophy and concepts
- Visits to TQM companies, read books, attend seminars
- Need a roadmap/framework for implementation – consider timing (any crisis)
- Formation of Quality Council – policies, strategies, programmes

Criteria 2:Customer Satisfaction

- Customer is always right – in Japan customer is “King”
- Customer expectations constantly changing – 10 years ago acceptable, now not any more!
- Delighting customers (Kano Model)
- Satisfaction is a function of total experience with organization
- Need to continually examine the quality systems and practices to be responsive to ever – changing needs, requirements and expectations – Retain and Win new customers

Issues for customer satisfaction

Checklist for both internal and external customers

1. Who are my customers?
2. What do they need?
3. What are their measures and expectations?
4. Does my product/service exceed their expectations?
5. How do I satisfy their needs?
6. What corrective action is necessary?

Customer Feedback

- Discover customer dissatisfaction
- Discover priorities of quality, price, delivery
- Compare performance with competitors
- Identify customer’s needs
- Determine opportunities for improvement

Customer Feedback Tools/Method

- Warranty cards/Questionnaire
- Telephone/Mail Surveys
- Focus Groups
- Customer Complaints
- Customer Satisfaction Index

Criteria 3: Employee Involvement

- People – most important resource/asset
- Quality comes from people
- Deming – 15% operator errors, 85% management system
- Education and training – life long, continuous both knowledge and skills
- Motivational programmes, incentive schemes
- Conducive work culture, right attitude, commitment

Criteria 4: Continuous Process Improvement

- View all work as process
- Process – purchasing, design, invoicing, etc.
- Inputs – PROCESS – outputs
- Process improvement – increased customer satisfaction
- Improvement – 5 ways; Reduce resources, Reduce errors, Meet expectations of downstream customers, Make process safer, make process more satisfying to the person doing

Criteria 5: Supplier Partnership

- 40% prod. Cost comes from purchased materials, therefore supplier Quality Management important
- Substantial portion quality problems from suppliers
- Need partnership to achieve quality improvement – long-term purchase contract
- Supplier Management activities
- Define product/program requirements;

1. Evaluate potential and select the best suppliers
2. Conduct joint quality planning and execution
3. Require statistical evidence of quality
4. Certify suppliers, e.g. ISO 900, Ford Q1
5. Develop and apply Supplier Quality Ratings

- Defects/Percent non-conforming
- Price and Quality costs
- Delivery and Service

Criteria 6: Performance Measures

- Managing by fact rather than gut feelings
- Effective management requires measuring
- Use a baseline, to identify potential projects, to asses results from improvement
- E.g. Production measures – defects per million, inventory turns, on-time delivery
- Service – billing errors, sales, activity times
- Customer Satisfaction
- Methods for measuring
- Cost of poor quality

Performance Measures (continue)

- Benchmarking – grade to competitors, or best practice
- Statistical measures – control charts
- Certifications